APPENDIX-VII

PROJECT EVALUATION

APPENDIX VII: PROJECT EVALUATION

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CHAPTER 1 NORTH BEN TRE POLDER AREA IMPORVEMENT PROJECT

1.1 FARM BUDGET

Table 1.1.1 Farm Budge: Winter-Spring Paddy

Winter-Spring Paddy (per ha)	Financial Price			Economic Price			CF
	Unit Price VND/kg	Quantity kg/ha	Total value (VND)	Unit Price VND/kg	Quantity kg/ha	Total value (VND)	
(A) Income	6,398	5,781	36,986,838	7,217	5,781	41,721,153	1.128
Gross Income			36,986,838			41,721,153	
(B) Production Cost							
1. Land Preparation			1,632,265			1,469,039	0.9
2. Seedling			964,285			867,857	0.9
3. Input							
Urea			1,793,966			1,704,268	0.95
Compound			591,379			532,241	0.9
Compost			699,138			629,224	0.9
Pesticide			280,172			252,155	0.9
Herbicide			192,157			172,941	0.9
Fertilizer			165,097			156,842	0.95
4. Labor			12,492,315			9,993,852	0.8
5. Others			187,422			154,280	0.9
Sub total			18,998,196			15,932,698	
(C) Net Income			17,988,642			25,788,455	

Source: Statistical Year Book 2010, Ben Tre Province, and Household Economic Survey, JICA Study Team 2011

Table 1.1.2 Farm Budget: Fruit

Fruit (per ha)	Financial Price			Economic Price			CF
	Unit Price VND/kg	Quantity kg/ha	Total value (VND)	Unit Price VND/kg	Quantity kg/ha	Total value (VND)	
(A) Income	16,408	8,568	140,583,744	17,343	8,568	148,597,017	1.057
Gross Income			140,583,744			148,597,017	
(B) Production Cost			32,294,363			29,064,927	0.9
Depreciation Cost			13,858,191			13,858,191	1.0
Others							
Sub total			46,152,554			42,923,118	
(C) Net Income			94,431,190			105,673,900	

Source: Statistical Year Book 2010, Ben Tre Province, and Household Economic Survey, JICA Study Team 2011

1.2 PROJECT COST

Table 1.2.1 Project Cost for Stage 1

	Project Cost for Stage 1					
	FINANCIAL PRICE			*ECONOMIC PRICE*		
Project Cost	**Foreign (000VND)**	**Local (000VND)**	**Total (000VND)**	**Foreign (000VND)**	**Local (000VND)**	**Total (000VND)**
1. Construction cost	994,605,675	899,881,325	1,894,487,000	994,605,675	789,432,733	1,784,038,408
	52%	48%	100%	56%	44%	100%
Earth	34,100,766	136,403,064	170,503,830	34,100,766	122,762,758	156,863,524
	20%	80%	100%	22%	78%	100%
Concrete	341,007,660	227,338,440	568,346,100	341,007,660	204,604,596	545,612,256
	60%	40%	100%	63%	38%	100%
Steel	344,796,634	147,769,986	492,566,620	344,796,634	132,992,987	477,789,621
	70%	30%	100%	72%	28%	100%
Skilled Labor	53,045,636	79,568,454	132,614,090	53,045,636	79,568,454	132,614,090
	40%	60%	100%	40%	60%	100%
Unskilled Labor	0	284,173,050	284,173,050	0	227,338,440	227,338,440
	5%	95%	100%		100%	100%
Machine	221,654,979	24,628,331	246,283,310	221,654,979	22,165,498	243,820,477
	90%	10%	100%	91%	9%	100%
2. Land acquisition and Compensation	0	31,624,000	31,624,000	0	8,380,360	8,380,360
3. Project management Cost	1,894,487	17,050,383	18,944,870	1,894,487	15,345,345	17,239,832
	10%	90%	100%	11%	89%	100%
4. Consulting services cost	136,403,064	15,155,896	151,558,960	136,403,064	13,640,306	150,043,370
	90%	10%	100%	91%	9%	100%
5. Other expenses	3,788,974	34,100,766	37,889,740	3,788,974	30,690,689	34,479,663
	10%	90%	100%	11%	89%	100%
6. Tax	0	208,393,570	208,393,570	0	0	0
7. Contingency	112,459,111	121,830,703	234,289,814	112,459,111	109,647,633	222,106,744
	48%	52%	100%	51%	49%	100%
Stage I Total	1,249,151,311	1,328,036,643	2,577,187,954	1,249,151,311	967,137,066	2,216,288,377
	48%	52%	100%	56%	44%	100%
US$		43%	$125,656,722		47%	$108,060,234

Source: JICA Study Team

Table 1.2.2 Project Cost for Stage 2

	Project Cost for Stage 2					
	FINANCIAL PRICE			ECONOMIC PRICE		
Stage II	**Foreign (000VND)**	**Local (000VND)**	**Total (000VND)**	**Foreign (000VND)**	**Local (000VND)**	**Total (000VND)**
1. Construction cost	523,280,828	459,406,173	982,687,000	523,280,828	399,462,266	922,743,093
	52%	47%	99%	57%	43%	100%
Earth	17,688,366	70,753,464	88,441,830	17,688,366	63,678,118	81,366,484
	20%	80%	100%	22%	78%	100%
Concrete	176,883,660	117,922,440	294,806,100	176,883,660	106,130,196	283,013,856
	60%	40%	100%	63%	38%	100%
Steel	178,849,034	76,649,586	255,498,620	178,849,034	68,984,627	247,833,661
	70%	30%	100%	72%	28%	100%
Skilled Labor	27,515,236	41,272,854	68,788,090	27,515,236	37,145,569	64,660,805
	40%	60%	100%	43%	57%	100%
Unskilled Labor	7,370,153	140,032,898	147,403,050	7,370,153	112,026,318	119,396,471
	5%	95%	100%	6%	94%	100%
Macine	114,974,379	12,774,931	127,749,310	114,974,379	11,497,438	126,471,817
	90%	10%	100%	91%	9%	100%
2. Land acquisition and Compensation	0	332,479,222	332,479,222	0	88,106,994	88,106,994
3. Project management Cost	982,687	8,844,183	9,826,870	982,687	7,959,765	8,942,452
	10%	90%	100%	11%	89%	100%
4. Consulting services cost	70,753,464	7,861,496	78,614,960	70,753,464	7,075,346	77,828,810
	90%	10%	100%	91%	9%	100%
5. Other expenses	1,965,374	17,688,366	19,653,740	1,965,374	15,919,529	17,884,903
	10%	90%	100%	11%	89%	100%
6. Tax	0	108,095,570	108,095,570	0	0	0
7. Contingency	42,878,006	110,257,730	153,135,736	42,878,006	99,231,957	142,109,963
	28%	72%	100%	30%	70%	100%
Stage II Total	639,860,359	1,044,632,739	1,684,493,098	639,860,359	617,755,857	1,257,616,215
	38%	62%	100%	51%	49%	100%
US$		28%	$82,131,333		26%	$61,317,969

Source: JICA Study Team

Table 1.2.3 Project Cost for Stage 3

	Project Cost for Stage 3					
	FINANCIAL PRICE			ECONOMIC PRICE		
Project Cost	Foreign (000VND)	Local (000VND)	Total (000VND)	Foreign (000VND)	Local (000VND)	Total (000VND)
1. Construction cost	509,726,700 52%	461,181,300 48%	970,908,000 100%	509,726,700 56%	404,577,364 44%	914,304,064 100%
Earth	17,476,344 20%	69,905,376 80%	87,381,720 100%	17,476,344 22%	62,914,838 78%	80,391,182 100%
Concrete	174,763,440 60%	116,508,960 40%	291,272,400 100%	174,763,440 63%	104,858,064 38%	279,621,504 100%
Steel	176,705,256 70%	75,730,824 30%	252,436,080 100%	176,705,256 72%	68,157,742 28%	244,862,998 100%
Skilled Labor	27,185,424 40%	40,778,136 60%	67,963,560 100%	27,185,424 40%	40,778,136 60%	67,963,560 100%
Unskilled Labor	0 5%	145,636,200 95%	145,636,200 100%	0	116,508,960 100%	116,508,960 100%
Machine	113,596,236 90%	12,621,804 10%	126,218,040 100%	113,596,236 91%	11,359,624 9%	124,955,860 100%
2. Land acquisition and Compensation	0	405,162,240	405,162,240	0	107,367,994	107,367,994
3. Project management Cost	970,908 10%	8,738,172 90%	9,709,080 100%	970,908 11%	7,864,355 89%	8,835,263 100%
4. Consulting services cost	69,905,376 90%	7,767,264 10%	77,672,640 100%	69,905,376 91%	6,990,538 9%	76,895,914 100%
5. Other expenses	1,941,816 10%	17,476,344 90%	19,418,160 100%	1,941,816 11%	15,728,710 89%	17,670,526 100%
6. Tax	0	106,799,880	106,799,880	0	0	0
7. Contingency	76,304,160 48%	82,662,840 52%	158,967,000 100%	76,304,160 51%	74,396,556 49%	150,700,716 100%
Stage III Total	658,848,960 38%	1,089,788,040 62%	1,748,637,000 100%	658,848,960 52%	616,925,515 48%	1,275,774,475 100%
US$		29%	$85,258,816		27%	$62,203,317

Source: JICA Study Team

Table 1.2.4 Table Disbursement of the Project Cost at Financial Price

(VND million)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Stage 1:Compensation	92,248									
Stage 1: Construction		745,482	993,976	745,482						
Stage 2: Compensation				363,925						
Stage 2:Construction					396,170	528,227	396,170			
Stage 3:Compensation							436,231			
Stage 3:Construction								393,722	524,962	393,722
Total	92,248	745,482	993,976	1,109,407	396,170	528,227	832,402	393,722	524,962	393,722

Source: JICA Study Team

Table 1.2.5 Disbursement of the Project Cost at Economic Price

(VND million)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Stage 1:Compensation	68,398									
Stage 1: Construction		644,367	859,156	644,367						
Stage 2: Compensation				119,239						
Stage 2:Construction					341,513	455,351	341,513			
Stage 3:Compensation							138,126			
Stage 3:Construction								341,294	455,059	341,294
Total	68,398	644,367	859,156	763,606	341,513	455,351	479,640	341,294	455,059	341,294

Source: JICA Study Team

1.3 PROJECT COST AND BENEFIT

Table 1.3.1 Project Cost and Benefit

		Stage 1 & 2 & 3 (IRR: 24.0%)				**Stage 1 (IRR: 28.4%)**			
Year		Cost ('000VND)			Benefit ('000VND)	Cost ('000VND)		Cost ('000VND)	Benefit ('000VND)
		Investment	O & M	Total	Total	Investment	O & M	Total	Total
1	2014	68,397,708		68,397,708		68,397,708		68,397,708	
2	2015	644,367,201		644,367,201		644,367,201		644,367,201	
3	2016	859,156,268		859,156,268		859,156,268		859,156,268	
4	2017	763,605,719		763,605,719		644,367,201		644,367,201	
5	2018	341,513,309	17,840,384	359,353,693	857,708,601		17,840,384	17,840,384	857,708,601
6	2019	455,351,079	17,840,384	473,191,463	857,708,601		17,840,384	17,840,384	857,708,601
7	2020	479,639,668	17,840,384	497,480,052	857,708,601		17,840,384	17,840,384	857,708,601
8	2021	341,294,435	27,067,815	368,362,250	1,039,880,896		17,840,384	17,840,384	857,708,601
9	2022	455,059,246	27,067,815	482,127,061	1,060,122,263		17,840,384	17,840,384	857,708,601
10	2023	341,294,435	27,067,815	368,362,250	1,080,363,629		17,840,384	17,840,384	857,708,601
11	2024		36,210,856	36,210,856	1,204,703,449		17,840,384	17,840,384	857,708,601
12	2025		36,210,856	36,210,856	1,233,619,686		17,840,384	17,840,384	857,708,601
13	2026		36,210,856	36,210,856	1,262,535,924		17,840,384	17,840,384	857,708,601
14	2027		36,210,856	36,210,856	1,291,452,161		17,840,384	17,840,384	857,708,601
15	2028		36,210,856	36,210,856	1,320,368,398		17,840,384	17,840,384	857,708,601
16	2029		36,210,856	36,210,856	1,349,284,636		17,840,384	17,840,384	857,708,601
17	2030		36,210,856	36,210,856	1,378,200,873		17,840,384	17,840,384	857,708,601
18	2031		36,210,856	36,210,856	1,397,443,884		17,840,384	17,840,384	857,708,601
19	2032		36,210,856	36,210,856	1,416,686,894		17,840,384	17,840,384	857,708,601
20	2033		36,210,856	36,210,856	1,435,929,905		17,840,384	17,840,384	857,708,601
21	2034		36,210,856	36,210,856	1,455,172,916		17,840,384	17,840,384	857,708,601
22	2035		36,210,856	36,210,856	1,474,415,927		17,840,384	17,840,384	857,708,601
23	2036		36,210,856	36,210,856	1,493,658,937		17,840,384	17,840,384	857,708,601
24	2037		36,210,856	36,210,856	1,512,901,948		17,840,384	17,840,384	857,708,601
25	2038		36,210,856	36,210,856	1,532,144,959		17,840,384	17,840,384	857,708,601
26	2039		36,210,856	36,210,856	1,551,387,969		17,840,384	17,840,384	857,708,601
27	2040		36,210,856	36,210,856	1,570,630,980		17,840,384	17,840,384	857,708,601
28	2041		36,210,856	36,210,856	1,589,873,991		17,840,384	17,840,384	857,708,601
29	2042		36,210,856	36,210,856	1,609,117,001		17,840,384	17,840,384	857,708,601
30	2043		36,210,856	36,210,856	1,628,360,012		17,840,384	17,840,384	857,708,601
Total				5,608,620,778	34,461,383,043			2,680,138,363	22,300,423,633

CHAPTER 2 TRA VINH FRESH WATER RECRUITMENT PROJECT

2.1 FARM BUDGET

Table 2.1.1 Farm Budget: Winter-Spring Paddy

Winter-Spring Paddy (per ha)	Financial Price			Economic Price			CF
	Unit Price VND/kg	Quantity kg/ha	Total value (VND)	Unit Price VND/kg	Quantity kg/ha	Total value (VND)	
(A) Income	6,398	5,827	37,281,146	7,217	5,827	42,053,133	1.128
Gross Income			37,281,146			42,053,133	
(B) Production Cost							
1. Land Preparation			1,632,265			1,469,039	0.9
2. Seedling			964,285			867,857	0.9
3. Input							
Urea			1,793,966			1,704,268	0.95
Compound			591,379			532,241	0.9
Compost			699,138			629,224	0.9
Pesticide			280,172			252,155	0.9
Herbicide			192,157			172,941	0.9
Fertilizer			165,097			156,842	0.95
4. Labor			12,492,315			9,993,852	0.8
5. Others			187,422			154,280	0.9
Sub total			18,998,196			15,932,698	
(C) Net Income			18,282,950			26,120,434	

Source: Statistical Year Book 2010, Tra Vinh Province, and Household Economic Survey, JICA Study Team 2011

Table 2.1.2 Farm Budget: Fruit

Fruit (per ha)	Financial Price			Economic Price			CF
	Unit Price VND/kg	Quantity kg/ha	Total value (VND)	Unit Price VND/kg	Quantity kg/ha	Total value (VND)	
(A) Income	12,900	10,834	139,758,600	13,635	10,834	147,724,840	1.057
Gross Income			139,758,600			147,724,840	
(B) Production Cost			32,294,363			29,064,927	0.9
Depreciation Cost			13,858,191			13,858,191	1.0
Others							
Sub total			46,152,554			42,923,118	
(C) Net Income			93,606,046			104,801,723	

Source: Statistical Year Book 2010, Tra Vinh Province, and Household Economic Survey, JICA Study Team 2011

2.2 PROJECT COST

Table 2.2.1 Project Cost for Tan Dinh Sluice Gate

	Tan Dinh Sluice Gate					
	FINANCIAL PRICE			*ECONOMIC PRICE*		
Project Cost	**Foreign (000VND)**	**Local (000VND)**	**Total (000VND)**	**Foreign (000VND)**	**Local (000VND)**	**Total (000VND)**
1. Construction cost	86,093,026	85,236,379	171,329,405	86,093,026	74,990,880	161,083,906
	50%	50%	100%	53%	47%	100%
Earth	3,083,929	12,335,717	15,419,646	3,083,929	11,102,145	14,186,075
	20%	80%	100%	22%	78%	100%
Concrete	25,699,411	25,699,411	51,398,821	25,699,411	23,129,470	48,828,880
	50%	50%	100%	53%	47%	100%
Steel	31,181,952	13,363,694	44,545,645	31,181,952	12,027,324	43,209,276
	70%	30%	100%	72%	28%	100%
Skilled Labor	4,797,223	7,195,835	11,993,058	4,797,223	7,195,835	11,993,058
	40%	60%	100%	40%	60%	100%
Unskilled Labor	1,284,971	24,414,440	25,699,411	1,284,971	19,531,552	20,816,523
	5%	95%	100%	6%	94%	100%
Machine	20,045,540	2,227,282	22,272,823	20,045,540	2,004,554	22,050,094
	90%	10%	100%	91%	9%	100%
2. Land acquisition and Compensation		9,191,637	9,191,637	0	2,435,784	2,435,784
3. Project management Cost	1,178,950	1,178,950	2,357,900	1,178,950	1,061,055	2,240,005
	50%	50%	100%	53%	47%	100%
4. Consulting services cost	4,111,906	9,594,446	13,706,352	4,111,906	8,635,002	12,746,907
	30%	70%	100%	32%	68%	100%
5. Other expenses	239,560	239,560	479,119	239,560	215,604	455,163
	50%	50%	100%	53%	47%	100%
6. Tax		18,787,277	18,787,277	0	0	0
7. Contingency	10,145,029	11,440,140	21,585,169	10,145,029	10,296,126	20,441,155
	47%	53%	100%	50%	50%	100%
Stage I Total	101,768,470	135,668,388	237,436,859	101,768,470	97,634,450	199,402,921
	43%	57%	100%	51%	49%	100%
US$		43%	$125,656,722			9,722,348

Source: JICA Study Team

Table 2.2.2 Project Cost for Bong Bot Sluice Gate

	Bong Bot Sluice					
	FINANCIAL PRICE			*ECONOMIC PRICE*		
Project Cost	**Foreign (000VND)**	**Local (000VND)**	**Total (000VND)**	**Foreign (000VND)**	**Local (000VND)**	**Total (000VND)**
1. Construction cost	71,105,169	70,397,655	141,502,825	71,105,169	61,935,786	133,040,956
	50%	50%	100%	53%	47%	100%
Earth	2,547,051	10,188,203	12,735,254	2,547,051	9,169,383	11,716,434
	20%	80%	100%	22%	78%	100%
Concrete	21,225,424	21,225,424	42,450,847	21,225,424	19,102,881	40,328,305
	50%	50%	100%	53%	47%	100%
Steel	25,753,514	11,037,220	36,790,734	25,753,514	9,933,498	35,687,012
	70%	30%	100%	72%	28%	100%
Skilled Labor	3,962,079	5,943,119	9,905,198	3,962,079	5,943,119	9,905,198
	40%	60%	100%	40%	60%	100%
Unskilled Labor	1,061,271	20,164,153	21,225,424	1,061,271	16,131,322	17,192,593
	5%	95%	100%	6%	94%	100%
Machine	16,555,830	1,839,537	18,395,367	16,555,830	1,655,583	18,211,414
	90%	10%	100%	91%	9%	100%
2. Land acquisition and Compensation		7,408,477	7,408,477	0	1,963,246	1,963,246
3. Project management Cost	992,622	992,622	1,985,243	992,622	893,359	1,885,981
	50%	50%	100%	53%	47%	100%
4. Consulting services cost	3,396,068	7,924,158	11,320,226	3,396,068	7,131,742	10,527,810
	30%	70%	100%	32%	68%	100%
5. Other expenses	203,078	203,078	406,155	203,078	182,770	385,848
	50%	50%	100%	53%	47%	100%
6. Tax		15,521,444	15,521,444	0	0	0
7. Contingency	8,372,785	9,441,652	17,814,437	8,372,785	8,497,486	16,870,272
	47%	53%	100%	50%	50%	100%
Stage I Total	84,069,722	111,889,085	195,958,807	84,069,722	80,604,391	164,674,113
	43%	57%	100%	51%	49%	100%
US$			9,554,422			8,029,065

Source: JICA Study Team

Table 2.2.3 Project Cost for Vung Liem Sluice Gate

	Vung Liem Sluice Gate					
	FINANCIAL PRICE			***ECONOMIC PRICE***		
Project Cost	**Foreign (000VND)**	**Local (000VND)**	**Total (000VND)**	**Foreign (000VND)**	**Local (000VND)**	**Total (000VND)**
1. Construction cost	115,163,773	114,017,865	229,181,638	115,163,773	100,312,803	215,476,576
	50%	50%	100%	53%	47%	100%
Earth	4,125,269	16,501,078	20,626,347	4,125,269	14,850,970	18,976,240
	20%	80%	100%	22%	78%	100%
Concrete	34,377,246	34,377,246	68,754,492	34,377,246	30,939,521	65,316,767
	50%	50%	100%	53%	47%	100%
Steel	41,711,058	17,876,168	59,587,226	41,711,058	16,088,551	57,799,609
	70%	30%	100%	72%	28%	100%
Skilled Labor	6,417,086	9,625,629	16,042,715	6,417,086	9,625,629	16,042,715
	40%	60%	100%	40%	60%	100%
Unskilled Labor	1,718,862	32,658,383	34,377,246	1,718,862	26,126,707	27,845,569
	5%	95%	100%	6%	94%	100%
Machine	26,814,252	2,979,361	29,793,613	26,814,252	2,681,425	29,495,677
	90%	10%	100%	91%	9%	100%
2. Land acquisition and Compensation		8,953,497	8,953,497	0	2,372,677	2,372,677
3. Project management Cost	1,525,987	1,525,987	3,051,973	1,525,987	1,373,388	2,899,375
	50%	50%	100%	53%	47%	100%
4. Consulting services cost	5,500,359	12,834,172	18,334,531	5,500,359	11,550,755	17,051,114
	30%	70%	100%	32%	68%	100%
5. Other expenses	310,321	310,321	620,642	310,321	279,289	589,610
	50%	50%	100%	53%	47%	100%
6. Tax		25,118,878	25,118,878	0	0	0
7. Contingency	13,407,275	15,118,841	28,526,116	13,407,275	13,606,957	27,014,232
	47%	53%	100%	50%	50%	100%
Stage I Total	135,907,715	177,879,561	313,787,276	135,907,715	129,495,869	265,403,583
	43%	57%	100%	51%	49%	100%
US$			15,299,420			12,940,362

Source: JICA Study Team

Table 2.2.4 Project Cost for Say Don Canal Extension

	Say Don Canal					
	FINANCIAL PRICE			*ECONOMIC PRICE*		
Project Cost	**Foreign (000VND)**	**Local (000VND)**	**Total (000VND)**	**Foreign (000VND)**	**Local (000VND)**	**Total (000VND)**
1. Construction cost	67,931,468	67,255,533	135,187,000	67,931,468	59,171,350	127,102,817
	50%	50%	100%	53%	47%	100%
Earth	2,433,366	9,733,464	12,166,830	2,433,366	8,760,118	11,193,484
	20%	80%	100%	22%	78%	100%
Concrete	20,278,050	20,278,050	40,556,100	20,278,050	18,250,245	38,528,295
	50%	50%	100%	53%	47%	100%
Steel	24,604,034	10,544,586	35,148,620	24,604,034	9,490,127	34,094,161
	70%	30%	100%	72%	28%	100%
Skilled Labor	3,785,236	5,677,854	9,463,090	3,785,236	5,677,854	9,463,090
	40%	60%	100%	40%	60%	100%
Unskilled Labor	1,013,903	19,264,148	20,278,050	1,013,903	15,411,318	16,425,221
	5%	95%	100%	6%	94%	100%
Machine	15,816,879	1,757,431	17,574,310	15,816,879	1,581,688	17,398,567
	90%	10%	100%	91%	9%	100%
2. Land acquisition and Compensation		193,951,040	193,951,040	0	51,397,026	51,397,026
3. Project management Cost	883,500	883,500	1,767,000	883,500	795,150	1,678,650
	50%	50%	100%	53%	47%	100%
4. Consulting services cost	5,407,480	5,407,480	10,814,960	5,407,480	4,866,732	10,274,212
	50%	50%	100%	53%	47%	100%
5. Other expenses	7,723,800	3,310,200	11,034,000	7,723,800	2,979,180	10,702,980
	70%	30%	100%	72%	28%	100%
6. Tax				0	0	0
7. Contingency	8,818,850	8,818,850	17,637,700	8,818,850	7,936,965	16,755,815
	50%	50%	100%	53%	47%	100%
Stage I Total	90,765,098	279,626,603	370,391,700	90,765,098	127,146,403	217,911,500
	25%	75%	100%	42%	58%	100%
US$			18,059,299			15,050,820

Source: JICA Study Team

Table 2.2.5 Disbursement of the Project Cost at Financial Price

Total Project	1	2	3	4	5	6	7	8	9
	2014	2015	2016	2017	2018	2019	2020	2021	2022
(1) Vung Liem Sluice Gate Compensation					16,287				
(1) Vung Liem Sluice Gate Construction						178,500	119,000		
(2) Bong Bot Sluice Gate Compensation	11,937								
(2) Bong Bot Sluice Gate Construction		110,413	73,609						
(3) TanDinh Sluice Gate Compensation			14,674						
(3) TanDinh Sluice Gate Construction				133,658	89,105				
(4) Say Don Canal Extension Compensation			39,655	39,655	39,655	39,655	39,655		
(4)Say Don Canal Extension Construction								103,269	68,846
Total	11,937	110,413	127,938	173,313	145,048	218,155	158,655	103,269	68,846

Source: JICA Study Team

Table 2.2.6 Disbursement of the Project Cost at Economic Price

Total Project	1	2	3	4	5	6	7	8	9
	2014	2015	2016	2017	2018	2019	2020	2021	2022
(1) Vung Liem Sluice Gate Compensation					9,193				
(1) Vung Liem Sluice Gate Construction						153,726	102,484		
(2) Bong Bot Sluice Gate Compensation	6,174								
(2) Bong Bot Sluice Gate Construction		95,100	63,400						
(3) TanDinh Sluice Gate Compensation			7,535						
(3) TanDinh Sluice Gate Construction				115,121	76,747				
(4) Say Don Canal Extension Compensation			11,101	11,101	11,101	11,101	11,101		
(4)Say Don Canal Extension Construction								97,443	64,962
Total	6,174	95,100	82,036	126,222	97,042	164,828	113,586	97,443	64,962

Source: JICA Study Team

2.3 PROJECT COST AND BENEFIT

Table 2.3.1 Project Cost and Benefit: Whole Project and Tan Dinh Sluice Gate

Year		Whole Project: 3 Sluice Gates & Canal Extension (EIRR: 27.7%)				(1) Tan Dinh Sluice Gate (IRR: 14.4%)			
		Cost ('000VND)			Benefit ('000VND)	Cost ('000VND)		Cost ('000VND)	Benefit ('000VND)
		Investment	O & M	Total	Total	Investment	O & M	Total	Total
1	2014	6,174,370		6,174,370		7,534,547		7,534,547	
2	2015	95,099,845		95,099,845		115,121,024		115,121,024	
3	2016	82,035,786		82,035,786		76,747,350		76,747,350	
4	2017	126,222,366	1,330,410	127,552,776	37,443,597		1,610,839	1,610,839	30,422,923
5	2018	97,041,814	1,330,410	98,372,223	38,133,433		1,610,839	1,610,839	30,983,415
6	2019	164,827,619	2,941,249	167,768,867	70,367,176		1,610,839	1,610,839	31,543,906
7	2020	113,585,527	2,941,249	116,526,775	71,617,503		1,610,839	1,610,839	32,104,398
8	2021	97,442,874	5,096,014	102,538,888	133,172,243		1,610,839	1,610,839	32,664,890
9	2022	64,961,916	5,096,014	70,057,930	135,457,325		1,610,839	1,610,839	33,225,382
10	2023		6,367,043	6,367,043	415,826,132		1,610,839	1,610,839	33,785,873
11	2024		6,367,043	6,367,043	422,724,492		1,610,839	1,610,839	34,346,365
12	2025		6,367,043	6,367,043	429,622,852		1,610,839	1,610,839	34,906,857
13	2026		6,367,043	6,367,043	436,521,211		1,610,839	1,610,839	35,467,348
14	2027		6,367,043	6,367,043	443,419,571		1,610,839	1,610,839	36,027,840
15	2028		6,367,043	6,367,043	450,317,931		1,610,839	1,610,839	36,588,332
16	2029		6,367,043	6,367,043	457,216,291		1,610,839	1,610,839	37,148,824
17	2030		6,367,043	6,367,043	464,114,650		1,610,839	1,610,839	37,709,315
18	2031		6,367,043	6,367,043	471,836,795		1,610,839	1,610,839	38,336,740
19	2032		6,367,043	6,367,043	479,558,939		1,610,839	1,610,839	38,964,164
20	2033		6,367,043	6,367,043	487,281,084		1,610,839	1,610,839	39,591,588
21	2034		6,367,043	6,367,043	495,003,228		1,610,839	1,610,839	40,219,012
22	2035		6,367,043	6,367,043	502,725,373		1,610,839	1,610,839	40,846,437
23	2036		6,367,043	6,367,043	510,447,517		1,610,839	1,610,839	41,473,861
24	2037		6,367,043	6,367,043	518,169,662		1,610,839	1,610,839	42,101,285
25	2038		6,367,043	6,367,043	525,891,806		1,610,839	1,610,839	42,728,709
26	2039		6,367,043	6,367,043	533,613,951		1,610,839	1,610,839	43,356,133
27	2040		6,367,043	6,367,043	541,336,095		1,610,839	1,610,839	43,983,558
28	2041		6,367,043	6,367,043	549,058,239		1,610,839	1,610,839	44,610,982
29	2042		6,367,043	6,367,043	556,780,384		1,610,839	1,610,839	45,238,406
30	2043		6,367,043	6,367,043	564,502,528		1,610,839	1,610,839	45,865,830
Total				1,090,612,405	10,742,160,010			242,895,575	1,024,242,373

Source: JICA Study Team

Table 2.3.2 Project Cost and Benefit: Bong Bot Sluice Gate and Vung Liem Sluice Gate

		(2) Bong Bot Sluice Gate (IRR: 20.9%)				(3) Vung Liem Sluice Gate (IRR: 19.6%)			
Year		Cost ('000VND)			Benefit ('000VND)	Cost ('000VND)		Cost ('000VND)	Benefit ('000VND)
		Investment	O & M	Total	Total	Investment	O & M	Total	Total
1	2014	6,174,370		6,174,370		9,193,122		9,193,122	
2	2015	95,099,845		95,099,845		153,726,277		153,726,277	
3	2016	63,399,897		63,399,897		102,484,184		102,484,184	
4	2017		1,330,410	1,330,410	37,443,597		2,154,766	2,154,766	56,165,396
5	2018		1,330,410	1,330,410	38,133,433		2,154,766	2,154,766	57,200,150
6	2019		1,330,410	1,330,410	38,823,269		2,154,766	2,154,766	58,234,904
7	2020		1,330,410	1,330,410	39,513,105		2,154,766	2,154,766	59,269,658
8	2021		1,330,410	1,330,410	40,202,941		2,154,766	2,154,766	60,304,412
9	2022		1,330,410	1,330,410	40,892,777		2,154,766	2,154,766	61,339,166
10	2023		1,330,410	1,330,410	41,582,613		2,154,766	2,154,766	62,373,920
11	2024		1,330,410	1,330,410	42,272,449		2,154,766	2,154,766	63,408,674
12	2025		1,330,410	1,330,410	42,962,285		2,154,766	2,154,766	64,443,428
13	2026		1,330,410	1,330,410	43,652,121		2,154,766	2,154,766	65,478,182
14	2027		1,330,410	1,330,410	44,341,957		2,154,766	2,154,766	66,512,936
15	2028		1,330,410	1,330,410	45,031,793		2,154,766	2,154,766	67,547,690
16	2029		1,330,410	1,330,410	45,721,629		2,154,766	2,154,766	68,582,444
17	2030		1,330,410	1,330,410	46,411,465		2,154,766	2,154,766	69,617,198
18	2031		1,330,410	1,330,410	47,183,679		2,154,766	2,154,766	70,775,519
19	2032		1,330,410	1,330,410	47,955,894		2,154,766	2,154,766	71,933,841
20	2033		1,330,410	1,330,410	48,728,108		2,154,766	2,154,766	73,092,163
21	2034		1,330,410	1,330,410	49,500,323		2,154,766	2,154,766	74,250,484
22	2035		1,330,410	1,330,410	50,272,537		2,154,766	2,154,766	75,408,806
23	2036		1,330,410	1,330,410	51,044,752		2,154,766	2,154,766	76,567,128
24	2037		1,330,410	1,330,410	51,816,966		2,154,766	2,154,766	77,725,449
25	2038		1,330,410	1,330,410	52,589,181		2,154,766	2,154,766	78,883,771
26	2039		1,330,410	1,330,410	53,361,395		2,154,766	2,154,766	80,042,093
27	2040		1,330,410	1,330,410	54,133,610		2,154,766	2,154,766	81,200,414
28	2041		1,330,410	1,330,410	54,905,824		2,154,766	2,154,766	82,358,736
29	2042		1,330,410	1,330,410	55,678,038		2,154,766	2,154,766	83,517,058
30	2043		1,330,410	1,330,410	56,450,253		2,154,766	2,154,766	84,675,379
Total				200,595,171	1,260,605,997			323,582,259	1,890,908,996

Source: JICA Study Team

CHAPTER 3 SALINE INTRUSION PREVENTION SLUICE GATE CONSTRUCTION PROJECT

3.1 FARM BUDGET

Table 3.1.1 Farm Budget: Winter-Spring Paddy

Winter- Spring Paddy (per ha)	Financial Price			Economic Price			CF
	Unit Price VND/kg	Quantity kg/ha	Total value (VND)	Unit Price VND/kg	Quantity kg/ha	Total value (VND)	
(A) Income	6,398	4,792	30,659,216	7,217	4,792	34,583,596	1.128
Gross Income			30,659,216			34,583,596	
(B) Production Cost							
1. Land Preparation			1,632,265			1,469,039	0.9
2. Seedling			964,285			867,857	0.9
3. Input							
Urea			1,793,966			1,704,268	0.95
Compound			591,379			532,241	0.9
Compost			699,138			629,224	0.9
Pesticide			280,172			252,155	0.9
Herbicide			192,157			172,941	0.9
Fertilizer			165,097			156,842	0.95
4. Labor			12,492,315			9,993,852	0.8
5. Others			187,422			154,280	0.9
Sub total			18,998,196			15,932,698	
(C) Net Income			11,661,020			18,650,897	

Source: JICA Study Team

Table 3.1.2 Farm Budget: Fruit

Fruit (per ha)	Financial Price			Economic Price			CF
	Unit Price VND/kg	Quantity kg/ha	Total value (VND)	Unit Price VND/kg	Quantity kg/ha	Total value (VND)	
(A) Income	21,141	6,650	140,587,650	22,346	6,650	148,601,146	1.057
Gross Income			140,587,650			148,601,146	
(B) Production Cost			32,294,363			29,064,927	0.9
Depreciation Cost			13,858,191			13,858,191	1.0
Others							
Sub total			46,152,554			42,923,118	
(C) Net Income			94,435,096			105,678,028	

Source: JICA Study Team

Table 3.1.3 Farm Budget: Shrimp

Shrimp (per ha)	Financial Price			Economic Price			CF
	Unit Price VND/kg	Quantity kg/ha	Total value (VND)	Unit Price VND/kg	Quantity kg/ha	Total value (VND)	
(A) Income	158,000	409	64,622,000	158,000	409	64,622,000	1.0
Gross Income			64,622,000			64,622,000	
(B) Production Cost							
1. Baby/egg			5,761,170			5,185,053	0.9
2. Medicine			4,894,149			4,404,734	0.9
3. Food			10,329,255			9,296,330	0.9
4. CaCO3			818,085			736,277	0.9
5. Labor			1,525,000			1,220,000	0.8
6. Fertilizer			815,426			774,655	0.95
7. Others			5,869,681			5,282,713	0.9
Sub total			30,012,766			26,899,761	
(C) Net Income			34,609,234			37,722,239	

Source: JICA Study Team

3.2 LIST OF PROPOSED GATES

Table 3.2.1 List of Proposed Gates

No	Name	Province	Investment Stage	Gate Width (m)	Investment Year	Total Target Area (ha)	Paddy (ha)	Fruit (ha)	Shrimp (ha)	Financial Price Cost (VND billion)	Economic Price Cost (VND billion)	EIRR
1	Sau Au	Tien Giang	A	20	2019	3,133	2,037	1,097	-	229	164	26%
2	An Hoa	Ben Tre	A	130	2016	2,167	433	1,733	-	229	164	4%
3	Ben Ro	Ben Tre	A	20	2018	1,700	340	1,360	-	153	109	4%
4	Ben Tre	Ben Tre	A	70	2016	2,667	533	2,133	-	153	109	10%
5	Dinh Trung	Ben Tre	A	40	2013	3,333	667	2,667	-	146	104	22%
6	Huong Diem	Ben Tre	A	20	2013	1,500	300	1,200	-	229	164	23%
7	Mo Cay Bac	Ben Tre	A	50	2016	4,167	833	3,333	-	153	109	17%
8	Mo Cay Nam	Ben Tre	A	40	2015	2,667	533	2,133	-	146	104	20%
9	Son Doc 2	Ben Tre	A	60	2013	2,267	453	1,813	-	229	164	11%
10	Tan Phu	Ben Tre	A	20	2018	1,500	300	1,200	-	153	109	33%
11	Thu Cuu	Ben Tre	A	60	2015	3,333	667	2,667	-	829	708	16%
12	Bong Bot	Tra Vinh	A	60	2014	2,467	1,727	740	-	92	76	15%
13	Mang Thit 1	Tra Vinh	A	80	2018	4,633	3,243	1,390	-	534	465	10%
14	Tân Dinh	Tra Vinh	A	20	2016	2,617	1,832	785	-	239	171	14%
15	Vung Liem	Tra Vinh	A	60	2017	2,617	1,832	785	-	318	228	11%
16	Rach Đai An	Soc Trang	A	20	2014	2,033	2,033	-	-	796	570	6%
17	Rach Vop	Soc Trang	A	20	2015	1,767	1,767	-	-	153	109	5%
18	So 1	Soc Trang	A	20	2014	3,200	3,200	-	-	318	228	11%
19	Cau Sao	Tien Giang	B	20	2029	2,233	1,452	782	-	318	228	20%
20	Nguyen Tan Thanh	Tien Giang	B	30	2029	2,533	1,647	887	-	431	309	17%
21	Dong Cao	Tra Vinh	B	30	2022	1,217	852	365	-	318	228	8%
22	Khau Lau	Tra Vinh	B	30	2021	1,400	980	420	-	637	456	10%
23	Lang Nuoc	Tra Vinh	B	60	2024	1,800	1,260	540	-	498	356	5%
24	Mang Thit 2	Tra Vinh	B	80	2028	4,700	3,290	1,410	-	85	72	11%
25	Phuoc Thien	Tra Vinh	B	20	2023	867	607	260	-	518	371	9%
26	Rach Co	Tra Vinh	B	20	2025	733	513	220	-	239	171	8%
27	Rach Doi	Soc Trang	B	20	2026	1,767	1,767	-	-	196	166	6%
28	Rach Trang 2	Soc Trang	B	20	2026	2,500	2,500	-	-	229	164	10%
29	Bong ket	Ca Mau	B	30	2027	1,867	-	-	1,867	229	164	8%
30	Cai Bat 2	Ca Mau	B	20	2022	3,167	-	-	3,167	498	356	22%
31	Cai Be	Ca Mau	B	60	2024	4,767	-	-	4,767	663	475	10%
32	Cai Doi Nho	Ca Mau	B	30	2021	4,033	-	-	4,033	690	494	18%
33	Cong Nghiep	Ca Mau	B	40	2021	5,200	-	-	5,200	229	164	17%
34	Kenh Dung	Ca Mau	B	60	2024	3,967	-	-	3,967	153	109	8%
35	Nam Can	Ca Mau	B	20	2023	3,600	-	-	3,600	498	356	24%
36	Ong Nam	Ca Mau	B	20	2026	2,200	-	-	2,200	153	109	15%
37	Rach Ba Quan 1	Ca Mau	B	20	2022	1,300	-	-	1,300	237	201	9%
38	Tam Giang	Ca Mau	B	20	2023	2,400	-	-	2,400	314	268	17%
39	Tan Phuoc	Ca Mau	B	20	2028	2,200	-	-	2,200	153	109	15%
40	Thuan Hoa	Ca Mau	B	20	2026	2,200	-	-	2,200	153	109	15%
41	An Hoa	Kien Giang	B	30	2026	1,833	1,742	92	-	153	109	4%
42	Kenh Nhanh	Kien Giang	B	40	2025	2,500	2,375	125	-	153	109	3%
43	Rach Soi	Kien Giang	B	60	2027	2,500	2,375	125	-	153	109	0%
44	Song Kien	Kien Giang	B	40	2025	2,500	2,375	125	-	175	125	3%
45	Mu U	Tien Giang	C	20	2039	2,233	1,452	782	-	104	75	21%
46	Rau Ram	Tien Giang	C	20	2038	2,233	1,452	782	-	175	125	20%
47	Cong Be	Ben Tre	C	30	2031	1,800	360	1,440	-	104	75	24%
48	Eo Loi	Ben Tre	C	100	2033	1,767	353	1,413	-	209	150	7%
49	Khau Bang	Ben Tre	C	40	2032	1,000	200	800	-	139	100	10%
50	Khem Thuyen	Ben Tre	C	40	2032	1,667	333	1,333	-	438	313	17%
51	Rach Ot	Ben Tre	C	80	2034	2,833	567	2,267	-	219	157	14%
52	Vung Luong	Ben Tre	C	30	2031	1,667	333	1,333	-	292	209	22%
53	Nguyen Van Pho	Tra Vinh	C	30	2034	2,467	1,727	740	-	438	313	20%
54	Quan Chanh Bo	Tra Vinh	C	60	2033	2,317	1,622	695	-	139	100	8%
55	3/40	Bac Lieu	C	24	2035	2,200	-	-	2,200	139	100	12%
56	Cai Cung	Bac Lieu	C	15	2036	3,067	-	-	3,067	139	100	27%
57	Chua Phat	Bac Lieu	C	24	2037	2,533	-	-	2,533	139	100	14%
58	Huyen Ke	Bac Lieu	C	15	2038	2,567	-	-	2,567	139	100	23%
59	Ta Xang	Kien Giang	C	40	2036	2,500	2,375	125	-	139	100	4%
60	Tam Ban	Kien Giang	C	40	2035	2,500	2,375	125	-	219	157	4%
61	Xeo Ro	Kien Giang	C	60	2037	2,600	2,470	130	-	552	396	1%
62	Bang Lang	Tien Giang	D	30	2043	4,833	3,142	1,692	-	3,625	2,597	29%
63	Ba Rai	Tien Giang	D	30	2041	3,000	1,950	1,050	-	305	219	19%
64	Cai Be	Tien Giang	D	20	2042	3,500	2,275	1,225	-	478	342	30%
65	Tra Lot	Tien Giang	D	30	2042	2,233	1,452	782	-	305	219	14%
66	Tra Tan	Tien Giang	D	20	2041	3,667	2,383	1,283	-	305	219	32%
67	Cai Be	Kien Giang	D	64	2045	7,733	7,347	387	-	305	219	10%
68	Cai Lon	Kien Giang	D	390	2046	29,333	27,867	1,467	-	478	342	3%
	Total					206,000	108,497	50,237	47,267	22,688	16,571	

Source: JICA Study Team

3.3 DIBURSEMENT OF THE PROJECT COST

Table 3.3.1 Disbursement of the Cost: Stage A

(VND million)

No	Name	Province	Investment Stage	2013	2014	2015	2016	2017	2018	2019	2020	Total
1	Sau Au	Tien Giang	A						14,697	56,332	33,449	104,478
2	An Hoa	Ben Tre	A				25,523	226,130	295,634	160,810		708,097
3	Ben Ro	Ben Tre	A						4,338	46,488	25,619	76,445
4	Ben Tre	Ben Tre	A			12,785	150,040	196,157	105,733			464,715
5	Dinh Trung	Ben Tre	A	32,087	122,980	73,015						228,082
6	Huong Diem	Ben Tre	A		15,372	58,917	34,987					109,276
7	Mo Cay Bac	Ben Tre	A					43,470	166,616	98,924		309,011
8	Mo Cay Nam	Ben Tre	A		32,087	122,980	73,015					228,082
9	Son Doc 2	Ben Tre	A	50,151	192,208	114,126						356,484
10	Tan Phu	Ben Tre	A		3,140	44,726	24,406					72,273
11	Thu Cuu	Ben Tre	A			52,167	199,945	118,720				370,832
12	Bong Bot	Tra Vinh	A	7,350	102,642	56,035						166,027
13	Mang Thit 1	Tra Vinh	A					63,785	133,754	173,415	104,355	475,309
14	Tân Dinh	Tra Vinh	A			8,960	124,248	67,841				201,050
15	Vung Liem	Tra Vinh	A						11,002	166,132	90,453	267,587
16	Rach Đai An	Soc Trang	A	15,372	58,917	34,987						109,276
17	Rach Vop	Soc Trang	A	0	15,372	58,917	34,987					109,276
18	So 1	Soc Trang	A	15,372	58,917	34,987						109,276
		Stage A: Total		120,332	601,636	672,600	667,152	716,103	731,774	702,101	253,875	4,465,574

Source: JICA Study Team

Table 3.3.2 Disbursement of the Cost: Stage B

				2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
19	Cau Sao	Tien Giang	B								15,372	58,917	34,987	109,276
20	Nguyen Tan Thanh	Tien Giang	B								23,054	88,366	52,470	163,890
21	Dong Cao	Tra Vinh	B	23,054	88,366	52,470								163,890
22	Khau Lau	Tra Vinh	B	23,054	88,366	52,470								163,890
23	Lang Nuoc	Tra Vinh	B			50,151	192,208	114,126						356,484
24	Mang Thit 2	Tra Vinh	B							66,351	139,135	180,393	108,548	494,426
25	Phuoc Thien	Tra Vinh	B		15,372	58,917	34,987							109,276
26	Rach Co	Tra Vinh	B					15,372	58,917	34,987				109,276
27	Rach Doi	Soc Trang	B					15,372	58,917	34,987				109,276
28	Rach Trang 2	Soc Trang	B						15,372	58,917	34,987			109,276
29	Bong ket	Ca Mau	B						21,038	80,635	47,879			149,552
30	Cai Bat 2	Ca Mau	B	14,025	53,756	31,917								99,698
31	Cai Be	Ca Mau	B				44,094	169,000	100,348					313,442
32	Cai Doi Nho	Ca Mau	B	22,046	84,501	50,175								156,721
33	Cong Nghiep	Ca Mau	B	29,398	112,668	66,899								208,965
34	Kenh Dung	Ca Mau	B			44,094	169,000	100,348						313,442
35	Nam Can	Ca Mau	B		14,025	53,756	31,917							99,698
36	Ong Nam	Ca Mau	B				14,025	53,756	31,917					99,698
37	Rach Ba Quan 1	Ca Mau	B	14,025	53,756	31,917								99,698
38	Tam Giang	Ca Mau	B		14,025	53,756	31,917							99,698
39	Tan Phuoc	Ca Mau	B							14,025	53,756	31,917		99,698
40	Thuan Hoa	Ca Mau	B					14,025	53,756	31,917				99,698
41	An Hoa	Kien Giang	B					22,046	84,501	50,175				156,721
42	Kenh Nhanh	Kien Giang	B						30,742	117,824	69,957			218,523
43	Rach Soi	Kien Giang	B						48,130	184,473	109,534			342,137
44	Song Kien	Kien Giang	B				30,742	117,824	69,957					218,523
		Stage B: Total		125,603	524,837	546,521	548,890	621,870	573,595	674,289	493,675	359,592	196,004	4,664,876

Source: JICA Study Team

Table 3.3.3 Disbursement of the Cost: Stage C

				2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Total
45	Mu U	Tien Giang	C								14,697	56,332	33,449	104,478
46	Rau Ram	Tien Giang	C							15,372	58,917	34,987		109,276
47	Cong Be	Ben Tre	C		24,062	92,232	54,765							171,059
48	Eo Loi	Ben Tre	C			76,524	160,463	208,044	125,188					570,219
49	Khau Bang	Ben Tre	C	32,087	122,980	73,015								228,082
50	Khem Thuyen	Ben Tre	C		32,087	122,980	73,015							228,082
51	Rach Ot	Ben Tre	C				61,218	128,369	166,434	100,152				456,173
52	Vung Luong	Ben Tre	C	24,062	92,232	54,765								171,059
53	Nguyen Van Pho	Tra Vinh	C			23,054	88,366	52,470						163,890
54	Quan Chanh Bo	Tra Vinh	C		50,151	192,208	114,126							356,484
55	3/40	Bac Lieu	C				17,640	67,601	40,137					125,378
56	Cai Cung	Bac Lieu	C					10,519	40,318	23,940				74,778
57	Chua Phat	Bac Lieu	C						17,640	67,601	40,137			125,378
58	Huyen Ke	Bac Lieu	C							10,519	40,318	23,940		74,778
59	Ta Xang	Kien Giang	C					30,742	117,824	69,957				218,523
60	Tam Ban	Kien Giang	C				30,742	117,824	69,957					218,523
61	Xeo Ro	Kien Giang	C						48,130	184,473	109,534			342,137
		Stage C: Total		56,149	321,512	634,778	600,335	615,569	625,629	472,015	263,602	115,259	33,449	3,738,296

Source: JICA Study Team

Table 3.3.4 Disbursement of the Cost: Stage D

				2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Total
62	Bang Lang	Tien Giang	D			23,054	88,366	52,470						163,890
63	Ba Rai	Tien Giang	D	23,054	88,366	52,470								163,890
64	Cai Be	Tien Giang	D		15,372	58,917	34,987							109,276
65	Tra Lot	Tien Giang	D			23,054	88,366	52,470						163,890
66	Tra Tan	Tien Giang	D	15,372	58,917	34,987								109,276
67	Cai Be	Kien Giang	D				53,080	111,308	144,314	86,837				395,539
68	Cai Lon	Kien Giang	D					325,238	601,130	601,130	484,376	477,934	107,036	2,596,844
		Stage D: Total		38,426	162,656	192,481	264,799	541,485	745,444	687,967	484,376	477,934	107,036	3,702,605

Source: JICA Study Team

3.4 PROJECT COSTAND BENEFIT

Table 3.4.1 Project Cost and Benet for the Whole Project

EIRR= 16.8%

	Year	Cost ('000VND)	Benefit ('000VND)	Benefit -Cost ('000VND)
1	2013	120,332,003	0	-120,332,003
2	2014	601,635,920	0	-601,635,920
3	2015	672,600,420	0	-672,600,420
4	2016	673,984,258	148,680,290	-525,303,968
5	2017	726,569,408	264,881,298	-461,688,110
6	2018	746,401,720	363,612,211	-382,789,509
7	2019	720,506,004	423,685,957	-296,820,047
8	2020	280,084,392	560,155,198	280,070,806
9	2021	158,555,100	726,102,652	567,547,552
10	2022	557,789,922	741,046,103	183,256,181
11	2023	579,473,338	755,989,553	176,516,216
12	2024	587,944,529	918,688,840	330,744,311
13	2025	663,033,706	995,570,304	332,536,598
14	2026	619,336,978	1,067,758,998	448,422,019
15	2027	724,347,573	1,155,716,649	431,369,075
16	2028	546,979,132	1,218,497,640	671,518,509
17	2029	418,497,132	1,289,603,752	871,106,620
18	2030	255,590,372	1,324,408,402	1,068,818,030
19	2031	120,980,589	1,457,357,954	1,336,377,364
20	2032	386,343,574	1,471,579,813	1,085,236,238
21	2033	699,609,990	1,485,801,671	786,191,682
22	2034	667,894,554	1,570,475,904	902,581,350
23	2035	688,292,500	1,712,734,711	1,024,442,210
24	2036	699,472,536	1,766,729,587	1,067,257,051
25	2037	552,105,454	1,865,058,784	1,312,953,330
26	2038	348,815,077	2,001,618,983	1,652,803,906
27	2039	203,666,872	2,056,795,680	1,853,128,808
28	2040	123,114,127	2,123,926,125	2,000,811,998
29	2041	128,805,710	2,169,690,952	2,040,885,242
30	2042	253,035,093	2,189,043,101	1,936,008,008
31	2043	282,860,605	2,208,395,250	1,925,534,645
32	2044	357,045,329	2,307,764,883	1,950,719,554
33	2045	634,478,330	2,369,573,672	1,735,095,343
34	2046	840,677,251	2,474,813,860	1,634,136,608
35	2047	783,199,930	2,494,924,491	1,711,724,562
36	2048	582,312,360	2,561,832,569	1,979,520,209
37	2049	575,869,987	2,582,239,049	2,006,369,062
38	2050	204,972,090	2,602,645,530	2,397,673,440
39	2051	115,683,096	2,815,787,380	2,700,104,284
40	2052	115,683,096	2,849,177,306	2,733,494,210
41	2053	115,683,096	2,882,567,231	2,766,884,135
42	2054	115,683,096	2,915,957,157	2,800,274,061
43	2055	115,683,096	2,949,347,083	2,833,663,987
44	2056	115,683,096	2,982,737,009	2,867,053,913
45	2057	115,683,096	3,016,126,935	2,900,443,839
46	2058	115,683,096	3,049,516,860	2,933,833,764
47	2059	115,683,096	3,082,906,786	2,967,223,690
48	2060	115,683,096	3,116,296,712	3,000,613,616
49	2061	115,683,096	3,149,686,638	3,034,003,542
50	2062	115,683,096	3,183,076,564	3,067,393,468
51	2063	115,683,096	3,216,466,489	3,100,783,393
52	2064	115,683,096	3,249,856,415	3,134,173,319
53	2065	115,683,096	3,283,246,341	3,167,563,245
54	2066	115,683,096	3,316,636,267	3,200,953,171
55	2067	115,683,096	3,350,026,192	3,234,343,096
56	2068	115,683,096	3,383,416,118	3,267,733,022
57	2069	115,683,096	3,416,806,044	3,301,122,948
58	2070	115,683,096	3,450,195,970	3,334,512,874
59	2071	115,683,096	3,483,585,896	3,367,902,800
60	2072	115,683,096	3,516,975,821	3,401,292,725
61	2073	115,683,096	3,550,365,747	3,434,682,651
62	2074	115,683,096	3,583,755,673	3,468,072,577
63	2075	115,683,096	3,617,145,599	3,501,462,503
64	2076	115,683,096	3,650,535,525	3,534,852,429
65	2077	115,683,096	3,683,925,450	3,568,242,354
66	2078	115,683,096	3,717,315,376	3,601,632,280
67	2079	115,683,096	3,750,705,302	3,635,022,206
68	2080	115,683,096	3,784,095,228	3,668,412,132
	Total	22,257,706,743	152,425,639,530	130,167,932,787

Source: JICA Study Team

Table 3.4.2 Project Cost and Benefit for Investment Stage A

EIRR= 18.6%

Year		Cost ('000VND)	Benefit ('000VND)	Benefit -Cost ('000VND)
		Total	Total	
1	2013	120,332,003	0	-120,332,003
2	2014	601,635,920	0	-601,635,920
3	2015	672,600,420	0	-672,600,420
4	2016	673,984,258	148,680,290	-525,303,968
5	2017	726,569,408	264,881,298	-461,688,110
6	2018	746,401,720	363,612,211	-382,789,509
7	2019	720,506,004	423,685,957	-296,820,047
8	2020	280,084,392	560,155,198	280,070,806
9	2021	32,952,460	726,102,652	693,150,192
10	2022	32,952,460	741,046,103	708,093,643
11	2023	32,952,460	755,989,553	723,037,093
12	2024	32,952,460	770,933,004	737,980,544
13	2025	32,952,460	785,876,455	752,923,995
14	2026	32,952,460	800,819,905	767,867,445
15	2027	32,952,460	815,763,356	782,810,896
16	2028	32,952,460	830,706,807	797,754,347
17	2029	32,952,460	845,650,257	812,697,797
18	2030	32,952,460	860,593,708	827,641,248
19	2031	32,952,460	871,645,225	838,692,765
20	2032	32,952,460	882,696,743	849,744,283
21	2033	32,952,460	893,748,260	860,795,800
22	2034	32,952,460	904,799,777	871,847,317
23	2035	32,952,460	915,851,295	882,898,835
24	2036	32,952,460	926,902,812	893,950,352
25	2037	32,952,460	937,954,329	905,001,869
26	2038	32,952,460	949,005,847	916,053,387
27	2039	32,952,460	960,057,364	927,104,904
28	2040	32,952,460	971,108,881	938,156,421
29	2041	32,952,460	982,160,399	949,207,939
30	2042	32,952,460	993,211,916	960,259,456
Total		5,267,068,245	20,883,639,603	15,616,571,358

Source: JICA Study Team

Table 3.4.3 Project Cost and Benefit for Investment Stage B

EIRR= 13.5%

Year		Cost ('000VND)	Benefit ('000VND)	Benefit -Cost ('000VND)
		Total	Total	
1	2021	125,602,640	0	-125,602,640
2	2022	524,837,462	0	-524,837,462
3	2023	546,520,878	0	-546,520,878
4	2024	554,992,069	147,755,836	-407,236,233
5	2025	630,081,246	209,693,849	-420,387,396
6	2026	586,384,518	266,939,092	-319,445,426
7	2027	691,395,113	339,953,293	-351,441,821
8	2028	514,026,672	387,790,834	-126,235,838
9	2029	385,544,672	443,953,495	58,408,823
10	2030	222,637,912	463,814,694	241,176,782
11	2031	31,879,340	585,712,728	553,833,388
12	2032	31,879,340	588,883,070	557,003,730
13	2033	31,879,340	592,053,411	560,174,071
14	2034	31,879,340	595,223,753	563,344,413
15	2035	31,879,340	598,394,094	566,514,754
16	2036	31,879,340	601,564,436	569,685,096
17	2037	31,879,340	604,734,777	572,855,437
18	2038	31,879,340	607,905,119	576,025,779
19	2039	31,879,340	611,075,460	579,196,120
20	2040	31,879,340	614,245,802	582,366,462
21	2041	31,879,340	617,416,144	585,536,804
22	2042	31,879,340	620,586,485	588,707,145
23	2043	31,879,340	623,756,827	591,877,487
24	2044	31,879,340	626,927,168	595,047,828
25	2045	31,879,340	630,097,510	598,218,170
26	2046	31,879,340	633,267,851	601,388,511
27	2047	31,879,340	636,438,193	604,558,853
28	2048	31,879,340	639,608,534	607,729,194
29	2049	31,879,340	642,778,876	610,899,536
30	2050	31,879,340	645,949,217	614,069,877
Total		5,419,609,980	14,219,070,863	9,156,910,568

Source: JICA Study Team

Table 3.4.4 Project Cost and Benefit for Investment Stage C

EIRR= 14.9%

Year		Cost ('000VND)	Benefit ('000VND)	Benefit -Cost ('000VND)
		Total	Total	
1	2031	56,148,789	0	-56,148,789
2	2032	321,511,774	0	-321,511,774
3	2033	634,778,190	0	-634,778,190
4	2034	603,062,754	70,452,374	-532,610,380
5	2035	623,460,700	198,489,322	-424,971,379
6	2036	634,640,736	238,262,339	-396,378,397
7	2037	487,273,654	322,369,677	-164,903,977
8	2038	283,983,277	444,708,017	160,724,740
9	2039	138,835,072	485,662,855	346,827,783
10	2040	58,282,327	538,571,441	480,289,114
11	2041	25,547,628	570,114,410	544,566,782
12	2042	25,547,628	575,244,700	549,697,072
13	2043	25,547,628	580,374,990	554,827,362
14	2044	25,547,628	585,505,280	559,957,652
15	2045	25,547,628	590,635,570	565,087,942
16	2046	25,547,628	595,765,860	570,218,232
17	2047	25,547,628	600,896,150	575,348,522
18	2048	25,547,628	606,026,440	580,478,812
19	2049	25,547,628	611,156,730	585,609,102
20	2050	25,547,628	616,287,019	590,739,391
21	2051	25,547,628	624,410,102	598,862,474
22	2052	25,547,628	632,533,185	606,985,557
23	2053	25,547,628	640,656,267	615,108,639
24	2054	25,547,628	648,779,350	623,231,722
25	2055	25,547,628	656,902,433	631,354,805
26	2056	25,547,628	665,025,515	639,477,887
27	2057	25,547,628	673,148,598	647,600,970
28	2058	25,547,628	681,271,681	655,724,053
29	2059	25,547,628	689,394,763	663,847,135
30	2060	25,547,628	697,517,846	671,970,218
Total		4,352,929,834	14,571,221,216	10,487,233,078

Source: JICA Study Team

Table 3.4.5 Project Cost and Benefit for Investment Stage D

EIRR= 11.6%

Year		Cost ('000VND)	Benefit ('000VND)	Benefit -Cost ('000VND)
		Total	Total	
1	2031	38,426,282	0	-38,426,282
2	2032	162,655,665	0	-162,655,665
3	2033	192,481,177	0	-192,481,177
4	2034	266,665,901	80,017,484	-186,648,416
5	2035	544,098,902	122,474,125	-421,624,777
6	2036	750,297,823	208,362,163	-541,935,660
7	2037	692,820,502	209,120,646	-483,699,855
8	2038	491,932,932	256,676,575	-235,256,357
9	2039	485,490,559	257,730,907	-227,759,652
10	2040	114,592,662	258,785,239	144,192,577
11	2041	25,303,668	443,314,548	418,010,880
12	2042	25,303,668	448,091,934	422,788,266
13	2043	25,303,668	452,869,320	427,565,652
14	2044	25,303,668	457,646,706	432,343,038
15	2045	25,303,668	462,424,092	437,120,424
16	2046	25,303,668	467,201,478	441,897,810
17	2047	25,303,668	471,978,864	446,675,196
18	2048	25,303,668	476,756,250	451,452,582
19	2049	25,303,668	481,533,636	456,229,968
20	2050	25,303,668	486,311,022	461,007,354
21	2051	25,303,668	491,088,408	465,784,740
22	2052	25,303,668	495,865,794	470,562,126
23	2053	25,303,668	500,643,179	475,339,511
24	2054	25,303,668	505,420,565	480,116,897
25	2055	25,303,668	510,197,951	484,894,283
26	2056	25,303,668	514,975,337	489,671,669
27	2057	25,303,668	519,752,723	494,449,055
28	2058	25,303,668	524,530,109	499,226,441
29	2059	25,303,668	529,307,495	504,003,827
30	2060	25,303,668	534,084,881	508,781,213
Total		4,245,535,764	10,964,669,822	6,921,625,668

Source: JICA Study Team

CHAPTER 4 TREND OF YIELD

Table 4.1.1 Trend of Yield

	Tien Giang		Ben Tre		Tra Vinh		Soc Trang		Kien Giang	
Year	Rice	Fruit	Rice	Fruit	Rice	Fruit	Rice	Fruit	Rice	Fruit
2012	4,792	6,650	4,792	6,650	4,792	6,650	4,792	6,650	4,792	6,650
2013	4,787	6,639	4,773	6,624	4,782	6,627	4,787	6,643	4,792	6,650
2014	4,782	6,628	4,754	6,597	4,771	6,605	4,783	6,636	4,792	6,650
2015	4,776	6,618	4,734	6,571	4,761	6,582	4,778	6,630	4,792	6,649
2016	4,771	6,607	4,715	6,545	4,750	6,559	4,773	6,623	4,792	6,649
2017	4,766	6,596	4,696	6,518	4,740	6,537	4,769	6,616	4,792	6,649
2018	4,761	6,585	4,677	6,492	4,729	6,514	4,764	6,609	4,792	6,649
2019	4,755	6,574	4,658	6,466	4,719	6,491	4,759	6,602	4,792	6,648
2020	4,750	6,564	4,639	6,439	4,708	6,469	4,755	6,596	4,792	6,648
2021	4,745	6,553	4,619	6,413	4,698	6,446	4,750	6,589	4,792	6,648
2022	4,740	6,542	4,600	6,386	4,687	6,423	4,745	6,582	4,792	6,648
2023	4,734	6,531	4,581	6,360	4,677	6,400	4,741	6,575	4,792	6,647
2024	4,729	6,520	4,562	6,334	4,666	6,378	4,736	6,568	4,792	6,647
2025	4,724	6,510	4,543	6,307	4,656	6,355	4,732	6,561	4,792	6,647
2026	4,719	6,499	4,523	6,281	4,645	6,332	4,727	6,555	4,792	6,647
2027	4,713	6,488	4,504	6,255	4,635	6,310	4,722	6,548	4,792	6,646
2028	4,708	6,477	4,485	6,228	4,624	6,287	4,718	6,541	4,792	6,646
2029	4,703	6,466	4,466	6,202	4,614	6,264	4,713	6,534	4,792	6,646
2030	4,698	6,456	4,447	6,176	4,603	6,242	4,708	6,527	4,792	6,646
2031	4,695	6,451	4,433	6,158	4,591	6,217	4,703	6,521	4,788	6,639
2032	4,693	6,447	4,420	6,141	4,579	6,192	4,699	6,514	4,783	6,632
2033	4,690	6,443	4,406	6,123	4,567	6,167	4,694	6,507	4,779	6,625
2034	4,688	6,439	4,393	6,106	4,555	6,142	4,689	6,500	4,774	6,618
2035	4,685	6,435	4,379	6,089	4,542	6,117	4,684	6,493	4,770	6,611
2036	4,683	6,431	4,365	6,071	4,530	6,092	4,679	6,486	4,765	6,604
2037	4,680	6,427	4,352	6,054	4,518	6,067	4,674	6,479	4,761	6,597
2038	4,678	6,422	4,338	6,036	4,506	6,042	4,669	6,473	4,756	6,590
2039	4,675	6,418	4,325	6,019	4,494	6,017	4,665	6,466	4,752	6,583
2040	4,673	6,414	4,311	6,002	4,481	5,992	4,660	6,459	4,748	6,576
2041	4,670	6,410	4,298	5,984	4,469	5,967	4,655	6,452	4,743	6,569
2042	4,668	6,406	4,284	5,967	4,457	5,942	4,650	6,445	4,739	6,562
2043	4,665	6,402	4,271	5,950	4,445	5,917	4,645	6,438	4,734	6,555
2044	4,663	6,398	4,257	5,932	4,433	5,892	4,640	6,431	4,730	6,548
2045	4,660	6,394	4,244	5,915	4,420	5,867	4,636	6,425	4,725	6,541
2046	4,658	6,389	4,230	5,897	4,408	5,842	4,631	6,418	4,721	6,534
2047	4,656	6,385	4,216	5,880	4,396	5,817	4,626	6,411	4,716	6,527
2048	4,653	6,381	4,203	5,863	4,384	5,792	4,621	6,404	4,712	6,520
2049	4,651	6,377	4,189	5,845	4,372	5,767	4,616	6,397	4,708	6,513
2050	4,648	6,373	4,176	5,828	4,360	5,742	4,611	6,390	4,703	6,506

Source: JICA Study Team

APPENDIX-VIII

ENVIRONMENTAL AND SOCIAL CONSIDERATION

APPENDIX VIII: ENVIRONMENTAL AND SOCIAL CONSIDERATION

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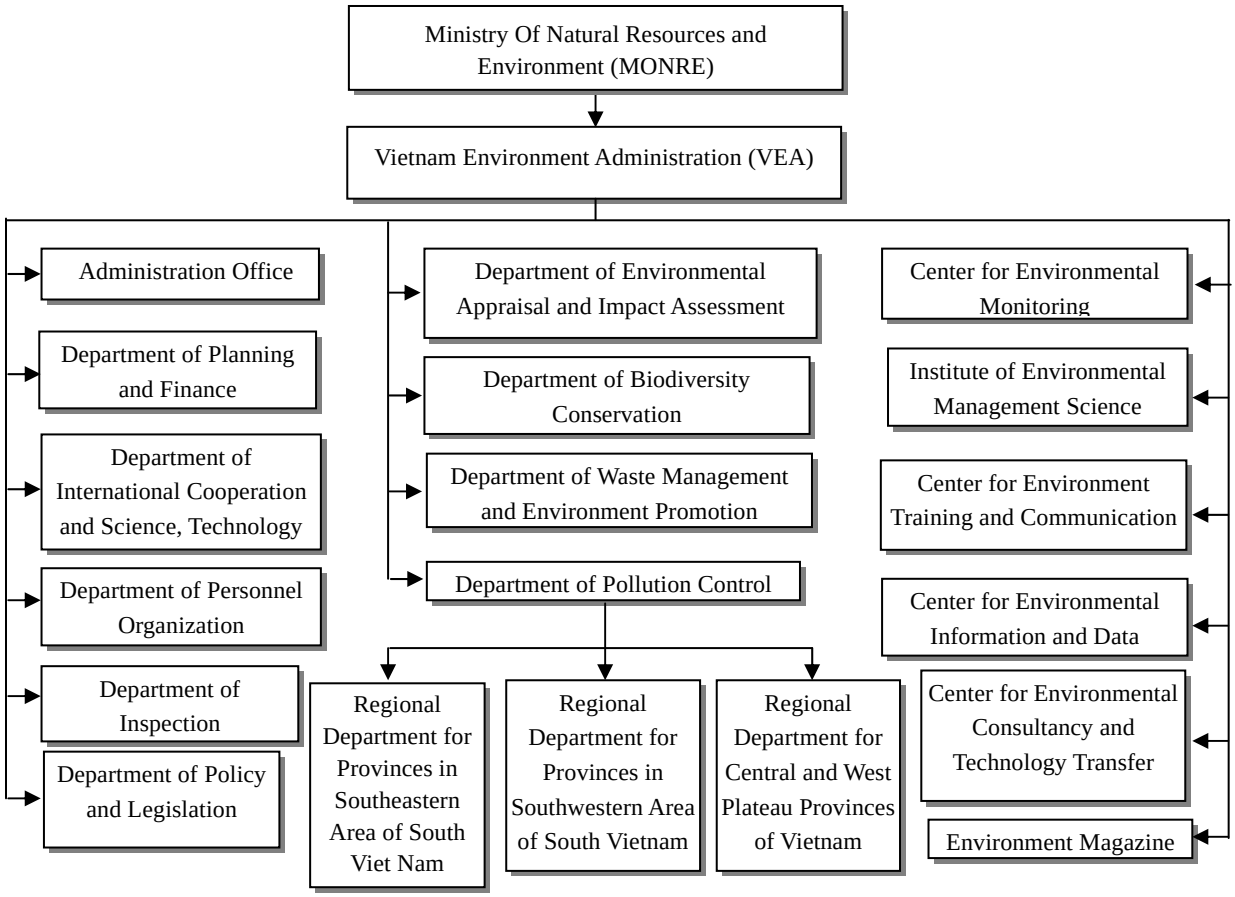
APPENDIX VIII ENVIRONMENTAL AND SOCIAL CONSIDERATION

As a result of remarkable development in the State, various environmental problems such as air pollution, water quality deterioration have been identified in these days. Given these circumstances, the Government has revised some environmental laws, regulations, standards so on. Especially, it is note worthy to introduce the concept of Strategic Environment Assessment (SEA) covering policy, plan and programme[1] in addition to conventional Environmental Impact Assessment (EIA) which covers project only. This Chapter VII presents the laws/standards regarding environmental conservation in Vietnam, SEA of the proposed development options, and Initial Environmental Examination (IEE) of the proposed priority projects.

CHAPTER 1 ENVIRONMENTAL LEGISLATIVE AND INSTITUTIONAL FRAMEWORK

1.1 Organizations Concerning Environmental Protection

The responsible organization for environmental protection in Vietnam is the Ministry of Natural Resources and Environment (MONRE). The ministry manages not only environmental protection but also research of natural resources development. Vietnam Environment Administration (VEA) is a subsidiary body under the MONRE to provide public services in compliance with the laws. VEA develops laws and regulations, policies, strategies, plans, national target plans, programs and projects on environment, controls environmental quality in urban, rural and natural areas. Moreover, it assesses and appraises SEA and EIA reports; providing guidance to examine, evaluate and appraise equipments.



[1] JICA Environmental Guideline (2012) stipulates that SEA covers policy, plan and programme level while SEA in Vietnam targets strategy, planning and plan according to the Law on Environmental Protection (2005).

Figure 1.1.1 Organization Chart of MONRE and VEA

Under the ministry, there is the Department of Natural Resources and Environment (DONRE) in each Province. The Departments are in charge of issuance of environmental license to factories, monitoring of air pollution, water quality and so on, controls exhaust gas, effluent from factories and waste, and revelation of violators.

1.2 Laws Concerning Environmental Protection

Basic principles regarding environmental protection in Vietnam is stipulated in Law on Environment Protection (2005). The law had been enforced since 1994 and it was revised in 2005. After that, some Decrees, Circulars to stipulate process of EIA/SEA based on the law have been established, in addition to that, compensation for resettlement, penalty against violator of laws, land recovery, resettlement and so on were established as shown below:

Table 1.2.1 Environmental Laws, Decrees and Circulars

No	Name of Law/Decree/Circular	Contents
1	Law on Environment Protection No.52/2005/QH11	This Law provides activities of environmental protection; policies, measures and resources for environmental protection. Also, it mentions and details EIA and SEA.
2	Decree No.80/2006/ND-CP	This Decree provides implementation of Environment Protection Law regarding environmental standards, SEA, EIA, disclosure of environmental data and so on.
3	Decree No.140/2006/ND-CP	This decree providing environmental protection at stages of elaboration, evaluation, approval and implementation of development strategies, plannings, plans, programs and projects
4	Decree No.80/2006 ND-CP	This decree provides penalty for violators against the Law on Environment Protection
5	Law on Forest Protection and Development No.29/2004/QH11	This Law provides management, protection, development and use of forests and owners rights.
6	Land Law 13/2003QH11	This Law regulates the administration and use of land.
7	Decree No. 197/2004/ND-CP Compensation, Support And Resettlement When Land Is Recovered by The State	This Decree provides compensation, support and resettlement when land is recovered by the State for defense and security purposes, for national interests, public interests and economic development purposes
8	Decree No. 84/2007/ND-CP	This decree stipulates procedures for compensation, assistance and resettlement when the state recovers land; and resolution of complaints about land.
9	Decree No.69/2009/ND-CP	This decree regulate additional planning of land use, land prices, land acquisition, compensation and resettlement assistance
10	Circular No.14/2009/TT-BTNMT	Land price is set by PPC and it is announced January 1st every year. It regulates detailed regulations on compensation, assistance and resettlement and procedures of land acquisition, land allocation and land lease.

1.3 National Standards for Environmental Protection

1) Environmental Regulations in Vietnam

In Vietnam, there are various national environmental standards to be complied covering, air pollution, water quality, noise, waste, and so on. They are called as national technical regulations as shown below. On top of that, contents of regulations for air pollution, water quality (irrigation, surface water, coastal water, water of for aquaculture protection) and noise are also attached, and parameters and limit values regarding in some major regulations concerned to the Project are described by comparison with international guidelines.

Table 1.3.1 National Environmental Regulations in Vietnam

No	Code Symbol	Name of Code	Promulgated
1	QCVN 01:2008/BNTMT	National technical regulation on the effluent of natural rubber processing industry	MONRE
2	QCVN 02:2008/BNTMT	National technical regulation on the emission of health care solid waste incinerators	MONRE

No	Code Symbol	Name of Code	Promulgated
3	QCVN 03:2008/BNTMT	National technical regulation on the allowable limits of heavy metals in the soils	MONRE
4	QCVN 09:2008/BTNMT	National technical regulation on underground water quality	MONRE
5	QCVN 10:2008/BTNMT	National technical regulation on coastal water quality	MONRE
6	QCVN 11:2008/BTNMT	National technical regulation on the effluent of aquatic products processing industry	MONRE
7	QCVN 12:2008/BTNMT	National technical regulation on the effluent of pulp and paper mills	MONRE
8	QCVN 13:2008/BTNMT	National technical regulation on the effluent of textile industry	MONRE
9	QCVN 14:2008/BTNMT	National technical regulation on domestic wastewater	MONRE
10	QCVN 15:2008/BTNMT	National technical regulation on the pesticide residues in the soils	MONRE
11	QCVN 01:2009/BYT	National technical regulation on drinking water quality	Ministry of Health
12	QCVN 02:2009/BYT	National technical regulation on domestic water quality	Ministry of Health
13	QCVN 05: 2009/BTNMT	National technical regulation on ambient air quality	MONRE
14	QCVN 06: 2009/BTNMT	National technical regulation on hazardous substances in ambient air	MONRE
15	QCVN 07: 2009/BTNMT	National Technical Regulation on Hazardous Waste Thresholds	MONRE
16	QCVN 19:2009/BTNMT	National Technical Regulation on Industrial Emission of Inorganic Substances and Dusts	MONRE
17	QCVN 20:2009/BTNMT	National Technical Regulation on Industrial Emission of Organic Substances	MONRE
18	QCVN 21:2009/BTNMT	National Technical Regulation on Emission of Chemical Fertilizer Manufacturing Industry	MONRE
19	QCVN 22:2009/BTNMT	National Technical Regulation on Emission of Thermal Power Industry	MONRE
20	QCVN 23:2009/BTNMT	National Technical Regulation on Emission of Cement Manufacturing Industry	MONRE
21	QCVN 25:2009/BTNMT	National Technical Regulation on Wastewater of the Solid Waste Landfill Sites	MONRE
22	QCVN 26:2010/BTNMT	National Technical Regulation on Noise	MONRE
23	QCVN 27:2010/BTNMT	National Technical Regulation on Vibration	MONRE
24	QCVN 28:2010/BTNMT	National Technical Regulation on Health Care Waste Water	MONRE
25	QCVN 29:2010/BTNMT	National Technical Regulation on the Effluent of Petroleum Terminal and Stations	MONRE
26	QCVN 34:2010/BTNMT	National technical Regulation on Emission of Refining and Petrochemical Industry of Inorganic Substances and Dusts	MONRE
27	QCVN 01:2011/BYT	National technical regulation on Hygienic conditions for Latrines	Ministry of Health
28	QCVN 38:2011/BTNMT	National Technical Regulation on Surface Water Quality for Protection of Aquatic Life	MONRE
29	QCVN 39:2011/BTNMT	National Technical Regulation on Water Quality for Irrigated Agriculture	MONRE
30	QCVN 40:2011/BTNMT	National Technical Regulation on Industrial Wastewater	MONRE

2) National Technical Regulation on Air Pollution

Compared with the values of international standard, Vietnamese regulation on air pollution's levels are almost same, some pollutants limitations such as ozone are higher than those of international ones, though.

Table 1.3.2 Regulation on Ambient Air Quality (QCVN05:2009/BTNMT)

Pollutants	Measurement Method	Standards (ppm)	Standards ($\mu g/Nm^3$)	International Guideline* ($\mu g/m^3$)
Sulfur Dioxide (SO_2)	1 hr 24 hrs 1 year	0.155 - -	350 125 50	- 125 (Interim target-1) (24hrs)** 50 (Interim target-2) (24hrs)** 20 (guideline) (24hr)
Carbon Monoxide (CO)	1 hr 8 hrs 24 hr	31 10 5.2	30,000 10,000 5,000	- - -
Nitrogen Oxide	1 hr	0.093	200	200

Pollutants	Measurement Method	Standards (ppm)	Standards ($\mu g/Nm^3$)	International Guideline* ($\mu g/m^3$)
(NO_x)	24 hrs 1 year	0.05 -	100 40	- 40
Ozone (O_3)	1 hr 8hrs 24hrs	- - -	180 120 80	- 100 -
Total Suspended Particles (TSP)	1 hr 24 hrs 1 year	300 200 140	0.3 (mg/m^3) 0.2 (mg/m^3) -	- - -
Lead (Pb)	24 hrs 1 year	- -	2 1	- -

*EHS (Environmental, Health and Safety) General Guideline (April 2007, IFC; International Finance Cooperation)/ WHO Guideline

** Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines (refer the Guideline mentioned above).

3) National Technical Regulation on Irrigation Water Quality

Regulation on irrigation water quality in Vietnam is shown in the following table. Vietnamese salinity standard is almost same level as international ones (FAO) under the restricted conditions.

Table 1.3.3 Regulation on Irrigation Water Quality (QCVN 39:2011/BTNMT)

Parameter	Limit value in Vietnam	International Guideline (FAO)*
pH	5.5-9.0	6.5-8.4
Dissolved Oxygen	2	-
Total Dissolved Solid	2,000mg/l	No restriction :<450 Restricted moderately: 450-2000
SAR	9	No restriction :<3 Restricted moderately: 3-9
Chloride (Cl^-)	350 mg/l	No restriction :<4meq/l (=158 mg/l) Restricted moderately:4 to 10meq/l (=395mg/l)
Sulfate (SO_4^{2-})	600 mg/l	-
Bo (B)	3mg/l	<3meq/l (=32.43mg/l)
Arsenic (As)	0.05mg/l	-
Cadmium (Cd)	0.01mg/l	-
Chromium (Cr)	0.1mg/l	-
Mercury (Hg)	0.001mg/l	-
Copper (Cu)	0.5mg/l	-
Lead (Pb)	0.05mg/l	-
Zinc (Zn)	2.0mg/l	-
E. Coli	100/100ml	-

*: FAO, 1994, Water Quality for Agriculture

4) National Technical Regulation on Coastal Water Quality

In case of coastal water quality, the Japanese standard for coastal water quality is applied for comparison. The Japanese standard is a little stricter than the Vietnamese one, however, Class B's limit value is almost same as one of "Aquaculture and aquatic conservation" in the Vietnamese standard.

Table 1.3.4 Regulation on Coastal Water Quality (QCVN 10: 2008/BTNMT)

	Parameter	Unit	Limit value in Vietnam			Japanese Standard*		
			Aquaculture and aquatic conservation	Beach and underwater sports	Others	Class A	Class B	Class C
1	Temperature	℃	30	30	-	-	-	-
2	pH		6.5-8.5	6.5-8.5	6.5-8.5	7.8-8.3	7.8-8.3	7.8-8.3
3	Total Suspnded Solid	mg/l	50	50	-	-	-	-

	Parameter	Unit	Limit value in Vietnam			Japanese Standard*		
			Aquaculture and aquatic conservation	Beach and underwater sports	Others	Class A	Class B	Class C
4	Dissolved Oxygen	mg/l	5	4	-	>7.5	>5	>2
5	COD (Mn)	mg/l	3	4	-	2	3	8
6	Ammonium (NH_4-N)	mg/l	0.1	0.5	0.5	-	-	-
7	Fluoride (F^-)	mg/l	1.5	1.5	1.5	-	-	-
8	Sulfur (S^{2-})	mg/l	0.005	0.01	0.01	-	-	-
9	Cyanide(CN)	mg/l	0.005	0.005	0.01	-	-	-
10	Arsenic (As)	mg/l	0.01	0.04	0.05	-	-	-
11	Cadmium (Cd)	mg/l	0.005	0.005	0.005	-	-	-
12	Lead (Pb)	mg/l	0.05	0.02	0.1	-	-	-
13	Chromium (Cr3)	mg/l	0.1	0.1	0.2	-	-	-
14	Chromium (Cr6)	mg/l	0.02	0.05	0.05	-	-	-
15	Copper (Cu)	mg/l	0.03	0.5	1.0	-	-	-
16	Zinc (Zn)	mg/l	0.05	1.0	2.0	-	-	-
17	Manganese (Mn)	mg/l	0.1	0.1	0.1	-	-	-
18	Iron (Fe)	mg/l	0.1	0.1	0.3	-	-	-
19	Mercury (Hg)	mg/l	0.001	0.002	0.005	-	-	-
20	Oil, grease	mg/l	Not detected	Not detected	-	-	-	-
21	Mineral grease	mg/l	Not detected	0.1	0.2	-	-	-
22	Total phenol	mg/l	0.001	0.001	0.002	-	-	-
23	Chlorinated organic pesticides					-	-	-
	Aldrin + Dieldrin	µg/l	0.008	0.008	-	-	-	-
	Endrin	µg/l	0.014	0.014	-	-	-	-
	BHC	µg/l	0.13	0.13	-	-	-	-
	DDT	µg/l	0.004	0.004	-	-	-	-
	Endosunfan (Thiodan)	µg/l	0.01	0.01	-	-	-	-
	Lindan	µg/l	0.38	0.38	-	-	-	-
	Chlordane	µg/l	0.02	0.02	-	-	-	-
	Heptachlo	µg/l	0.06	0.06	-	-	-	-
24	Organophosphate pesticides					-	-	-
	Paration	µg/l	0.40	0.40	-			
	Malation	µg/l	0.32	0.32	-			
25	Herbicides	mg/l				-	-	-
	2,4D	mg/l	0.45	0.45	-	-	-	-
	2,4,5T	mg/l	0.16	0.16	-	-	-	-
	Paraquat	mg/l	1.80	1.80	-	-	-	-
26	Total Radiation α	Bq/l	0.1	0.1	0.1	-	-	-
27	Total Radiation β	Bq/l	1.0	1.0	1.0	-	-	-
28	Coliform	MPN /100ml	1000	1000	1000	1000	-	-

*Ministry of Environment, Japan, "Environmental Quality Standard for Conservation of Living Environment, Coastal Waters", 1971

Class A is for Fishery class 1, bathing, conservation of natural environment and uses listed in B & C.

Class B is for Fishery class 2, industrial water, and uses listed in C.

Class C is for conservation of environment: limit of not disrupting the day-to-day lives of the population

5) National Technical Regulation on Surface Water Quality for Protection of Aquatic Life

With regard to surface water quality for protection of aquatic life, the Japanese standard for lakes is

applied for comparison. The Vietnamese standard is between class B and C of Japanese Standard.

Table 1.3.5 Regulation on Surface Water Quality for Protection of Aquatic Life (QCVN 38:2011/BTNMT)

	Parameter (mg/l)	Unit	Limit Value	Japanese			
				AA	A	B	C
1	pH	mg/l	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.0-8.5
2	Dissolved Oxygen	mg/l	4	7.5	7.5	5	2
3	Total Suspended Solid (TSS)	mg/l	100	-	-	-	-
4	Total Dissolved Solid (TDS)	mg/l	1000	-	-	-	-
5	Nitrite(NO2)	mg/l	0.02	-	-	-	-
6	Nitrate(NO3)	mg/l	5	-	-	-	-
7	Ammonium (NH4-N)	mg/l	1	-	-	-	-
8	Cyanide(CN)	mg/l	0.01	-	-	-	-
9	Arsenic (As)	mg/l	0.02	-	-	-	-
10	Cadmium (Cd)	mg/l	0.005	-	-	-	-
11	Lead (Pb)	mg/l	0.02	-	-	-	-
12	Chromium (Cr6)	mg/l	0.02	-	-	-	-
13	Copper (Cu)	mg/l	0.2	-	-	-	-
14	Mercury (Hg)	mg/l	0.001	-	-	-	-
15	Chlorinated organic pesticides						
	Aldrin	µg/l	3.0	-	-	-	-
	Chlordane	µg/l	2.4	-	-	-	-
	DDT	µg/l	1.1	-	-	-	-
	Dieldrin	µg/l	0.24	-	-	-	-
	Endrin	µg/l	0.09	-	-	-	-
	Heptachlo	µg/l	0.52	-	-	-	-
	Toxaphene	µg/l	0.73	-	-	-	-
16	Herbicides						
	2,4D	mg/l	0.2	-	-	-	-
	2,4,5T	mg/l	0.1	-	-	-	-
	Paraquat	mg/l	1.2	-	-	-	-
17	Total oil, mineral	mg/l	0.05	-	-	-	-
18	Phenol	mg/l	0.005	-	-	-	-
19	Surface active agent	mg/l	0.2	-	-	-	-

*Ministry of Environment, Japan, "Environmental Quality Standard for Conservation of Living Environment, for lake", 1971

Class AA is for water supply class 1, fishery class 1, conservation of natural environment (conservation of natural sight seeing and other environment), and uses in listed up A- C.

Class A is for water supply class 2, fishery class 2, bathing, and uses in listed up B- C.

Class B is for fishery class 3, industrial water class 1, agricultural water and uses listed in C.

Class C is for industrial water class 2 and conservation of environmental

6) National Technical Regulation on Noise

Concerning regulation on noise, locational conditions for the standard values are different between Vietnamese regulation and International Guideline (IFC, 2007), however, those tendencies are almost same, it can be said that the Vietnamese regulation can clear the international standard.

Table 1.3.6 Regulation on Noise (QCVN 26:2010/BTNMT)

Vietnam Standard			IFC EHS Guideline (2007)		
Location	Daytime (06:00-21:00)	Nighttime (21:00-06:00)	Location	Daytime (07:00-22:00)	Nighttime (22:00-07:00)
Special areas (hospital, school, church and so on)	55 dB	45 dB	Residential; institutional; Educational	55 dB	45 dB
Normal residential areas	70 dB	55 dB	Industrial; commercial	70 dB	70 dB

1.4 EIA in Vietnam

1) Projects subject to EIA

According to the Law on Environmental Protection (2005), proponents of following projects shall prepare EIA reports:

(1) Projects of national importance;
(2) Projects planned to use part of land of or exerting adverse impacts on, the natural sanctuaries, national parks, historical and cultural relic sites, natural heritages or beautiful landscapes which have been ranked;
(3) Projects to potentially exert adverse impacts on the river watershed, coastal areas or areas of protected ecosystems;
(4) Projects to construct infrastructure works in economic zones, industrial parks, hi-tech parks, export-processing zones or craft village areas;
(5) Projects to construct new urban centers or concentrated residential areas;
(6) Projects to exploit and use groundwater or natural resources on a large scale; and
(7) Other projects having potential risks or adverse impacts on the environment.

If a project requires EIA, an EIA report shall be prepared simultaneously with feasibility study report of the project. Only after the approval of EIA report, the project is approved and granted licenses, construction and operation permit.

2) Contents of EIA report

In accordance with the Law on Environmental Protection (2005), an EIA report shall consist of following contents as shown below:

(1) Enumeration and detailed description of the project's construction components, construction area, time and workload; operational technology;
(2) Overall assessment of the environmental status at the project site and neighboring areas;
(3) Detailed assessment of possible environmental impacts when the project is executed;.
(4) Specific measures to minimize bad environmental impacts;
(5) Commitments to take environmental protection measures during project construction and operation.
(6) Lists of project items, the program on management and supervision of environmental issues during project execution.
(7) Cost estimates for environmental protection works;
(8) Opinions of the commune/ward or township People's Committees and representatives of population communities in the place where the project is located;
(9) Citation of sources of figures and data, assessment methods.

3) Procedures of Appraisal of EIA report

a) Responsible organizations

Responsible organization for the appraisal of EIA reports depend on the project scale or location. They are defined as shown in the following table:

Table 1.4.1 Responsible Organization for EIA Reports Approval

Project level	Responsible organization
Projects which are decided or approved by the National Assembly, the Government or the Prime Minister or Inter-branch or inter-provincial projects	MONRE shall organize boards or choose service organizations for appraisal of environmental impact assessment reports of projects.
Projects under other ministries' respective deciding or approving competence projects	Ministries, ministerial-level agencies or Government-attached agencies shall organize boards or choose service organizations for appraisal of environmental impact assessment reports of the projects mentioned left.
Projects located in localities and under provincial People Committees' deciding or approving competence	PPC shall organize boards or choose service organizations for appraisal of environmental impact assessment reports for the projects mentioned left.

b) Appraisal of EIA reports

The responsible organization shall appraise EIA reports within forty-five (45) working days after receiving EIA reports of project falling jurisdiction of prime minister, government or national assembly and inter-branch or inter-provincial. For other projects, the limit of appraisal is within thirty (30) working days from the date of receiving of EIA reports. Within fifteen (15) working days after receiving EIA reports which have been modified to comply with conclusions of appraisal councils or appraisal service organizations, heads of organizations must consider and decide to approve environmental impact assessment reports; if refusing to approve, they must reply in writing to project owners, clearly stating the reasons.

There are cases that additional EIA report should be prepared. Such cases are as shown below:

- If there are some changes of location, scope, design, technology of projects
- Within 24months from the date of approval of EIA reports, the projects are not implemented

c) Rights of communities

Organizations, population communities and individuals have rights to send petitions and recommendations concerning environmental protection to the responsible organizations mentioned above, which shall have to consider such petitions and prepare recommendations before making conclusions or decisions.

d) Publication of Projects

Project information on kinds of wastes, treatment technologies, standard parameters of wastes and environmental protection solutions for population communities to know, inspect and supervise are publicized by posting up at the project site.

1.5 SEA in Vietnam

1) Projects subject to SEA

According to the Law on Environment Protection, Article 14, following strategies, plannings and plans are subject to preparation of SEA:

(1) National socio-economic development strategies, planning and plans;
(2) Strategies, planning and plans for development of branches or domains on a national scale;
(3) Socio-economic development strategies, planning and plans of provinces, centrally run cities or regions;
(4) Planning for land use, forest protection and development; exploitation and utilization of

other natural resources in inter-provincial or inter-regional areas;

(5) Planning for development of key economic regions; and

(6) General planning of inter-provincial river watersheds.

Strategic environmental assessment report constitutes an important content of the project and they must be made at the same time with project formulation.

2) Contents of SEA report

All SEA reports shall consist of following contents:

(1) Overview of the project's objectives, size and characteristics related to the environment;

(2) General description of natural, socio-economic and environmental conditions related to the project;

(3) Forecasts for possible bad environmental impacts when the project is executed;

(4) Citation of sources of figures and data, methods of assessment; and

(5) Proposed orientations and measures to address environmental issues during project execution.

3) Procedures of Appraisal of SEA reports

a) Responsible organizations

A SEA report is appraised by the council which is composed of persons concerned shown below:

Table 1.5.1 Responsible Organization for SEA Report Approval

Project level	Responsible organization
National and inter-provincial projects	Project-approving agency, ministries and ministerial-level agencies concerned, government-attached agencies, PPC concerned, experts, individuals and so on
Provincial-level projects	PPC, an environmental protection agency, related provincial-level departments and branches; experts, individuals and so on

b) Appraisal of SEA reports

The appraisal procedures of SEA reports are almost same as one of EIA reports. The responsible organization shall appraise SEA reports within forty-five (45) working days after receiving SEA reports of project falling jurisdiction of prime minister, government or national assembly and inter-branch or inter-provincial. For other projects, the limit of appraisal is within thirty (30) working days from the date of receiving of SEA reports.

c) Rights of communities

Organizations and individuals may send petitions and recommendations concerning environmental protection to the agency setting up the appraisal council and the project-approving agency; the council and project-approving agency shall have to take into consideration petitions and recommendations before making conclusions or decisions.

d) Publication of Projects

When the elaboration of development strategies, plannings and plans is studied, opinions of concerned ministries, branches, localities, scientists and experts must be gathered. Particularly, when urban and rural plannings are studied for elaboration, they must be publicized for comments by people and People's Councils in the planned areas.

1.6 Gap between JICA Guideline and Vietnamese Legislative Frame

There are some gaps between JICA Environmental and Social Consideration Guidelines and Vietnamese environmental legal frame. For instance, in Vietnamese regulation, it is not needed to prepare alternatives of project, while it is necessary according to JICA Guideline. Moreover, the chance to express opinions for local stakeholder in EIA preparation is limited in Vietnamese regulation compared with Japanese one. Following table presents the gaps between them.

Table 1.6.1 Responsible Organization for SEA Report Approval

JICA Guideline	Vietnamese regulation	Remarks
▪ JICA conducts (at the EIA level for Category A projects and at the IEE level for Category B projects) environmental and social considerations studies, including mitigation measures to avoid, minimize, or compensate for adverse impacts; a monitoring plan; and an institutional arrangement.	▪ No mention for IEE	-
▪ Alternatives of project shall be included in EIA report (JICA Guideline)	▪ No mention about examination of alternatives in EIA report contents preparation	-
▪ After the disclosure of the scoping drafts, project proponents etc. conduct consultations with local stakeholders. JICA incorporates the results of such consultations into its TOR. The consultations cover the needs of projects and the analysis of alternatives. (JICA Guideline)	▪ no mention	▪ There are description about consultation, however, the agenda does not cover scoping nor alternatives (Decree No.29-2011, Article 15).
▪ For all Category A projects and for Category B projects as needed, after disclosing scoping drafts, project proponents etc. conduct consultations with local stakeholders based on stakeholder analyses. JICA incorporates the results of such consultations in the TOR of environmental and social considerations studies. The consultations cover project needs and analyses of alternatives. (JICA Guideline)	▪ After an environmental impact assessment report is approved, the project owner shall formulate, approve and publicly display its environmental control plan at the office of the commune-level People's Committee of the locality in which consultation of the community is made for people's information, examination and oversight. (Decree No.29/2011/ND-CP, Article 22)	▪ The timing of consultation with local stakeholders is after approval of EIA report. The opportunity for local stakeholders to participate in EIA report preparation is limited.

1.7 Laws related to Land Recovery and Resettlement

1) Land Price Determination

In 2003, the new Land Law was established According to Decree 188-2004 ND-CP, Article 4 and 5, there are two methods to determine land prices as follows:

(1) The method of direct comparison is to analyze of actual land use right transfer at market price levels, which are classed into similar land categories for comparison and determination of prices of the land plots, land categories which need to be priced.

(2) The income-based method is to determine the price level being the quotient between the annual net income level earned on a land acreage unit and the annual average savings interest rate (up to the time of land pricing) of VND deposits with one-year (12 months) term at the State-run commercial bank having the highest savings interest rate in the locality.

Based on the practical land use right transfer at the market, documents on various land categories, and the gathered data, the PPC shall select appropriate price-determining methods; in case of necessity, two land price-determining methods mentioned above can be combined for examining,

comparing the estimated price to decide on the specific price.

Land prices are publicized by each PPC every year. The price is determined depending on the location. For example, publicized land prices in Trung Thanh commune, HuyỆn Vung Liem District, Vinh Long province by the PPC are as follows: Location 1 is the most convenient place which shows the highest unit price while location 7 is the most inconvenient place and shows the cheapest price.

Table 1.7.1 Land Prices depending on the Locational Conditions

Location	1	2	3	4	5	6	7
Price (thousand VDN/m^2)	135	105	70	60	50	35	30

Source: 27/2011/QĐ-UBND (2011), Vinh Long PPC

Generally, land prices at private sale tend to be higher than that of official one according to the official personnel of People's Committee of Trung Thanh commune (JICA, 2012). One resident who has a land in Trung Thanh commune said that they sell their lands at around 100 thousand VDN per square meter between farmers (JICA, 2012), which is a little high compared with official one mentioned above, the accurate location of land or class is not confirmed, though.

2) Targets of Land Recovery by the State

According to the Law on Land (2003), Article 38, the State shall recover land in twelve (12) cases. Out of them, only 1st clause, namely, "the land used by the State for objectives of national defense and security, national interest, public interest, or economic development" can be target for compensation.

3) Procedures of Land Recovery

No later than ninety (90) days with respect to agricultural land and one hundred and eighty (180) days with respect to non-agricultural land prior to recovery of land, the competent State body must notify the person having the land to be recovered of the reason for recovery of the land, the time-limit and plan for removal, and the general plan for compensation, site clearance and resettlement. After a decision on land recovery and a plan for compensation, site clearance and resettlement are approved by the competent State body, publicly announced and become effective, the person having land to be recovered must comply with the decision on land recovery. Where a person having land to be recovered fails to comply with the decision on land recovery, the people's committee at the level which is authorized to make the decision on land recovery shall have the right to issue an enforcement decision. Any person subject to a land recovery enforcement decision must comply with it and shall have the right to make a complaint (Article 39 of Land Law 2003).

At a sequence of land price determination, land recovery and compensation, province, district and commune's levels People's Committee have their own tasks. Those are summarized as follows:

Table 1.7.2 Tasks of Each Level of People's Committee

Administrative level	Tasks
PPC	▪ Determination of land price based on the current land use ▪ Land recovery from organizations, religious establishments, Vietnamese residing overseas and foreign organizations and individuals ▪ Compensation equal to the value of land use rights to a person by way of allocation of new land for the same purpose as the type of land ▪ Assignment of resettlement councils of rural districts, urban districts, towns and provincial cities
DPC	▪ Land recovery from family households, individuals, communities of citizens, and Vietnamese residing overseas who are entitled to purchase residential houses attached to residential land use rights in Vietnam ▪ Coordination with the compensation, support of district level resettlement councils, ▪ Approval of the compensation, support and resettlement plans prepared by

	the provincial-level People's Committees;
Commune People's Committee	▪ Coordination with the compensation, support and resettlement councils in certifying land and property ▪ Creation of conditions for the payment of compensation and support money, arrangement resettlement for persons who have land recovered, and creation of conditions for the ground clearance

*Summarized from Decree No. 197/2004/ND-CP, Article 39 and 43

Land recovery legislation in Vietnam is well-developed, however, there are still some gaps with the Japanese Guideline. For instance, those who own land utilization certificates only are qualified for compensation for land recovery, moreover, price of land to be recovered is determined based on the land price fixed by Provincial People's Committee. In general, market price is higher than that set by People's Committee, there is possibility it is disadvantage for those who resettle in case they are compensated by cash for land recovery.

4) Resettlement Policy of JICA

The key principle of JICA policies on involuntary resettlement is summarized below.

(1) Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.

(2) When, population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.

(3) People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.

(4) Compensation must be based on the full replacement cost[2] as much as possible.

(5) Compensation and other kinds of assistance must be provided prior to displacement.

(6) For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. It is desirable that the resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP 4.12, Annex A.

(7) In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.

(8) Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.

(9) Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

[2] Description of "replacement cost" is as follows:
Land is categorized in to "Agricultural Land" and "Land in Urban Areas". For former, The pre-project or pre-displacement, whichever is higher, market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes. For latter, The pre-displacement market value of land of equal size and use, with similar or improved public infrastructure facilities and services and located in the vicinity of the affected land, plus the cost of any registration and transfer taxes.
Concerning structure (Houses and Other Structures), The market cost of the materials to build a replacement structure with an area and quality similar or better than those of the affected structure, or to repair a partially affected structure, plus the cost of transporting building materials to the construction site, plus the cost of any labor and contractors' fees, plus the cost of any registration and transfer taxes.

Above principles are complemented by World Bank OP 4.12, since it is stated in JICA Guideline that "JICA confirms that projects do not deviate significantly from the World Bank's Safeguard Policies". Additional key principle based on World Bank OP 4.12 is as follows.

(10) Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits.

(11) Eligibility of Benefits include, the Prject Affected Persons (PAPs) who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.

(12) Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.

(13) Provide support for the transition period (between displacement and livelihood restoration.

(14) Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.

(15) For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared.

In addition to the above core principles on the JICA policy, it also laid emphasis on a detailed resettlement policy inclusive of all the above points; project specific resettlement plan; institutional framework for implementation; monitoring and evaluation mechanism; time schedule for implementation; and, detailed Financial Plan etc.

5) Comparison of Resettlement Policy of JICA and Vietnam

Followings are gaps concerning land recovery between Vietnamese legislation and JICA Guideline.

Table 1.7.3 Gap between the JICA Environmental Guideline and Vietnamese Environmental Legislation

JICA Guideline	Vietnamese regulation	Remarks
▪ The socio-economic studies should be implemented in the early stages of project preparation and with the involvement of potentially displaced people (WB OP4.12, Para 6)	▪ No mention	-
▪ Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL)	▪ Not clearly mentioned	-
▪ When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken. (JICA GL)	▪ Not clearly mentioned	-
▪ People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels	▪ A resettlement area shall be zoned for several projects in the same locality and must have developmental conditions equal to or better than the former place of residence. (Law on Land, 2003, Article 42)	-

JICA Guideline	Vietnamese regulation	Remarks
to pre-project levels. (JICA GL)		
▪ Compensation based on the full replacement cost must be provided as much as possible (JICA Guideline).	▪ The land prices stipulated by people's committees of provinces and cities under central authority shall be used as the basis for calculating compensation when the State recovers land. They must be close to actual market prices for assignment of land use right in normal conditions and, when there is a big difference compared with actual market prices, they must be adjusted for conformity. (Law on Land Article 56)	▪ Since compensation is based on the land price specified by PPC, there are some cases that there are gaps between actual land price and compensated ones (interview result by the JICA Team, 2012).
▪ Compensation and other kinds of assistance must be provided prior to displacement. (JICA GL)	▪ Responsible organizations shall handover a house or residential land together with a certificate of residential land use right [and/or] a certificate of ownership of residential housing to the person to be resettled, prior to conducting site clearance (Decree No. 84, 2007, Article 58).	-
▪ For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. (JICA GL)	▪ The organization in charge of compensation and site clearance shall prepare and submit a specific plan for compensation, assistance and resettlement (Decree No. 84, 2007, Article 56)	-
▪ In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. (JICA Guideline) ▪ Appropriate participation by affected people and their communities must be promoted in the planning, implementation, and monitoring of resettlement action plans and measures to prevent the loss of their means of livelihood (JICA Guideline)	▪ Agencies (organizations) that are assigned by the provincial-level People's Committees to arrange resettlement must inform every household that has land recovered and must be relocated of the tentative resettlement arrangement plans and publicly post up these plans at their headquarters, at the offices of the commune-level People's Committees of the localities where exists the recovered land and in the resettlement areas 20 days before such resettlement plans are approved by competent State bodies (Decree 197-2004, Article 34)	▪ Draft resettlement arrangement plan is informed to the affected people, however, people's participation in planning is limited.
▪ Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey, preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12 Para.6) ▪ Persons who encroach on the area after the cut-off date are not entitled to compensation or any other form of resettlement assistance (WB OP4.12, Para 16)	▪ Those who have a certificate of land use right or satisfying all of the conditions for issuance of a certificate of land use right are qualified as targets of compensation by the State (Law on Land 2003, Article 42) ▪ The organization in charge of compensation shall prepare an overall plan including land of different types, the number of households, household members and employees and so on (Decree 84/2007 Article 51)	-
▪ Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12 Para.6)	▪ When households, individuals directly engaged in agricultural production have over 30% of their assigned agricultural land areas recovered, they shall receive life stabilization supports for 3 months if they must not be relocated and for 6 months if they must be	The target of job training is those whose lands are recovered only. Landless people are not covered.

JICA Guideline	Vietnamese regulation	Remarks
	relocated; where they must be relocated to places with difficult or specially difficult socio-economic conditions, they shall receive supports for 12 months at most. The level of monetary support per household member per month shall be equivalent to 30 kg of rice, calculated at the average local price. (Decree 197-2004, Article 28) ▪ Support for life and production stabilization, and support for job-change training and job creation in case of recovery of agricultural land (Decree No. 69/2004 -ND-CP, Article 17)	
▪ Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc. (WB OP4.12 Para.8)	▪ No mention	
▪ Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. (WB OP4.12 Para.11)	▪ A person shall be compensated by way of allocation of new land for the same purpose as the type of land which was recovered or shall be paid compensation equal to the value of land use rights as at the time when the decision on recovery is made where no land is available for compensation (Law on Land, 2003, Article 42).	▪ In practice, both sides of governmental personnel and persons affected prefer to be compensated by cash (Ben Tre Province, 2011)
▪ Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12 Para.15)	▪ Compensation will be paid to current users of land recovered by the State who fully satisfy the conditions specified in Article 8 of Decree No. 197/2004/ND-CP. ▪ For land users who are ineligible for compensation, provincial-level People's Committees shall consider these cases in order to provide support. (Decree No. 69/2009 ND-CP, Article 14)	▪ In principle, no compensation shall be paid to those who do not have legal rights to land, however, there is a case that 50% of full compensation was paid to them based on Provincial Committee's decision, seemingly it is case-by-case (Ben Tre Province, 2011)

6) Resettlement Policy of the Project

(1) The Government of Vietnam will use the Resettlement Policy for a series of programs to be supported by JICA to cope with the climate change. This section discusses the principles of the Project Policy and the entitlements of the PAPs based on the type and degree of their losses.

(2) Land acquisition and involuntary resettlement will be avoided where feasible, or minimized, by identifying possible alternative project designs that have the least adverse impact on the communities in the project area.

(3) Where displacement of households is unavoidable, all PAPs (including communities) losing assets, livelihoods or resources will be fully compensated and assisted so that they can improve, or at least restore, their former economic and social conditions

(4) Compensation and rehabilitation support will be provided to any PAPs, that is, any person or household or business which on account of project implementation would have his, her or their:

- Standard of living adversely affected;
- Right, title or interest in any house, interest in, or right to use, any land (including premises, agricultural and grazing land, commercial properties, tenancy, or right in annual or perennial

crops and trees or any other fixed or moveable assets, acquired or possessed, temporarily or permanently;

- Income earning opportunities, business, occupation, work or place of residence or habitat adversely affected temporarily or permanently; or
- Social and cultural activities and relationships affected or any other losses that may be identified during the process of resettlement planning.

(5) Compensation will be paid to current users of land recovered by the State who fully satisfy the conditions specified in Clauses 1, 2, 3, 4, 5, 7, 9, 10 and 11, Article 8 of the Government's Decree No. 197/2004/ND-CP. For land users who are ineligible for compensation, PPC shall consider these cases in order to provide support. Support for life and production stabilization, and support for job-change training and job creation in case of recovery of agricultural land.

(6) PAPs that lose only part of their physical assets will not be left with a portion that will be inadequate to sustain their current standard of living. The minimum size of remaining land and structures will be agreed during the resettlement planning process.

(7) People temporarily affected are to be considered PAPs and resettlement plans address the issue of temporary acquisition.

(8) Where a host community is affected by the development of a resettlement site in that community, the host community shall be involved in any resettlement planning and decision-making. All attempts shall be made to minimize the adverse impacts of resettlement upon host communities.

(9) The resettlement plans will be designed in accordance with the Land Law (2003), Decrees No.84/2007,/ND-CP, Decree No. 69/2009/ND-CP and other decrees or circulars concerned.

(10) The Resettlement Plan will be translated into local languages and disclosed for the reference of PAPs as well as other interested groups such as communes.

(11) Payment for land and/or non-land assets will be based equal to the value of land use rights and non-land assets as at the time when the decision on recovery is made by PPC where no land is available for compensation or PAPs prefer the monetary compensation to land-based compensation.

(12) Compensation for PAPs dependent on agricultural activities will be land-based wherever possible. Land-based strategies may include provision of replacement land, ensuring greater security of tenure, and upgrading livelihoods of people without legal land titles. If replacement land is not available, other strategies may be built around opportunities for re-training and skill development.

(13) Replacement lands, if the preferred option of PAPs, should be within the immediate vicinity of the affected lands wherever possible and new land for the same purpose as the type of land which was recovered. As a second option, sites should be identified that minimize the social disruption of those affected; such lands should also have access to services and facilities similar to those available in the lands affected.

(14) Resettlement assistance will be provided not only for immediate loss, but also for a transition period needed to restore livelihood and standards of living of PAPs. Such support includes implementation of vocational training and payment of cash equivalent to 30 kg of rice to each affected person per month.

(15) The resettlement plan must consider the needs of those most vulnerable to the adverse impacts of resettlement such as without legal title to land.

(16) Representatives of PAPs will be involved in the process of developing and implementing resettlement plans

(17) PAPs and their communities will be consulted about the project, the rights and options available to them, and proposed mitigation measures for adverse effects, and to the extent possible be involved in the decisions that are made concerning their resettlement.

(18) Adequate budgetary support will be fully committed and made available to cover the costs of

land acquisition (including compensation and income restoration measures) within the agreed implementation period. The funds for all resettlement activities will come from the Government.

(19) Displacement does not occur before provision of compensation and of other assistance required for relocation. Sufficient civic infrastructure must be provided in resettlement site prior to relocation. Acquisition of assets, payment of compensation, and the resettlement and start of the livelihood rehabilitation activities of PAPs, will be completed prior to any construction activities, except when a court of law orders so in expropriation cases. (Livelihood restoration measures must also be in place but not necessarily completed prior to construction activities, as these may be ongoing activities.)

(20) Organization and administrative arrangements for the effective preparation and implementation of the resettlement plan will be identified and in place prior to the commencement of the process; this will include the provision of adequate human resources for supervision, consultation, and monitoring of land acquisition and rehabilitation activities.

(21) Appropriate reporting (including auditing and redress functions), monitoring and evaluation mechanisms, will be identified and set in place as part of the resettlement management system. An external monitoring group will evaluate the resettlement process and final outcome. Such groups may include qualified NGOs, research institutions or universities.

Principle of Replacement Cost

All compensation for land and non-land assets owned by households/shop owners will be based on the principle of replacement cost. Replacement cost is the amount calculated before displacement which is needed to replace an affected asset without depreciation and without deduction for taxes and/or costs of transaction as follows:

a. Existing local government regulations for compensation calculations for building, crops and trees will be used where ever available.
b. For perennial crops, cash compensation at replacement cost that should be in line with local government regulations.
c. For timber trees, cash compensation at replacement cost that should be in line with local government regulations.

CHAPTER 2 STRATEGIC ENVIRONMENTAL ASSESSMENT OF THE DEVELOPMENT OPTIONS

2.1 Development Options

The Mekong Delta is located on almost the sea level and could be greatly affected by the climate change. Not just waiting for the consequences, the Government has embarked on a program to take measures against the issue. Climatic change adaptation is under the discussion in each and every sector, and so does the agriculture and rural development sector. The objective is to promote rural and agricultural development in the Mekong Delta (seven coastal provinces, namely, the Project area) to cope with the expected climate change in the future.

To meet the development objective, there should be paths, which are called development options or development scenarios. In examining the development options, this Project integrates two of the most important means of intervention that are Structural and Non-structural interventions which together makes a four-quadrant matrix as shown in Figure 2.1.1 and elaborated in Table 2.1.1;

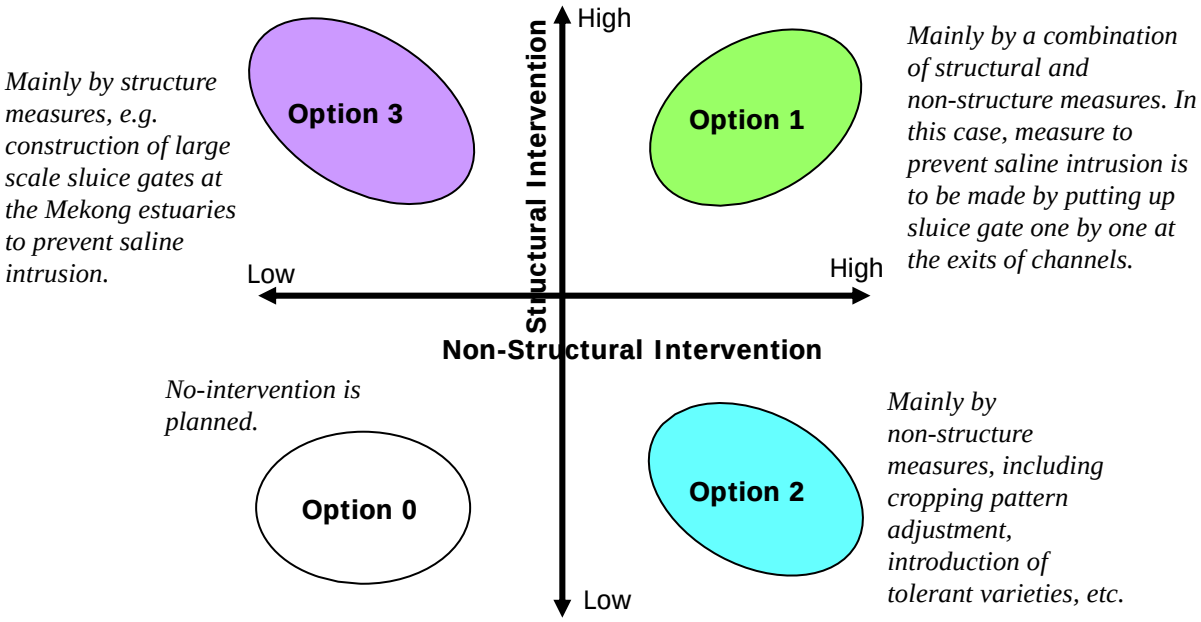


Figure 2.1.1 Four Potential Development Options based on Structural and Non-structural Interventions

Table 2.1.1 Development Options

Option	Explanation
Option 0	No measure will be made. It means no specific measurement will be undertaken to adapt to and cope with, e.g., saline intrusion.
Option 1	To adapt to and cope with climate change, both structural measurements and non-structural measures will be undertaken. Especially with regards to saline intrusion, sluice gate will be constructed one by one at the exits of channels out to the Mekong River. Aside from the construction, such non-structural measures will be undertaken e.g. cropping pattern adjustment, introduction of saline tolerant crops including brackish shrimp culture.
Option 2	Interventions will be made mainly by non-structural measures. In this case, fro example, saline water will intrude as the sea level rises whereby saline tolerant crops and/or brackish shrimp culture should be introduced. Cost for this option 2 may be the lowest; however there may be a limitation to cope against all the impacts from the climate change.
Option 3 (Option 3A) (Option 3B)	Interventions will be made mainly by structural measures. Typical example is the construction of large scale sluice gates at the estuaries of Mekong River. In fact, SIWRP master plan (2011) proposes 3 large scale sluices at the 3 tributaries of Tien Mekong River (Cung Hau, Co Chien, and Ham Luong). According to SIWRP, since the 3 tributaries are located in almost mid of total 9

	tributaries, the closure will contribute to augmenting fresh water to other tributaries located both sides of the closed tributaries, which in turn prevent saline water intrusion for those tributaries having no closure sluices. Beside, Mekong Delta Plan being formulated in collaboration with Dutch government as of 2012 proposes to close all the tributaries of Mekong River, except for one which is Hau River, as the version 0. This is meant to generate fresh water by storing and also to prevent saline water intrusion. The former plan may be called Option 3A, while the latter Option 3B. In both cases, since saline water intrusion is prevented with the structure to a large extent, non-structural measures will rarely be expected.

Source: JICA Project Team

2.2 Scoping of Development Options

As shown in the following table, the expected adverse impacts by Option 1, 2, 3A and 3B are examined. Out of those options, Option 1, 3A and 3B will take structural measures, therefore, issues regarding air pollution, waste and so on can take place during the construction. However, these impacts are tentative and limited for a certain period. On the other hand, water pollution due to gate construction, involuntary resettlement, land acquisition (recovery), suspension of navigation in the Mekong River/tributaries by those options will be very tough issues. Especially, resettlement of people and land recovery including displacement of tombs can lead to change of social institutions, socio-economy, disparity between beneficiaries and adversely affected people and so on.

Table 2.2.1 Expected Environmental Impacts by the Proposed Options

Environmental Parameters	Option 1	Option 2	Option 3A	Option 3B
1. Air Pollution	X (construction stage)	-	X (construction stage)	X (construction stage)
2. Water Pollution	X	-	X	X
3. Waste	X (construction stage)	-	X (construction stage)	X (construction stage)
4. Soil Contamination/ salinization *1	-	-	-	-
5. Noise and Vibration	X (construction stage)	-	X (construction stage)	X (construction stage)
6. Ground Subsidence	-	-	-	-
7. Offensive Odor	-	-	-	-
8. Bottom sediment	-	-	-	-
9. Protected area *2	-	-	-	-
10. Ground water	-	-	-	-
11. Hydrological Situation	-	-	X	X
12. Topography and Geographical features	-	-	-	-
13. Involuntary Resettlement	X	-	X	X
14. Land Acquisition	X	-	X	X
15. Cultural heritage (tombs)	X	-	X	X
16. Landscape	-	-	-	-
17. The poor, indigenous and ethnic people	-	-	-	-
18. Livelihood	X	- and X	X	X
19. Local economy *3	X	-	X	X
20. Existing social infrastructures and services	X	-	X	X
21. Misdistribution of benefit and damage	X	-	X	X
22. Social institutions	X	-	X	X
23. Water Usage or Water Rights and Rights of Common *4	-	-	-	-
24. Gender	-	-	-	-
25. Children rights	-	-	-	-
26. Hazards (Risk), Infectious	X (construction	-	X (construction	X (construction

Environmental Parameters	Option 1	Option 2	Option 3A	Option 3B
diseases such as HIV/AIDS	stage)		stage)	stage)
27. Accidents	X (construction stage)	-	X (construction stage)	X (construction stage)
28. Global Warming	-	-	-	-

X: Negative impact is expected - : Either positive or negligible negative impact is expected

Remarks:

*1: During construction stage, soil contamination by, e.g., oil leakage from heavy vehicles may take place; however this shall be controlled by the construction supervisor and even if it should take place, the impact should be minimal because it is limited only during the construction period.

*2: There is no protected area in and around the potential construction sites.

*3 Local economy would be negatively affected, e.g. by enlarging the economy gap between the beneficiaries and those who have to resettle.

*4: With the construction of sluice gates, water usage would be changed. However this change takes place in positive way by augmenting fresh water, whereby no negative impact is expected.

Based on the examination mentioned above, only permanent and key issues are picked up and compared among all options including Option 0. Not only negative impacts but also positive impacts by each option and those degrees of impacts are discussed. The summarized comparison is as follows;

Table 2.2.2 Main Environmental Impacts by Option

Environmental items	Option 0*	Option 1	Option 2	Option 3A	Option 3B
Water quality of Mekong River	-	-	-	XXX	XXX
Farming	XX	+++	+	++	++
Shrimp cultivation	-	++	+ and X	XX	XX
Eco-system of Mekong River	-	-	-	XXX	XXX
Resettlement and land acquisition (land recovery)	-	XXX	-	XX	XX
Transportation by water (Mekong River)	-	-	-	XX	XX
Possibility to be regrettable project	None	None	None	High	Very high
Project cost	Zero	Medium-high	Very low	High	Very high

X : small-scale negative impact, XX: middle-scale negative impact, XXX: large-scale negative impact

+ : small-scale positive impact, ++: middle-scale positive impact, +++: large-scale positive impact

-: no impact or negligible

* Option 0 is compared with the current situation in terms of environmental impact.

2.3 Basic Environmental and Social Conditions in the Target Area

1) Land Use

Ratio of agricultural land use in the Project area as well as Mekong Delta is much higher than other areas of the Country. While 55% and 63% of the area is used for agricultural purposes in the Project area and Mekong Delta respectively, only 29% is used in the whole Country, which is far greater than any other regions including the Red River Delta (36%). Among the provinces of the Project area, Kien Giang (83%) is the highest in the paddy land, which is followed by Bac Lieu (75%) and Soc Trang (73%). On the other hand, paddy area of Ben Tre (27%) is quite limited followed by Tien Giang (53%), suggesting that the most agricultural areas in Ben Tre, also followed by Tien Giang province, are now planted with perennial cops i.e. fruits.

The agriculture in the Project area and Mekong Delta by large is diversified. The land use is consequently quite diverse. By and large, double and triple cropping of paddy is dominant in the upper-middle delta especially along the Rivers, while brackish fishery stretches out along the coastal areas including the Project area. Those major two patterns of land use are further diversified by the different types of forest areas (protective, productive, reforestation etc.), annual crops

(mostly fruits), and freshwater fishery (in this classification, shrimp culture is included in "fishery").

2) Socio-Economic Situations

Provincial population in the Project area varies from 867,800 being the minimum in Bac Lieu to about 1.7 million being the maximum in Kien Giang while the area from 2,295 km^2 to as much as 6,346 km^2. Total population for the Project area arrives at 9.02 million, sharing about 52% of the whole Mekong Delta population, while the total area comes to 24,631km^2 equivalent to about 61% of the total Mekong Delta area. Population density is estimated at 366 persons/km^2. This population density is relatively high, for example, as compared with the national average of 263 persons per km^2.

Endorsed with the high GDP growth ratio, the GDP per capita in the Project area as well as in the Mekong Delta has been higher than that of national level. The GDP per capita, estimated at constant 1994 prices with exchange rate of 11,045 VND/US$, is much higher in the Project and Mekong Delta areas than that of national level. The average of the Project area arrives at US$ 848 (US$ 847 for the Mekong Delta) per capita while that of national level remains US$ 575 only, which is about one-third lower than that of the Project area.

The Mekong Delta waterway network carries seagoing and inland traffic, including some cargo traffic from Vietnam to Cambodia. Domestic waterway traffic is highly dense in the whole delta area. Hundreds of waterways varying in size (for vessels from 10 to 600 tons) interlace in this area; such as rivers, rivers' tributaries, constructed canals, and natural creeks. It is counted that a total navigable length arrives at approximately 4,785 km in the Delta. The waterway network connects major cities each other, and it plays a vital role in the economy and human life of the area.

The share of the primary sector, represented by agriculture, in the Project area is 41%. Paddy production shows much higher share in the national production, e.g. 24% and as much as 54% by the Project area and Mekong Delta respectively. The average comes to 1,066 kg and 1,249 kg for the Project area and the Mekong Delta respectively in 2010. The most paddy producing province per capita is Kien Giang, 2,046 kg/capita. Mekong Delta is well known as Rice Bowl of Vietnam. If it is presumed that self-sufficiency is achieved if paddy is produces more than 200kg per capita annually, all of provinces in the Project area exceed the target values (100%) greatly as illustrated in figure right.

Aquaculture in the Mekong Delta has been a common aspect of daily life of the people, and commercial aquaculture started rapidly developing in the mid to late 1980's with the introduction of Doi Moi. The overall aquaculture production by Mekong Delta (1,940,181 tons) shares as much as 72% of the national production (2,706,752 tons) in 2010. Per-capita production of aquaculture fish in the Project area is estimated at 59 kg, which is far bigger than the national per-capita production of 24 kg only. On top of that, the aquaculture shrimp production in the Project area by far exceeds those of other regions including mid-upper parts of Mekong Delta. The Project area produced as much as 76%, three-quarters of the national production.

GDP per capita in the Project area is, however, not as high as the national average. For example, the average GDP per capita in the Project area is US$ 987-US$1,040 for Mekong Delta as a whole - while the national average is US$ 1,127. (These GDP estimates are based on 2009 figures reflecting an exchange rate of 17,100 VND/US$). The province showing the lowest GDP per capita is Tra Vinh, followed by Ben Tre. The province with the highest GDP -US$ 1,286- is Kien Giang. There is little secondary and/or tertiary sector industry in the Project area despite huge production figures in the primary sector. As a result the GDP per capita in the Project area has been lowered.

Due to the recent climate change, there may be two major issues; flood/inundation and saline intrusion. The saline intrusion gives damage to paddy production in the Project area. For example, in Tra Binh Province, winter-spring paddy production was decreased by more than 70% and 30-70% in 8,000 ha paddy field and 3,000ha paddy field, respectively, in 2011 (source: JICA Team). In addition, those issues also can cause negative impacts on shrimp cultivation, since flood can cause overflow of shrimps from the cultivation ponds, moreover, shrimps can not adapt to the rapid salinity increase or water temperature change by sea water intrusion.

3）Conservation Area and Rare/Endangered Species in the Target Area

In the target area, 5 natural reseve areas, which have unique eco-system, are specifeid to be conserved Basic information and location of those areas are shown in folllowing table and figure:

Table 2.3.1 Basic Information of Natural Reserve in the Target Area

Ca Mau Cape National Prk	
Ca Mau province 41,862 ha	To conserve the saline-ecosystem forest in Ca Mau, a typical wetland area in the coastal zone of Mekong River
U Minh Thuong National Park	
Kien Giang rovince 8,038 ha	To conserve the ecosystem of malaleuca forest and the alkaline wetland on peat base, rare wild animals and historical place of U Minh
Thach Phu Nature Reserve	
Ben Tre Province 4,510 ha	To conserve the saline wetland ecosystem of Mekong Delta and National historical place of Ho Chi Minh Rail at Sea.
Bac Lieu Bird Sanctuary	
Bac Lieu province 127 ha	To conserve saline wetland ecosystem and water bird species
U Minh Ha National Park	
Ca Mau Province 8,286 ha	To conserve ecosystem of ancient alkaline inundated malaleuca forest and water bird species.

Source: Ministry of Agriculture and Rural Development (2004) Forestry Handbook
Institute for Environment and Natural Resources National University at HCM City (2010), Inventory of Peat lands in U Minh Ha Region, Ca Mau Province, Viet Nam

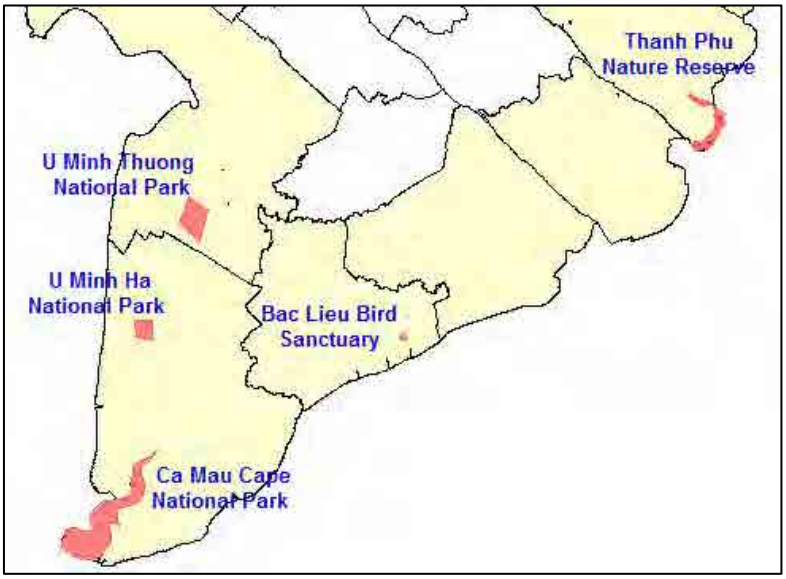


Figure 2.3.1 Location of Natural Reserve in the Mekong Delta[1]

The Mekong River within the Mekong Delta has rich and unique fish diversity, 481 fish species in total, including 28 endemic species, and the number of species in the Delta is bigger than those of

[1] Modified based on the map of "Forestry Planning in the Mekong Delta", SIWRP 2011

other Mekong River basins (MRC, 2010a)[2]. Some of them are migratory between marine/estuarine and freshwater for spawning, their migration paths are thought to be various dependent on the species as illustrated in the Figure 2.3.2 (MRC, 2002)[3]. The migratory species are as follows (MRC, 2010b)[4] (see following photos), and as of now no species below except for *Pangasius krempfi* are listed as Globally Threatened -Critical (GT-CR) nor as Globally Threatened-Endangered (GT-EN). Note that *pangasius krempfI* is specified as Vulnerable (VU), which is presumed to face a high risk of extinction in the wild.

i) Krempf's catfish (*Pangasius krempfi),* which is believed to spend its life in the coastal waters of the South China Sea, but returns to the Mekong River to spawn (designed as a Vulnerable species in 2011 by IUCN).
ii) Engraved Catfish *(Arius caelatus)* is reported to undertake diadromous migrations;
iii) Giant mottled eel (*Anguilla marmorata)* is known to migrate from the ocean to upland tributaries for spawning;
iv) Threadfins: *Eleutheronema tetradactylum* and *Polynemus borneensis;*
v) Perch: *Lates calcarifer*; and
vi) Herrings: *Coila* sp., *Setipinna* sp.

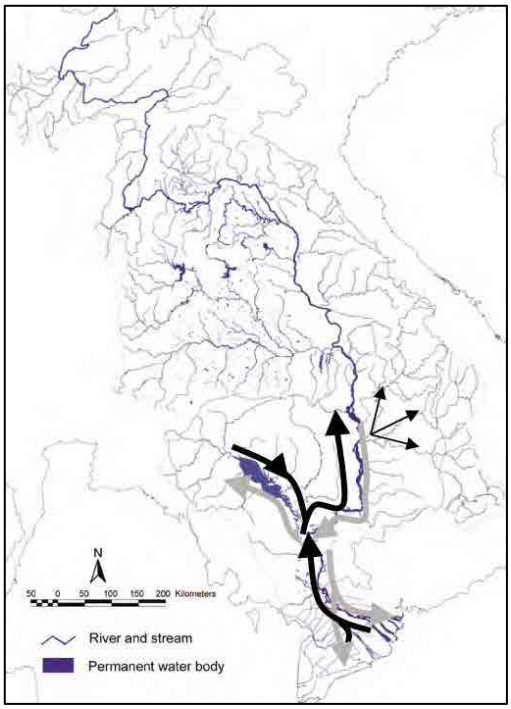


Figure 2.3.2 Paths of Migratory Fish in the Lower Mekong Basin (MRC, 2010b)

Pangasius krempfi

Arius caelatus

Anguilla marmorata

Eleutheronema tetradactylum

[2] MRC (March 2010), SEA for Hydropower on the Mekong Mainstream, Aquatic Systems Baseline Assessment, Working paper 8
[3] MRC (Oct. 2002), Fish migrations of the Lower Mekong River Basin: implications for development, planning and environmental management, Technical Paper 8
[4] MRC (June 2010), Impacts on Wetland and Biodiversity (Draft), Technical Note 9

Polynemus borneensis

Septina melanochir

Coilia macrognathos

Lates calcarifer

The rapid development of the Mekong River Basin in those several decades, such as dam constructions, has caused big-scale environmental changes; consequently, the unique ecosystem has been affected adversely to some extent. Many fish species, especially, migratory fish (within the river) may have been damaged, and some of them are threatened as GT-CR or GT-EN. The Lower Mekong River basin has the richest biodiversity in the whole Mekong River basins; however, it faces to the same issue. Following table illustrates globally threatened fish species in Vietnam.

Table 2.3.2 Globally Threatened Fish Species in Vietnam (Mekong Delta)[5]

Scientific name	Common name	Status (IUCN) [6]	Remarks
Chela caeruleostigmata	Leaping Barb	GT-CR	
Pangasius sanitwongsei	Giant Catfish	GT-CR	Highly migratory
Pristis microdon	Freshwater Sawfish	GT-CR	
Pristis zijsron	Green Sawfish	GT-CR	
Scleropages formosus	Golden Arowana	GT-EN	Heavily traded
Tenualosa thibaudeaui	Laotian Shad, Freshwater Herring	GT-EN	Highly migratory, Endemic
Probarbus jullieni	Jullien's Barb	GT-EN	Highly migratory
Himantura chaophraya	Giant Freshwater Stingray	GT-EN	
Himantura oxyrhynchus	Marbled Mekong Stingray	GT-EN	
Balantiocheilos melanopterus	Silver Shark	GT-EN	
Pangasius krempfI	Krempf's catfish	VU	Highly migratory between sea and river
Carcharhinus leucas	Bull Shark	LC	
Mekongina erythrospila	Striped River Barb		Endemic
Puntioplites falcifer	Silver Barb		Endemic

GT-CR: Globally Threatened-Critical, GT-EN: Globally Threatened-Endangered, LC: Least Concern

Following table summarizes behaviors of migratory and spawning of endangered fish species which range in Mekong Delta mentioned above. As illustrated below, information on spawning habitats for migratory fish species of Mekong River is not sufficient, especially very rare for

[5] This table is prepared based on the data of MRC (2010b)
http://fish.mongabay.com/data/VietNam.htm and
http://www.iucnredlist.org/apps/redlist/details/181328/0

[6] IUCN Red List Categories: EX: Extinct, EW - Extinct in the Wild, CR: Critically Endangered, EN: Endangered, VU: Vulnerable, NT: Near Threatened and LC: Least Concern. Out of those categories, CR, EN and VU are classified as "Threatened". The categorization contributes to setting priorities to conserve threatened species.

spawning, since most of migratory fish spawn in deep pools, which makes it very difficult to observe directly. Moreover, available data of migratory path in the Mekong Delta is limited to only Haw River and Tien River, and there is no data for other small tributaries and canals. A detailed ecological survey of the fish in the area is needed. In other spots within Mekong River such as Khone fall far upstream of Mekong Delta, those species are observed more frequently than in Mekong Delta.

Table 2.3.3 Migratory and Endangered Fish Species in Vietnam (Mekong Delta)

	Movement in Mekong Delta in dry season (March to May)	Spawning situations	Trigger of movement	Level of endanger
Pangasius Kremfi	Going downward to the sea	There were no reports from the Mekong delta on spawning or the occurrence of eggs.	Water level, rainfall	VU
Pangasius sanitwongsei	It is rarely observed in these days.	Spawn in the upper sections of stretches during May to July.	Water level	GT-CR
Tenualosa thibaudeaui	No information on migration was reported from the Mekong Delta.	Unknown	First rainfall, water level and increased tributaries (above of Khone wall)	GT-EN
Probarbus jullieni	Going downward to the sea	There were no reports on actual spawning sites below the Khone Falls.	Water level	GT-EN

Source: MRC, http://ns1.mrcmekong.org/programmes/fisheries/mig_probarbus_j.htm
MRC, 2006, Fish migration triggers in the Lower Mekong Basin and other freshwater tropical systems, MRC Technical Paper No. 14

Photos of the fish listed up in the table above (except *Pangasius Kremfi*) are as shown below:

Pangasius sanitwongsei

Tenualosa thibaudeaui

Probarbus jullieni

Aside from the threatened fish species listed in the above table, the Riverine Irrawaddy Dolphin (*Orcaella brevirostris*) is very famous as a flagship endangered wildlife in the Mekong River (see Figure 2.3.3 for the range areas). The freshwater sub-population ranges in the Mekong River, while the dolphins are distributed in the coastal, shallow, blackish, or fresh waters in Southeastern Asia from India to Indonesia. It is said that oil from boats, blast fishing, gillnet entanglement and so on have damaged the species [7] and recently the sighting of dolphin within Vietnam is very rare. The sub-population in the Mekong River is designated as critically endangered by IUCN in 2004

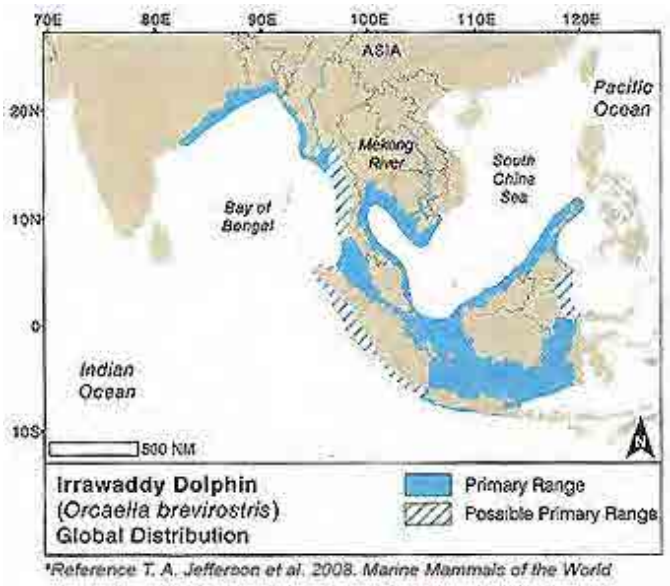


Figure 2.3.3 Distribution of Irrawaddy Dolphin

[7] IUCN, 2011, The IUCN Red List of Threatened Species, http://www.iucnredlist.org/apps/redlist/details/44555/0

and the population number is estimated at 127 minimally (WCS, 2007)[8].

2.4 Legislative and Institutional Framework of Environmental Consideration in Vietnam

In Vietnam, based on the Environment Protection Law enforced in January 1994, the government ordinance for the law practice (Government Decree No.175/CP) was enacted on October in the same year. Furthermore, many regulations regarding the penalty to violation, an environmental impact assessment, etc. were enacted. After 2008, QCVN which have a role of regulation accompanied by a penalty.and become a new standard was applied instead of TCVN. Some parts of TCVN were replaced for QCVN, and TCVN itself became invalid. The environmental standards of Vietnam have cleared the international level as a standard, and even if they compare with environmental standards of Japan, they are in an appropriate level (see Appendix VIII Chapter 1 for detail).

Current Environment Protection Law stipulates projects which need EIA and SEA, however, it does not mention neccecity of pubication of scoping and exmination of alternatives of proposed projects, while they are stiplulated in the JICA Environemtnal and Social Consideration Guideline. Following table illustlates differences between the JICA Guideline and Vietnamese law.

Table 2.4.1 Gap between JICA Guideline and Vietnamese Legal Frame

JICA Guideline	Vietnamese regulation	Remarks
▪ Alternatives of project shall be included in EIA report (JICA Guideline)	▪ No mention about examination of alternatives in EIA report contents preparation	
▪ After the disclosure of the scoping drafts, project proponents etc. conduct consultations with local stakeholders*. JICA incorporates the results of such consultations into its TOR. The consultations cover the needs of projects and the analysis of alternatives. (JICA Guideline)	▪ no mention	▪ There are description about consultation, however, the agenda does not cover scoping nor alternatives (Decree No.29-2011, Article 15).
▪ The socio-economic studies should be implemented in the early stages of project preparation and with the involvement of potentially displaced people (WB OP4.12, Para 6)	▪ no mention	
▪ Those who do not have formal legal rights to land at the time the census begins but have a claim to such land or assets--provided that such claims are recognized under the laws of the country or become recognized through a process identified in the resettlement plan are eligible for benefit (WB OP4.12, Para 15)	▪ Those who have a certificate of land use right or satisfying all of the conditions for issuance of a certificate of land use right are qualified as targets of compensation by the State	
▪ Compensation based on the full replacement cost must be provided as much as possible (JICA Guideline).	▪ The land prices stipulated by people's committees of provinces and cities under central authority shall be used as the basis for calculating compensation when the State recovers land. They must be close to actual market prices for assignment of land use right in normal conditions and, when there is a big difference compared with actual market prices, they must be adjusted for conformity. (Law on Land Article 56)	▪ Since compensation is based on the land price specified by Provincial People's Committee, there are some cases that there are differences between actual land price and compensated ones, they are not significant ones, though (interview result by the JICA Team, 2012).
▪ In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. (JICA Guideline)	▪ Agencies (organizations) that are assigned by the provincial-level People's Committees to arrange resettlement must inform every household that has land recovered and must be relocated of the	▪ Draft resettlement arrangement plan is informed to the affected people, however, people's participation in planning is

[8] Wildlife Conservation Society (WCS), 2007, Status and Conservation of Freshwater Populations of Irrawaddy Dolphins, Working Paper No. 31

JICA Guideline	Vietnamese regulation	Remarks
▪ Appropriate participation by affected people and their communities must be promoted in the planning, implementation, and monitoring of resettlement action plans and measures to prevent the loss of their means of livelihood (JICA Guideline)	tentative resettlement arrangement plans and publicly post up these plans at their headquarters, at the offices of the commune-level People's Committees of the localities where exists the recovered land and in the resettlement areas 20 days before such resettlement plans are approved by competent State bodies (Decree 197-2004, Article 34)	limited.

2.5 Anticipated Environmental Impacts

1) Option 0 (No Intervention)

Since no countermeasure will be taken against current issues, damage to crops by the sea water intrusion will increase in the future. Furthermore, it is difficult to avoid decrease of shrimp production due to overflow caused by flood. On the other hand, other negative impacts are not expected and no construction cost is necessary.

2) Option 1 (Combination of Structural and Non-structural Measures)

This option will make it possible to prevent sea water intrusion by structural measure, which means it can alleviate the crop production decrease. Also, non-structural measures, namely, salinity tolerance crop such as new rice variety introduction or coconut plantation can reduce the damage to the farming by saline water. Moreover, it is possible to change planting season depending on the water quality to avoid the salt damage. During dry season, sluice gates (not large-scale) can keep water salinity of shrimp cultivation ponds at the appropriate and constant level by gate switching to adjust sea water intrusion. As a whole, it means that the structural and non-structural intervention will give positive impacts on the farming and aquaculture in the area.

As mentioned before, discharge of Mekong River can be changed depending on development at the catchment area of the river in future. Proposed structures in the Option 1 are not large-scale, whereby it is possible to construct sluice gates in conformity with the situation change regarding discharge and salinization step by step. Therefore, there is very little possibility that the construction works in this Option 1 will be regrettable.

Concerning negative impacts by the Option 1, sluice gate establishment to prevent saline water intrusion requires construction space to some extent. In case of only sluice gate construction, the scale of resettlement would not be so big. However, if expansion of existing water canal is planned, large scale involuntary resettlement of the residents and land recovery by the State may be needed. In such case, compensation to the affected people for land and house resettlement is necessary, which leads to increase of project cost. Furthermore, close of water flow by sluice gates could change the eco-system in water channels.

3) Option 2 (Mainly Non-structural Measures)

Due to no construction works in this Option, project cost will be low and any damages to social and natural environment would not be expected. Conversion of crop varieties, e.g. from conventional paddy varieties to salinity tolerance ones will be efficient to reduce salinity damage to the crops. Also, it is possible to expand shrimp cultivation area to some extent based on the level of water salinity, though it is needed to take notice of disease control in the ponds.

Regarding negative impacts by the Option 2, it is very difficult to keep constant salinity of shrimp cultivation ponds in case of salinity increase and to prevent shrimp's flow out in case of flood. In addition, in case of drought after rice transplanting or coconut planting, those crops will be

damaged. It can be said that effectiveness of non-structural measures is limited, and it man be very difficult to take measures to meet the changeable situations within a limited time of period under climate change.

4) Option 3A (Mainly Structural Measures, 3 Large Scale Sluices on the Mekong River)

Structural interventions will be very efficient to prevent sea water intrusion, which leads to decrease of crop salt damage. However, this option will close flow of Mekong River at three tributaries, which can cause irreversible negative impacts on eco-system and transportation in the river. Furthermore, involuntary resettlement and land recovery for the large-scale structure construction will be needed; however, the scale will be small as compared with that of Option 1 in case of canal expansion since the proposed number of construction site is only three (3). Yet, the project cost of this option will be much bigger than that of Option 1, and given the possibility that discharge of the Mekong River may be increased during dry season in future due to planned hydropower dams construction, the construction in this option may have a possibility of becoming regrettable project.

As mentioned above, there are species to be affected by the construction work on the Mekong River. Option 3A and Option 3B are to construct large scale sluices on the tributaries of Mekong River. The large scale sluices will give negative impact to the migratory species, for which total 6 species are known as of now, and also GT-CR and GT EN species will be further endangered. Though it is rare to see Riverine Irrawaddy Dolphin in the Mekong Delta, the endangered mammal will also be affected. Therefore, taking into account the existence of these species, Option 3A and Option 3B which require large scale construction work on the Mekong River shall need thorough environmental examination, or the options shall be set aside.

5) Option 3B (Mainly Structural Measures, Large Scale Sluices on all the Tributaries of Mekong River excluding Hau Ricer)

The tendencies of positive and negative environmental impacts caused by Option 3A and 3B are very similar. However, the number of large-scale construction points by Option 3B is more than that of 3A. Therefore, project cost of option 3B will be much higher than that of 3A. It means that the scale of negative impacts on the eco-system and transportation in the Mekong River will be more significant. Given these circumstances, there is a high possibility that Option 3B could be also a regrettable project by the same reason mentioned above.

2.6 Mitigation Measures

1) Option 1 (Combination of Structural and Non-structural Measures)

The most important issue in this option is land recovery and resettlement. Especially, if existing canals are expanded, many houses along the canals have to be resettled. To reduce the resettlement as much as possible, it is possible to select construction and expansion points where number of houses is smaller than the others. Also, tombs are very important for the residents, and therefore it is needed to avoid such places as the construction sites. For the resettlement and land recovery, it is necessary to prepare a compensation plan based on the regulations/rules set by the Government. On the other hand, there is a possibility that the discharge of Mekong River would be increased; based on the change, planning of sluice gate construction e.g. location or number of the gates have to be modified to avoid becoming regrettable project.

2) Option 2 (Mainly Non-structural Measures)

In the Option 2, since structural measure is not taken, severe negative environmental impacts are not expected while positive impacts are limited as mentioned before. Therefore, there is no point to

be considered to minimize the expected adverse environmental impacts for this option.

3) Option 3A (Mainly Structural Measures, 3 Large Scale Sluices on the Mekong River)

It is important to consider the construction locations to minimize resettlement and land recovery as same as Option 1. Also, it is needed to study eco-system, especially in water body. Probably, Mekong River in the sites comprises diversified eco-system, namely, endangered species, rare species, indigenous species, commercially worthy species, dominant species, vulnerable species, etc. and those should be examined in advance and list of existing species shall be prepared. Moreover, transportation by water in and around the construction sites will be affected. Weight transported per day, contents of freights, frequency of daily navigation should be studied to estimate economic damage by the structure constructions. Even though those countermeasures are taken, the effect would be limited. As compensation of environmental negative impacts, it is possible to examine compensation for the damage to transportation by water or to construct new range area for endangered/rare species, however, the cost can be significantly large, which is not realistic.

4) Option 3B (Mainly Structural Measures, Large Scale Sluices on all the Tributaries of Mekong River excluding Hau Ricer)

The points to consider environmental impacts for Option 3B is almost same as that of Option 3A. It is noted that the scale of negative impacts and project cost will be much bigger than those of Option 3A since all the tributaries except for one on the Hau River are planned to be closed under this Option 3B.

2.7 Evaluation and Examination of Alternatives

As a whole, large-scale structural measure, namely, Option 3A or Option 3B can cause significant adverse impacts on the surrounding environment. One may say, nevertheless, that such project should be taken into consideration on condition that the benefit surpasses the cost including mitigation measures for those significant adverse impacts. However, it should be considered that those options would have a possibility of becoming a regrettable project should the Mekong River discharge during dry season be increased. There are plans to construct hydropower dams in the upper most catchment areas of the Mekong River, which would augment the dry season discharge. Moreover, impacts by large-scale construction can be significant on eco-system, and effects of mitigation measures will be very limited. Given this probable scenario, therefore, the structural measure only, especially Option 3A and 3B cannot be recommended.

Concerning Option 2, the negative impacts are hardly expected; however, the positive impact will also be limited. As mentioned before, it can be said that effectiveness of non-structure measures only is not enough to cope with the impacts incurred by climate change. On the other hand, Option 1 will not be “Regrettable Project” and would not cause significant environmental impact, it will need resettlement and land recovery, though. It will give positive impacts on farming and shrimp cultivation. Considering those circumstances, the Option 1, namely, the intervention by both non-structural and structural measure is the most suitable as the path of development in the Project area under the condition that resettlement and land recovery are minimized as much as possible.

2.8 Monitoring

Monitoring of anticipated impacts by Option 1 will be implemented in terms of both negative and positive impacts, and whether planned mitigation measures are implemented. Proposed monitoring indicators are salinity of water canal, change of water level, crop production, frequency of high tide and so on. In addition, it is needed to confirm whether examination to minimize resettlement and land

recovery is done or not. Draft monitoring plan is shown as below:

Table 2.8.1 Proposed Monitoring Plan

Development option	Positive/Negative impact	Mitigation measure	Monitoring indicator	Responsible organization
Structural measure of Option 1	Negative impacts: • Resettlement • Land recovery	• Site selection to minimize resettlement • Site selection to minimize land recovery	• To confirm whether proper construction sites to minimize resettlement are selected • To confirm whether proper construction sites to minimize land recovery are selected	• DARD • DARD
Non-structural measure of Option 1	Negative impacts: none Positive impact: • stabilization of farming	None None	• Production of crops	• DARD

CHAPTER 3 INITIAL ENVIRONMENTAL EXAMINATION OF THE IN-DEPTH STUDIES

An action plan framework to cope with the climate change in Mekong Delta was established by the Vietnamese government covering the rural and agriculture sector (2008-2020). However, there are issues which shall be further studied prior to the designing of priority projects since there are still unknown factors to be conformed before the designing. The In-depth Study is therefore planned to identify and clarify the unknown factors for the project design. This chapter briefly presents the in-depth studies and IEE of those studies.

3.1 Assignments of the In-depth Studies

Assignment-1: Study on the Best-suited Polder Area Improvement coping with Saline Intrusion (North Ben Tre Area)

Works of Assignment 1 are as follows:

1) Update/establishment of the digital land use map together with irrigation and drainage networks with all the structures already put in places to be served for hydrodynamic and advection-dispersion simulations.

2) Simulations on the saline intrusion into this North Ben Tre area with different river discharges and sea level rises.

3) Based on the simulation results, estimation of the probability of the saline water reaching the point-A at certain years such as year 2020, 2030, 2050, 2100.

4) Measurement of the salinity level (ppt) at high tide time and low tide time at 3 depths for 3 places.

5) Study the possibility of introduction of vertical sluice gate instead of the currently used swing sluice type gate.

6) Examination of the storage capacity in the canal network including rivers of the North Ben Tre area.

7) Implementation of water quality test for the samples collected at 4 locations along the Ba Lai river

Assignment-2: Study on the Fresh Water Recruitment for Tra Vinh Paddy Areas (from Vinh Long province)

The works required under this Assignment-2 are;

1) Update/establishment of the digital land use map together with irrigation and drainage networks with all the structures already put in places to be served for hydrodynamic and advection-dispersion simulations (saline intrusion simulation);

2) Simulations on the saline intrusion into this Tra Vinh and Vinh Long provinces with projected discharges and sea level rises;

3) Based on the simulation results, estimation of the probability of the saline water; and

4) Examination of the resettlement plan, and with additional field surveys including observation, counting the houses, mapping of those houses, prepare detail resettlement plan with reference to a JICA guideline.

Assignment-3: Study on the Water Management for Bac Lieu Centre and its Coastal Area

The works required under this Assignment-3 are;

1) Update/establishment of the digital land use map together with irrigation and drainage networks;
2) Simulations on the inundation/flood for the established digital model of this Bac Lieu centre area; and
3) Based on the simulation results, examination of the best combination of the facilities in order to prevent the Bac Lieu centre from inundation

Assignment-4: Study on the Flow Mobilization in the Water Tranquil Areas of the Ca Mau Peninsula

The works required under this Assignment-4 are;

1) Update/establishment of the digital land use map together with irrigation and drainage networks
2) Simulations on the water mobilization by hydrodynamic and advection-dispersion model
3) Based on the simulation results, examination of the best combination of the sluice gates in the canal network with sluice in the Song Cai Lon river

Assignment-5: Study on the best-suited sea dyke types adaptive to the Local Situation

The works required under this Assignment-5 are;

1) Collection of the data and information of sea dykes which have been so far constructed in Vietnam.
2) Computer simulation on morphology of the costal area of the Mekong Delta
3) Recommendation of types of sea dykes along the coastal line according to the local situation and also simulation results together with typical cross sectional drawings and construction cost per km.

Assignment-6: Study on the Sustainability of Extensive to Semi (Family level) Intensive Shrimp Cultures

The works required under this Assignment-5 are;

1) Implementation of household interview with prescribed structured interview form, covering a total 270 samples
2) Encoding of the interviewed data
3) Implementation of multiple regression analysis to identify which factors contribute to what extent in terms of sustainability, and based on the results, recommendation of sustainable shrimp culture method which can be practically adaptable by village farmers and actions to be taken by Government officers in charge.
4) Water quality test for the samples collected at 2 locations one in Ca Mau province and the other in Soc Tran province

3.2 IEE of the In-depth Studies

As described in precious sub-chapter, major assignments of the in-depth studies are simulations, update/ establish of maps, examination of appropriate facilities, salinity measurement and so on. It means that there are no construction works which can cause any negative impacts on the surrounding

environment, therefore, no environmental impacts by the in-depth studies are expected.

Table 3.2.1 Expected Environmental Impacts by the In-depth Studies

Environmental Parameters	Assignment 1	Assignment 2	Assignment 3	Assignment 4	Assignment 5	Assignment 6
1. Air Pollution	-	-	-	-	-	-
2. Water Pollution	-	-	-	-	-	-
3. Waste	-	-	-	-	-	-
4. Soil Contamination/ salinization	-	-	-	-	-	-
5. Noise and Vibration	-	-	-	-	-	-
6. Ground Subsidence	-	-	-	-	-	-
7. Offensive Odor	-	-	-	-	-	-
8. Bottom sediment	-	-	-	-	-	-
9. Protected area	-	-	-	-	-	-
10. Ground water	-	-	-	-	-	-
11. Hydrological Situation	-	-	-	-	-	-
12. Topography and Geographical features	-	-	-	-	-	-
13. Involuntary Resettlement	-	-	-	-	-	-
14. Land Acquisition	-	-	-	-	-	-
15. Cultural heritage (tombs)	-	-	-	-	-	-
16. Landscape	-	-	-	-	-	-
17. The poor, indigenous and ethnic people	-	-	-	-	-	-
18. Livelihood	-	-	-	-	-	-
19. Local economy	-	-	-	-	-	-
20. Existing social infrastructures and services	-	-	-	-	-	-
21. Misdistribution of benefit and damage	-	-	-	-	-	-
22. Social institutions	-	-	-	-	-	-
23. Water Usage or Water Rights and Rights of Common	-	-	-	-	-	-
24. Gender	-	-	-	-	-	-
25. Children rights	-	-	-	-	-	-
26. Hazards (Risk), Infectious diseases such as HIV/AIDS	-	-	-	-	-	-

Environmental Parameters	Assignment 1	Assignment 2	Assignment 3	Assignment 4	Assignment 5	Assignment 6
27. Accidents	-	-	-	-	-	-
28. Global Warming	-	-	-	-	-	-

X: Negative impact is expected - : Either positive or negligible negative impact is expected

Attachment VIII-A-1 Format of Questionnaire for Household Survey

Questionnaire for Household Survey

Interviewee's Profile

Name: Age: Mobile No.:

Address: Village:

Commune: Province:

Number of family member: Number of female family member:

Educational status:

Domestic Finance

Main income source:

Main cultivated crops:

Area of farmland: (cong)

Annual harvest of paddy: (tons) Annual harvest of paddy: (tons)

Annual sale of paddy: (tons) Annual cash income by paddy: (million VND)

Annual cost of paddy: (million VND)

Annual harvest of fruit: (tons or fruit) Annual cash income by fruit: (million VND)

Annual cost of fruit: (million VND)

Other income source (apart from farming):

Other cash income (apart from farming): (million VND)

Living Conditions

Floor area of house: (m^2) Yard area of house: (m^2)

House structure/material: Years to stay in the area: (years)

Water source of domestic use in rainy season:

Water source of domestic use in dry season:

Availability of electricity: [Yes / No]

Others

Do you have an official land use certificate? [Yes / No]

Do you want to continue your present job after the resettlement? [Yes / No]

Which compensation measure is preferable for you, by cash or land? [Cash / Land]

What kind of technical support by the Government is needed except for farming?

What is the most important infrastructure for you?

Household Survey Results in Tra Vinh Province and Vinh Long Province

No.1

Sluice	No.	Name	Address Hamlet-Commune-Province	Number of family members	Number of female member	Age of Interviewees	Educational status of Interviewees	Phone numbers	Domestic finance									
									Main income source	Main cultivated crop	Area of farmland (cong)	Annual Havest of Paddy (tons)	Annual Sold of Paddy (tons)	Annual Cash income by Paddy (million VND)	Annual Cost by Paddy (million VND)	Annual Cash net income by Paddy (million VND)	Annual havest of fruits (tons)	Annual Cash income by fruit (million VND)
Tan Dinh	1	Le Van Cuong	Dinh An-An Phu Tan-Tra Vinh	5	1	60	5/12	01647606416	Fruit production	Pomelo, Coconut, Longan	6	0	0	0	0	0	0	20
Tan Dinh	2	Nguyen Van Thanh Duoc	Dinh An-An Phu Tan-Tra Vinh	3	1	29	8/12	01226817894	Fruit production	Pomelo, Coconut, Longan	1	0	0	0	0	0	0	0
Tan Dinh	3	Nguyen Van Han	Dinh An-An Phu Tan-Tra Vinh	4	3	29	6/12	None	Labor	-	0	0	0	0	0	0	0	0
Tan Dinh	4	Pham Quoc Khang	Dinh An-An Phu Tan-Tra Vinh	4	3	31	9/12	None	Labor	-	0	0	0	0	0	0	0	0
Tan Dinh	5	Phan Minh Tuan	Dinh An-An Phu Tan-Tra Vinh	No one at home		-	-	-	-	-	-	-	-	-	-	-	-	-
Tan Dinh	6	Nguyen Thi Mau	Dinh An-An Phu Tan-Tra Vinh	No one at home		-	-	-	-	-	-	-	-	-	-	-	-	-
Tan Dinh	7	Nguyen Thi Nhi	Dinh An-An Phu Tan-Tra Vinh	3	2	55	not sure	None	Grocery	-	0	0	0	0	0	0	0	0
Tan Dinh	8	Ho Thi Lan	Phu Quoi-Tich Thien-Vinh Long	8	3	81	not sure	None	Farming	Paddy	10	15	15	67.5	45	22.5	0	0
Tan Dinh	9	Mai Van Tung	Phu Quoi-Tich Thien-Vinh Long	3	1	42	not sure	None	Labor	-	0	0	0	0	0	0	0	0
Tan Dinh	10	Mai Van Chieu	Phu Quoi-Tich Thien-Vinh Long	4	3	56	not sure	None	Farming	Paddy	4	7.2	7.2	31.5	18	13.5	0	0
Tan Dinh	11	Mai Van Thom	Phu Quoi-Tich Thien-Vinh Long	2	1	76	not sure	None	Business	Mixing Garden	1.5	0	0	0	0	0	not sure	not sure
Tan Dinh	12	Ngo Thanh Binh	Phu Quoi-Tich Thien-Vinh Long	6	3	38	not sure	None	Fruit production	all year round	4	0	0	0	0	0	not sure	30
Tan Dinh	13	Ngo Van Bay	Phu Quoi-Tich Thien-Vinh Long	5	2	38	4/12	01204880424	Farming	Paddy+Garden	20	21.6	7	94.5	72	22.5	not yet	not yet
Tan Dinh	14	Nguyen Van Em	Phu Quoi-Tich Thien-Vinh Long	4	1	51	4/12	None	Farming	Paddy+Garden	16	21.6	7	94.5	72	22.5	not sure	2-3
Tan Dinh	15	Nguyen Van Tri	Phu Quoi-Tich Thien-Vinh Long	5	4	50	3/12	None	Labor	-	1.5	0	0	0	0	0	0	0
Tan Dinh	16	Ngo Van Liem	Phu Quoi-Tich Thien-Vinh Long	1	0	64	None	None	children's supports	-	0	0	0	0	0	0	0	0
Vung Liem	1	Ta Tan Men	Tan Trung-Trung Thanh Dong-Vinh Long	4	2	83	not sure	0918156076	Fruit production	Pomelo, Coconut, Longan	6.3	0	0	0	0	0	not sure	15
Vung Liem	2	Nguyen Van Cuong Em	Tan Trung-Trung Thanh Dong-Vinh Long	3	1	24	5/12	01653189595	Labor	-	4	0	0	0	0	0	0	0

Household Survey Results in Tra Vinh Province and Vinh Long Province

No.2

			Domestic finance					Living conditions							Others				
Sluice	**No.**	Name	Annual Cost by fruit (million VND)	Annual Cash net income by fruit (million VND)	Other income source apart from farming	Total Other income (million VND)	Total income (million VND)	Floor area of house	Yard area where house put up, (m2)	Structure of house (material)	Years to stay in the area	Kind of domestic water, rainy season	Kind of domestic water, dry season	Availability of electricity, (Yes or No)	Official Land use certificate (Yes or No)	Do you want to continue job? (Yes or No)	Compensation (in cash or in farm land)	Required technical support from GOV (no-farmig case only)	Required puublic infrastructure the most important
Tan Dinh	**1**	Le Van Cuong	4	16	None	0	16	15	0	Leaf house	60	River	River	Yse	Yes	not sure	No idea	No idea	No idea
Tan Dinh	**2**	Nguyen Van Thanl	0	0	Labor	36	36	50	0	Corrugated iron roof, leaf wall, concrete floor	5	Supply system	Supply system	Yse	Yes	not sure	No idea	No idea	No idea
Tan Dinh	**3**	Nguyen Van Han	0	0	Labor	0	0	30	0	Corrugated iron roof, leaf wall	29	River	River	Yse	Yes	not sure	No idea	No idea	No idea
Tan Dinh	**4**	Pham Quoc Khang	0	0	Labor	25	25	55		Corrugated iron roof, brick wall, concrete floor	31	River	River	Yse	Yes	not sure	No idea	No idea	No idea
Tan Dinh	**5**	Phan Minh Tuan	-	-	-	-	-	-	-	Leaf house	-	-	-	-	Yes	-	-	-	-
Tan Dinh	**6**	Nguyen Thi Mau	-	-	-	-	-	-	-	Leaf house	-	-	-	-	Yes	-	-	-	-
Tan Dinh	**7**	Nguyen Thi Nhi	0	0	Grocery	48	48	60	not sure	Corrugated iron roof, leaf+brick wall	16	Supply system	Supply system	Yse	Yes	not sure	No idea	No idea	No idea
Tan Dinh	**8**	Ho Thi Lan	0	0	None	0	22.5	320	20	Tile roof and brick wall; Leaf house	81	Drilling well	Drilling well	Yes	Yes	not sure	No idea	No idea	No idea
Tan Dinh	**9**	Mai Van Tung	0	0	Labor	36	36	70	5	Tile roof and wood wall	42	River	River	Yes	Yes	not sure	No idea	No idea	No idea
Tan Dinh	**10**	Mai Van Chieu	0	0	None	0	13.5	90	10	Tile roof, wood wall	56	Rainfall and River	Rainfall and River	Yes	Yes	not sure	No idea	No idea	No idea
Tan Dinh	**11**	Mai Van Thom	not sure	0	Businces	15	15	48	10	Brick house	76	Rainfall and River	Rainfall and River	Yse	Yes	not sure	No idea	No idea	No idea
Tan Dinh	**12**	Ngo Thanh Binh	10	20	Labor	10	30	120	10	Tile roof, brick wall	38	Supply systen	Supply system	Yse	Yes	not sure	No idea	No idea	No idea
Tan Dinh	**13**	Ngo Van Bay	2	-2	None	0	20.5	200	30	Tile roof, brick wall	38	Drilling well	Drilling well	Yse	Yes	No	No idea	No idea	No idea
Tan Dinh	**14**	Nguyen Van Em	1.8	0.7	None	0	23.2	180	50	Tile roof, brick wall	51	Drilling well	Drilling well	Yse	Yes	No	Money	No idea	No idea
Tan Dinh	**15**	Nguyen Van Tri	0	0	Labor	30	30	30	0	Leaf house	50	Drilling well	Drilling well	Yse	Yes	No	No idea	No idea	No idea
Tan Dinh	**16**	Ngo Van Liem	0	0	None	0	0	84	0	Tile roof, brick wall and leaf house (20 m2)	64	Drilling well	Drilling well	Yse	Yes	No	Money	No idea	No idea
Vung Liem	**1**	Ta Tan Men	3	12	shipping	200	212	200	50	Tile roof, brick wall	83	Rainfall	Rainfall and River	Yse	Yes	not sure	No idea	No idea	No idea
Vung Liem	**2**	Nguyen Van Cuon	0	0	Labor	60	60	50	5	Tile roof, wood wall	24	Rainfall	Rainfall and River	Yse	Yes	not sure	No idea	No idea	No idea

Household Survey Results in Tra Vinh Province and Vinh Long Province

No.3

									Domestic finance									
Sluice	**No.**	Name	Address Hamlet-Commune-Province	Number of family members	Number of female member	Age of Interviewees	Educational status of Interviewees	Phone numbers	Main income source	Main cultivated crop	Area of farmland (cong)	Annual Havest of Paddy (tons)	Annual Sold of Paddy (tons)	Annual Cash income by Paddy (million VND)	Annual Cost by Paddy (million VND)	Annual Cash net income by Paddy (million VND)	Annual havest of fruits (tons)	Annual Cash income by fruit (million VND)
Vung Liem	**3**	Nguyen Van Truong	Tan Trung-Trung Thanh Dong-Vinh Long	2	1	31	not sure	None	Labor	-	0	0	0	0	0	0	0	0
Vung Liem	**4**	Nguyen Thi Bay	Tan Trung-Trung Thanh Dong-Vinh Long	5	4	52	not sure	None	Shipping	-	12	0	0	0	0	0	0	0
Vung Liem	**5**	Ta Cong Day	Phu An-Trung Thanh Tay-Vinh Long	4	1	48	not sure	None	Farming	Paddy	3	4.8	4.8	19.2	15.3	3.9	0	0
Vung Liem	**6**	Pham Thi Nhung	Phu An-Trung Thanh Tay-Vinh Long	4	1	86	not sure	None	Labor	-	0	0	0	0	0	0	0	0
Vung Liem	**7**	Huynh Van Nguon	Phu An-Trung Thanh Tay-Vinh Long	1	0	64	not sure	None	Aquaculture	-	1.5	0	0	0	0	0	0	0
Vung Liem	**8**	Nguyen Van Hoang	Phu An-Trung Thanh Tay-Vinh Long	6	1	56	not sure	None	Farming	Paddy	4	7.2	7.2	10.8	8.64	2.16	0	0
Vung Liem	**9**	Huynh Thi Loi	Phu An-Trung Thanh Tay-Vinh Long	3	2	60	not sure	None	Labor	-	0	0	0	0	0	0	0	0
Vung Liem	**10**	Huynh Thi Chong	Phu An-Trung Thanh Tay-Vinh Long	6	4	38	3/12	01206603699	Labor	-	3.7	0	0	0	0	0	not sure	6-7
Vung Liem	**11**	Nguyen Thi Dieu	Phu An-Trung Thanh Tay-Vinh Long	1	1	56	4/12	None	Fruit production	Pomelo, Coconut, Longan	2	0	0	0	0	0	not sure	2-3
Bong Bot	**1**	Le Van Ut	An Trai-An Phu Tan-Tra Vinh	4	1	36	5/12	0975273409	Fruit production	Pomelo, Coconut, Longan	1.2	0	0	0	0	0	not sure	0
Bong Bot	**2**	Trinh Van Bong	An Trai-An Phu Tan-Tra Vinh	6	3	61	4/12	01672783722	Fruit production	Pomelo, Coconut, Longan	4	0	0	0	0	0	not sure	20
Bong Bot	**3**	Nguyen Thi Be	An Trai-An Phu Tan-Tra Vinh	6	3	49	not sure	None	Shipping	-	0	0	0	0	0	0	0	0
Bong Bot	**4**	Pham Van Et	An Trai-An Phu Tan-Tra Vinh	7	3	42	not sure	01653850363	Business and Garden	Pomelo, Coconut, Longan	7	0	0	0	0	0	0	8
Bong Bot	**5**	Trinh Van Mien	An Trai-An Phu Tan-Tra Vinh	4	1	35	not sure	None	Labor	-	0	0	0	0	0	0	0	0
Bong Bot	**6**	Trinh Van Thang	An Trai-An Phu Tan-Tra Vinh	4	1	30	not sure	None	Labor	-	0	0	0	0	0	0	0	0
Bong Bot	**7**	Le Van Dung	An Hoa-An Phu Tan-Tra Vinh	5	4	52	7/12	None	Fruit production	Pomelo, Coconut, Longan	5	0	0	0	0	0	not sure	not sure
Bong Bot	**8**	Tran Van Hon	An Hoa-An Phu Tan-Tra Vinh	No one at home				-	-	-	-	-	-	-	-	-	-	-

Household Survey Results in Tra Vinh Province and Vinh Long Province

No.4

Sluice	No.		Domestic finance					Living conditions							Others				
		Name	Annual Cost by fruit (million VND)	Annual Cash net income by fruit (million VND)	Other income source apart from farming	Total Other income (million VND)	Total income (million VND)	Floor area of house	Yard area where house put up, (m2)	Structure of house (material)	Years to stay in the area	Kind of domestic water, rainy season	Kind of domestic water, dry season	Availability of electricity, (Yes or No)	Official Land use certificate (Yes or No)	Do you want to continue job? (Yes or No)	Compensation (in cash or in farm land)	Required technical support from GOV (no-farmig case only)	Required puublic infrastructure the most important
Vung Liem	**3**	Nguyen Van Truong	0	0	Labor	30	30	30	0	Leaf house	31	Rainfall	Rainfall and River	Yse	Yes	not sure	No idea	No idea	No idea
Vung Liem	**4**	Nguyen Thi Bay	0	0	Shipping	500	500	400	50	Tile roof, brick wall	52	Rainfall	Rainfall and River	Yse	Yes	not sure	No idea	No idea	No idea
Vung Liem	**5**	Ta Cong Day	0	0	None	0	3.9	150	20	Tile roof and brick wall	48	Rainfall	Rainfall and River	Yse	Yes	not sure	No idea	No idea	No idea
Vung Liem	**6**	Pham Thi Nhung	0	0	Labor	36	36	110	10	Tile roof and wood wall	86	Rainfall	Rainfall and River	Yse	Yes	not sure	No idea	No idea	No idea
Vung Liem	**7**	Huynh Van Nguon	0	0	aquaculture	300	300	36	10	Tile roof and brick wall	64	Rainfall	Rainfall and River	Yse	Yes	not sure	No idea	No idea	No idea
Vung Liem	**8**	Nguyen Van Hoang	0	0	Labor	100	102.16	140	20	Tile roof and wood wall	56	Rainfall	Rainfall and River	Yse	Yes	not sure	No idea	No idea	No idea
Vung Liem	**9**	Huynh Thi Loi		0	Labor	36	36	100	20	Tile roof and brick wall	60	Rainfall	Rainfall and River	Yse	Yes	not sure	No idea	No idea	No idea
Vung Liem	**10**	Huynh Thi Chong	2	4.5	Labor	36	40.5	250	20	Tile roof and wood wall	38	River	River	Yse	Yes	No	No idea	No idea	No idea
Vung Liem	**11**	Nguyen Thi Dieu	1.6	0.9	None	0	0.9	100	20	Tile roof and brick wall	56	River	River	Yse	Yes	No	No idea	No idea	No idea
Bong Bot	**1**	Le Van Ut	0	0	Labor	72	72	50	30	Corrugated iron roof, leaf wall	36	Supply system	Supply system	Yse	Yes	not sure	No idea	No idea	No idea
Bong Bot	**2**	Trinh Van Bong	not sure	20	Aquaculture	36	56	60	16	Corrugated iron roof, brick wall, ceramic floor	36	River	River	Yse	Yes	not sure	No idea	No idea	No idea
Bong Bot	**3**	Nguyen Thi Be	0	0	Transport goods by boat	360	360	120	50	Corrugated iron roof, brick wall, ceramic floor	36	Supply system	Supply system	Yse	Yes	not sure	No idea	No idea	No idea
Bong Bot	**4**	Pham Van Et	2	6	Labor	36	42	150	60	Tile roof and brick wall	42	Supply system	Supply system	Yse	Yes	not sure	No idea	No idea	No idea
Bong Bot	**5**	Trinh Van Mien	0	0	Labor	36	36	210	30	Tile roof and brick wall	35	Supply system	Supply system	Yse	Yes	not sure	No idea	No idea	No idea
Bong Bot	**6**	Trinh Van Thang	0	0	Labor	36	36	100	30	Tile roof and brick wall	36	Supply system	Supply system	Yse	Yes	not sure	No idea	No idea	No idea
Bong Bot	**7**	Le Van Dung	not sure	0	Labor	36	36	420	30	Brick house and Leaf house	52	Drilling well	Drilling well	Yse	Yes	not sure	No idea	No idea	No idea
Bong Bot	**8**	Tran Van Hon	-	-	-	-	-	-	-	-	-	-	-	-	Yes	-	-	-	-

VIII-A-3 Results of Household Survey in Ben Tre Province

Household Survey Results in Ben Tre Province

No.1

Sluice	No.	Name of householder	Address		Status of Family					Domestic finance										
			Commune	Village	Number of family member	Number of female family member	Age of Interviewees	Educational status of Interviewees	Phone numbers	Main income source	Main cultivated crop	Area of farmland (cong=1000m2)	Annual havest of paddy (ton)	Annual sold paddy (ton)	Annual cash income by paddy (million VND)	Annual estimation cost for paddy cultivation (million VND)	Annual havest of fruit or shimp	Unit of fruit or shrimp (fruits or tons)	Annual cash gross income by fruit (million VND)	Annual cost for fruit cultivation (million VND)
AN HOA	1	Dong Kim Nguyen	Giao Hoa	1	3	1	45	6/12	01682081550	Labor	-	0.0	0	0	0	0	0	0	0	0
AN HOA	2	Vo Van Lam	Giao Hoa	1	4	1	51	6/12	None	Labor	-	0.0	0	0	0	0	0	0	0	0
AN HOA	3	Dang Minh Hoang	Giao Hoa	1	5	1	48	12/12	01655092775	Fruit production	Longan	4.0	0	0	0	0	N.D.	N.D.	70	12
AN HOA	4	Ho Thanh Hai	Giao Hoa	1	4	2	51	9/12	0909865023	Livestock	-	1.3	0	0	0	0	-	-	70	3.5
AN HOA	5	Nguyen Thi Tim	Giao Hoa	1	7	3	51	3/12	0985858119	shipping	-	0.0	0	0	0	0	-	-	-	-
AN HOA	6	Tran Quang Nhan	Giao Hoa	1	7	4	48	9/12	0906858902	Factory worker	_	0.0	0	0	0	0	-	-	-	-
AN HOA	7	Trinh Van Nam	Giao Hoa	1	10	5	52	5/12	None	Fruit production	Longan	4.0	0	0	0	0	24	tons	120	6
AN HOA	8	Trinh Thi Tu	Giao Hoa	1	12	6	55	2/12	None	Fruit production	Longan	3.6	0	0	0	0	-	-	-	7
AN HOA	9	Tuong Thi Hai	Giao Hoa	1	4	2	56	2/10	None	Labor	-	No	0	0	0	0	-	-	-	-
AN HOA	10	Nguyen Nhu Hien	Giao Hoa	1	4	1	41	9/12	None	Labor	-	No	0	0	0	0	-	-	-	-
AN HOA	11	Vo Van Moi	Giao Hoa	1	7	3	53	3/12	None	Labor	-	1.0	0	0	0	0	-	-	-	1
AN HOA	12	Vo Thi Kim Anh	Giao Hoa	1	3	1	29	6/12	None	Driving	-	No	0	0	0	0	-	-	-	-
AN HOA	13	Ho Thi Liem	Giao Hoa	1	11	4	60	2/12	None	Fruit production	Longan	6.5	0	0	0	0	8	tons	120	5
AN HOA	14	Nguyen Van Em	Giao Hoa	Hoa Thanh	6	2	70	10/12	None	Fruit production	Longan	2.4	0	0	0	0	-	-	3.0	1.5
AN HOA	15	Pham Van Tan	Giao Hoa	Hoa Thanh	3	0	79	5/12	None	Support by children	-	4.3	0	0	0	0	-	-	-	-
AN HOA	16	Vo Van Phuoc	Giao Hoa	Hoa Thanh	4	2	48	7/12	None	Labor	-	_	0	0	0	0	-	-	-	-
AN HOA	17	Vo Minh Ngoc	Giao Hoa	Hoa Thanh	2	1	75	7/12	None	Support by children	-	_	0	0	0	0	-	-	-	-
AN HOA	18	Nguyen Van Mau	Giao Hoa	Hoa Thanh	7	3	75	8/12	None	Woodworker	-	_	0	0	0	0	-	-	-	-
AN HOA	19	Do Van Hoang	Long Dinh	Long Hoa 1	4	2	54	7/12	0919878006	Fruit production	Coconut	2.5	0	0	0	0	9,600	fruits	40	5
AN HOA	20	Nguyen Cong Thinh	Long Dinh	Long Hoa 1	6	2	66	11/12	0753746434	Fruit production	Coconut	8.0	0	0	0	0	48,000	fruits	200	50

Household Survey Results in Ben Tre Province

No.2

Sluice	No.	Name of householder	Domestic finance				Living conditions							Others				
			Annual cash net income by fruit (million VND)	Other income source apart from farming	Other cash income (million VND)	Total cash income (million VND)	Floor area of house, (m^2)	Yard area where house put up, (m^2)	Structure of house (material)	Years to stay in the area	Kind of domestic water, Rainy season	Kind of domestic water, dry season	Availability of Electricity, (Yes or No)	Official Land use certificate (Yes or No)	Continue your job or not after resettlement (Yes or No)	Preferable compensation (in cash or in farm land)	Needed technical support by the GOV (no-farmig case only)	Required puublic infrastructure the most important
AN HOA	1	Dong Kim Nguyen	0	Labor	36.0	36.0	31.5	20	Iron sheet, wood wall house	15	Tap-water	Tap-water	Yes	No	No	Land	No	Roads
AN HOA	2	Vo Van Lam	0	Labor	36.0	36.0	72	15	Iron sheet, wood wall house	51	Tap-water	Tap-water	Yes	No	No	Cash	vocational training	Roads
AN HOA	3	Dang Minh Hoang	58	N.D.	43.0	101.0	120	180	Iron sheet, concrete wall house	48	Tap-water	Tap-water	Yes	Yes	No	Land	No	Roads
AN HOA	4	Ho Thanh Hai	67	Labor	30.0	96.5	300	0	Iron sheet, brick wall house	51	Tap-water	Tap-water	Yes	Yes	No	Land	No	Roads
AN HOA	5	Nguyen Thi Tim	0	Labor	36.0	36.0	217	0	Iron sheet, brick wall house	51	Tap-water	Tap-water	Yes	Yes	No	Land	No	Roads
AN HOA	6	Tran Quang Nhan	0	Labor	54.0	54.0	320	0	Iron sheet, brick wall house	48	Tap-water	Tap-water	Yes	Yes	No	Land	No	Roads
AN HOA	7	Trinh Van Nam	114	0	35.0	149.0	300	50	Iron sheet, leaf wall	52	Tap-water	Tap-water	Yes	Yes	No	Land	No	Roads
AN HOA	8	Trinh Thi Tu	-7	6 Labors	124.0	117.0	139	32	Iron sheet, brick wall house	55	Rain water	Drilling well	Yes	Yes	Yes	Cash	vocational training	Electricity
AN HOA	9	Tuong Thi Hai	0	Labor	50.0	50.0	63	0	Iron sheet, brick wall house	56	Rain water	Rain and river water	Yes	No	Yes	Cash	No	Electricity
AN HOA	10	Nguyen Nhu Hien	0	Labor	80.0	80.0	35	15	Iron sheet, brick wall house	41	Rain water	Drilling well	Yes	No	Yes	Cash	liverstock technical	Electricity
AN HOA	11	Vo Van Moi	-1	Labor	80.0	79.0	112	14	Iron sheet, brick wall house	53	Rain water	Drilling well	Yes	No	No	Cash	No	Electricity
AN HOA	12	Vo Thi Kim Anh	0	Labor	84.0	84.0	36	0	Iron sheet, brick wall house	29	Rain water	Drilling well	Yes	No	No	Cash	No	Electricity
AN HOA	13	Ho Thi Liem	115	1 worker	50.0	165.0	100	17	cottage	60	Rain water	Drilling well	Yes	Yes	No	Cash	vocational training	Electricity
AN HOA	14	Nguyen Van Em	2	None	18.0	19.5	96	32	Iron sheet, leaf wall house	30	Drilling well	Drilling well	Yes	Yes	No	Cash	liverstock technical	Hospitals
AN HOA	15	Pham Van Tan	0	None	18.0	18.0	150	40	Iron sheet, brick wall house	56	Drilling well	Drilling well	Yes	Yes	No	Cash	No	Hospitals
AN HOA	16	Vo Van Phuoc	0	None	84.0	84.0	40	0	Iron sheet, leaf wall house	25	Rain water	river water	Yes	No	Yes	Land	No	Electricity
AN HOA	17	Vo Minh Ngoc	0	None	18.0	18.0	144	30	Iron sheet, leaf wall house	53	Drilling well	Drilling well	Yes	No	No	Cash	No	Hospitals
AN HOA	18	Nguyen Van Mau	0	Labor	50.0	50.0	120	0	Iron sheet, leaf wall house	38	Drilling well	Drilling well	Yes	No	No	Cash	No	Hospitals
AN HOA	19	Do Van Hoang	35	None	0.0	35.0	150	60	Brick sheet, wood wall house	54	Rain water	River water	Yes	Yes	No	Cash	No	Electricity
AN HOA	20	Nguyen Cong Thinh	150	None	0.0	150.0	140	50	Brick sheet, wood wall house	45	Rain water	River water	Yes	Yes	Yes	Cash	vocational training	Schools

Household Survey Results in Ben Tre Province

Sluice	No.	Name of householder	Address		Status of Family					Domestic finance										
			Commune	Village	Number of family member	Number of female family member	Age of Interviewees	Educational status of Interviewees	Phone numbers	Main income source	Main cultivated crop	Area of farmland (cong=1000m2)	Annual havest of paddy (ton)	Annual sold paddy (ton)	Annual cash income by paddy (million VND)	Annual estimation cost for paddy cultivation (million VND)	Annual havest of fruit or shimp	Unit of fruit or shrimp (fruits or tons)	Annual cash gross income by fruit (million VND)	Annual cost for fruit cultivation (million VND)
AN HOA	21	Dang Van Dung	Long Dinh	Long Hoa 1	5	3	50	3/12	01688863090	Fruit production	Longan	1.8	0	0	0	0	1.2	tons	18	6
AN HOA	22	Vo Minh Luy	Long Dinh	Long Hoa 1	5	3	44	6/12	0986220684	Fruit production	Coconut	1.0	0	0	0	0	2,640	fruits	11	3
AN HOA	23	Vo Van Tre	Long Dinh	Long Hoa 1	5	3	42	5/12	01223563280	Fruit production	Coconut	2.0	0	0	0	0	7,200	fruits	30	5
AN HOA	24	Nguyen Thi Thao	Long Dinh	Long Hoa 1	5	2	52	9/12	01692438138	Fruit production	Longan	1.0	0	0	0	0	0.7	tons	10	2
AN HOA	25	Nguyen Thi Ngoc Tha	Long Dinh	Long Hoa 1	2	1	63	5/12	0926645948	Fruit production	Coconut	1.5	0	0	0	0	3,600	fruits	15	3
AN HOA	26	Nguyen Thi Kim Ngan	Long Dinh	Long Hoa 1	2	2	41	8/12	01213400392	Labor	-	0.0	0	0	0	0	-	-	-	-
AN HOA	27	Bui Cong Toan	Long Dinh	Long Hoa 1	1	0	37	10/12	0939319949	Labor	-	0.0	0	0	0	0	-	-	-	-
AN HOA	28	Ly Van Vong	Long Dinh	Long Hoa 1	3	1	74	Bachelor	01699074823	Fruit production	Coconut	6.0	0	0	0	0	34,080	fruits	142	32
AN HOA	29	Nguyen Van Tu	Long Dinh	Long Hoa 1	6	3	48	5/12	01667959939	Fruit production	Longan	1.2	0	0	0	0	0.5	tons	7	2
AN HOA	30	Nguyen Thi Minh	Long Dinh	Long Hoa 1	3	1	85	5/12	0939722426	Fruit production	Coconut	5.5	0	0	0	0	16,800	fruits	70	20
BEN RO	1	Nguyen Thi Dao	Tien Long	Tien Hung	5	3	76	5/12	0756563169	Fruit production	Rambutant	9.0	0	0	0	0	11	tons	250	25
BEN RO	2	Nguyen Hong Quyen	Tien Long	Tien Hung	3	2	35	5/12	01692475304	Fruit production	Rambutant	3.6	0	0	0	0	5	tons	130	30
BEN RO	3	Tran Van Phat	Tien Long	Tien Hung	4	1	44	7/12	01216932026	Fruit production	Rambutant	2.9	0	0	0	0	5	tons	120	25
TAN PHU	1	Huynh Van Minh	Tan Phu	Tan Bac	2	1	63	12/12	0753867099	Fruit production	Rambutant	4.7	0	0	0	0	8	tons	100	50
TAN PHU	2	Huynh Thi Kim Ba	Tan Phu	Tan Bac	4	1	42	9/12	None	Labor	-	0.0	0	0	0	0	-	-	0	0
TAN PHU	3	Pham Thi Dung	Tan Phu	Tan Bac	6	4	50	5/12	01669274331	Fruit production	Rambutant	12.0	0	0	0	0	15	tons	180	90
TAN PHU	4	Huynh Van Nghiep	Tan Phu	Tan Bac	4	2	61	12/12	01684608423	Fruit production	Rambutant	2.0	0	0	0	0	5	tons	60	20
TAN PHU	5	Huynh Cong Ly	Tan Phu	Tan Bac	6	1	42	9/12	0985804229	Labor	-	0.0	0	0	0	0	-	-	0	0
TAN PHU	6	Tran Van Thoi	Tan Phu	Tan Bac	5	2	50	5/12	0753620679	Fruit production	Rambutant	7.5	0	0	0	0	5	tons	75	35
TAN PHU	7	Nguyen Ngoc Em	Tan Phu	Tan Bac	4	1	51	9/12	0753867493	Fruit production	Rambutant	10.0	0	0	0	0	13	tons	200	80
TAN PHU	8	Nguyen Hoang Phong	Tan Phu	Tan Bac	2	0	38	12/12	0985858533	Fruit production	Rambutant	3.0	0	0	0	0	5	tons	60	25
BEN TRE	1	Can Van Khai	Nhon Thanh	4	4	3	58	12/12	None	Fruit production	Coconut	2.4	0	0	0	0	2,400	fruits	25	3

* It is estimated based on the calculattion, 3 million/month (for labor work by one guy) × 12 months (=36million/year

Household Survey Results in Ben Tre Province

No.4

Sluice	No.	Name of householder	Domestic finance				Living conditions							Others				
			Annual cash net income by fruit (million VND)	Other income source apart from farming	Other cash income (million VND)	Total cash income (million VND)	Floor area of house, (m^2)	Yard area where house put up, (m^2)	Structure of house (material)	Years to stay in the area	Kind of domestic water, Rainy season	Kind of domestic water, dry season	Availability of Electricity, (Yes or No)	Official Land use certificate (Yes or No)	Continue your job or not after resettlement (Yes or No)	Preferable compensation (in cash or in farm land)	Needed technical support by the GOV (no-farmig case only)	Required puublic infrastructure the most important
AN HOA	21	Dang Van Dung	12	None	0.0	12.0	90	35	Iron sheet, brick wall house	50	Rain water	River water	Yes	No	No	Cash	No	Electricity
AN HOA	22	Vo Minh Luy	8	None	0.0	8.0	100	10	Iron sheet, brick wall house	44	Rain water	River water	Yes	Yes	No	Cash	No	Electricity
AN HOA	23	Vo Van Tre	25	None	0.0	25.0	200	50	Iron sheet, brick wall house	42	Rain water	River water	Yes	Yes	No	Cash	No	Schools
AN HOA	24	Nguyen Thi Thao	8	None	0.0	8.0	200	100	brick sheet, wood wall house	52	Rain water	River water	Yes	Yes	No	Cash	No	Schools
AN HOA	25	Nguyen Thi Ngoc Thanh	12	None	0.0	12.0	180	30	Cottage	63	Rain water	River water	Yes	No	No	Cash	No	Electricity
AN HOA	26	Nguyen Thi Kim Ngan	0	Labor	36.0	36.0	180	60	Cottage	41	Rain water	River water	Yes	No	No	Cash	No	Schools
AN HOA	27	Bui Cong Toan	0	Labor	36.0	36.0	200	50	Iron sheet, brick wall house	37	Rain water	River water	Yes	No	No	Cash	No	Schools
AN HOA	28	Ly Van Vong	110	None	0.0	110.0	100	50	Iron sheet, brick wall house	74	Rain water	River water	Yes	Yes	No	Cash	No	Electricity
AN HOA	29	Nguyen Van Tu	5	None	0.0	5.0	200	100	Iron sheet, brick wall house	48	Rain water	River water	Yes	Yes	No	Cash	No	Electricity
AN HOA	30	Nguyen Thi Minh	50	None	0.0	50.0	95	15	Iron sheet, brick wall house	85	Rain water	River water	Yes	Yes	No	Cash	No	Electricity
BEN RO	1	Nguyen Thi Dao	225	None	0.0	225.0	200	100	Tile sheet, brick wall house	57	Rain water	River water	Yes	Yes	No	Cash	No	Schools
BEN RO	2	Nguyen Hong Quyen	100	None	0.0	100.0	30	130	Iron sheet, brick wall house	13	Rain water	River water	Yes	Yes	Yes	Cash	vocational training	Schools
BEN RO	3	Tran Van Phat	95	None	0.0	95.0	50	0	Cottage	13	Rain water	River water	Yes	Yes	Yes	Cash	vocational training	Schools
TAN PHU	1	Huynh Van Minh	50	None	0.0	50.0	140	45	Iron sheet, brick wall house	40	Rain water	River water	Yes	Yes	No	Cash	No	Schools
TAN PHU	2	Huynh Thi Kim Ba	0	Labor	* 36.0	36.0	80	20	Iron sheet, brick wall house	42	Rain water	River water	Yes	Yes	No	Cash	No	Schools
TAN PHU	3	Pham Thi Dung	90	None	36.0	126.0	160	45	Concrete and brick house	50	Rain water	River water	Yes	Yes	No	Cash	No	Schools
TAN PHU	4	Huynh Van Nghiep	40	None	0.0	40.0	140	20	brick sheet, wood wall house	61	Rain water	River water	Yes	Yes	No	Cash	No	Schools
TAN PHU	5	Huynh Cong Ly	0	Labor	36.0	36.0	100	10	Iron sheet, wood wall house	42	Rain water	River water	Yes	Yes	No	Cash	No	Schools
TAN PHU	6	Tran Van Thoi	40	None	0.0	40.0	100	20	Iron sheet, brick wall house	50	Rain water	River water	Yes	Yes	No	Cash	No	Schools
TAN PHU	7	Nguyen Ngoc Em	120	None	0.0	120.0	170	40	Tile sheet, brick wall house	51	Rain water	River water	Yes	Yes	No	Cash	No	Schools
TAN PHU	8	Nguyen Hoang Phong	35	None	0.0	35.0	140	30	Concrete and brick house	38	Rain water	River water	Yes	Yes	No	Cash	No	Schools
BEN TRE	1	Can Van Khai	23	1 Labor	0.0	22.5	100	100	Iron sheet, brick wall house	60	Rain water	River water	Yes	Yes	No	Cash	No	Roads

VIII-A-4 Minutes of Consultation Meeting (1) Vung Liem

[Vietnamese]

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

BIÊN BẢN
V/v họp phổ biến triển khai dự án xây dựng cống Vũng Liêm
và lấy ý kiến người dân trong vùng ảnh hưởng.

Hôm nay, ngày tháng năm tại: Nhà Văn hóa xã Trung Thành Tây - Vũng Liêm - Vĩnh Long

I.Thành phần tham dự cuộc họp gồm có:

+ Đại diện cấp tỉnh:

1. Nguyễn Văn Trường - Chức vụ: Phó Chủ tịch Thường trực Tỉnh Vĩnh Long
2. Nguyễn Văn ... - Chức vụ: Phó Chủ tịch Thường trực Tỉnh Vĩnh Long
3. Trần Thanh Tuyền - Trưởng Phòng ... Sở NN&PTNT Tỉnh Vĩnh Long
4. .....

+ Đại diện cấp huyện:

1. Nguyễn Thế Hùng - Phó Trưởng phòng Kinh tế Huyện Vũng Liêm - VL
2. Lê Chiến Thắng - Phó Trưởng phòng Kinh tế Huyện Vũng Liêm - VL
3. .....
4. .....

+ Đại diện cấp xã:

1. Nguyễn Văn Tám - CT UBND xã Trung Thành Tây - Vũng Liêm - VL
2. Trương Quang Minh - CT MTTQ xã Trung Thành Tây - Vũng Liêm - VL
3. Nguyễn Thanh Hùng - CT UBND xã Trung Thành Tây - Vũng Liêm - VL
4. Trần Văn Duy - CT LMTN xã Trung Thành Tây - Vũng Liêm - VL
5. .....
6. .....

+ Về phía người dân: (Có danh sách đính kèm)

II- Đồng chủ trì cuộc họp:

1. UBND xã Trung Thành Tây - Vũng Liêm - Vĩnh Long
2. UBND xã Trung Thành Tây - Vũng Liêm - Vĩnh Long

III- Thư kýcuộc họp: .....

IV- Nội dungcuộc họp:

1- Thông báo chính thức với người dân về Dự án đã được chọn đầu tư.
2- Ý kiến của người dân về việc XD dự án cống Vũng Liêm

-1-

+ Người dân có tán thành hay không tán thành nếu xây dựng cống ?
+ Người dân có kiến nghị hay đề xuất gì với Nhà nước nếu thực hiện việc xây dựng cống?
+ Có những ý kiến thắc mắc gì liên quan đến việc đầu tư xây dựng cống ?

V- Ý kiến của người dân:

1-. Nguyễn Văn Trường: đồng ý việc xây dựng cống, đảm bảo giao thông thủy thuận lợi.....

2-. Nguyễn Văn Cường: Hoàn toàn nhất trí xây dựng cống...

3-. Nguyễn Thị Hải: đồng thành nhà nước xây dựng cống... nhưng khi giải phóng mặt bằng phải bồi thường thỏa đáng cho người dân.....

4-. Tạ Văn Hiếu: đồng thuận với xây dựng cống nhưng còn lo lắng khi công trình xây dựng xong mất đất, sau này không có chỗ ở để nghỉ ngơi. Nhà nước có những chính sách hỗ trợ thỏa đáng bảo vệ đời sống sau khi công trình.....

5-. Nguyễn Văn Hoàng: đồng thành việc nhà nước xây dựng cống, nhưng còn lo lắng sau khi xây dựng công trình thì mất mát phần diện tích đất mà gia đình đang sinh sống, buôn bán ảnh hưởng đến cuộc sống sinh hoạt hàng ngày.....

6-. Phạm Thị Nhung: Hoàn toàn đồng ý xây dựng cống, nhưng phải đảm bảo giao thông thuận lợi giảm bớt giao thông trong quá trình xây dựng cống.....

7-. Huỳnh Thị Chông: đồng ý xây dựng bồi thường thỏa đáng theo quy định của nhà nước.....

8-. Huỳnh Thị Lợi: đồng thành xây dựng cống.....

9-. Tạ Công Hải: đồng thành việc xây dựng cống.....

10-. Nguyễn Thị Diễm: đồng thành xây dựng cống để ngăn nước mặn xâm nhập, chống sạt lở bờ sông.....

11-. Huỳnh Văn Nguyên: Hoàn toàn nhất trí xây dựng cống, đập cống nhỏ, cần thiết thiết phục vụ sản xuất.....

VI- Ý kiến kết luận cuộc họp: *(Đại diện chính quyền địa phương)*

Qua tất cả các ý kiến của người dân, thay mặt chủ trì cuộc họp, chúng tôi xin gút lại ý kiến đề xuất, kiến nghị của người dân khi triển khai dự án cụ thể sau:

1. 100% hộ dân đồng tình nhà nước xây dựng cống để ngăn nước mặn xâm nhập, giảm ngập lụt khi triều cường dâng cao, cung cấp đủ nước tưới đảm bảo sản xuất ổn định đời sống người dân.

2. Công tác giải phóng mặt bằng, di dời đề nghị nhà nước có những chính sách hỗ trợ phù hợp để đảm bảo ổn định cuộc sống người dân, nhất là những hộ mất đất hoàn toàn.

3. Khi xây dựng cống phải đảm bảo giao thông thủy được thuận lợi, không bị gián đoạn.

Cuộc họp kết thúc lúc… giờ….phút, ngày……tháng…..năm ……và có đọc lại biên bản cuộc họp cho tất cả mọi người tham dự cùng nghe và đồng ý ký tên dưới đây./.

1. Nguyễn Văn Trường	7. Huỳnh Thị Chóng
2. Nguyễn Văn Cường	8. Huỳnh Thị Lọc
3. Nguyễn Thị Bảy	9. Tạ Công Đầy
4. Tạ Tấn Mến	10. Nguyễn Thị Điều
5. Nguyễn Văn Hoàng	11. Huỳnh Văn Nguồn
6. Phạm Thị Nhung	

Thư ký	**Đồng Chủ trì**
	CHỦ TỊCH
1. Ng... V... Tâm	2. Nguyễn Thanh Đáy

-4-

Minutes of meeting on Vung Liem Sluice (English version)

I- Officials attended the Meeting

	Full Name	Organisation	Position
1	Nguyen Van Nhan	Branch of Water Resources in Vinh Long Province (DARD)	Director
2	Nguyen Van Tam	PPC of Trung Thanh Dong Commune	Chairman
3	Truong Quang Dinh	PPC of Trung Thanh Dong Commune	Official
4	Nguyen Thanh Dung	PPC of Trung Thanh Tay Commune	Chairman
5	Bui Van Ly	PPC of Trung Thanh Tay Commune	Official
6	Nguyen Van Sanh	PPC of Trung Thanh Dong Commune	Leader of Phu An Village
7	Nguyen Thi Kim Ba	Division of Agriculture and Rural Development of Vung Liem District	Head of Division
8	Le Chien Thang	Division of Agriculture and Rural Development of Vung Liem District	Deputy Head of Division
9	Nguyen Van Truong	Branch of Water Resources in Tra Vinh Province (DARD)	Director

II- Location of Meeting

1- PPC of Trung Thanh Dong Commune, Vung Liem District, Vinh Long Province

2- PPC of Trung Thanh Tay Commune, Vung Liem District, Vinh Long Province.

III- Content of Meeting

1- To announce about Vung Liem Sluice Construction Project

2- To collect farmers' comments and questions about the Project

IV- Farmers' Ideas and Questions

1- Household-Nguyen Van Truong: I agree to project, but waterway should be continued during Sluice Construction.

2- Household-Nguyen Van Cuong Em: I agree to project.

3- Household-Nguyen Thi Bay: I agree to project, but due to resettlement farmers will be satisfied (*that mean they will receive the compensation enough to deal with new life*.)

4- Household-Ta Van Men: I agree to project, but government needs to help farmers' life have to be stabilized as soon as possible after sluice construction.

5- Household-Nguyen Van Hoang: I agree to project, but I worry about our life will be affected by sluice construction.

6- Household-Pham Thi Nhung: I agree to project, but waterways have to be continued during sluice construction.

7- Household-Huynh Thi Chong: I agree to project, but Resettlement and Compensation have to be based on Policy fully.

8- Household-Huynh Thi Loi: I agree to project

9- Household-Ta Cong Day: I agree to project

10- Household-Nguyen Thi Dieu: I agree to project to prevent saline intrusion and high tides damage.

11- Household-Huynh Van Nguon: I agree to project to get fresh water for irrigation.

V- Meeting Conclusion (*By Commune Official*)

1- 100 % households agreed on the project to meet the purpose such as the prevention of saline intrusion and inundation due to high tide.

2- It was suggest that the government presents suitable policies to stabilize affected people.

3- During sluice construction, the waterway has to be continued.

At the end of consultation meeting, official personnel read the minute of meeting loudly to all of participants and all affected households put their signatures on the minutes. It was stamped by the commune leader.

VIII-A-4 Minutes of Consultation Meeting (2) Bong Bot Sluice

[Vietnamese]

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

BIÊN BẢN
V/v họp phổ biến triển khai dự án xây dựng cống Bông Bót
và lấy ý kiến người dân trong vùng ảnh hưởng.

Hôm nay, ngày tháng năm tại: Hội trường UBND xã An Thới Tây ấp Cầu Kè Trà Vinh

I.Thành phần tham dự cuộc họp gồm có:

+ Đại diện cấp tỉnh:

1. Nguyễn Văn Trường Chức vụ Trưởng Chi nhánh TV;
2. Lê Thị Thiều Nguyên Trưởng phòng VPĐD - CCTL;
3. .....;
4. .....;

+ Đại diện cấp huyện:

1. Ngô Thanh Xuân ACT UBND huyện Cầu Kè TV;
2. Nguyễn Văn Phương Phó phòng KTHT&ĐT huyện Cầu Kè - TV
3. .....;
4. .....

+ Đại diện cấp xã:

1. Nguyễn Hoàng Khải ACT UBND Xã An Thới Tây Cầu Kè - TV
2. Lâm Văn Hùng CTUBMTTQ xã An Thới Tây Cầu Kè - TV
3. .....;
4. .....;
5. .....
6. .....

+ Về phía người dân: (Có danh sách đính kèm)

II- Đồng chủ trì cuộc họp:

1. UBND xã An Thới Tây Cầu Kè Trà Vinh
2. .....

III- Thư kýcuộc họp:.....

IV- Nội dungcuộc họp:

1- Thông báo chính thức với người dân về Dự án đã được chọn đầu tư.
2- Ý kiến của người dân về việc XD dự án cống Bông Bót..

-1-

+ Người dân có tán thành hay không tán thành nếu xây dựng cống ?
+ Người dân có kiến nghị hay đề xuất gì với Nhà nước nếu thực hiện việc xây dựng cống?
+ Có những ý kiến thắc mắc gì liên quan đến việc đầu tư xây dựng cống ?

V- Ý kiến của người dân:

1- Lê Văn Vững : đồng ý việc nhà nước xây dựng cống, đảm bảo thuận tiện giao thông thủy.

2- Trần Văn Nhỏ : đồng ý xây dựng, bồi hoàn khi giải phóng mặt bằng.

3- Lê Văn Út : đồng ý xây dựng cống, hỗ trợ di dời thỏa đáng theo pháp luật của nhà nước khi giải phóng mặt bằng.

4- Trịnh Văn Thắng : đồng ý nhà nước xây dựng cống, đáp ứng được nhu cầu đi lại và vui hỗ.

5- Trịnh Văn Đông : thống nhất xây dựng cống, bồi hoàn thoả đáng không để thiệt thòi cho người dân.

6- Nguyễn Thị Bé : thống nhất việc xây dựng cống, đảm bảo giao thông thủy thuận tiện giao thông.

7- Trịnh Văn Nhỏ : đồng ý xây dựng cống.

8- Phạm Văn Út : thống nhất xây dựng cống, bồi hoàn theo pháp luật của nhà nước.

9- Lê Sơn Nhi trưởng ấp An Trung đồng ý nhà nước xây dựng cống, bồi hoàn thỏa đáng cho người dân theo quy định của nhà nước. Đề nghị cơ quan Nhà nước ra văn bản yêu cầu bà con không xây dựng công trình nhà trong phạm vi xây dựng cống.

-5-

VI- Ý kiến kết luận cuộc họp: *(Đại diện chính quyền địa phương)*

Qua tất cả các ý kiến của người dân, thay mặt chủ trì cuộc họp, chúng tôi xin gửi lại ý kiến đề xuất, kiến nghị của người dân khi triển khai dự án cụ thể sau:

1. ……

Cuộc họp kết thúc lúc… giờ….phút, ngày……tháng….năm ……và có đọc lại biên bản cuộc họp cho tất cả mọi người tham dự cùng nghe và đồng ý ký tên dưới đây./.

1. …… 5. ……
2. …… 6. ……
3. …… 7. ……
4. …… 8. ……

Thư ký

Đồng Chủ trì

1……. 2…….

Minutes of meeting on Bong Bot Sluice (English version)

I. Officials attended the Meeting

	Full Name	Organization	Position
1	Nguyen Van Truong	Branch of Water Resources in Tra Vinh Province (DARD)	Director
2	Tu Thieu Quyen	Branch of Water Resources in Tra Vinh Province (DARD)	Official
3	Ngo Thanh Xuan	PPC of Cau Ke District, Tra Vinh Province	Vice Chairman
4	Huynh Van Phuong	Division of Agriculture and Rural Development of Cau Ke District, Tra Vinh	Deputy Head of Division
5	Nguyen Hoang Khoi	PPC of An Phu Tan Commune, Cau Ke District, Tra Vinh Province	Vice Chairman
6	Cao Van Hung	PPC of An Phu Tan Commune, Cau Ke District, Tra Vinh Province	Official

II. Location of Meeting

PPC of An Phu Tan Commune, Cau Ke District, Tra Vinh Province

III. Content of Meeting

1. To announce about Bong Bot Sluice Construction Project
2. To collect farmers comment and questions about the Project

IV. Farmers' Ideas and Questions

1. Household-Le Van Dung: I agree to project, but waterways could be continued during period of sluice construction.
2. Household-Tran Van Hen: I agree to project, but compensation should be undertaken completely before resettlement.
3. Household-Le Van Ut: I agree to project, but compensation and resettlement have to follow state policies fully.
4. Household-Trinh Van Thang: I agree to project to meet transportation demand of households who are living two sides of river.
5. Household-Trinh Van Bong: I agree to project, but should not let affected people's life turn to poor condition than before.

6. Household-Nguyen Thi Be: I agree to project, but waterways could be continued during period of sluice construction.

7. Household-Trinh Van Mien: I agree to project.

8. Household-Pham Van Et: I agree to project.

9. Le Son Khe-Leader of An Trai Village: I agree to project. And, compensation and resettlement for affected people enough to their living standard do not less than before project. Moreover, should be have an official document to ban affected people built new constructions in the construction area.

V. Meeting Conclusion (*By Commune Official*)

1. 100% households (8/8) agreed on the project to meet the purpose such as the prevention of saline intrusion and inundation due to high tide.

2. It was suggested that the government present suitable policies to stabilize affected people.

3. During sluice construction, the waterway could be continued.

At the end of consultation meeting, official personnel read the minute of meeting loudly to all of participants and all affected households put their signatures on the minutes. It was stamped by the commune leader.

VIII-A-4 Minutes of Consultation Meeting (3) Tan Dinh

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

BIÊN BẢN
V/v họp phổ biến triển khai dự án xây dựng cống TÂN DINH
và lấy ý kiến người dân trong vùng ảnh hưởng.

Hôm nay, ngày tháng năm tại:...

I.Thành phần tham dự cuộc họp gồm có:

+ Đại diện cấp tỉnh:

1.
2.
3.
4.

+ Đại diện cấp huyện:

1.
2.
3.
4.

+ Đại diện cấp xã:

1.
2.
3.
4.
5.
6.

+ Về phía người dân: (Có danh sách đính kèm)

II- Đồng chủ trì cuộc họp:

1.
2.

III- Thư kýcuộc họp:

IV- Nội dungcuộc họp:

1- Thông báo chính thức với người dân về Dự án đã được chọn đầu tư.

2- Ý kiến của người dân về việc XD dự án cống TÂN DINH.

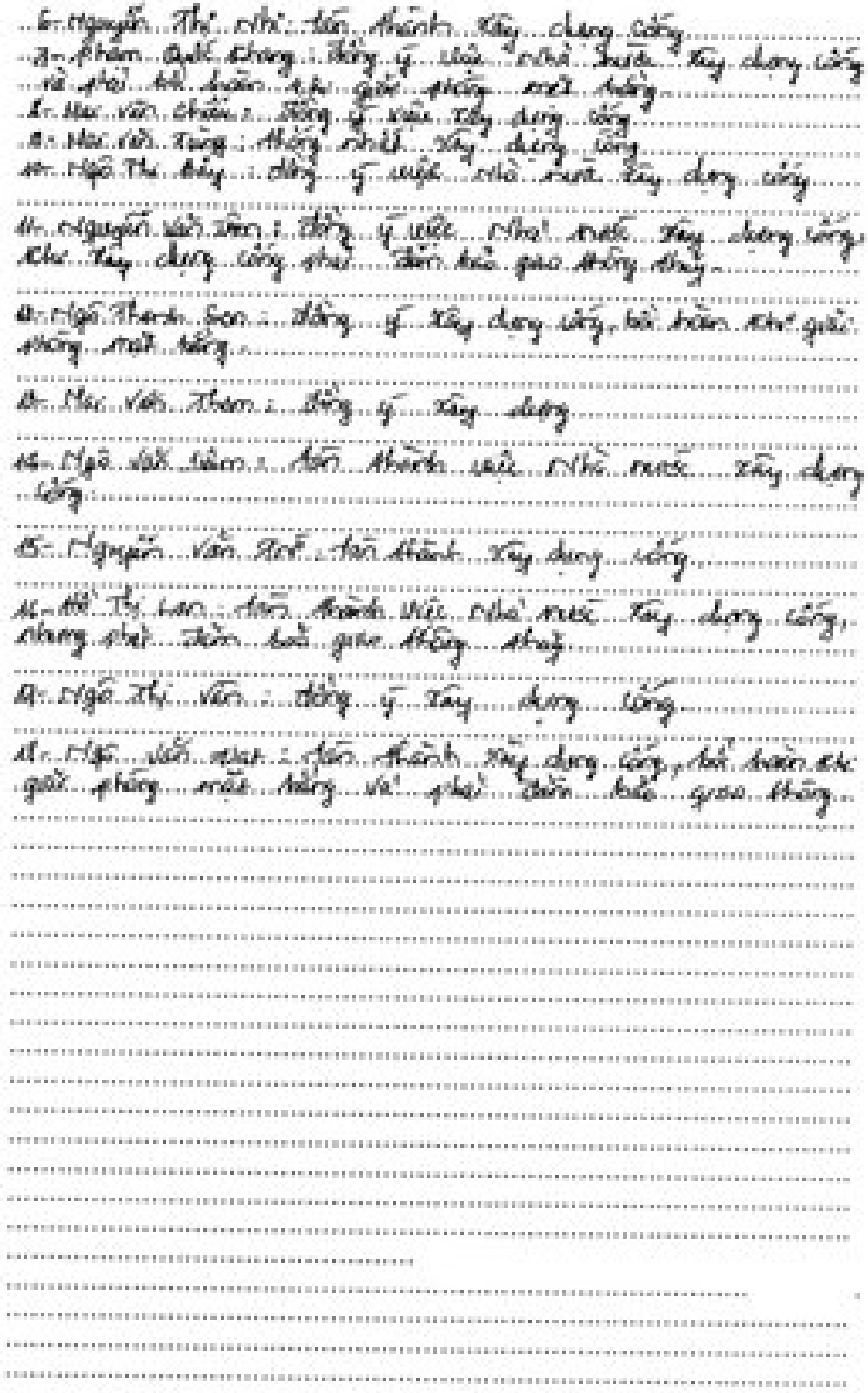
+ Người dân có tán thành hay không tán thành nếu xây dựng cống ?

+ Người dân có kiến nghị hay đề xuất gì với Nhà nước nếu thực hiện việc xây dựng cống?

+ Có những ý kiến thắc mắc gì liên quan đến việc đầu tư xây dựng cống ?

V- Ý kiến của người dân:

1-
2-
3-
4-
5-



VI- Ý kiến kết luận cuộc họp: *(Đại diện chính quyền địa phương)*

Qua tất cả các ý kiến của người dân, thay mặt chủ trì cuộc họp, chúng tôi xin gửi lại ý kiến đề xuất, kiến nghị của người dân khi triển khai dự án cụ thể sau:

1. ...

2. ...

3. ...

Cuộc họp kết thúc lúc... giờ....phút, ngày.....tháng.....năm .....và có đọc lại biên bản cuộc họp cho tất cả mọi người tham dự cùng nghe và đồng ý ký tên dưới đây./.

Thư ký

Đồng Chủ trì

Minutes of meeting on Tan Dinh Sluice (English version)

I- Officials attended the Meeting

No.	Full Name	Organization	Position
1.	Nguyen Van Nhan	Branch of Water Resources in Vinh Long Province (DARD)	Director
2.	Nguyen Van Truong	Branch of Water Resources in Tra Vinh Province (DARD)	Director
3.	Tu Thieu Quyen	Branch of Water Resources in Tra Vinh Province (DARD)	Official
4.	Ngo Thanh Xuan	PPC of Cau Ke District, Tra Vinh Province	Vice Chairman
5.	Huynh Van Phuong	Division of Agriculture and Rural Development of Cau Ke District, Tra Vinh	Deputy Head of Division
6.	Nguyen Van Tam	Division of Agriculture and Rural Development of Tra On District, Vinh Long	Head of Division
7.	Nguyen Hoang Khoi	PPC of An Phu Tan Commune, Cau Ke District, Tra Vinh Province	Vice Chairman
8.	Luu Chi Nghia	PPC of Tich Thien Commune, Tra On, Vinh Long	Chairman

II- Meeting Holding

1 .PPC of An Phu Tan Commune, Cau Ke District, Tra Vinh Province

2. PPC of Tich Thien Commune, Tra On District, Vinh Long Province.

III- Content of Meeting

1. To announce about Tan Dinh Sluice Construction Project
2. To collect farmers' comments and questions about the Project

IV- Farmers' Ideas and Questions

1- Household-Le Van Cung: I agree to project, but compensation should be undertaken completely before resettlement.

2- Household-Phan Minh Tuan: I agree to project.

3- Household-Nguyen Thi Mau: I agree to project.

4- Household-Nguyen Thanh Hau: I agree to project, but waterways have to be continued during sluice construction.

5- Household-Nguyen Van Thanh Duoc: I agree to project.

6- Household-Nguyen Thi Nhi: I agree to project.

7- Household-Pham Quoc Khang: I agree to project, but compensation should be undertaken completely before resettlement.

8- Household-Mai Van Chieu: I agree to project.

9- Household-Mai Van Tung: I agree to project

10- Household-Ngo Thi Bay: I agree to project to prevent inundation.

11- Household-Nguyen Van Tam: I agree to project, but waterways have to be continued during sluice construction.

12- Household-Ngo Thanh Son: I agree to project, but compensation should be undertaken completely before resettlement.

13- Household-Mai Van Thom: I agree to project.

14- Household-Ngo Van Liem: I agree to sluice construction.

15- Household-Nguyen Van Tri: I agree to sluice construction.

16- Household-Ho Thi Lan: I agree to sluice construction, but waterways could be continued during period of sluice construction.

17- Household-Ngo Thi Van: I agree to sluice construction.

18- Household-Ngo Van Dat: I agree to sluice construction, but waterways could be continued during period of sluice construction.

V- Meeting Conclusion (*By Commune Official*)

1. 100% households (18/18) agree to project to meet the purpose such as the prevention of saline intrusion and inundation due to high tide.

2. To suggest government have suitable policies to stabilized affected people.

3. During sluice construction, the waterway could be continued.

At the end of consultation meeting, official personnel read the minute of meeting loudly to all of participants and all affected households put their signatures on the minutes. It was stamped by the commune leader.

VIII-A-5 Attendant List of Consultation Meeting (1) Vung Liem

1) Participants of Official Personnel

	Full Name	Organization	Position
1	Nguyen Van Nhan	Branch of Water Resources in Vinh Long Province (DARD)	Director
2	Nguyen Van Tam	PPC of Trung Thanh Dong Commune	Chairman
3	Truong Quang Dinh	PPC of Trung Thanh Dong Commune	Official
4	Nguyen Thanh Dung	PPC of Trung Thanh Tay Commune	Chairman
5	Bui Van Ly	PPC of Trung Thanh Tay Commune	Official
6	Nguyen Van Sanh	PPC of Trung Thanh Dong Commune	Leader of Phu An Village
7	Nguyen Thi Kim Ba	Division of Agriculture and Rural Development of Vung Liem District	Head of Division
8	Le Chien Thang	Division of Agriculture and Rural Development of Vung Liem District	Deputy Head of Division
9	Nguyen Van Truong	Branch of Water Resources in Tra Vinh Province (DARD)	Director

2) Participants of Affected Persons

	Name	Hamlet-Commune-Province
1	Ta Tan Men	Tan Trung-Trung Thanh Dong-Vinh Long
2	Nguyen Van Cuong Em	Tan Trung-Trung Thanh Dong-Vinh Long
3	Nguyen Van Truong	Tan Trung-Trung Thanh Dong-Vinh Long
4	Nguyen Thi Bay	Tan Trung-Trung Thanh Dong-Vinh Long
5	Ta Cong Day	Phu An-Trung Thanh Tay-Vinh Long
6	Pham Thi Nhung	Phu An-Trung Thanh Tay-Vinh Long
7	Huynh Van Nguon	Phu An-Trung Thanh Tay-Vinh Long
8	Nguyen Van Hoang	Phu An-Trung Thanh Tay-Vinh Long
9	Huynh Thi Loi	Phu An-Trung Thanh Tay-Vinh Long
10	Huynh Thi Chong	Phu An-Trung Thanh Tay-Vinh Long
11	Nguyen Thi Dieu	Phu An-Trung Thanh Tay-Vinh Long

VIII-A-5 Attendant List of Consultation Meeting (2) Bong Bot

1) Participants of Official Personnel

	Full Name	Organization	Position
1	Nguyen Van Truong	DARD、Tra Vinh Province	Director of Water Resources Management Department, DARD
2	Tu Thieu Quyen	DARD	Head of Investment Management Division, Water Resources Management Department, DARD
3	Ngo Thanh Xuan	PPC of Cau Ke Distirct	Vice Chairmain of PPC of Cau Ke District, Tra Vinh Province
4	Huynh Van Phuong	DARD, Cau Ke Distirct	Deputy Director of Agriculture and Rural Development, Cau Ke District, Tra Vinh Province.
5	Nguyen Hoang Khoi	PPC of An Phu Tan Commune	Vice Chairman of PPC of An Phu Tan Commune, Cau Ke District, Tra Vinh Province.
6	Cao Van Hung	An Phu Tan Commune	Official, An Phu Tan Commune, Cau Ke District, Tra Vinh Province

2) Participants of Affected Persons

	Name	Hamlet-Commune-Province
1	Le Van Ut	Trai-An Phu Tan-Tra Vinh
2	Trinh Van Bong	Trai-An Phu Tan-Tra Vinh
3	Nguyen Thi Be	Trai-An Phu Tan-Tra Vinh
4	Pham Van Et	Trai-An Phu Tan-Tra Vinh
5	Trinh Van Mien	Trai-An Phu Tan-Tra Vinh
6	Trinh Van Thang	Trai-An Phu Tan-Tra Vinh
7	Le Van Dung	Hoa-An Phu Tan-Tra Vinh
8	Tran Van Hon	Hoa-An Phu Tan-Tra Vinh

VIII-A-5 Attendant List of Consultation Meeting (3) Tan Dinh

1) Participants of Official Personnel

No.	Full Name	Organization	Position
1	Nguyen Van Nhan	Branch of Water Resources in Vinh Long Province (DARD)	Director
2	Nguyen Van Truong	Branch of Water Resources in Tra Vinh Province (DARD)	Director
3	Tu Thieu Quyen	Branch of Water Resources in Tra Vinh Province (DARD)	Official
4	Ngo Thanh Xuan	PPC of Cau Ke District, Tra Vinh Province	Vice Chairman
5	Huynh Van Phuong	Division of Agriculture and Rural Development of Cau Ke District, Tra Vinh	Deputy Head of Division
6	Nguyen Van Tam	Division of Agriculture and Rural Development of Tra On District, Vinh Long	Head of Division
7	Nguyen Hoang Khoi	PPC of An Phu Tan Commune, Cau Ke District, Tra Vinh Province	Vice Chairman
8	Luu Chi Nghia	PPC of Tich Thien Commune, Tra On, Vinh Long	Chairman

2) Participants of Affected Persons

	Name	Hamlet-Commune-Province
1	Le Van Cuong	Dinh An-An Phu Tan-Tra Vinh
2	Nguyen Van Thanh Duoc	Dinh An-An Phu Tan-Tra Vinh
3	Nguyen Van Han	Dinh An-An Phu Tan-Tra Vinh
4	Pham Quoc Khang	Dinh An-An Phu Tan-Tra Vinh
5	Phan Minh Tuan	Dinh An-An Phu Tan-Tra Vinh
6	Nguyen Thi Mau	Dinh An-An Phu Tan-Tra Vinh
7	Nguyen Thi Nhi	Dinh An-An Phu Tan-Tra Vinh
8	Ho Thi Lan	Phu Quoi-Tich Thien-Vinh Long
9	Mai Van Tung	Phu Quoi-Tich Thien-Vinh Long
10	Mai Van Chieu	Phu Quoi-Tich Thien-Vinh Long
11	Mai Van Thom	Phu Quoi-Tich Thien-Vinh Long
12	Ngo Thanh Binh	Phu Quoi-Tich Thien-Vinh Long
13	Ngo Van Bay	Phu Quoi-Tich Thien-Vinh Long
14	Nguyen Van Em	Phu Quoi-Tich Thien-Vinh Long
15	Nguyen Van Tri	Phu Quoi-Tich Thien-Vinh Long
16	Ngo Van Liem	Phu Quoi-Tich Thien-Vinh Long

VIII-A-6 Photos of Consultation Meeting

(1) Vung Liem

DARD officer explained the Vung Liem sluice construction to the affected persons.

Affected persons by Vung Liem sluice construction attended the consultation meeting.

One of the affected persons by Vung Liem sluice construction asked a question.

The consultation meeting for Vung Liem sluice construction was closed with consensus.

(2) Bong Bot

DARD officer made opening remarks of the consultation meeting with the affected persons.

DARD officer explained the Bong Bot sluice construction to the affected persons.

One of the affected persons by Bong Bot sluice construction presented his opinion.

The affected person put his signatures on the Minutes of Meetings of the consultation meeting.

(3) Tan Dinh

Opening remarks was presented by one of DARD staff for the consultation meeting of Tan Dinh sluice.

Explanation of the Tan Dinh sluice construction was implemented by one of DARD staff.

DARD official personnel answered to a question by the affected persons due to Tan Dinh sluice construction.

The affected persons by Tan Dinh sluice construction listened to the explanation by DARD.

APPENDIX-IX

SIMULATION MODEL AND REFERENCE

APPENDIX IX: SIMULATION MODEL AND REFERENCE

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ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
AMSL	Above Mean Sea Level
AusAID	Australian Agency for International Development
B/C	Benefit Cost Ratio
CP	Counterpart
DARD	(Provincial) Department of Agriculture and Rural Development
DONRE	Department of Natural Resources and Environment
DPC	District People's Committee
EU	European Union
ERR	Economic Rate of Return
FAO	Food and Agriculture Organization
FY	Fiscal Year
GDP	Gross Domestic Products
GOJ	Government of Japan
GOV	Government of Vietnam
GCM	Global Climate Model (or General Circulation Model)
GSO	General Statistical Office
HDI	Human Development Index
IAS	Institute of Agricultural Science for Southern Vietnam
ICB	International Competitive Bidding
IDA	International Development Association
IDMC	Irrigation and Drainage Management Company
IMF	International Monetary Fund
IMHEN	Institute of Metrology, Hydrology and Environment
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
IRR	Internal Rate of Return
IWMI	International Water Management Institute
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt für Wiederaufbau (German government-owned development bank)
MARD	Ministry of Agriculture and Rural Development
MDG	Millennium Development Goal
M&E	Monitoring and Evaluation
MKD	Mekong Delta
MOF	Ministry of Finance
MONRE	Ministry of Natural Resources and Environment
MPI	Ministry of Planning and Investment
MRC	Mekong River Commission
NCB	National Competitive Bidding
NPK	Nitrogen, Phosphate, Potassium
NPV	Net Present Value
O&M	Operation and Maintenance
PRA	Participatory Rural Appraisal
PRECIS	Providing Regional Climates for Impacts Studies (a regional climate model system)
PCM	Project Cycle Management

PPC	Provincial People's Committee
RCM	Regional Climate Model
SIWRP	Southern Institute of Water Resources Planning (the CP organization)
SIWRR	Southern Institute of Water Resources Research
SWOT	Strengths, Weaknesses, Opportunities, and Threats
Sub-NIAPP	Sub-national Institute of Agricultural Planning and Projection
GIZ	(Deutsche) Gesellschaft für Internationale Zusammenarbeit

UNIT CONVERSION

1 meter (m)	=	3.28 feet
1 kilometer (km)	=	0.62 miles
1 hectare (ha)	=	2.47 acres
1 acre	=	0.405 ha
1 inch (in.)	=	2.54 cm
1 foot (ft.)	=	12 inches (30.48 cm)
1 ac-ft	=	1233.4 cum

CURRENCY EQUIVALENTS (AS AT DECEMBER 2012)

US$ 1.00	=	VND 21,054 (TTB)
US$ 1.00	=	82.11 Japanese Yen (TTB)
VND 1.00	=	0.0039Yen

VIETNAM FISCAL YEAR

January 1 to December 31

LIST OF FIGURES

APPENDIX IX: SIMULATION MODEL AND REFERENCE

This section describes simulation models being applied and conducted in this study. IMHEN (Vietnam Institute of Meteorology, Hydrology and Environment) under MONRE (Ministry of Natural Resources and Environment) has studied and simulated on temperature, rain fall, and sea level rise under climate change scenarios A1, A1FI, A2, B1, and B2 discussed and presented in International Panel on Climate Change (ICPP). For hydraulic simulation in Mekong delta, three steps are conducted; global circulation model simulation is the first step, downscaling regional model simulation is the second step and those steps are carried out IMHEN, and the last one is simulation in Mekong delta conducted in this study.

CHAPTER 1 GLOBAL CIRCULATION MODEL (HADCM3)

Hadley Centre Coupled Model, version 3 (HadCM3) is one of the major models used in the IPCC Assessment Report. HadCM3 does not need flux adjustment (additional "artificial" heat and freshwater fluxes at the ocean surface) to produce a good simulation. Boundary data is provided by three 31 year integrations of HadAM3P, a 150km resolution version of the Hadley Centre's global atmosphere-only model.

Each is started from different initial conditions but all used observed time series of HadISST sea-surface temperatures and sea-ice for 1960–1990. The three integrations form an initial condition ensemble. The observed evolution of greenhouse gas concentrations over this period is used to provide relevant information on atmospheric composition. Also, the estimated evolution of anthropogenic emissions of sulfur dioxide (and natural background emissions of this and other relevant chemicals) are prescribed and their evolution and impact on atmospheric composition are simulated within the GCM's sulfur cycle model component. The model uses an idealized 360-day calendar.

The aerosol models in this GCM and the PRECIS regional models are wholly compatible; when using LBCs from this model, emissions from within the RCM region are included as source terms, and aerosols may be advected into the domain via the lateral boundary conditions (source: PRECIS technical manual).

Simulated GCM data are available at IPCC official website: total 4 periods of monthly values can be obtained;

1961-1990 Mean monthly values;
2010-2039 Mean monthly change fields;
2040-2069 Mean monthly change fields;
2070-2099 Mean monthly change fields.

CHAPTER 2 REGIONAL CIRCULATION MODEL (PRECIS)

PRECIS (Providing Regional Climates for Impacts Studies) is a regional climatic dynamic model, which was developed by Haley Global Climatic Centre. The Model can run on a personal computer for establishment of CC scenarios in a small-scale region. The precursor of PRECIS model is HadRM3P model which was developed in 1991 and improved to simulate CC.

The model uses Lai coordinate system (Hybrid,) including 19 vertical levels. Each level , k (k = 1…19) is determined by a linear relation between topography and air pressure level. Horizontal is alternative grid, including scalar variables such as temperature, air pressure and humidity which are determined at the grid centre, while wind factor is determined at the grid nodes. PRECIS model uses rotated pole projection to ensure the model stability without none-physical filtering.

Equations in the model are solved by 3-dimentional numerical method. The model simulates individual variables, in which the distance between grids and time is the same. The changes of air pressure, wind, temperature, humidity, and others is followed 3 base conservation laws as law of conservation of angular momentum, law of conservation of mass, and law of conservation of energy. Vertical movement is also influenced by barometric pressure gradient force and gravity force. However, in the simulation of PRECIS, vertical velocity and acceleration of the factors are very small and ignored.

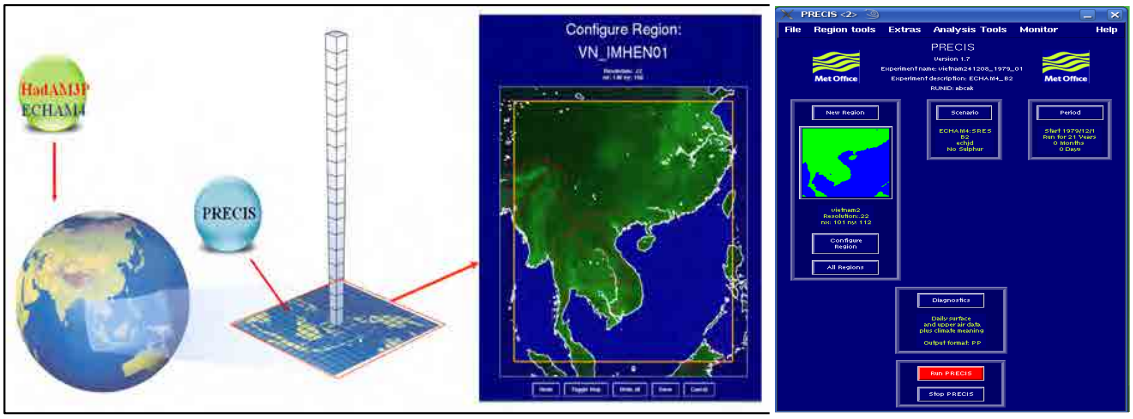


Figure 2.1.1 Location of PRECIS and its interface (Source: IMHEN)

The charts of physical parameterization of the mode include diagram of cloud and precipitation, diagram of radiation, diagram of sol gas, diagram of boundary layer, diagram of ground, and diagram of gravity wave. The boundaries are taken from global model or analysis data as wind, temperature, humidity, surface pressure, etc. There are more than 100 meteorological variables can be extracted from the model, in which mean, maximum, and minimum temperature of surface, and daily, monthly, and yearly rainfall are particularly considered for development of CC scenarios. The space used to simulate in Vietnam is from 4-36^{o}N and 93-120^{o}E, with horizontal resolution of 25x25 km, and grid of 140x160 nodes.

The model is used to simulate for 2 cases: 1) baseline: including 2 periods, 1961-1990 and 1999, and 2) future case is the period of 2000-2100 under medium and high GHGE scenario. The periods of future timeline is divided into 20-year-period, including 2000-2019, 2020-2039, 2040-2059, 2060-2079, and 2080-2100. In the study, the simulation is conducted for average of each such period and compared to simulated result of baseline to get the changes of future climatic factors.

CHAPTER 3 SIMULATION IN/AROUND MEKONG DELTA

3.1 Simulation Program

MIKE 11 and VRSAP are typical hydro-dynamic models to simulate hydrodynamic river flow. It is also able to simulate water flow in complex branched and looped river networks. Simulation on dissolved or suspended particulates in water (e.g. salinity, acidity etc) is available by using the implicit finite difference scheme for the advection-dispersion equation. The program deals with several data input as follows;

- ✓ A file of hydrological data comprising of water level, discharge, salinity at the boundaries and under initial conditions
- ✓ A file of topographic data comprising of the structure and hydraulic elements of the water system.
- ✓ Hydrological data needed to the program are boundary conditions and initial conditions.

Required boundary conditions are listed up as follows:

- ✓ Water level at stations corresponding to boundary nodes (upstream sites, river mouths or any internal nodes);
- ✓ Discharge (in/outflow, constant or varying with respect to time) at boundary segments;
- ✓ Salinity at boundary nodes; and
- ✓ Rainfall from stations located within the delta.
- ✓ Initial conditions comprise water level and salinity at node locations, and flow conditions in all segments.

Topographic data comprises geometric information on each segment of the river/ canal/ sewer and each parcel of the plain. Each segment is defined by a section bounded by two nodes. Water level and salinity at the nodes are computed while flow is calculated at the ends of each segment.

For each segment, required data includes:

- ✓ Segment type: river/canal or sewer pipe or hydraulic structure such as dam, weir, sluice, culvert, one-direction gate, etc;
- ✓ Length and roughness coefficient;
- ✓ Mean cross-section;
- ✓ Dispersion coefficient; and
- ✓ Rainfall station corresponding to the segment;
- ✓ For each parcel of plain (rural or urban land), the following data are required:
- ✓ Operation mode in connection with river/canal segment or node, for example, opened, directly connected or conditionally connected through a culvert, sluice or small creeks;
- ✓ Area and volume of the plain corresponding to different water level;
- ✓ Code of segment or node where the plain is connected;
- ✓ Rainfall station corresponding to the plain;
- ✓ Rainfall run-off coefficient; and
- ✓ Size and water conveyance capacity of the connection.

Upstream hydraulic boundary is given at Kratie in Cambodia. Hydraulic data from Phnom Penh to Tonle Sap are based on the Atlas of hydrological data from 1997 – 1998. Information on branches and canals connected to Mekong River to field are collected from the survey data in 1999. Topographical data of flooding area and Tonle Sap are from map 1/100.000 by SOGREAH. Topographical data on Mekong River from upstream boundary to the downstream boundary East Sea are employed from survey data of MONRE in 2005.

Topographical data on fields were employed from surveyed data from 1995 to 2008. The elevations of

national and provincial roads are updated and employed from survey data from 1996 to 2008. Cross sections of bridges on main transportation network were updated from survey data in 12/2000. Digital elevation map 1/25,000 was adopted to formulate the hazard map of submergence on fields.

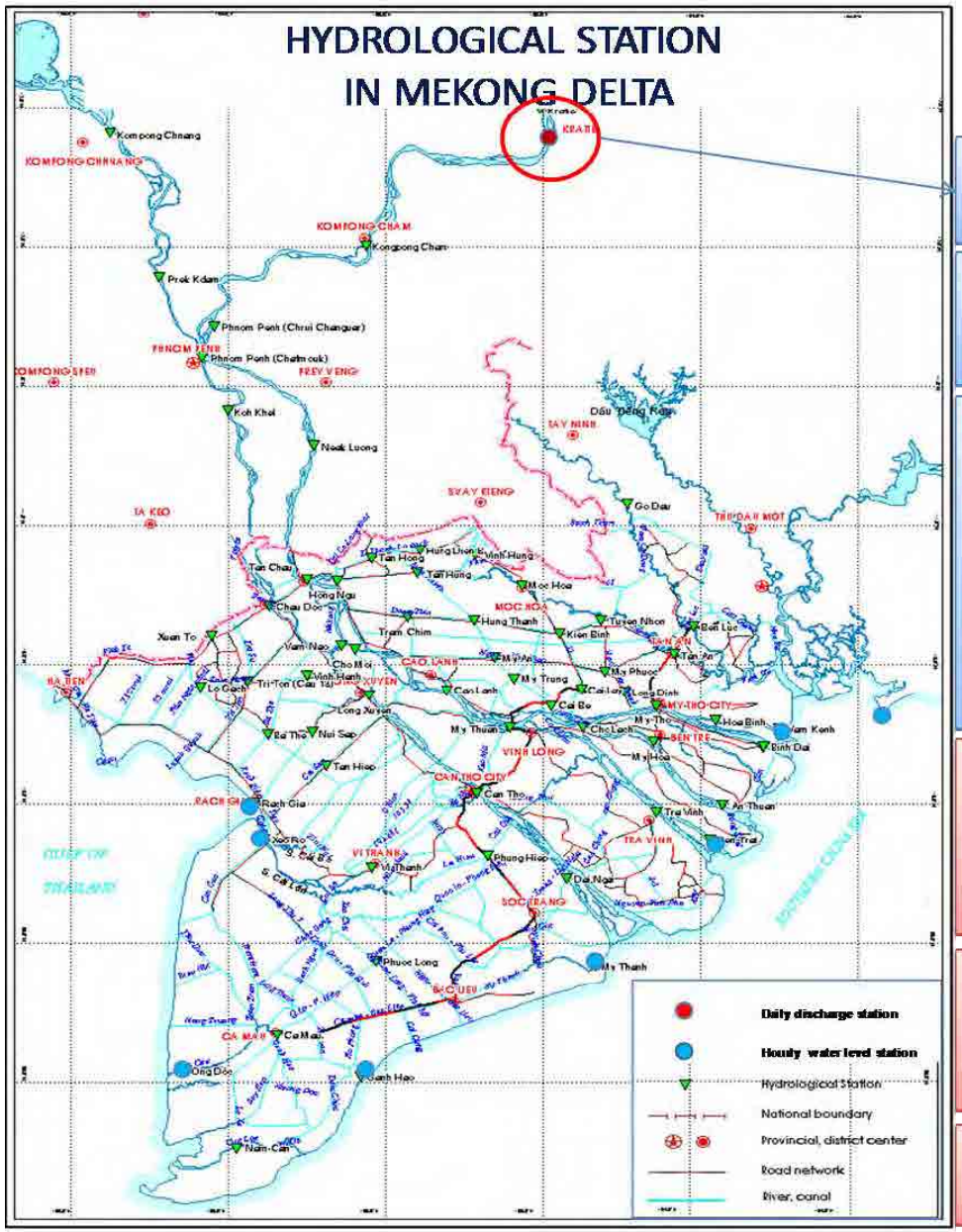
Output data including water level, salinity at selected nodes and flow at two ends of selected segments can be generated in tabular format and linked to the graphic software and GIS. The output data are linked with GIS for easing access and establishing maps to display the simulated results of water level, depth of inundation or salinity. The natural neighbour analysis in Vertical Mapper using an area-weighting technique (Thiessen polygon method) in MapInfo is applied to create maps on water level depth and salinity levels.

In dry season, maximum salinity level in selected month is computed. In flood season, maximum canal water level in selected month is calculated. The map of maximum inundation area is manipulated from the overlay of map of maximum canal water level with map of elevation at 1/25,000.

3.2 Boundary Condition for Saline Intrusion and Flood Inundation

Figure 3.1.1 shows hydrological stations for boundary condition applied in this study. A red color point is a daily discharge station at Kratie in Cambodia, which is used for upstream boundary of simulation. Blue color points show hourly water level stations along coastal area in Viet Nam, which are used for downstream boundary for simulation. Boundary conditions of simulation on saline water intrusion and flood inundation are summarized as follows;

- ✓ Simulation model covers from Kratie in Cambodia to Mekong Delta river mouth; the whole area of the model is applied for each simulation.
- ✓ Boundary conditions are given at; Kratie for upstream boundary with hourly water and salinity level, coastal 9 stations for downstream boundary with hourly water and salinity level.
- ✓ Discharge in 1991 represents the current discharge which has a similar annual value to the average discharge between 1991and 2000.
- ✓ Discharge in 1998 represents the experienced minimum discharge.
- ✓ Probable discharges by certain percents are employed for planning/design purpose on hydraulic system/structures projected during the period between 2011 and 2050 coupled with sea level rise.
- ✓ Rainfall data in 1998 are employed which are obtained from My Tho meteorological station.
- ✓ Different sea levels are applied to the simulation from 0cm to 100cm according to climate change scenario.



DATA FOR INPUT MODELS

Upstream Discharge stations (01):

Kratie

Hourly Water Level & salinty stations(09):

Vung Tau, Vam Kenh, Ben Trai, An Thuan, My Thanh, Ganh Hao, Ong Doc, Xeo Ro, Rach Gia

Rainfall stations (41):

Kratie, KomPongCham , KomPongChnang, DamDek, PhnomPenh, PreyVeng , SaDan, Snoul, SvayRieng, TaKeo, Chau Doc,Tinh Bien, Tan Chau, Vam Nao, Cao Lanh, Tan An, Ha Tien, Long Xuyen, Kien Binh, My Tho , Tri Ton, Nui Sap, Cai Lay, Moc Hoa , Rach Gia, Tan Hiep, Vinh Hung,Tuyen Nhon, Hung Thanh, My Thuan, Can Tho, Phung Hiep, Bac Lieu, Ngan Dua, Ca Mau, Binh Thanh, Go Dau Ha, Soc Trang, Vi Thanh, Ben Tre, Tra Vinh,

Inside Water level stations (23):For calibration

Tan Chau, Cao Lanh, Chau doc, Vam Nao, My Thuan, My Tho, Tra Vinh, Can Tho, Cau 13, Tan hiep, Tra Vinh, Cho Lach, Hung Thanh, Kien Binh, Cai Lay, Long Dinh, Moc hoa, Tuyen Nhon, Tan An, Ben Luc, Phuoc Long, Ca Mau, Phung Hiep

Inside Salinity stations (12):For calibration

Cau Noi, Cau Quan, Phuoc Long, Thanh Phu
Huong My, Long Phu, Dai Ngai, Tra vinh
Ca Mau, My Tho, Tan An, Ben Luc

Inside Discharge stations (02):

Tan Chau, Chau Doc

Figure 3.2.1 Locations for Simulation Boundary and Data Type Employed in the Study

✓ Source: SIWRP and Study Team

3.3 Model Calibration for Saline Intrusion and Flood Inundation

Model calibrations are applied by hourly data of 365days in targeted years; an average year for 2008, a flood year for 2000, a draught year for 1998. Model calibration in rainy season (flood) is carried out by comparison with 23 inland hourly water level stations; simulation errors are verified less than 5%. In dry season (draught), calibration is applied by comparison with 12 inland stations; the same magnitude and trend are confirmed between observed hourly but intermittence data and simulation results. The results of model calibrations are shown in the following Figures.

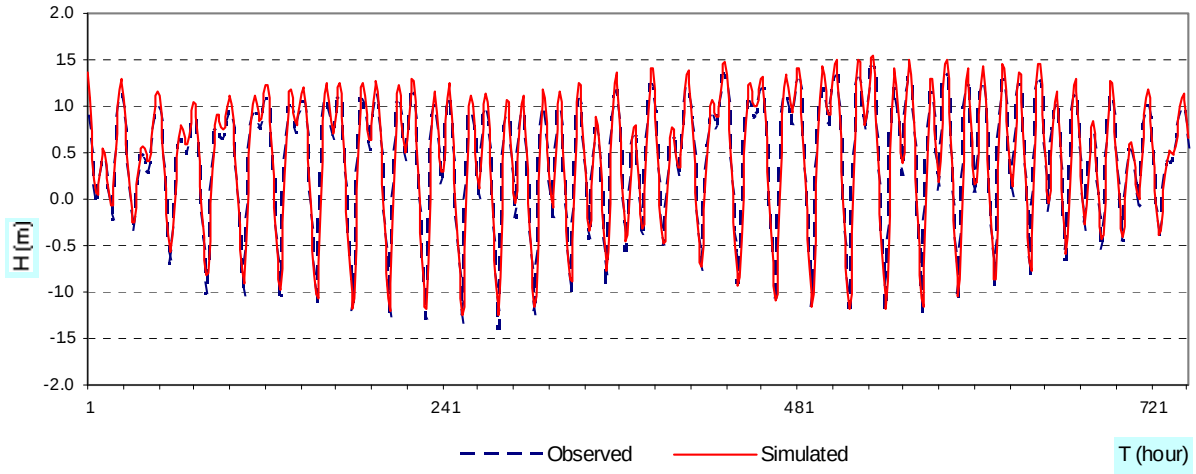


Figure 3.3.1 Calibration water level in January/2008 at My Tho station
Source: SIWRP and Study Team

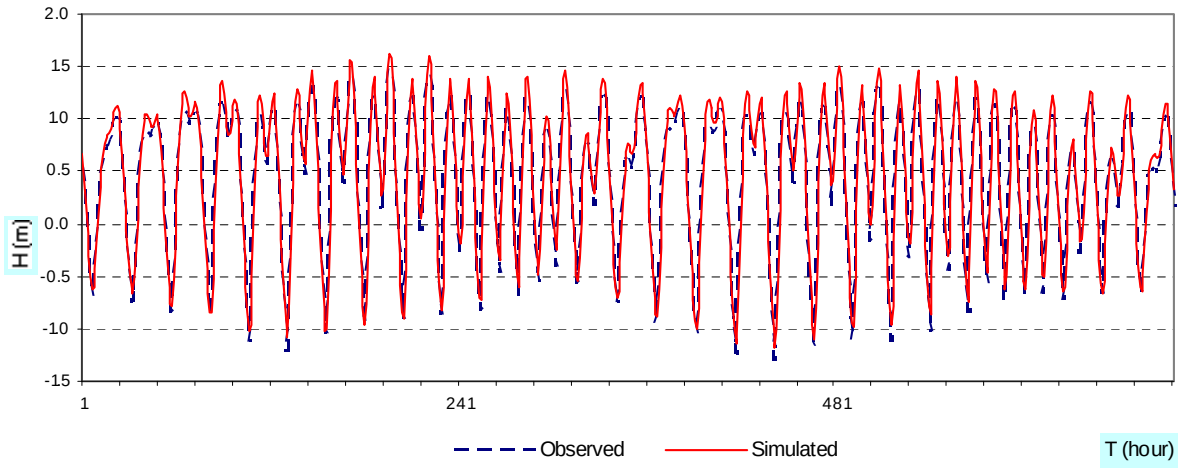


Figure 3.3.2 Calibration water level in February/2008 at My Tho station
Source: SIWRP and Study Team

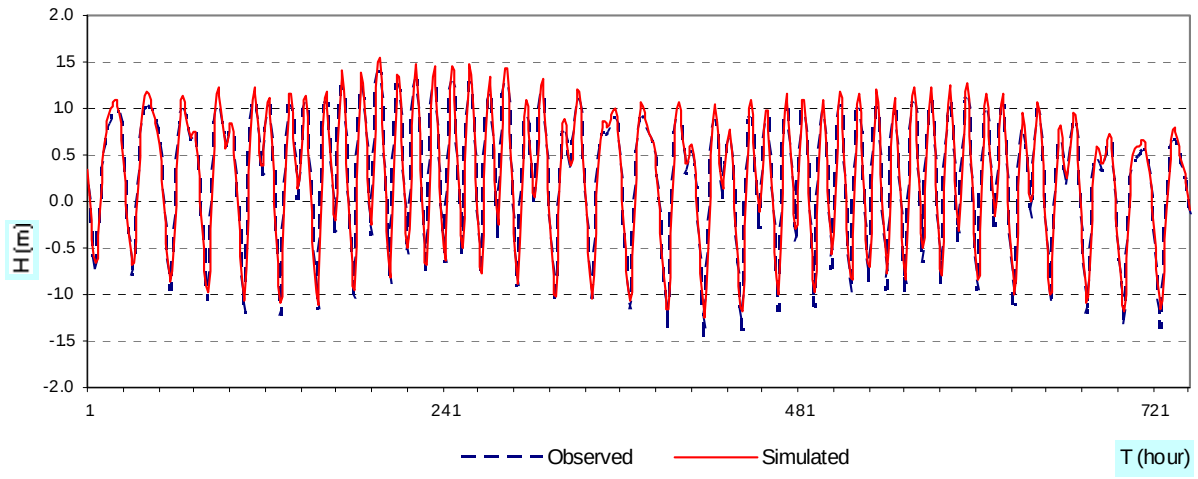


Figure 3.3.3 Calibration water level in March/2008 at My Tho station
Source: SIWRP and Study Team

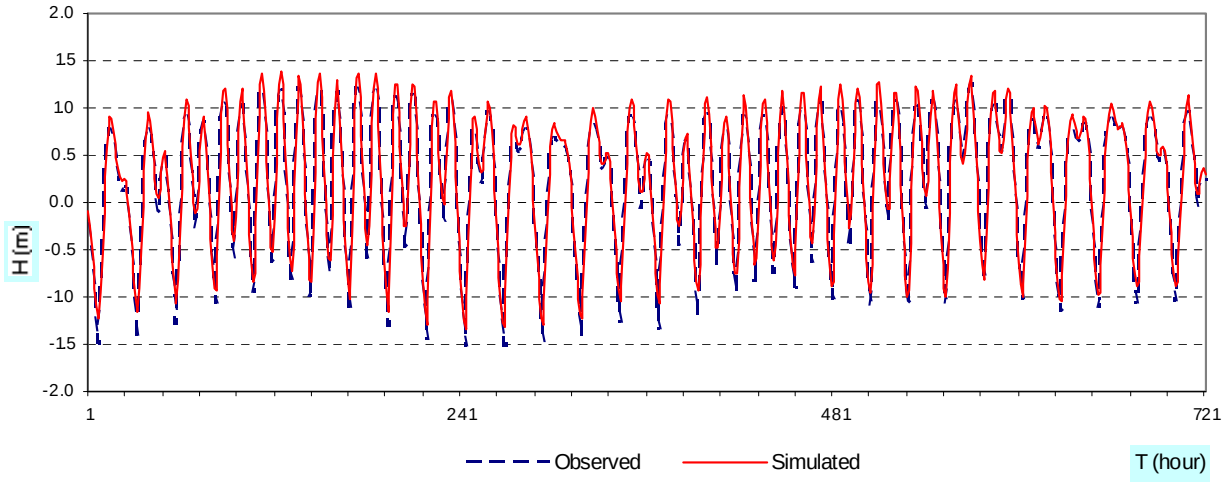


Figure 3.3.4 Calibration water level in April/2008 at My Tho station
Source: SIWRP and Study Team

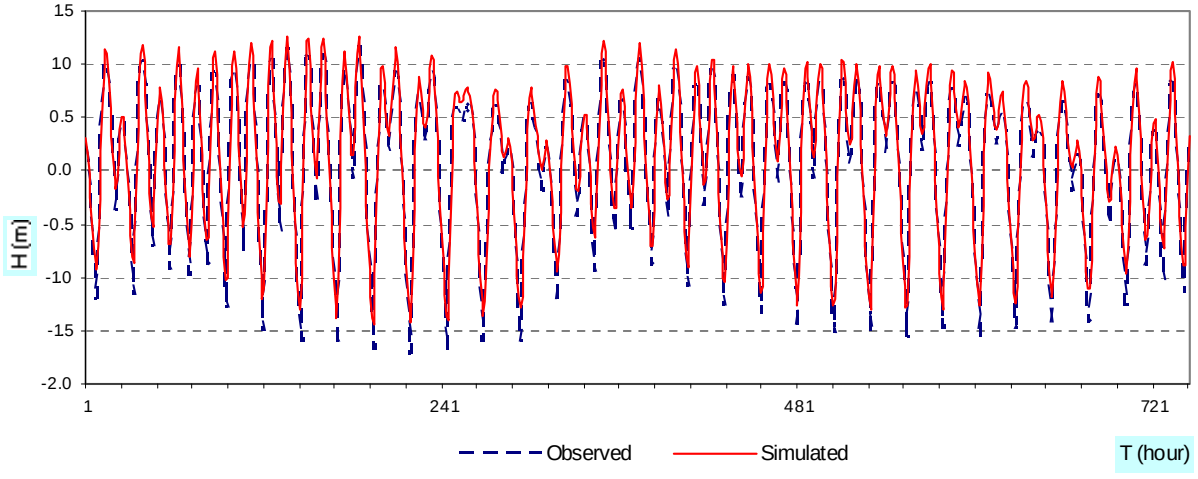


Figure 3.3.5 Calibration water level in May/2008 at My Tho station
Source: SIWRP and Study Team

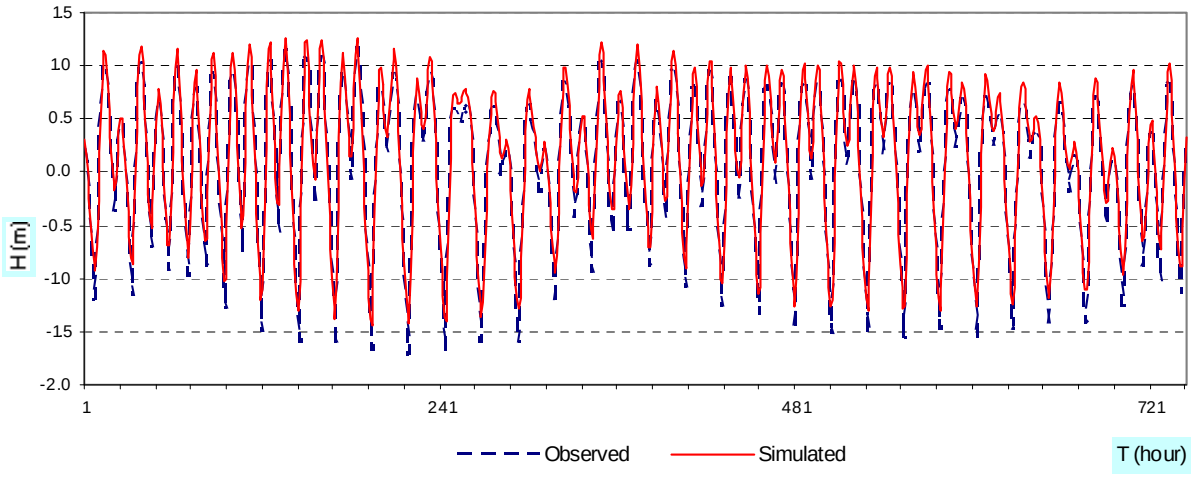


Figure 3.3.6 Calibration water level in June/2008 at My Tho station

Source: SIWRP and Study Team

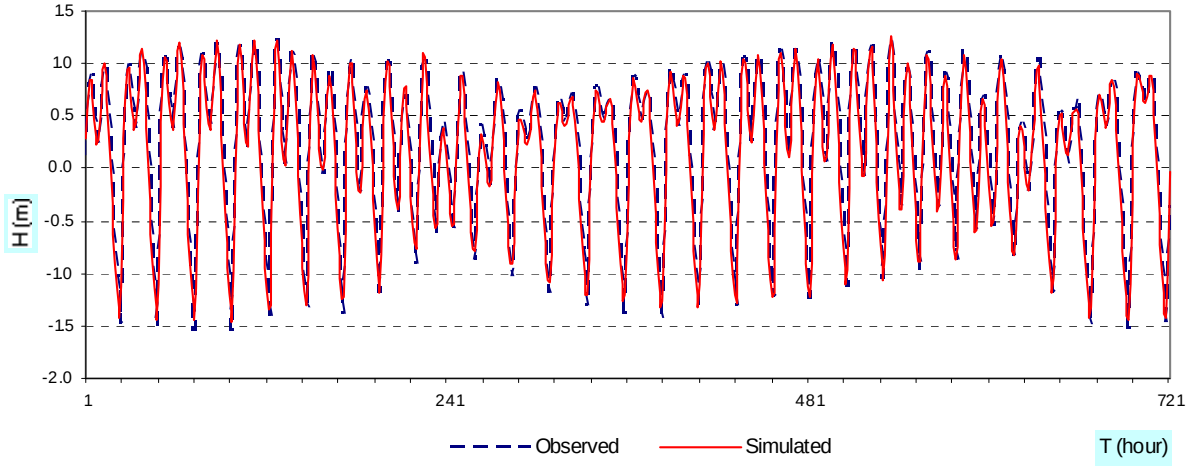


Figure 3.3.7 Calibration water level in July/2008 at My Tho station

Source: SIWRP and Study Team

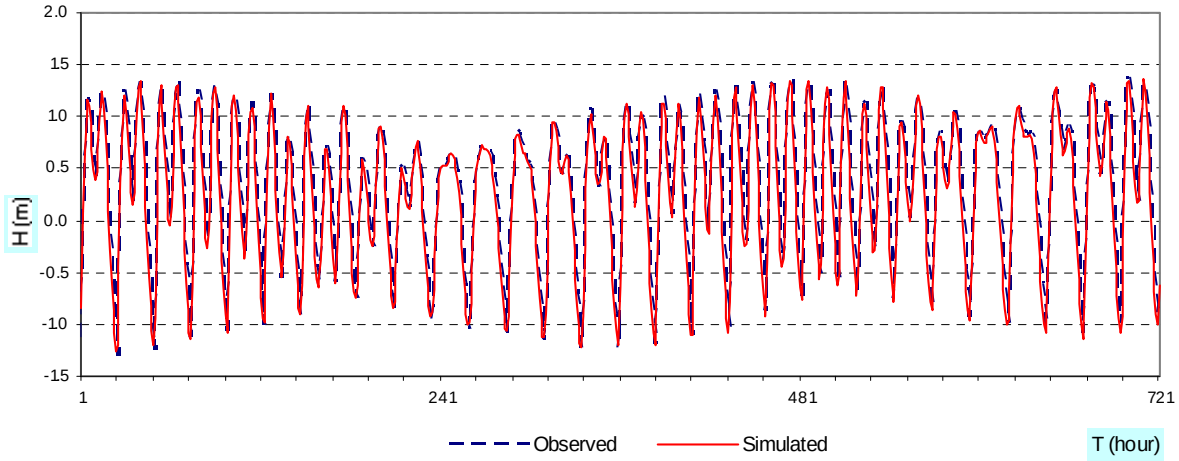


Figure 3.3.8 Calibration water level in August/2008 at My Tho station

Source: SIWRP and Study Team

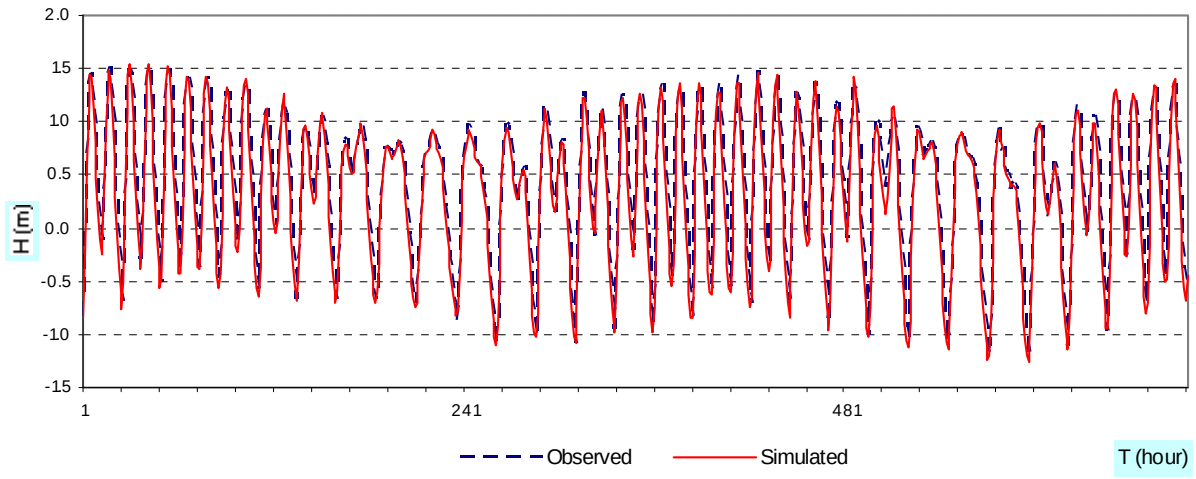


Figure 3.3.9 Calibration water level in September/2008 at My Tho station

Source: SIWRP and Study Team

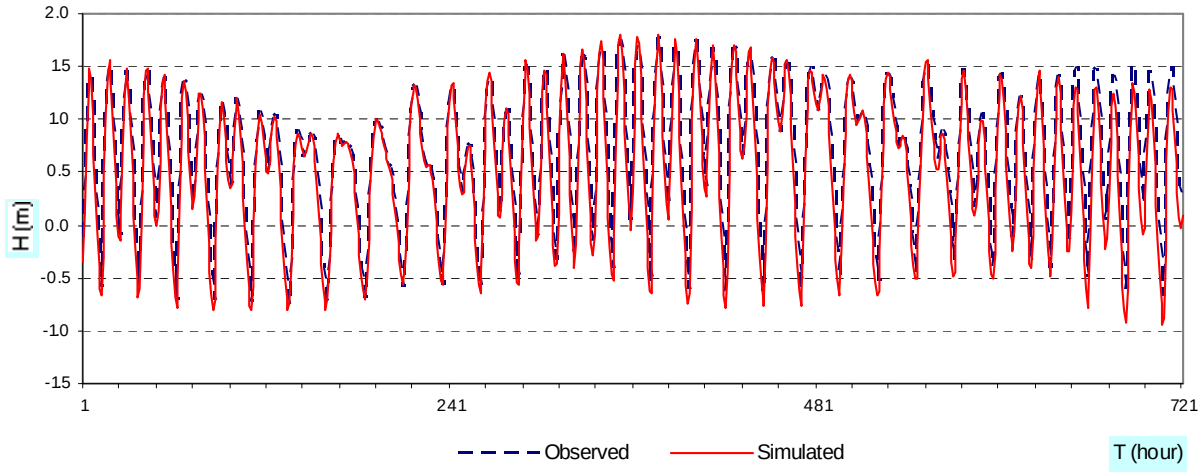


Figure 3.3.10 Calibration Water Level in October/2008 at My Tho Station

Source: SIWRP and Study Team

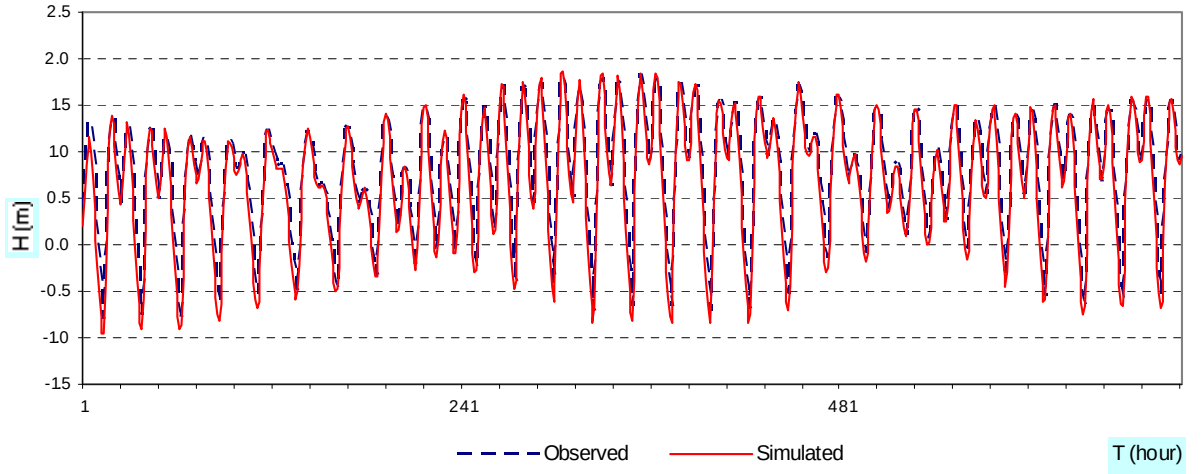


Figure 3.3.11 Calibration Water Level in November/2008 at My Tho Station

Source: SIWRP and Study Team

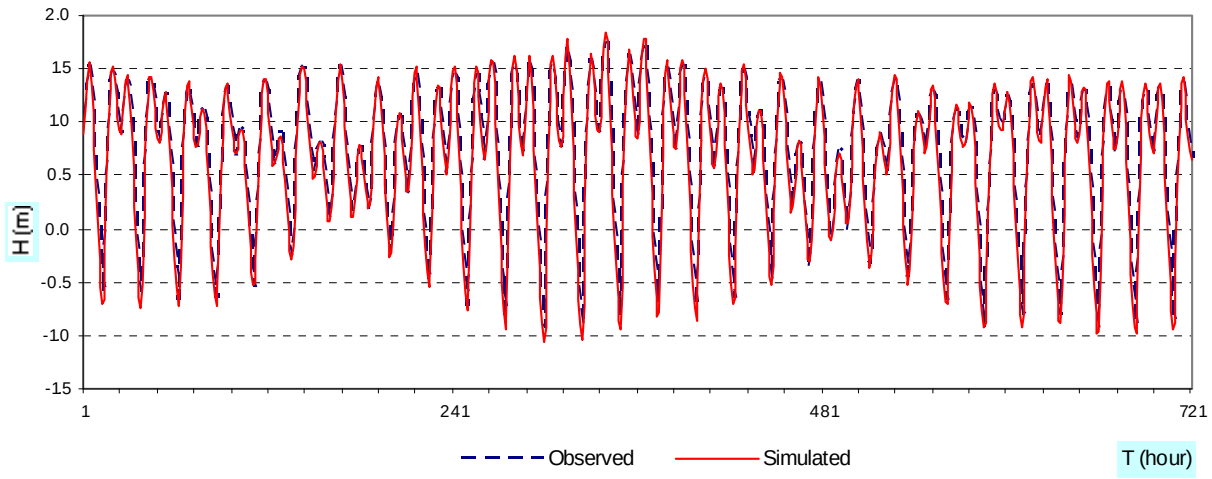


Figure 3.3.12 Calibration Water Level in December/2008 at My Tho Station

Source: SIWRP and Study Team

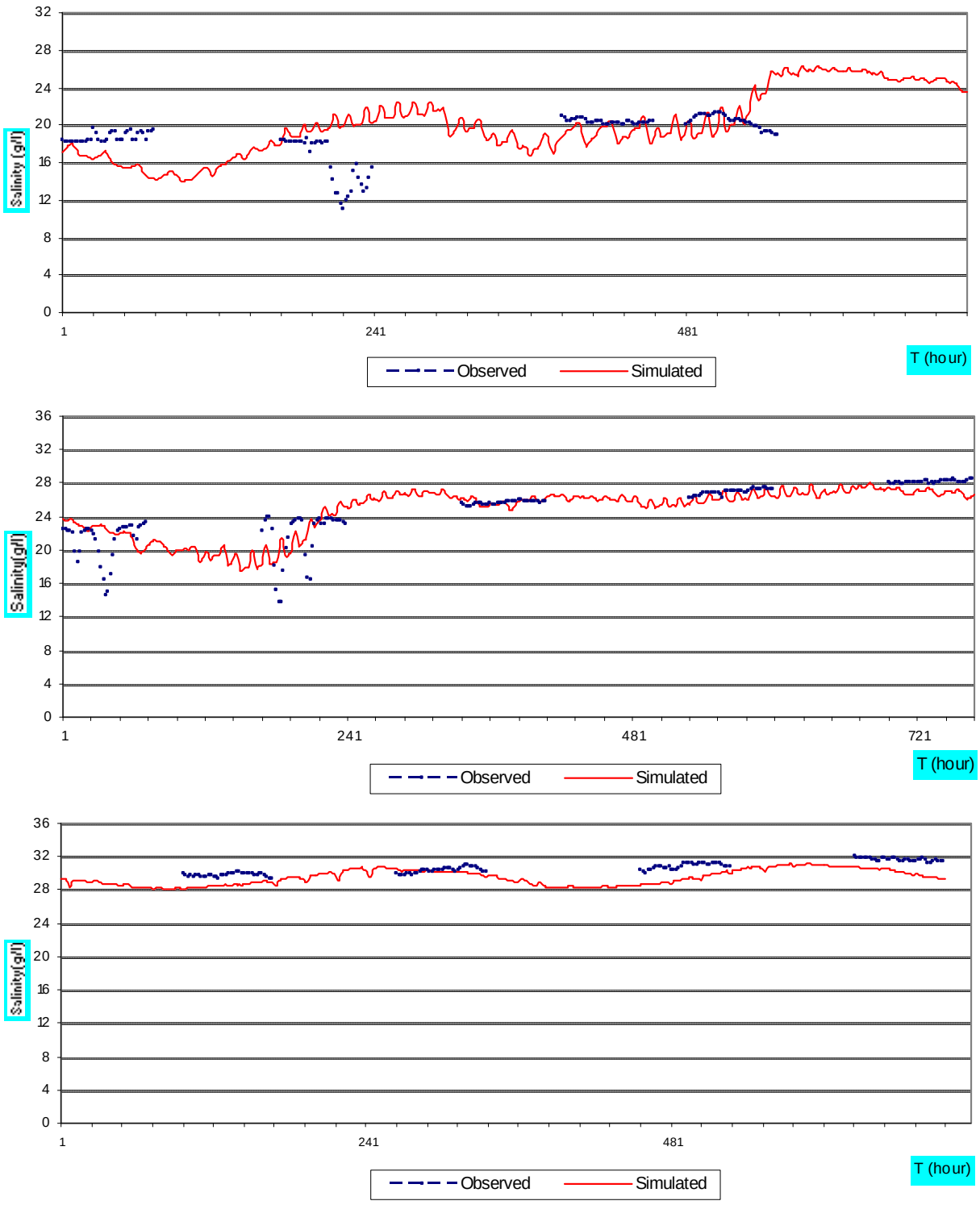


Figure 3.3.13 Calibration salinity level from February to April/2008 at Bac Lieu station
Source: SIWRP and Study Team

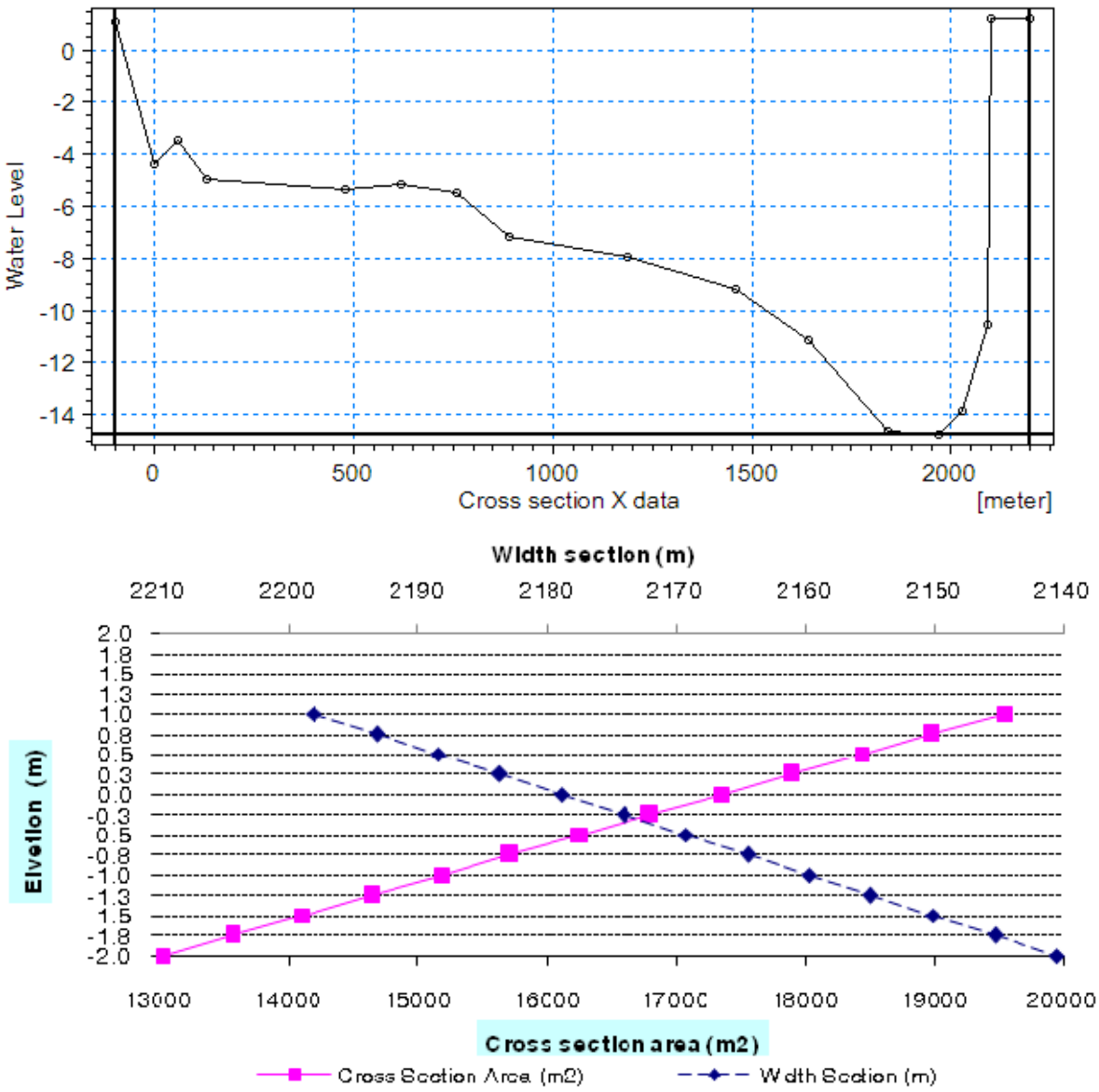


Figure 3.3.14 Samples of Cross Section and Area Capacity Curve: Bassac River
Source: SIWRP and Study Team

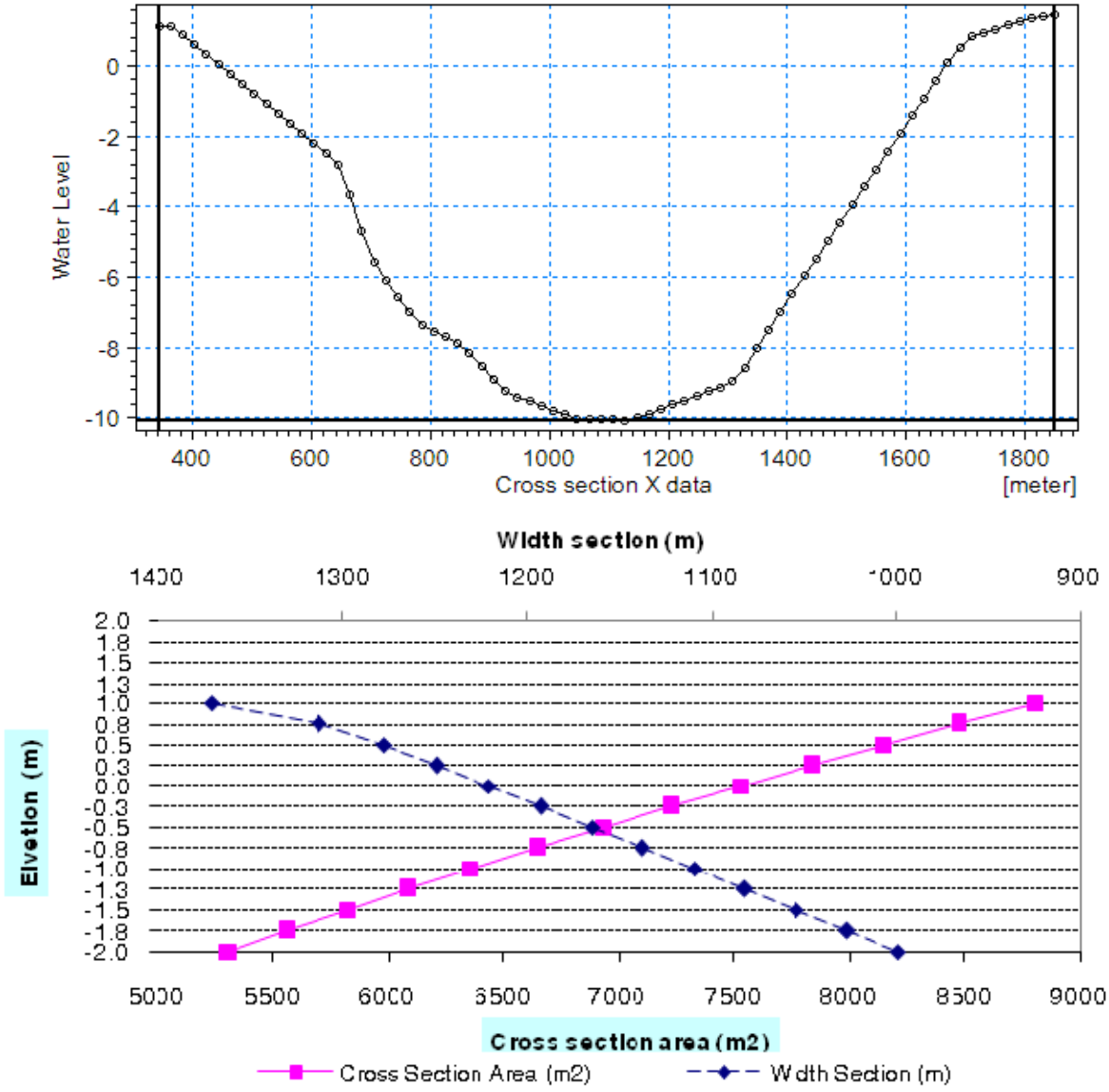


Figure 3.3.15 Samples of Cross Section: Mekong River
Source: SIWRP and Study Team

3.4 Boundary Condition for Water Mobilization

Simulation model covers from Ganh Hao and Song Doc canals as northern edges to southern side of these canas in the peninsula. Boundary conditions are given at; Ganh Hao station for east sea water level and Ca Mau station for west sea water level with hourly sea water level, sea water levels of these two points are also employed as water levels at other coastal canal mouths. Flow area is calculated from measured cross section of each canal and it is converted into numerical value of water level.

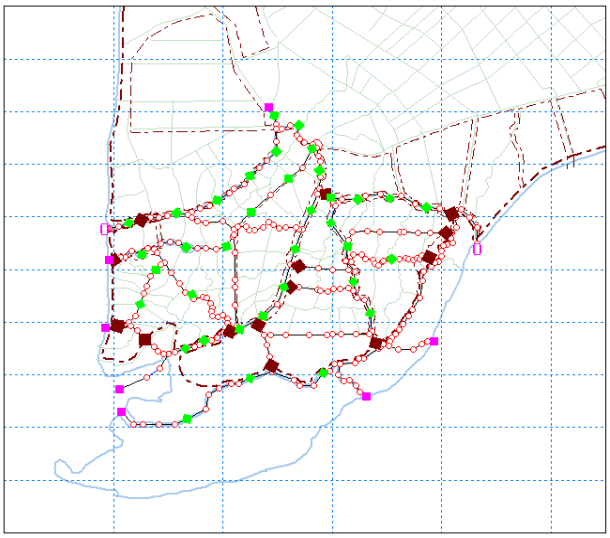


Figure 3.4.1 Model Boundary for Water Mobilization Simulation
Source: SIWRP and Study Team

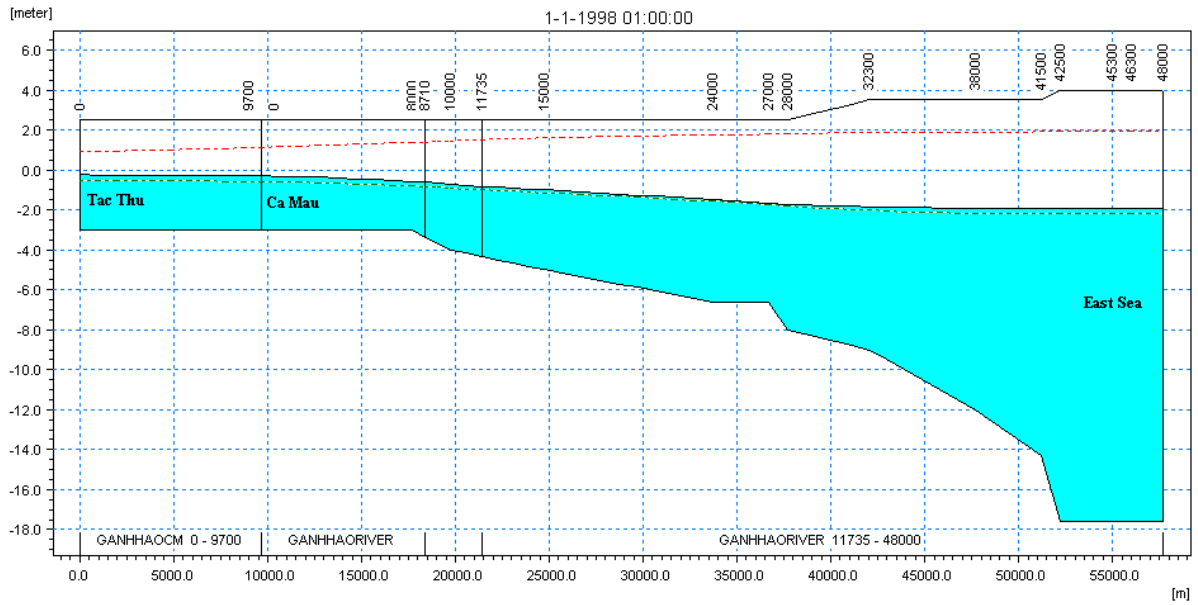


Figure 3.4.2 Sample of Longitudinal Profile at Gan Hoa Mouth
Source: SIWRP and Study Team

3.5 Model Calibration for Water Mobilization

Model calibrations are applied by hourly data from January to June in 1998 (draught year), 2001 (an average year); the calibration results show similar trend and magnitude of measured values.

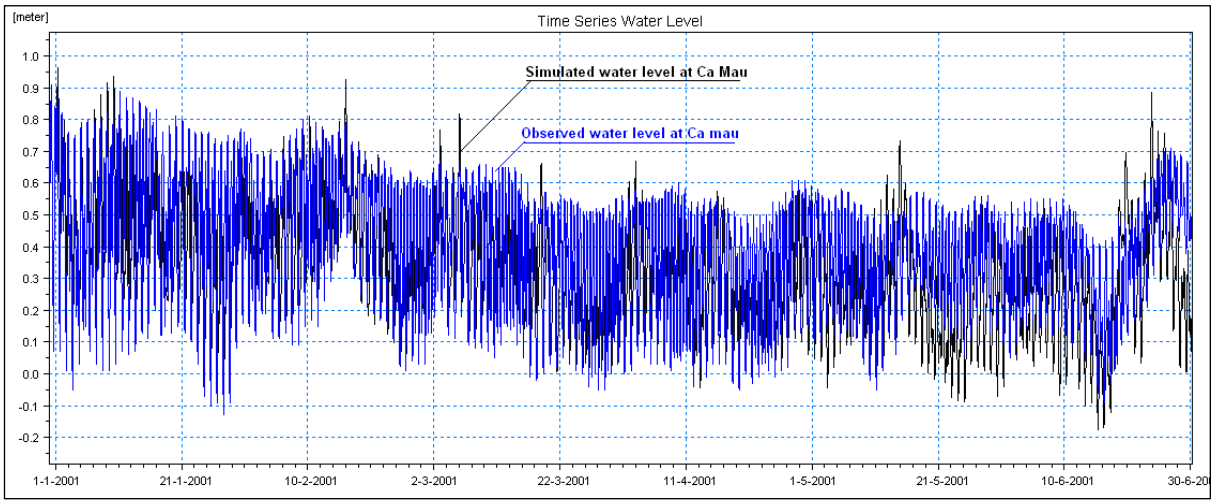


Figure 3.5.1 Model Calibration for Water Mobilization Simulation
Source: SIWRP and Study Team

3.6 Operation Rule for Water Mobilization

Gate operation for water mobilization has a rule on opening and closing which depend on water levels of front and back sides of a gate. Canal routes from East Sea to West Sea are basically divided into two (2) sections by three (3) sluices; one is from East Sea to inland, the other is from inland to West Sea. Due to daily large fluctuation of sea water level by tidal regime, East Sea is suitable for inlet side and the other side of sea (West Sea) is considered to be outlet side. Simulation has also proved natural water flow from East Sea to West Sea without existence and operation of gates like as this simulation of Ca Mau peninsula.

Figure 3.6.1 shows a case when water level of East Sea is lower than +1m above mean sea level

(AMSL); a gate facing East Sea is closed and a gate at midway of canal is opened. The gate at East Sea and the gate at midway are operated opposite direction. If the East Sea gate is opened, the midway gate is closed. Contrarily, if the East Sea gate is opened because East Sea water level is higher, midway gate is closed. A gate at West Sea is operated according to sea water level of West Sea; it doesn't relate to West Sea or inside Canal water level. The West Sea canal is opened when water level of West Sea becomes less than 0m of AMSL. Water in the canal will flow out to West Sea. If water level of West Sea becomes higher than 0m AMSL, the West Sea gate is closed.

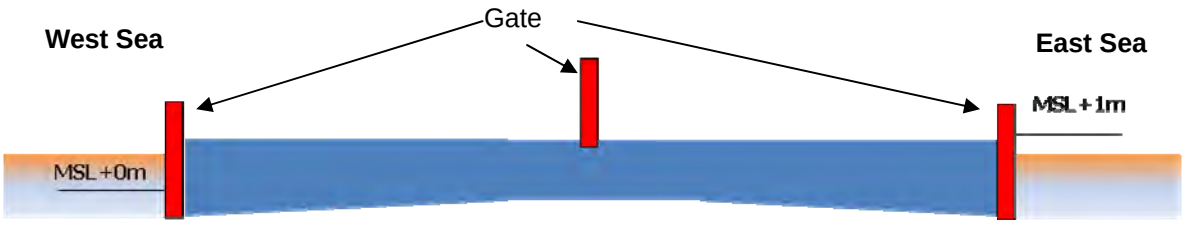


Figure 3.6.1 Gate Operation; both side gates are closed due to water level
Source: Study Team

Figure 3.6.2 shows gate operation at East Sea when water level of East Sea becomes higher than +1m AMSL; the East Sea gate is opened and sea water is let in a canal; the midway gate is operated opposite direction of the East Sea gate and the midway gate is closed. In the figure, West Sea water level is higher than 0m AMSL, then, the West Sea gate is closed.

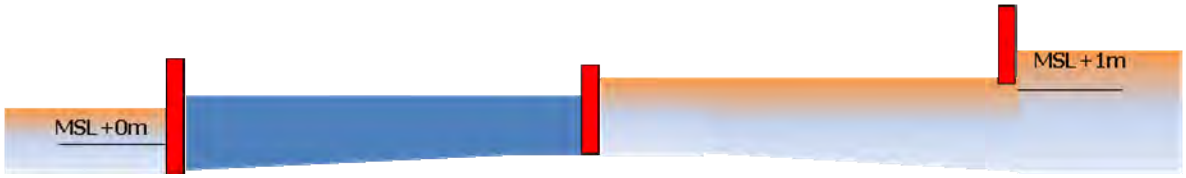


Figure 3.6.2 Gate Operation; East Sea Water Level is higher than +1m AMSL and Water is let into canal
Source: Study Team

Figure 3.6.3 shows operation at West Sea; when water level of West Sea descend lower than 0m AMSL, the West Sea gate is opened and water in the canal is released and flow out to West Sea. In the figure, water level at East Sea is lower than +1m AMSL, and then, the midway gate is opened.

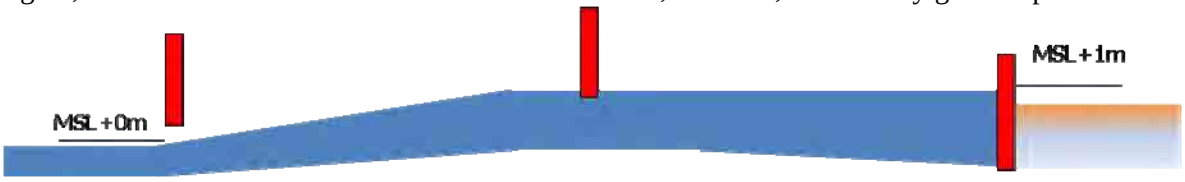


Figure 3.6.3 Gate Operation; West Sea water level is lower than 0m AMSL, the West Sea Gate is opened
Source: Study Team

Figure 3.6.4 shows the same situation at West Sea water level but East Sea water level rise higher than +1m AMSL. The West Sea gate is opened; the East Sea gate is opened but the midway gate is closed.

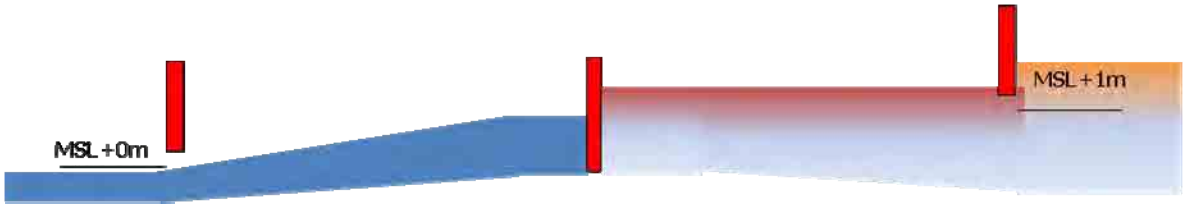


Figure 3.6.4 Gate Operation; West Sea water level < 0m AMSL, East Sea water level > +1m AMSL
Source: Study Team

3.7 Boundary Condition for Coastal Area Simulation

Water level data at 4 zones in South China Sea as Taiwan, Basi, Phillipine and Singapore are employed. Boundary conditions are given at 7 observation points at straits and rivers.

Discharge and suspened sediment concentration at some cross sections in Mekong river based on Water Resource Department of Viet Nam in 2009 as Tan Chau station in Dong Thap province and Chau Doc station in An Giang province.

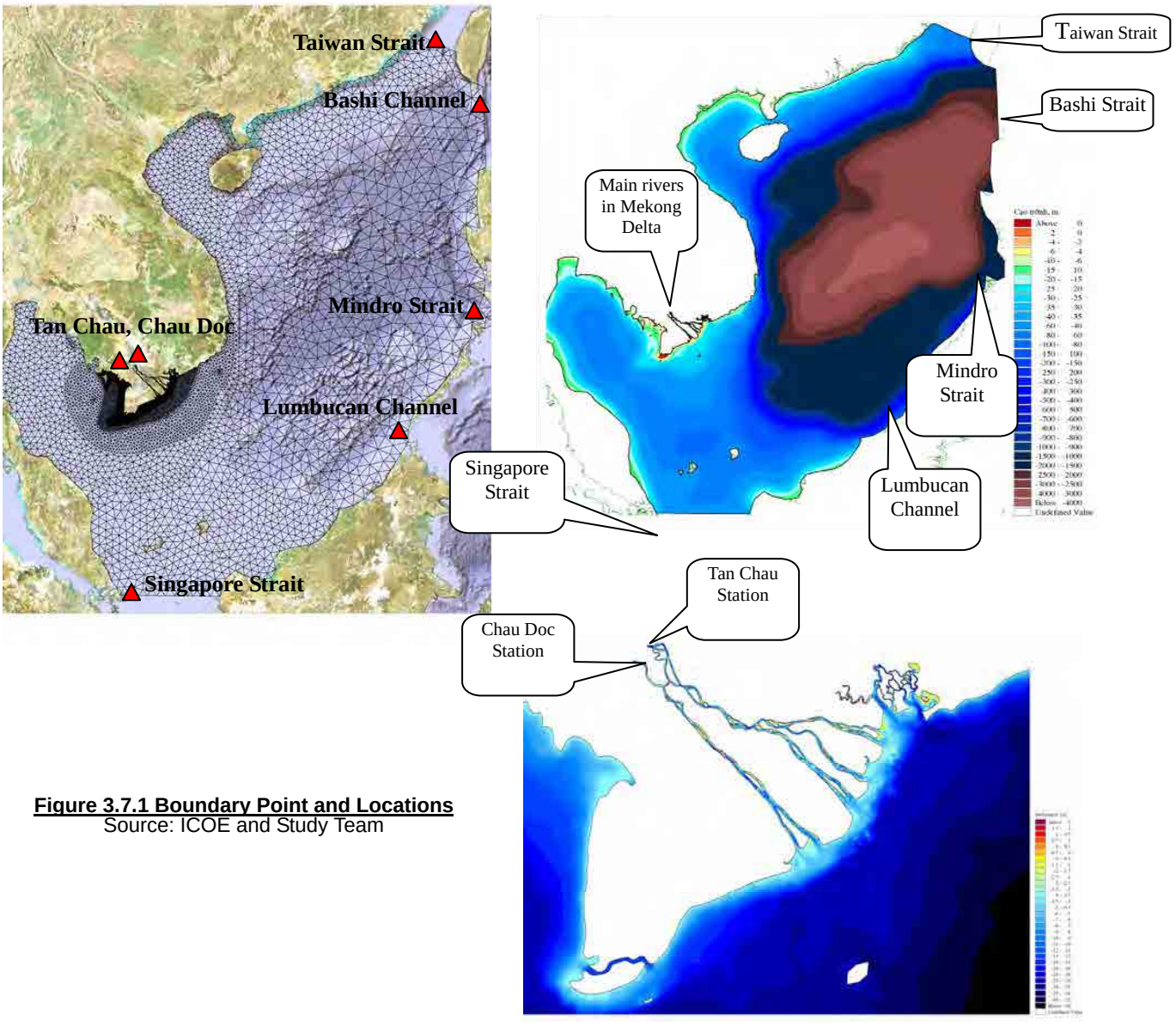


Figure 3.7.1 Boundary Point and Locations
Source: ICOE and Study Team

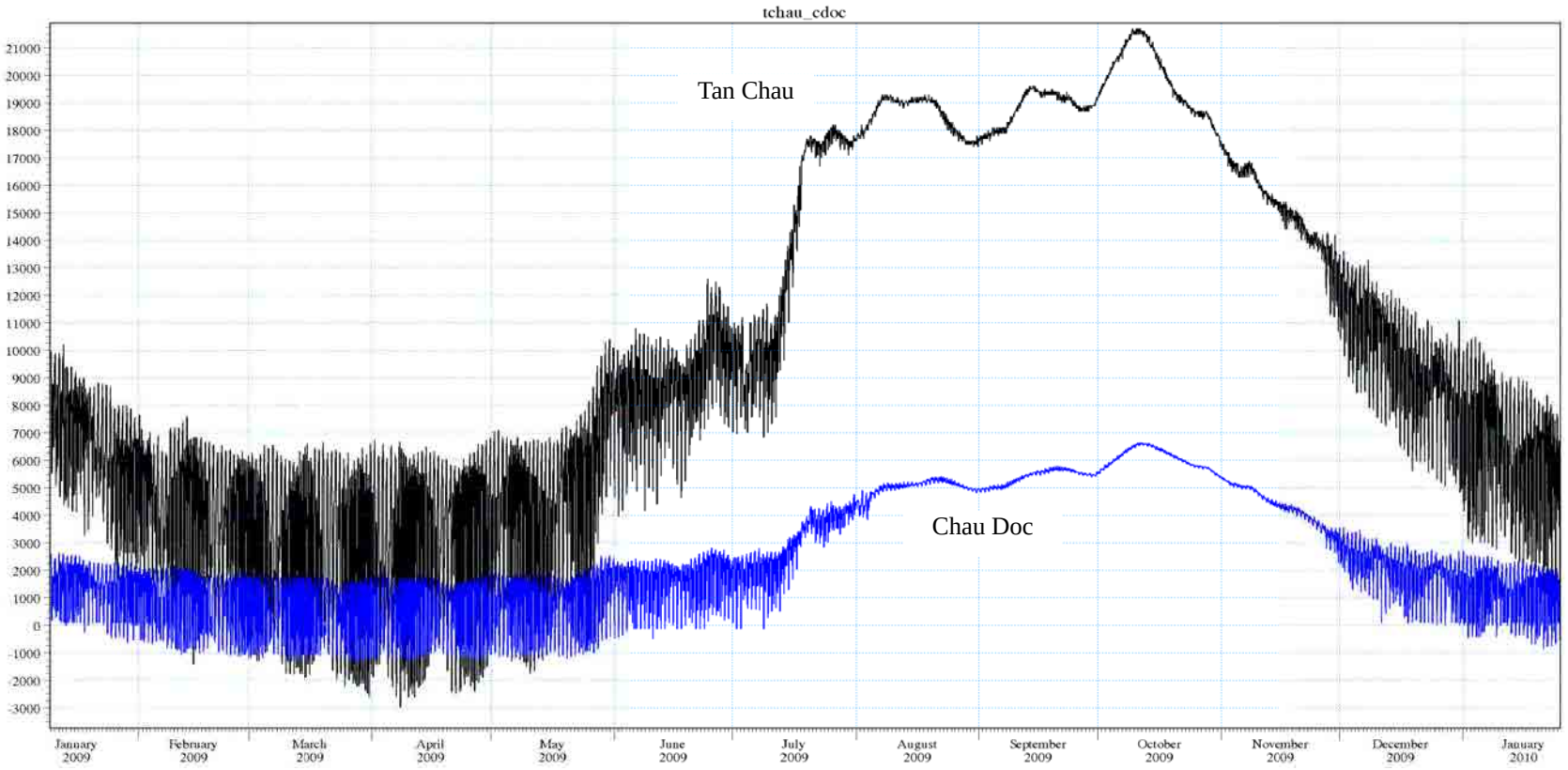


Figure 3.7.2 Discharge at boundary of Tan Chau and Chau Doc stations in 2009

✓ Source: ICOE and Study Team

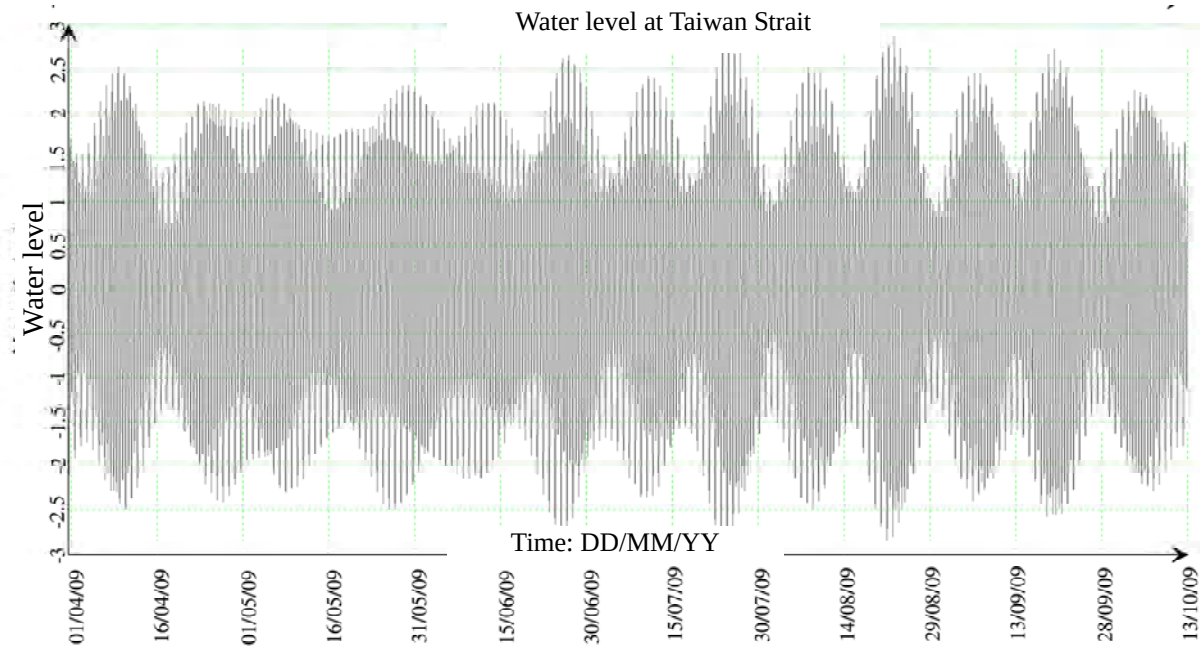


Figure 3.7.3 Water Level at Boundary of Taiwan Strait
Source: ICOE and Study Team

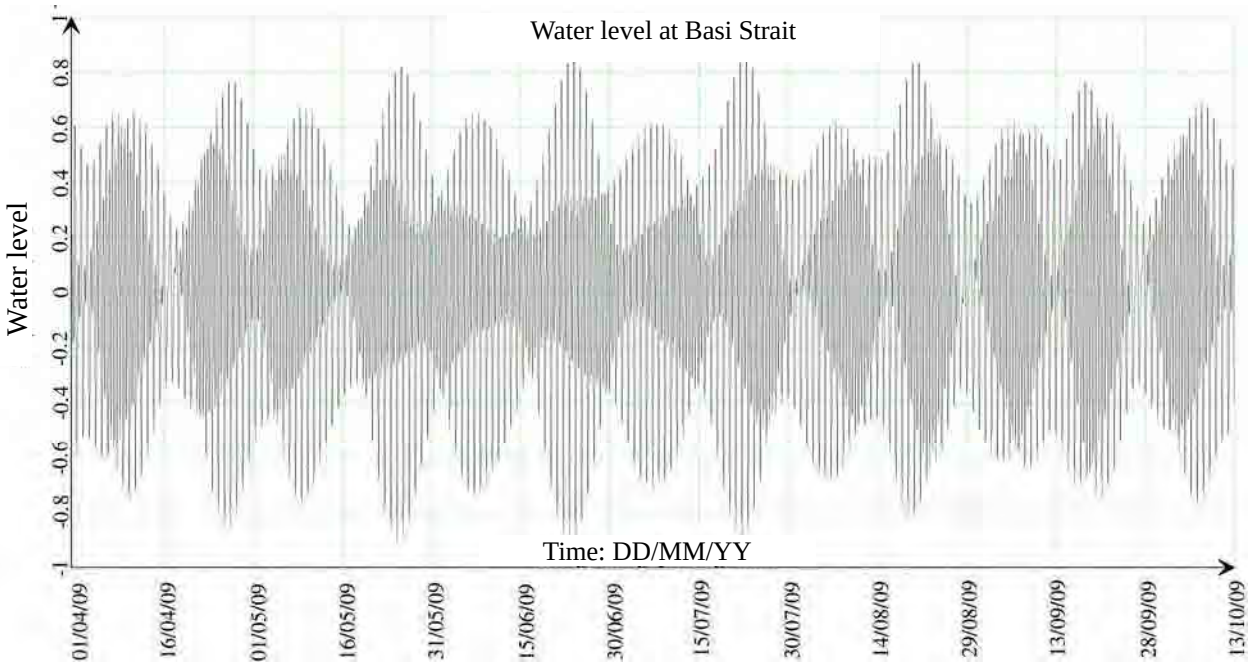


Figure 3.7.4 Water Level at Boundary of Bashi Strait
Source: ICOE and Study Team

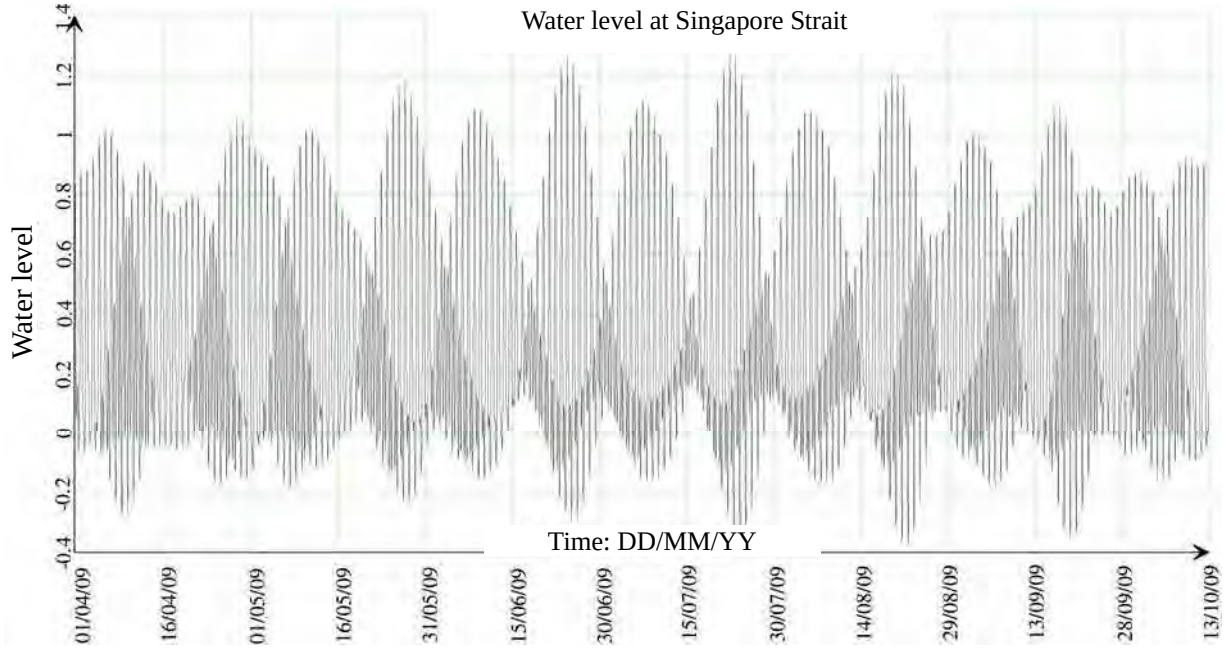


Figure 3.7.5 Water Level at Boundary of Singapore Strait
Source: ICOE and Study Team

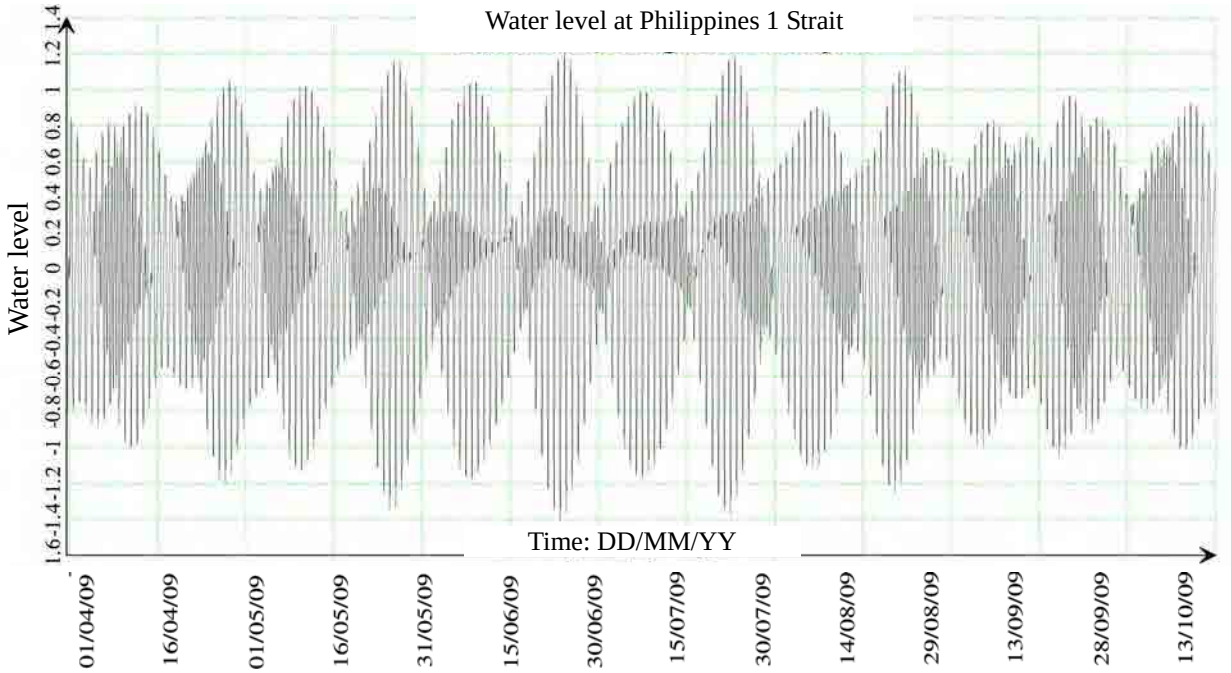


Figure 3.7.6 Water Level at Boundary of Mindro Strait
Source: ICOE and Study Team

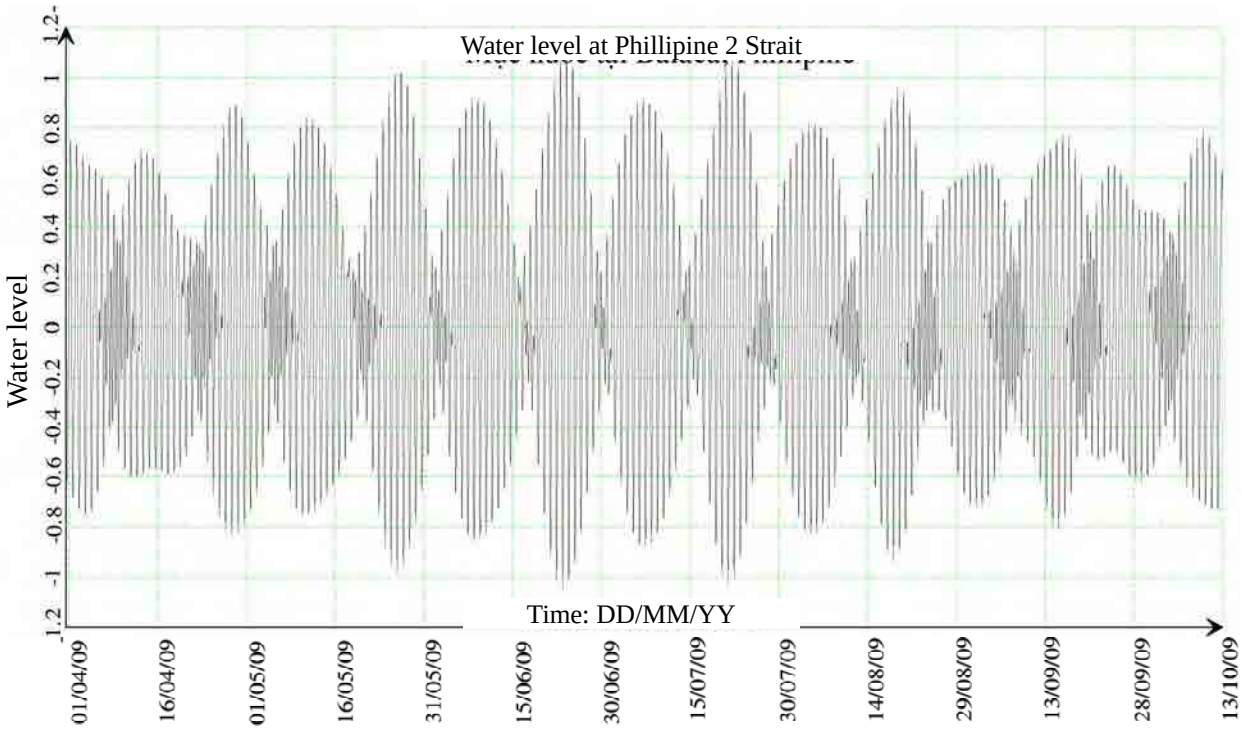


Figure 3.7.7 Water Level at Boundary of Lumbucan Channel
Source: ICOE and Study Team

3.8 Model Calibration for Coastal Area Simulation

Data obtained from Water Resource Department are employed in the simulation such as discharge and suspended sediment concentration at some cross section in Mekong River. Data obtained from 6 stations near Mekong River estuary are employed for calibration for wave and current data; data collection is carried out by Water Resource Department.

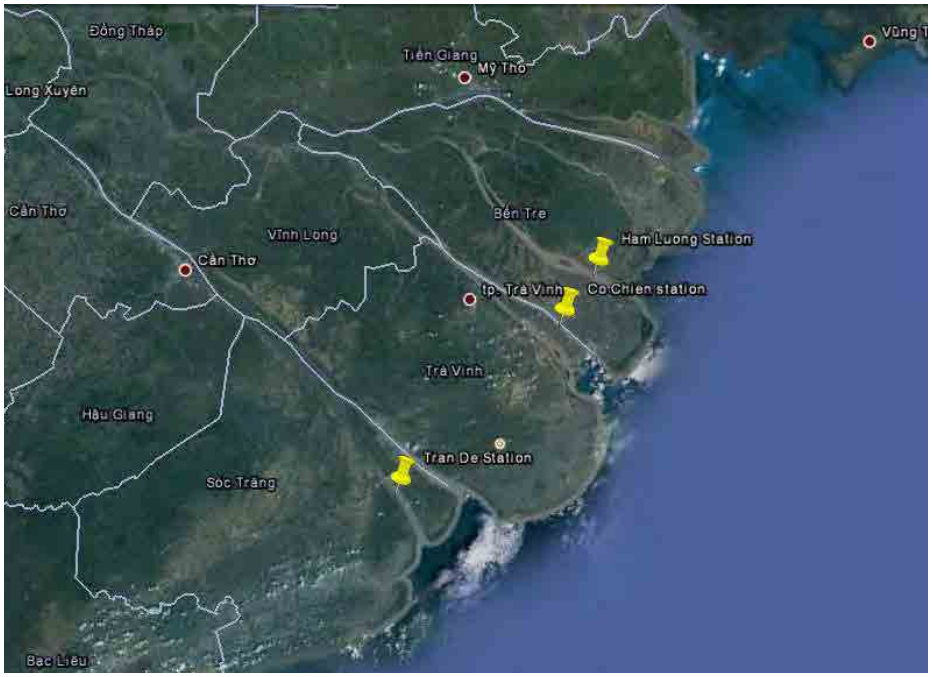


Figure 3.8.1 Three stations of Ham Luong, Co Chien and Tran De are used for calibration
Source: ICOE and Study Team

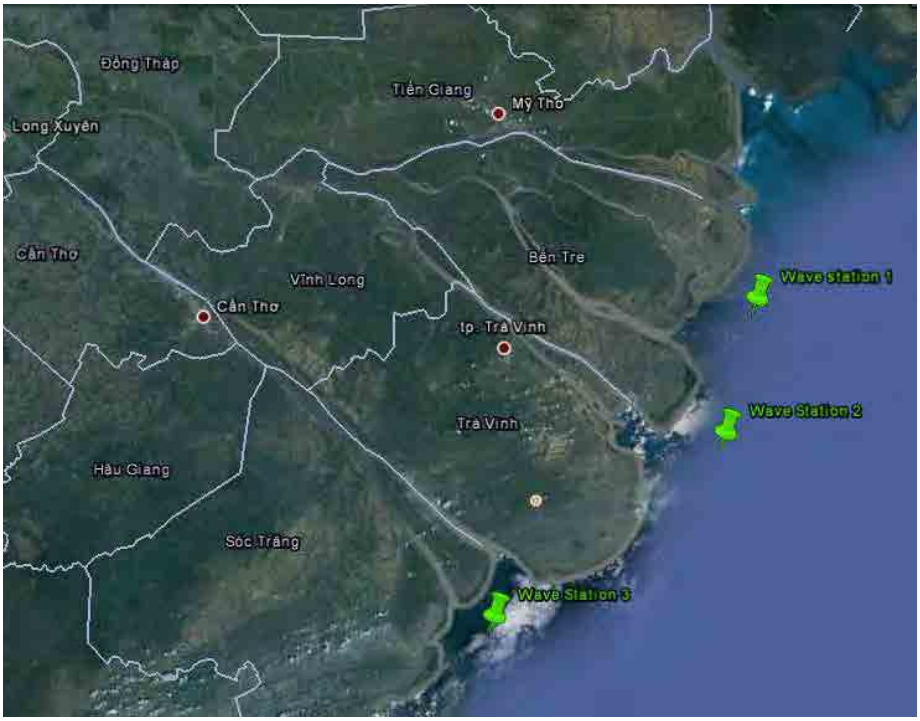


Figure 3.8.2 Three wave stations of 1, 2 and 3 are used for validation
Source: ICOE and Study Team

Some main parameters need to be calibrated such as; calculated mesh of finite element, bed resistance, eddy viscosity, time step, CFC coefficient, some main parameters of spectral wave and sediment.

The result of some main parameters have been adjusted after calibration and validation

- The bed resistance (Manning parameter) range from 37 to 42 in offshore and from 18 to 22 in shalow water zones.
- The eddy viscosity is 0.28
- Time step is 18 seconds.
- CFC coefficient is less than 1
- Gamma coefficient of wave breaking is 0.8
- Wave: type of spectra zero with formulation of Jonswap.
- Maximum wave fetch length: 10 km.
- Wave shape parameter: sigma σ_a = 0.07 and sigma σ_b= 0.09
- Wave peakness parameter: 3.3
- Sediment settling velocity coefficient of pappy mud is 50
- Dispersion coefficient is 0.025
- Concentration for floculation is 5 kg/m^3

Like the below figures from 10 to 16, it can be seen that the result of calculated value is rather extract. Compare with measured data, calculated value is suitable for trend, peak and trough values also. The average of correlation coefficient between measured and calculated values is about 0.86. This result is acceptable for research area.

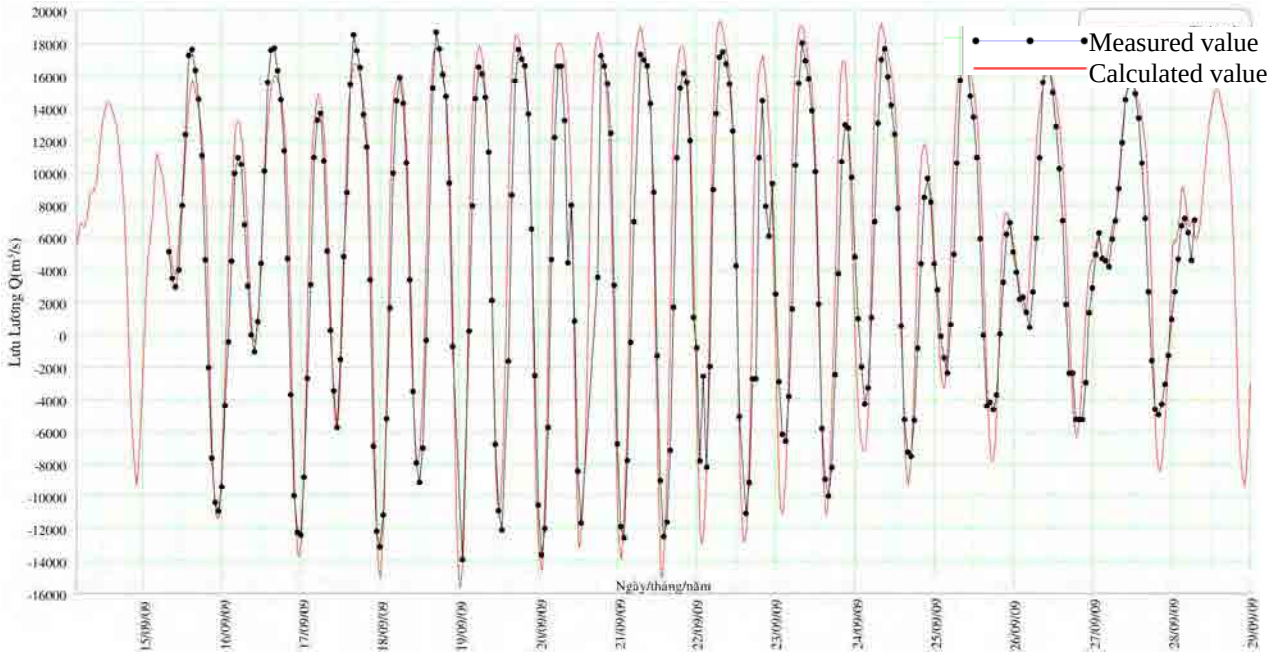


Figure 3.8.3 Comparison of measured and calculated discharge values at Co Chien estuary
Source: ICOE and Study Team

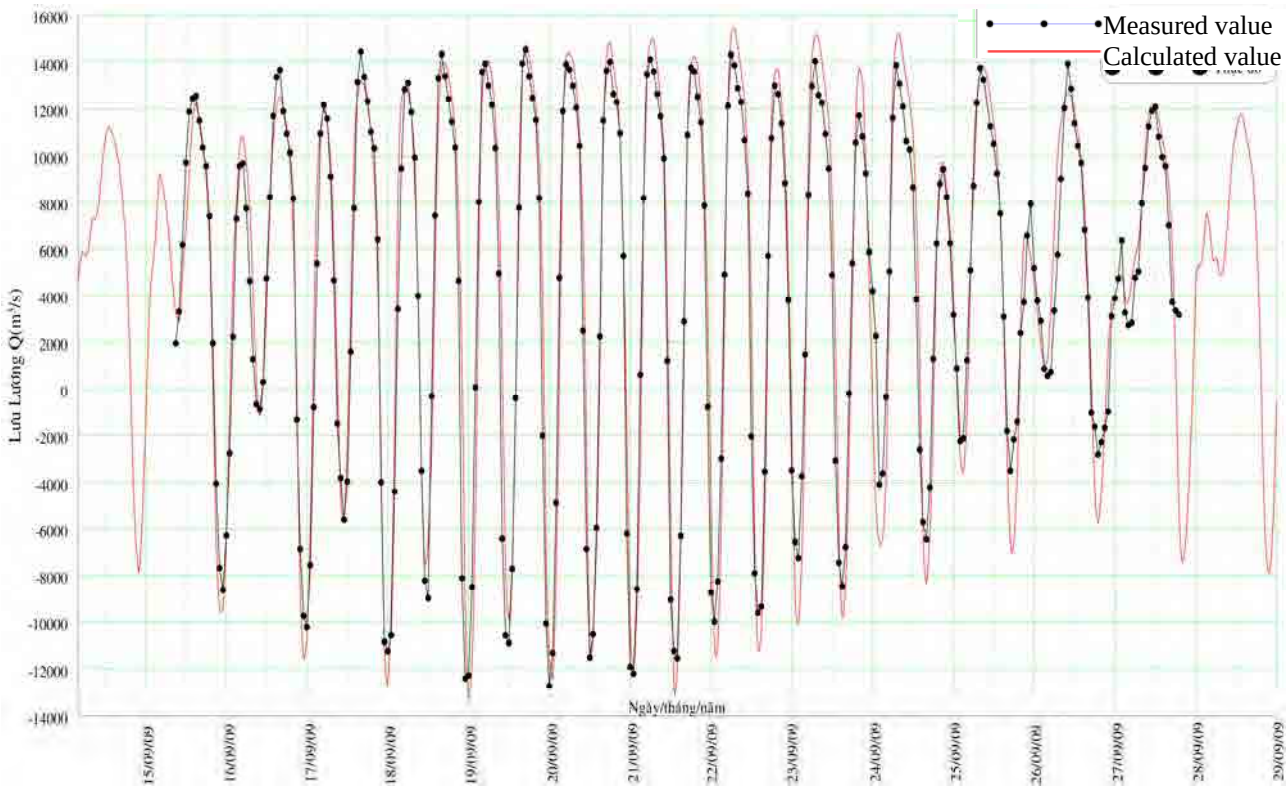


Figure 3.8.4 Comparison of measured and calculated discharge values at Tran De estuary

Source: ICOE and Study Team

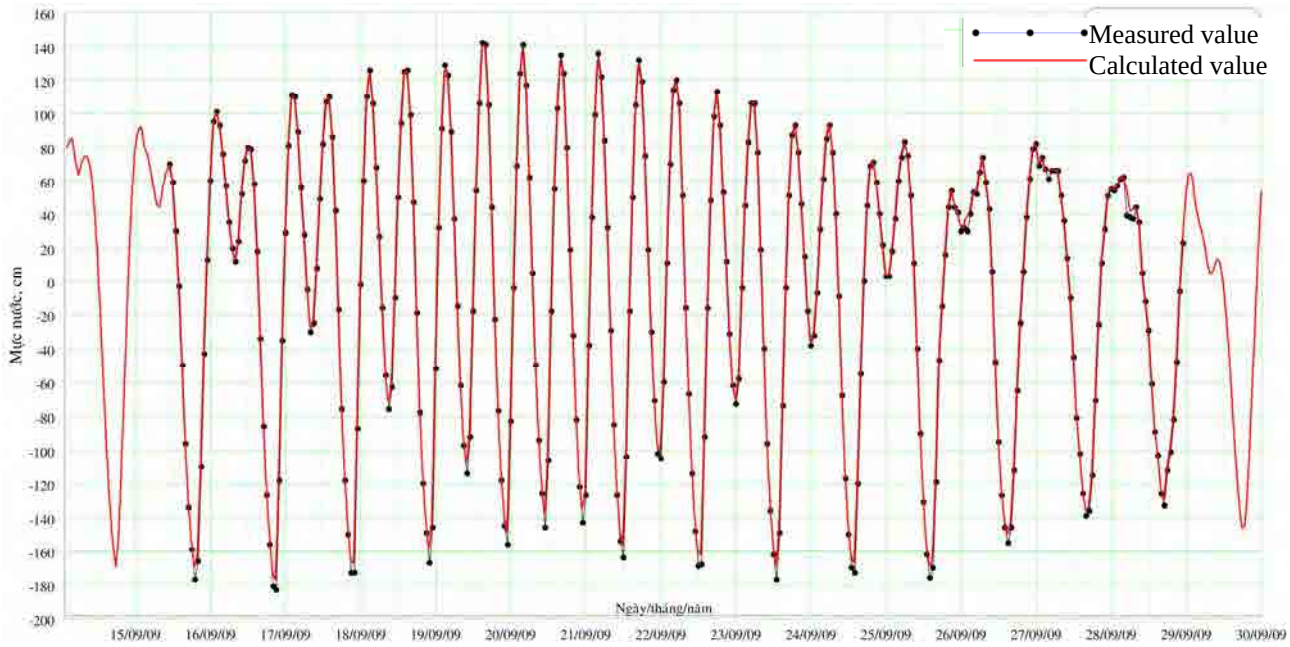


Figure 3.8.5 Comparison of measured and calculated water level values at Ham Luong estuary

Source: ICOE and Study Team

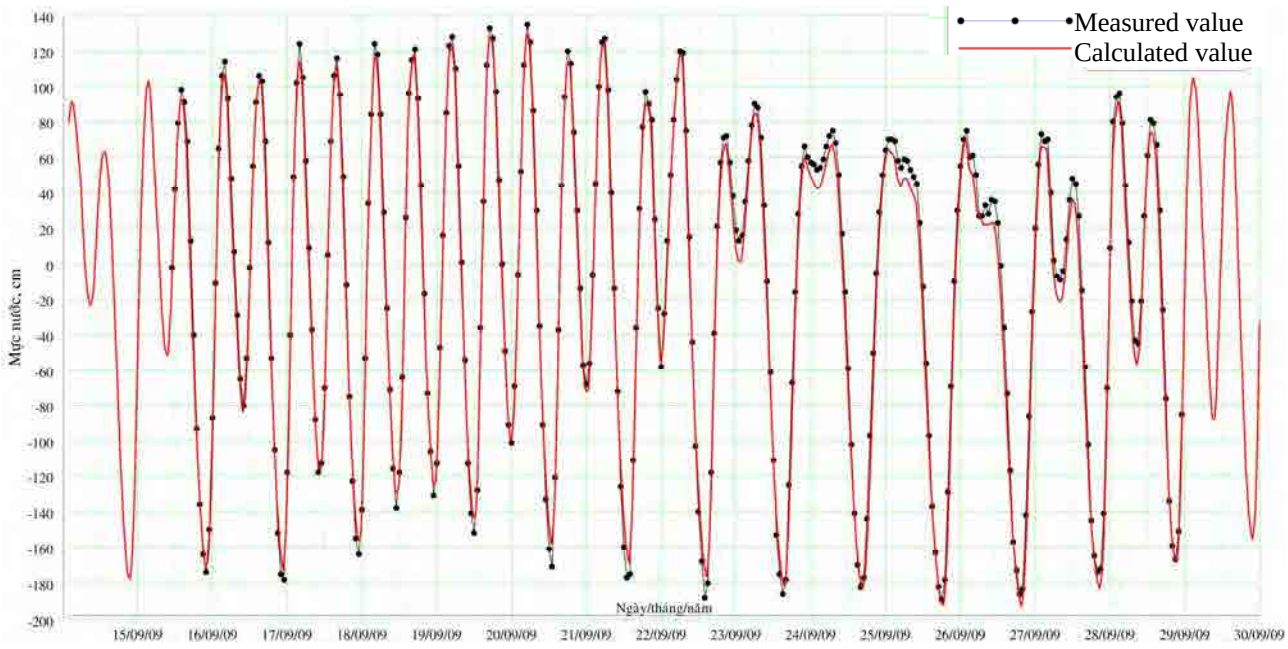


Figure 3.8.6 Comparison of measured and calculated discharge water level values at Co Chien estuary

Source: ICOE and Study Team

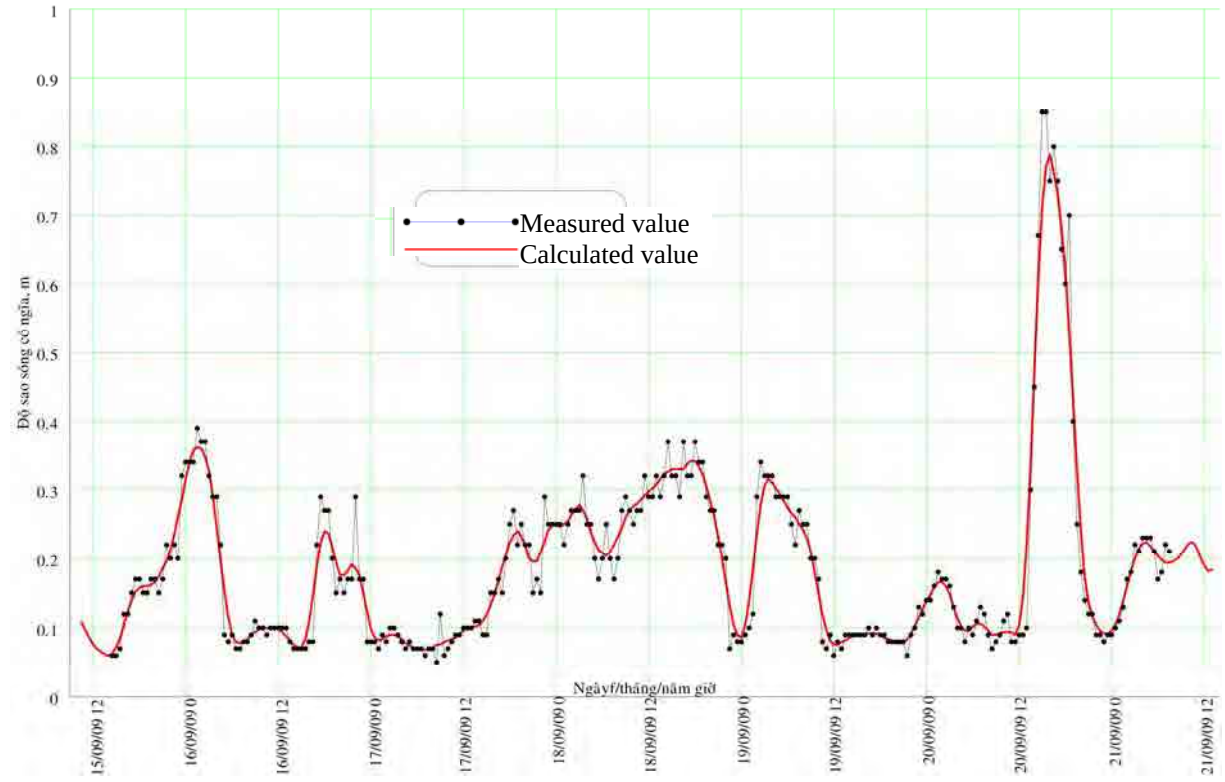


Figure 3.8.7 Comparison of measured and calculated high wave values at station 3

Source: ICOE and Study Team

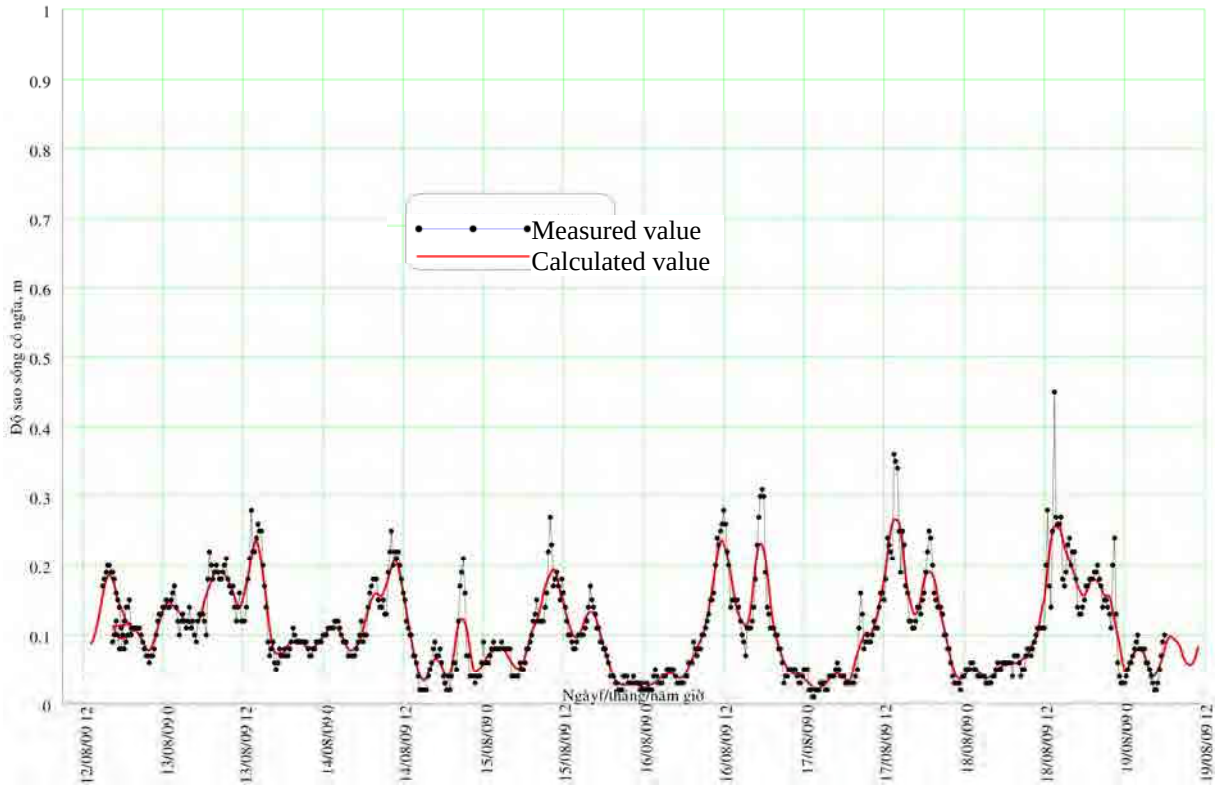


Figure 3.8.8 Comparison of measured and calculated high wave values at Dinh An station

Source: ICOE and Study Team

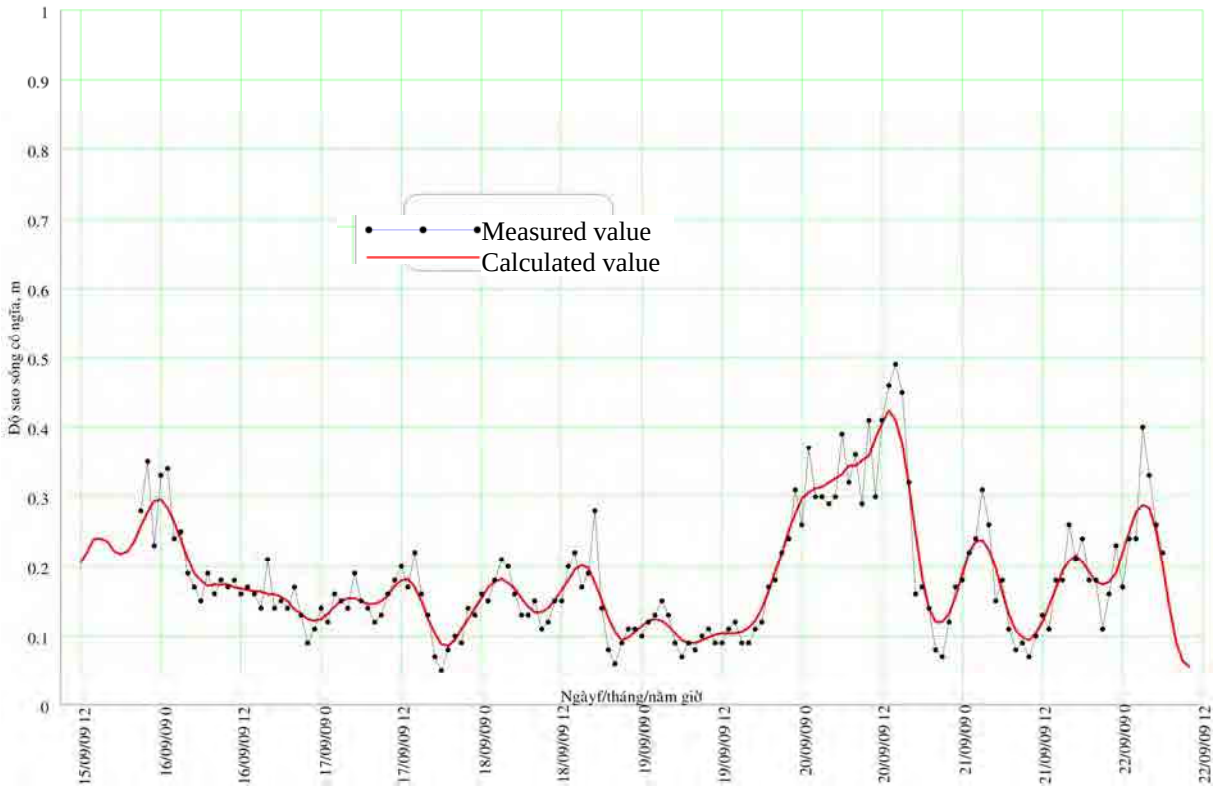


Figure 3.8.9 Comparison of measured and calculated high wave values at station 5

Source: ICOE and Study Team

3.9 Proposed Coastal Line Protection identified from Simulation and Observation

The following tables show protection plan for coastal lines identified by the results of simulation and field observations. Sections in the tables are shown in the figures of 'in-depth study' of the main report.

Tien Giang Province

Section	**A-R**	**B-C**	**C-D**
Length	2 km	11 km	2.1 km
Tendency	Stable	Erosion	Erosion
Present condition	Loose mangrove forest	Loose mangrove forest	Concrete dyke
Recommended structure	reforestation	reforestation	None
Length	2 km	11 km	
Unit price	7000$/km	7000$/km	
Sub total cost	14.000$	77.000$	
Priority	IV	I	V

Section	**D-E**	**-E-F**
Length	3.2 km	8 km
Tendency	Erosion	Erosion
Present condition	No mangrove forest	No mangrove forest
Recommended structure	Concrete dyke	reforestation
Length	3.2 km	8 km
Unit price	1.700.000	7000$/km
Sub total cost	5.440.000$	56.000$
Priority	II	III

Ben Tre Province

Section	**F-G**	**G-H**	**H-I**
Length	4 km	5 km	5 km
Tendency	Erosion	Stable	Erosion
Present condition	Loose mangrove forest	Loose mangrove forest	Loose mangrove forest
Recommended structure	Concrete dyke	Reforestation	Reforestation
Length	4 km	5 km	5 km
Unit price	1.700.000$/km	7000$/km	7000$/km
Sub total cost	6.800.000$	35.000$	35.000$
Priority	I	IV	II

Section	**I-J**	**J-K**	**K-L**
Length	20 km	5 km	20 km
Tendency	Stable	Erosion is not very strong	Stable
Present condition	Loose mangrove forest	No mangrove forest	Loose mangrove forest
Recommended structure	Reforestation	Reforestation	None
Length	20 km	5 km	
Unit price	7000$/km	7000$/km	
Sub total cost	140.000$	35.000$	
Priority	VI	III	V

Tra Vinh Province

Section	J-K	K-L	L-L1
Length	3 km	10 km	3.3 km
Tendency	Sedimentation	Sedimentation	Stable
Present condition	No mangrove forest	Dense mangrove forest	Very good concrete dyke
Recommended structure	Reforestation	None	None
Length	3 km		
Unit price	7000$/km		
Sub total cost	21.000$		
Priority	III	IV	V

Section	L1-M		M-N
Length	28km		20 km
Tendency	Erosion		Sedimentation
Present condition	No mangrove forest		Loose mangrove forest
Recommended structure	Riprap Reforestation		Reforestation
Length	28 km Riprap 28 km Reforestation		20 km
Unit price	Reforestation 7000$/km	7000$/km	Riprap 1.000.000$/km
Sub total cost	28.916.000$		140.000$
Priority	I		II

Soc Trang Province

Section	N-O	O-P	P-Q	
Length	12 km	22 km	32 km	
Tendency	Sedimentation	Sedimentation	Erosion	
Present condition	Dense mangrove forest	Dense mangrove forest	Loose mangrove forest	
Recommended structure	None	None	Riprap Reforestation	
Length			32 km Riprap 32 km Reforestation	
Unit price			Reforestation 7000$/km	Riprap 1.000.000$/km
Sub total cost			32.224.000$	
Priority	III	II	I	

Bac Lieu Province

Section	Q-R	R-S	S-T
Length	10 km	27.5 km	7 km
Tendency	Erosion	Sedimentation	Erosion
Present condition	Loose mangrove forest	Dense mangrove forest	1km concrete dyke Loose mangrove forest
Recommended structure	reforestation	None	Concrete dyke
Length	10 km		7 km
Unit price	7000$/km		2.500.000$/km
Sub total cost	70.000$		17.500.000$
Priority	II	III	I

Ca Mau Province (East)

Section	T-U		U-V	V-X
Length	25 km		13 km	35 km
Tendency	11 km Erosion		Erosion	Erosion
Present condition	Dense mangrove forest		Dense mangrove forest	Dense mangrove forest
Recommended structure	Protecting mangrove forest 1 km concrete dyke		Reforestation	Reforestation
Length	24km	1km	13 km	35 km
Unit price	7000$/km	2.500.000$/km	5000$/km	7000$/km
Sub total cost	168.000$	2.500.000$	65.000$	245.000$
	2.668.000$			
Priority	I		V	IV

Section	X-Y	Y-Z
Length	10 km	6 km
Tendency	1 km Erosion	Erosion
Present condition	Dense mangrove forest	Dense mangrove forest
Recommended structure	Concrete dyke	Concrete dyke
Length	10 km	6 km
Unit price	2.500.000$/km	2.500.000$/km
Sub total cost	25.000.000$	15.000.000$
Priority	II	III

Ca Mau Province (west)

Section	AA-AB	AB-AC	AC-AD	
Length	35 km	11.5 km	27 km	
Tendency	Erosion	Sedimentation	Erosion	
Present condition	Dense mangrove forest	Dense mangrove forest	Dense mangrove forest	
Recommended structure	Reforestation	Protecting mangrove forest	Concrete dyke Reforestation	
Length	35 km	11.5 km	25km Reforestation 2km Concrete Dyke	
Unit price	5000$/km	100.000$/km	Reforestation 7000$/km	Concrete Dyke 2.500.000$/km
Sub total cost	175.000$	1.150.000$	5.175.000$	
Priority	III	V	II	

Section	AD-AE	AE-AF
Length	21 km	20km
Tendency	Sedimentation	Erosion
Present condition	Loose mangrove forest	Loose mangrove forest
Recommended structure	Reforestation	Reforestation
Length	21 km	20km
Unit price	7000$/km	7000$/km
Sub total cost	147.000$	140.000$
Priority	IV	I

Kien Giang Province

Section	AE-AF	AF-AG	AG-AH
Length	22 km	12.5 km	25 km
Tendency	Erosion	Sedimentation	Erosion
Present condition	Loose mangrove forest	Loose mangrove forest	Loose mangrove forest
Recommended structure	Reforestation	Reforestation	Reforestation
Length	22 km	12.5 km	25 km
Unit price	7000$/km	7000$/km	7000$/km
Sub total cost	154.000$	87.500$	175.000$
Priority	IV	V	III

Section	AH-AI		AI-AJ		AJ-AK
Length	29 km		38 km		21 km
Tendency	Stable		7.8 km Erosion		Light Erosion
Present condition	Loose mangrove forest		Loose mangrove forest		Loose mangrove forest
Recommended structure	Concrete Dyke Reforestation		Concrete Dyke Reforestation		None
Length	19km Reforestation 10km Concrete Dyke		8km Reforestation 30km Concrete Dyke		
Unit price	Reforestation 7000$/km	Concrete Dyke 2.500.000$/km	Reforestation 7000$/km	Concrete Dyke 2.500.000$/km	
Sub total cost	25.133.000$		22.610.000$		
Priority	II		I		VI

APPENDIX-X

NORTH BEN TRE PROJECT TOWARD CLIMATE CHANGE

APPENDIX X:
NORTH BEN TRE PROJECT TOWARD CLIMATE CHANGE

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ATTACHMENT (DRAWINGS):

ACRONYMS AND ABBREVIATIONS

B/C	Benefit Cost Ratio
DARD	(Provincial) Department of Agriculture and Rural Development
DONRE	Department of Natural Resources and Environment
DPC	District People's Committee
ERR	Economic Rate of Return
FY	Fiscal Year
GOJ	Government of Japan
GOV	Government of Vietnam
GSO	General Statistical Office
IAS	Institute of Agricultural Science for Southern Vietnam
ICB	International Competitive Bidding
IDMC	Irrigation and Drainage Management Company
IMHEN	Institute of Metrology, Hydrology and Environment
IRR	Internal Rate of Return
JICA	Japan International Cooperation Agency
MARD	Ministry of Agriculture and Rural Development
MKD	Mekong Delta
MOF	Ministry of Finance
MONRE	Ministry of Natural Resources and Environment
MPI	Ministry of Planning and Investment
MRC	Mekong River Commission
NCB	National Competitive Bidding
NPV	Net Present Value
PPC	Provincial People's Committee
SIWRP	Southern Institute of Water Resources Planning (the CP organization)
Sub-NIAPP	Sub-national Institute of Agricultural Planning and Protection

UNIT CONVERSION

1 meter (m)	=	3.28 feet
1 kilometer (km)	=	0.62 miles
1 hectare (ha)	=	2.47 acres
1 acre	=	0.405 ha
1 inch (in.)	=	2.54 cm
1 foot (ft.)	=	12 inches (30.48 cm)
1 ac-ft		1233.4 cum

CURRENCY EQUIVALENTS (AS AT DECEMBER 2012)

US$ 1.00	=	VND 21,054 (TTB)
US$ 1.00	=	82.11 Japanese Yen (TTB)
VND 1.00	=	0.0039Yen

VIETNAM FISCAL YEAR

January 1 to December 31

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LIST OF FIGURES;

CHAPTER 1 RATIONAL AND GOAL OF THE PROJECT

1.1 Rationale of the Project

There is a global issue, i.e., climate change, which in most cases entails global warming. Global warning raises sea water level as is well known. Therefore, the Mekong Delta where the altitude is just over the sea level is believed to be greatly affected. Not just waiting for the consequences, the Government has embarked on a programme to cope with the climate change. The program is called National Target Program to Respond to Climate Change (NTP-RCC) with a target year of 2020.

Ben Tre Province, one of coastal provinces of Mekong Delta, is now being affected by the sea-level rise. Ben Tre Province is of large scale polder area confronted by the East Sea on its tail end and by tributaries of Mekong River. Ben Tre province is further divided into major 2 lands; one is south Ben Tre and the other is north Ben Tre. The North Ben Tre area is surrounded by Tien River on its northern side and by Ham Luong River on its southern side, both of which are tributaries of the Mekong River.

Saline intrusion along the two rivers has been taking place in keeping with sea-level rise. According to the past record of sea-level rise at Vung Tau station, about 15 cm sea-level rise was observed over the last 30 years from 1982 to 2011. The fifteen (15) cm sea-level rise has been causing salinity intrusion deep into upstream areas of the Ben Tre Province, giving huge negative impact to the agriculture, the major industry thereof, and also to the peoples' life for which still lots of them depend on canal/channel water for their domestic use during dry season.

Taking above statements into consideration, now a mean to prevent saline intrusion whereby keeping the people's livelihood and life itself free from the damage is due sought; hence this North Ben Tre Project is given one of the highest priorities in Vietnam in the Context of Climate Change.

1.2 Objectives of the Project

The objective of the Project is to protect the major industry, which is agriculture, and the people's life of the North Ben Tre area from the threat of saline intrusion being caused by sea level rise under climate change, whereby serve for socio-economic development for the Ben Tre Province in general and five (5) districts located in the north Ben Tre area in particular.

Under the objective of the Project, following are expected outputs by the Project;

1) To prevent saline water by means of sluice gate construction for approximately 139,000 hectares of natural land area including about 100,000 hectares of agricultural land and life activities of the local population in such districts of Chau Thanh, Giong Trom, Ba Tri, Binh Dai and Ben Tre center (town),

2) To retain and ensure fresh water supply by means of recruiting fresh water from the top most upstream area of the North Ben Tre for agriculture production and life activity for about 900,000 people, belonging to the 5 districts and Ben Tre center, and

3) To increase production of food crop plants with the saline water prevention as well as by bringing about the secured fresh water, particularly fruits and paddy, which are one of the major agricultural products in the Ben Tre Province.

1.3 The Project Area

The Project Area covers northern parts of Ben Tre Province where there are 4 districts and Ben Tre center (town), the capital of the province. The total population arrives at 762,308 as of 2010 while the total area comes to 1,387.3 km^2, giving population density of 549 persons/km^2. The project boundaries are as follows: north border with Tien River and My Tho River (Tien Giang province), south and

southwest border with Ham Luong River, and the east border with East Sea.

In particular, the Project area has a coastal line from Cua Dai to Cua Ham Luong which are composed of recent alluvial affected by tidal flood, more appropriate for mangrove forest and raising brackish aquatic products than agricultural production. Impact of sea, particularly saline intrusion through big estuaries going deeply inlands is associated with large tide fluctuation, also worsened with the effect of sea-level rise under climate change.

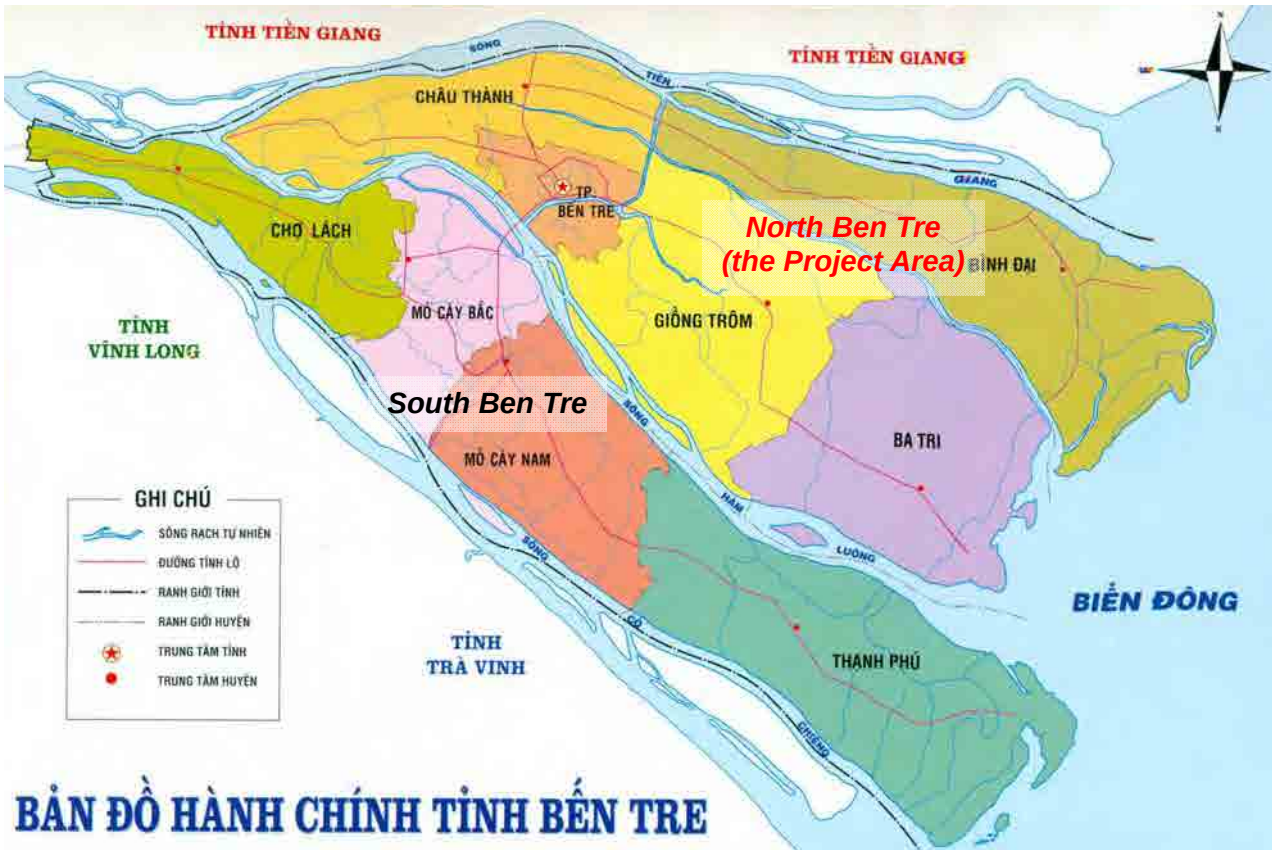

Figure 1.3.1 Ben Tre Province and its Districts (5 districts in North Ben Tre Area)

CHAPTER 2 THE PROPOSED PROJECT AREA

2.1 Special Settings and Demography

Ben Tre Province is located in between Tien Giang Province in its northern direction and Vinh Long – Tra Vinh Provinces in its south-western direction. The Province is of a large scale alluvial fun demarcated by Tien – My Tho River in the north and by Co Chien River in the south. The Project area occupies the northern parts of the Ben Tre Province and is demarcated by Ham Luong River in its south-western boundary. The Project area extends from 9 degrees 57 minutes 47 seconds to 10 degrees 20 minutes 1 second in its north latitude (35 km) and 106 degrees 0 minutes 13 seconds to 106 degrees 47 minutes 32 seconds in east latitude (63 km).

The topographical feature in the Project area is rather low in altitude, similar to other regions of Mekong Delta. It is generally very flat with popular altitude ranging from only 0.5m to 1.5m (accounting for about three – quarters natural land area) and gradually lowers from the West – North to the East – South direction. The whole Project area has average altitude ranging from 0.5m to 0.75m only, which is very susceptible to sea level rise now taking place under climate change.

The highest terrain belongs to the area of Chau Thanh district, Ben Tre center on the West of Binh Dai and Giong Tom with average altitude ranging of 1.25 – 1.50 m. On the other hand, the coastal area has altitude ranging from 0.75 – 1.25m. In particular, some places are very hollow, namely Dai Hoa Loc commune, Binh Thanh commune (Binh Dai district), and edge area of Lac Dia (Ba Tri district) having altitude range of only 0.30 – 0.50m where water-logging takes place very often in the rainy season.

Table 2.1.1 summarizes the area, population and the population density including other districts which form southern parts of the province. In the Project area, there are 645,500 population as of 2010, dwelling in a total area of 1,387 km^2. The population density comes therefore to 465 persons per km^2. The district which shows the highest population is, excluding Ben Tre center, Chau Thanh district located in the most upstream part of the North Ben Tre area while the least populated district is Binh Dai district. In all the districts, the population density is over 300 persons/km^2, implying relatively populated area.

Table 2.1.1 Area and Population of the Project Area

District/ Town	Population (2010)	Area, sq.km	Pop. Density Persons/sq.km	Remarks
Ben Tre city	116,777	67.5	1,730	
Chau Thanh district	157,097	228.7	687	
Giong Trom district	168,284	313.2	537	
Binh Dai district	132,315	419.5	315	
Ba Tri district	187,835	358.4	524	
Sub total (North Ben Tre)	**645,531**	**1,387**	**465**	
Cho Lach town	110,172	167.6	657	
South Mo Cay district	146,932	222.1	662	
North Mo Cay district	109,664	158.0	694	
Thanh Phu district	127,662	425.6	300	
Sub total (South Ben Tre)	**494,430**	973.0	**356**	
Total (Ben Tre Provice)	**1,139,961**	**2,361**	**411**	

Source; Statistical Yearbook 2010, Ben Tre Province

2.2 Meteorology, Hydrology and Irrigation & Drainage System

2.2.1 Meteorology

The average annual temperature in the Project area is little varied, relatively uniform. The average annual temperate in Ba Tri and My Tho is 26.80 Celsius degree and 26.80 Celsius degree respectively,

while that in Cao Lanh comes to 27.00 Celsius degree. The average monthly temperature in the dry season is not much higher than that of the rainy season. The highest average monthly temperature is 26.80 Celsius degree (April) in Ba Tri, 28.00 Celsius degree (April) in My Tho, 28.70 Celsius degree (April) in Cao Lanh.

Average minimum monthly temperature is 25.20 Celsius degree (January) in Ba Tri, 22.80 Celsius degree (January) in My Tho, and 25.40 Celsius degree (April) in Cao Lanh. The maximum monthly temperature appears in April: in Ba Tri 37.10 Celsius degree, in My Tho 36.70 Celsius degree, in Cao Lanh 37.20 Celsius degree. The minimum temperature appears in March: 17.20 Celsius degree, 17.10 Celsius degree and 15.80 Celsius degree in Ba Tri, My Tho and Cao Lanh respectively.

Rain regime is closely related to that of monsoon region; the rainy season coincides with the southwest wind monsoon, and the dry season coincides with the summer monsoon season. Year is divided into 2 clear seasons which are contrast clearly, namely the dry season and rainy season. The rainy season lasts from May to November while the dry season lasts from December to April of the following year.

Average annual rainfall in the Project area varies in a range of about 1,250 - 1,350 mm; the South and South West area have a higher rainfall of more than 1,400 mm, and the rainfall of the central area (Giong Trom area) is rather low of less than 1,200 mm. In general, rainfall tends to gradually reduce according to the North East and South West direction to the central area.

In general, the maximum rainfall often appears in September and October and reduces in July, August and September. Annually, there often appear 2 rain peaks: The first peak appears in October (main peak) and the second (sub-peak) often appears in June. Maximum rainfall in the rainy season makes up about 95 - 96% annual rainfall, in which rainfall of September and October makes up about 40% rainfall in the rainy season.

2.2.2 Hydrology

Within the scope of North Ben Tre Project, there are 3 big rivers belonging to Mekong River system, which run through and flow into East Sea with total length of 232 km; i.e., 1) My Tho – Cua Dai river with 90km long running along the North side of the area, 2) Ba Lai River with 70km long running along the middle part of the area, and 3) Ham Luong River being 72km long running along the South side of area. My Tho and Ham Luong Rivers are 2 main lines which discharge a significant water flow of Tien River, one of the 2 Mekong major tributaries, out to the East Sea. Upstream section of Ba Lai River is degraded and often gets dry; and therefore the mobility of fresh water from Tien River is relatively restricted.

Under effect of tide of the East Sea through rivers of My Tho, Cua Dai and Ham Luong, a thick network of channels and canals have been formulated. The network tends to develop more in the South - North direction, and dividing Ba Lai area into lots small areas. In particular, it forms a very big river across Ben Tre – Giao Hoa connected at the middle of Cua Dai and Ham Luong, creating very important water way transportation route in the area and in the province by large. On banks of Cua Dai River and Ham Luong River, canal mouth, opening to the rivers, appears each 1km interval on an average, some of which have very large width of 40-60 m getting gradually narrower and shallower inwards.

Table 2.2.1 Canals and Channels in the Project Area

No	Canals	Local (District)	Dimension		Length (km)	River System
			Width (m)	H (m)		
1	Soc Roai	Ch. Thanh	80	4.5	22	Ham Luong
2	Ben Ro – O.Da	Ch. Thanh	20	3.0	13	Soc Soai-BL
3	Bay Dac	Ch. Thanh	15	2.0	10	Soc Soai-BL
4	Son Dong	Ch. Thanh	20	2.0	9	H.Luong-BL
5	Ong Doc	Ch. Thanh	30	2.0	10	H.Luong -BL
6	Son Ma	Ch. Thanh	20	2.0	8	H.Luong -BL My
7	Vam Ho	Ch. Thanh	40	3.5	7	Tho-BL
8	Phu Huu	Ch. Thanh	15	2.5	10	Ba Lai-Gia Hoa
9	Ong Ho-B.Nhim	Binh Dai	30	2.5	7	My Tho-Ba Lai
10	Cai Cau	Binh Dai	30	3.0	3	My Tho
11	Cai Muong	Binh Dai	30	2.5	5	Ba Lai
12	Tan Dinh	Binh Dai	30	3.5	8	My Tho
13	Ca Nho	Binh Dai	20	2.5	8	My Tho
14	Ca Moi	Binh Dai	30	2.5	10	My Tho
15	Vung Luong	Binh Dai	60	3.5	15	Ba Lai-Cua Dai
16	Giong Trom	Giong Trom	200	10.0	15	Ben Tre river
17	Tho Cuu	Giong Trom	40	3.0	15	H.Luong-G.Tr
18	Son Doc	Giong Trom	40	3.0	20	Ham Luong
19	Cai Bong	Ba Tri	40	3.0	16	Ham Luong
20	Muong Dao	Ba Tri	40	3.0	9	Ham Luong
21	Ba Tri	Ba Tri	40	3.0	25	Ham Luong
22	Ba Hien	Ba Tri	30	3.0	8	Ham Luong
23	Ba Tri Nam	Giong Trom	30	5.0	30	Ba Lai
24	Ben Thang	Ba Tri	30		25	Ba Lai

Source: Ben Tre DARD

2.2.3 Irrigation and Drainage System

The irrigation systems in Northern Ben Tre have been invested since early years of liberation to date, so that there are many facilities being operated. Within the last 10 years, there have been many big, medium and small irrigation works built in Ba Lai area to serve agricultural development and improve living condition of the people dwelling in the area. So far, 9 pump stations of various kinds and 43 sluice gates for salinity prevention, drainage for about 45,000 hectares of annual cultivation have been built. Network of channels and canals has been dredged and upgraded with total length of nearly 360 km. In the Project area, there are many irrigation blocks (systems) completed and operated effectively, of which major ones are as follows:

1) Chau Binh – Vam Ho system: irrigating area of 5,150 hectares of farmland in 2 districts of Giong Tom and Ba Tri. Source of fresh water is Ben Tre- Chet Say through Giong Tom – Binh Chanh River through main systems of Channel 9A and Channel 9B,

2) System of Cay Da culvert and Cay Da – Ba Tri channel: completed in 1991 and gets water from Cay Da intake to irrigate 8,760 hectares,

3) Cau Sap irrigation system: Rach Mieu Ong – Huong Diem – Son Doc – Ba Tri channel leads water from Ben Tre River to Ba Tri to irrigate 7,792 hectares of cultivated land belonging to districts of Giong Tom – Ba Tri, and

4) Ba Lai irrigation works: Ba Lai leads water to irrigate from My Tho River, Tien River, Ben Tre River for irrigating most of the project area.

Salinity prevention works combined with drainage in the North Ben Tre is effective as a good ground for fresh water leading. At present, there are 33 big and small culverts in the area, and most of them are bringing into full play. The sluices built before year 2000 were designed mainly for irrigation. Besides, they act for the purpose of salinity prevention and retain fresh water in the period of fresh water not-available months of dry season. The culverts built after year 2000 are designed with more diversified tasks, i.e., 2-way working flow, controlling salinity, drainage, as well as water intake, etc.

Sluices constructed at the estuaries of channels and canals to increase capacity of drainage, prevent saline intrusion and/or take fresh water flow for irrigation in the area are; Chau Binh – Vam Ho system; Cay Da sluice and Cay Da – Ba Tri channel. They brought their capacity into full play to serve production, particularly increasing crop production in the Project area. Ba Lai sluice (width 84m) was built in year 2000, which has also contributed to soil-conditioning by leaching in a big area of Binh Dai, Ba Tri, etc.

2.3 Major Livelihood in the Project Area

Table 2.3.1 shows land use for the Project area; major land use is for agriculture sharing about 78 % of the total land area as at year 2005 (Note that water surface is excluded). Agriculture production land shares about 60% of the total land as at 2005, land for paddy shares 20%, perennial crop (mostly fruits and coconut) shares 35% and also land for aquaculture shares 16% of the total land area as at 2005. There is a trend by observing the 2 years' data, for which paddy area has been reduced while perennial (mostly fruits and coconut) and aquaculture land have been on a trend of increase.

Table 2.3.1 Land Use of the Project Area (2000 and 2005)

Category	Year 2000		Year 2005		Comparison 2005-2000
	Ha	%	Ha	%	
Total land areas in the Project Region	**136,248**	100.0	**136,888**	100.0	640
I. Agriculture land	**104,347**	**76.6**	**106,787**	**78.0**	2,440
I.1. Agriculture production land	86,303	63.3	82,104	60.0	-4,199
1.1.1 Annual crop	44,677	32.8	34,655	25.3	-10,022
- Land only for paddy cultivation	34,206	25.1	27,105	19.8	-7,101
- Land for other annual crop	10,471	7.7	7,550	5.5	-2,921
1.1.2. Perennial crop land (fruits)	41,626	30.6	47,449	34.7	5,823
I.2. Forestry land	2,233	1.6	1,834	1.3	-399
- Forest land for product	1,156	0.8	369	0.3	-787
- Forest land for protection	1,077	0.8	1,398	1.0	321
- Forest land for special	-	-	67	0.0	67
I.3. Land for aquaculture	12,963	9.5	21,318	15.6	8,355
I.4 Land use for salt	2,848	2.1	1,504	1.1	-1,344
I.5. Other land agriculture	-	-	27	0.0	27
II. Land non-agriculture	29,702	21.8	29,358	21.4	-344
- Land house	4,032	3.0	4,366	3.2	334
- Land specialized	4,461	3.3	5,448	4.0	987
III. Land not yet used	2,199	1.6	743	0.5	-1,456
IV. Land have water surface sea side	2,344	1.7	2,344	1.7	0

Source: Data available at Ben Tre Province

2.3.1 Agriculture (Paddy)

Planted area of paddy is summarized in Table 2.3.2 for the period of 2005 to 2010 (except 2006). As shown on the bottom row of the table, planted area of paddy had a slightly decreasing trend from 1.00 points as a value of 2005 to 0.96 by 2010 for whole Ben Tre province. Among the districts, Ba Tri district in the Project area enjoyed the biggest share, 47% of the total planted area on an average of the said 5-year period, which was followed by Giong Trom (15%) with in the Project area. On contrary, other three districts in the Project area and another 3 districts in the South Ben Tre area shared less than 10% each, implying that paddy production is concentrated on those Ba Tri and Giong Trom districts, and also Than Phu which is in the South Ben Tre.

To be sure, planted area per total land area of each district, or the cropping intensity, is shown at the end column. Similarly, Ba Tri showed the highest cropping intensity for paddy cultivation with 107% based on three cropping per year. Second highest was marked by Giong Trom which had 15% of share

in the planted area among the districts, further followed by Ben Tre city (27%), Chau Thanh (21%), and Binh Dai (16%) in the Project area.

Table 2.3.2 Planted Areas of Paddy

District	Planted Area of Paddy (ha)							Per Land Area
	2005	2007	2008	2009	2010	Ave	%	
Ben Tre city	2,540	1,987	1,744	1,475	1,286	1,806	2%	27%
Chau Thanh	5,552	5,010	4,656	4,510	4,255	4,797	6%	21%
Giong Trom	12,901	12,569	12,404	12,336	11,980	12,438	15%	40%
Binh Dai	8,804	6,328	5,818	6,147	6,180	6,655	8%	16%
Ba Tri	37,443	37,324	38,249	39,312	39,332	38,332	47%	107%
Sub Total	67,240	63,218	62,871	63,780	63,033	64,028	79%	46%
Cho Lach	722	269	144	93	36	253	0%	2%
South Mo Cay	3,560	3,045	2,748	831	568	700	1%	3%
North Mo Cay				1,473	1,416	1,416	2%	9%
Thanh Phu	11,982	13,200	13,494	14,877	15,157	13,742	17%	32%
Sub Total	16,264	16,514	16,386	17,274	17,177	16,723	21%	17%
TOTAL	**83,504 (1.00)**	**79,732 (0.95)**	**79,257 (0.95)**	**81,054 (0.97)**	**80,228 (0.96)**	**80,755 (0.97)**	**100%**	**34%**

Source: Ben Tre Statistical Year Book of 2010 (Ben Tre Province, 2011)

Note: Average of Mo Cay is calculated based only on the 2009-2010 data.

Following the share of planted area among the districts, an average amount of paddy production was also found significant in Ba Tri district (50%), followed by Giong Trom (18%) in the Project area, North Ben Tre. Thanh Phu (12%) district located in South Ben Tre is also ranked at 3rd position within the province. Contrary to the decrease in planted area, the trend of paddy production had shown an increasing trend from 1.00 point of 2005 to 1.07 point of 2010, suggesting the improvement of productivity of paddy.

Table 2.3.3 Production of Paddy

District	Production of Paddy (ton)						
	2005	2007	2008	2009	2010	Ave	%
Ben Tre city	10,593	7,664	7,787	5,984	5,943	7,594	2%
Chau Thanh	26,890	22,254	22,745	22,012	20,915	22,963	7%
Giong Trom	63,539	57,635	65,389	61,267	62,262	62,018	18%
Binh Dai	35,831	24,423	26,966	27,153	27,879	28,450	8%
Ba Tri	152,641	155,413	182,427	187,729	191,687	173,979	50%
Sub Total	289,494	267,389	305,314	304,145	308,686	295,006	85%
Cho Lach	2,563	972	517	342	128	904	0%
South Mo Cay	12,355	9,715	10,491	2,653	1,993	2,323	1%
North Mo Cay				4,927	6,453	6,453	2%
Thanh Phu	36,979	26,707	44,795	50,623	49,550	41,731	12%
Sub Total	51,897	37,394	55,803	58,545	58,124	52,353	15%
TOTAL	**341,391**	**304,783**	**361,117**	**362,690**	**366,810**	**347,358**	**100%**
	(1.00)	**(0.89)**	**(1.06)**	**(1.06)**	**(1.07)**	**(1.02)**	

Source: Ben Tre Statistical Year Book of 2010 (Ben Tre Province, 2011)

Note: Average of Mo Cay is calculated based only on the 2009-2010 data.

It should be also noted that while the productions of two districts, Ba Tri and Giong Trom, had increased from 2005 to 2010, productions of other 7 districts had decreased. This trend was caused mainly by the change of planted area as shown in the aforementioned Table 2.3.2. As other crops such as industrial crops and fruits are of potential alternatives, farmers can change the type of commodities/crops relatively easily in this province, and in fact they have changed to some extent.

Average yield of paddy is summarized in Table 2.3.4. On an average of the 5-year period, the highest yield was marked in Giong Trom (5.0 t/ha). This district marked the highest of 4.59 t/ha even in the poor harvesting year of 2007 when average yield of the province reached only 3.82 t/ha. The 2nd yield

is marked at Chau Thanh district, which is the upper most district in the North Ben Tre area.

Table 2.3.4 Yield of Paddy

District	Yield of Paddy (ton/ha)						
	2005	2007	2008	2009	2010	Ave	Rank
Ben Tre city	4.17	3.86	4.47	4.06	4.62	4.2	6
Chau Thanh	4.84	4.44	4.89	4.88	4.92	4.8	2
Giong Trom	4.93	4.59	5.27	4.97	5.20	5.0	1
Binh Dai	4.07	3.86	4.63	4.42	4.51	4.3	5
Ba Tri	4.08	4.16	4.77	4.78	4.87	4.5	4
Sub Total	4.31	4.23	4.86	4.77	4.90	4.6	
Cho Lach	3.55	3.61	3.59	3.68	3.56	3.6	7
South Mo Cay	3.47	3.19	3.82	3.19	3.51	3.4	8
North Mo Cay				3.34	4.56	4.6	3
Thanh Phu	3.09	2.02	3.32	3.40	3.27	3.0	9
Sub Total	3.19	2.26	3.41	3.39	3.38	3.1	
TOTAL	**4.09**	**3.82**	**4.56**	**4.47**	**4.57**	**4.3**	

Source: Ben Tre Statistical Year Book of 2010 (Ben Tre Province, 2011)

Note: Average of Mo Cay is calculated based only on the 2009-2010 data.

Table 2.3.5 estimates a production of paddy per capita. The production in Ba Tri reached 923 kg/person, which is far more than needed for individual consumption. On the other hand, production per capita in Ben Tre center (North Ben Tre), Chau Thanh (North Ben Tre), Chao Lach (South Ben Tre), South and North Mo Cay (South Ben Tre) is seemingly not enough for self-consumption. Assuming that one person consumes up to 200 kg per year, for the safer side, three out of 5 districts in the North Ben Tre area satisfied the necessary amount for self-consumption.

Yet, the production per capita for the North Ben Tre area had reached 387 kg/person and the production per capita for entire province came to 275 kg/person, implying that the province itself is self-sufficient through the export of paddy from the districts within the province that have enough production, such as Ba Tri, Giong Trom and Thanh Phu, to the districts that are deficit in paddy production such as Cho Lach, South Mo Cay and Ben Tre city.

Table 2.3.5 Production of Paddy per Capita

District	Production of Paddy per Capita (kg/person)						More than
	2005	2007	2008	2009	2010	Ave	200kg
Ben Tre city	95	67	68	51	51	66	
Chau Thanh	170	141	145	140	133	146	
Giong Trom	369	339	387	364	370	366	Sufficient
Binh Dai	277	187	205	205	211	217	Sufficient
Ba Tri	801	824	971	1,000	1,021	923	Sufficient
Sub Total	380	351	401	399	405	387	Sufficient
Cho Lach	20	8	4	3	1	7	
South Mo Cay	48	39	43	18	14	16	
North Mo Cay				45	59	59	
Thanh Phu	286	209	351	397	388	326	Sufficient
Sub Total	102	74	112	118	118	105	
TOTAL	**268**	**241**	**287**	**289**	**292**	**275**	**Sufficient**

Source: Ben Tre Statistical Year Book of 2010 (Ben Tre Province, 2011)

Note: Average of Mo Cay is calculated based only on the 2009-2010 data.

2.3.2 Industrial Crop (Coconut) and Fruits

In the statistics, coconut is categorized as perennial industrial crop. Ben Tre province is well known as the industrial perennial crop production area; coconut, and also fruits. In fact, in Mekong Delta area, there are two provinces which cultivate these perennial crops widely, Ben Tre province and Tien Giang province. Coconuts is known to be tolerant than paddy to saline water, yet fruits are not. Coconut and

fruits usually yield more profit than paddy. Following section briefs the planted area, production and yields of the industrial crop and fruit in the Ben Tre province.

1) Production of Coconuts

Table 2.3.6 shows the trend in planted area of coconuts from 2005 to 2010 except 2006 (data not available). The planted area had consistently increased from 1.00 point of 2005 to 1.37 point of 2010, 37% of increase in 5 years. Among the districts, South Mo Cay (South Ben Tre) and Giong Trom (North Ben Tre) shared the biggest portion (28% and 26%) as an average of the 5-year period, which was followed by North Mo Cay (15%), Chau Thanh (11%) and Binh Dai (11%). Ba Tri and Thanh Phu that are two of the biggest districts in the planted area of paddy marked only 3% and 6%, while Giong Trom which was also high in the planted area of paddy marked high in coconuts area.

Table 2.3.6 Planted Area of Coconuts by District

District	Planted Area of Coconuts (ha)						
	2005	2007	2008	2009	2010	Ave	%
Ben Tre city	1,336	1,436	1,492	1,500	1,528	1,458	3%
Chau Thanh	4,960	5,155	5,297	5,453	5,541	5,281	11%
Giong Trom	10,071	11,495	12,048	12,569	13,007	11,838	26%
Binh Dai	4,452	4,840	5,204	5,435	5,840	5,154	11%
Ba Tri	750	1,243	1,371	1,370	1,413	1,229	3%
Sub Total	21,569	24,169	25,412	26,327	27,329	24,961	54%
Cho Lach	914	1,050	1,154	771	803	938	2%
South Mo Cay	12,908	16,446	17,956	12,607	12,869	12,738	28%
North Mo Cay				6,955	7,244	7,100	15%
Thanh Phu	2,204	2,758	3,047	3,260	3,315	2,917	6%
Sub Total	16,026	20,254	22,157	23,593	24,231	21,252	46%
TOTAL	**37,595**	**44,423**	**47,569**	**49,920**	**51,560**	**46,213**	**100%**
	(1.00)	**(1.18)**	**(1.27)**	**(1.33)**	**(1.37)**	**(1.23)**	

Source: Ben Tre Statistical Year Book of 2010 (Ben Tre Province, 2011)

Note: Average of Mo Cay is calculated based only on the 2009-2010 data.

Production of coconuts is shown in Table 2.3.7 from 2005 to 2010 by district. On an average of the 5-year period, a total of 196,500 ton was produced in the 5 districts of North Ben Tre area while the total of 344,300 ton for the province was produced each year, which had shown a gradual and constant increase from 258,800 tons in 2005 to 420,200 tons in 2010 for the province. Among the districts, productions in two districts, Giong Trom (North Ben Tre) and South Mo Cay (South Ben Tre), shared more than half of the provincial production as it follows the trend in planted area.

Table 2.3.7 Production of Coconuts by District

District	Production of Coconuts (1,000 ton)						
	2005	2007	2008	2009	2010	Ave	%
Ben Tre city	8.8	11.3	12.4	12.7	13.1	11.7	3%
Chau Thanh	35.2	42.8	46.9	49.4	50.4	44.9	13%
Giong Trom	71.4	76.3	100.7	112.1	120.7	96.2	28%
Binh Dai	26.6	31.9	34.8	42.0	44.7	36.0	10%
Ba Tri	4.2	5.3	7.8	10.3	10.5	7.6	2%
Sub Total	146.2	167.6	202.6	226.5	239.4	196.5	57%
Cho Lach	4.7	7.5	9.9	7.0	7.3	7.3	2%
South Mo Cay	93.8	105.9	122.4	88.3	97.6	93.0	27%
North Mo Cay				48.8	52.6	50.7	15%
Thanh Phu	14.0	16.4	18.3	21.3	23.2	18.6	5%
Sub Total	113	130	151	165	181	148	43%
TOTAL	**258.8**	**297.4**	**353.2**	**391.9**	**420.2**	**344.3**	**100%**
	(1.00)	**(1.15)**	**(1.36)**	**(1.51)**	**(1.62)**	**(1.33)**	

Source: Ben Tre Statistical Year Book of 2010 (Ben Tre Province, 2011)

Note: Average of Mo Cay is calculated based only on the 2009-2010 data.

Not just the planted area, yield level of coconuts had also increased during the said period. As shown in Table 2.3.8, it had increased from 1.00 point of 2005 to 1.31 points of 2010, 31% of increase. The biggest yield was recorded in North Mo Cay (South Ben Tre) with 10.14 ton/ha per year, which was followed by South Mo Cay (South Ben Tre) of 10.02 ton/ha. In fact, top three districts showing higher yields are located in the South Ben Tre area, and within the North Ben Tre are Giong Trom is ranked at 4th, Chau Thanh at 5th, Ben Tre city at 6th position, so on.

Table 2.3.8 Yield of Coconuts per Harvested Area by District

District	Yield of Coconuts (ton/ha)						
	2005	2007	2008	2009	2010	Ave	Rank
Ben Tre city	6.88	8.82	9.35	9.67	9.79	8.90	6
Chau Thanh	7.52	9.00	9.69	10.14	10.18	9.31	5
Giong Trom	7.67	8.10	9.77	10.60	10.69	9.37	4
Binh Dai	6.54	7.80	8.03	9.28	9.29	8.19	7
Ba Tri	6.15	7.74	8.02	9.20	9.22	8.07	9
Sub Total	7.30	8.28	9.30	10.11	10.17	9.03	
Cho Lach	6.64	8.94	10.77	10.61	10.74	9.54	3
South Mo Cay	8.73	9.10	9.55	9.96	10.09	10.02	2
North Mo Cay				10.17	10.11	10.14	1
Thanh Phu	6.61	7.50	7.94	8.92	9.48	8.09	8
Sub Total	8.29	8.85	9.39	9.90	10.04	9.29	
TOTAL	**7.71**	**8.52**	**9.34**	**10.02**	**10.12**	**9.14**	
	(1.00)	**(1.11)**	**(1.21)**	**(1.30)**	**(1.31)**	**(1.19)**	

Source: Ben Tre Statistical Year Book of 2010 (Ben Tre Province, 2011)

Note: Average of Mo Cay is calculated based only on the 2009-2010 data.

2) Production of Fruits

Table 2.3.9 shows the trend in planted area of Fruits from 2005 to 2010 except 2006 (data not available in the source). The planted area had consistently decreased from 1.00 point of 2005 to 0.82 point of 2010, 11% of decrease in 5 years. Among the districts, Chau Thanh (North Ben Tre) and Cho Lach (South Ben Tre) shared the biggest portion (26% and 29%) as an average of the 5-year period, which was followed by Giong Trom (North Ben Tre, 13%), and North Mo Cay (South Ben Tre, 11%). Chau Thanh and Cho Lach districts are located in the upper most reach of the province in North Ben Tre and South Ben Tre respectively.

Table 2.3.9 Planted Area of Fruits by District

District	Planted Area of Fruits (ha)						
	2005	2007	2008	2009	2010	Ave	%
Ben Tre city	1,863	1,935	2,035	1,927	1,893	1,931	5%
Chau Thanh	9,210	9,458	9,404	9,181	9,166	9,284	26%
Giong Trom	5,171	5,028	4,539	4,680	4,472	4,778	13%
Binh Dai	2,370	2,248	2,143	2,120	2,105	2,197	6%
Ba Tri	451	470	417	331	334	401	1%
Sub Total	19,065	19,139	18,538	18,239	17,970	18,590	52%
Cho Lach	11,225	11,027	10,849	9,438	9,445	10,397	29%
South Mo Cay	9,179	6,136	5,213	1,448	1,310	*1,379*	4%
North Mo Cay				3,863	3,644	*3,754*	11%
Thanh Phu	270	335	320	295	311	306	1%
Sub Total	20,674	17,498	16,382	15,044	14,710	16,862	48%
TOTAL	**39,739**	**36,637**	**34,920**	**33,283**	**32,680**	**35,452**	**100%**
	(1.00)	**(0.92)**	**(0.88)**	**(0.84)**	**(0.82)**	**(0.89)**	

Source: Ben Tre Statistical Year Book of 2010 (Ben Tre Province, 2011)

Note: Average of Mo Cay is calculated based only on the 2009-2010 data.

As for major fruit crops, Figure 2.3.1 shows the trend of planted area from 2001 to 2010 for the entire Ben Tre province. During the 10-year period, total planted area used to increase for the first half

period and then started decreasing in the second half period as demonstrated in Table 2.3.9. Among the fruit crops, the most significant ones had been longan, orange (mandarin) and pomelo (excluding other fruits). While longan showed constant trend of decrease from 13,446 ha of 2001 to 6,249 ha of 2010 (46% of the original area), orange had demonstrated 5 years of increasing trend in the first half and another 5 years of decreasing trend in the second half. Pomelo has been on a constant increasing trend.

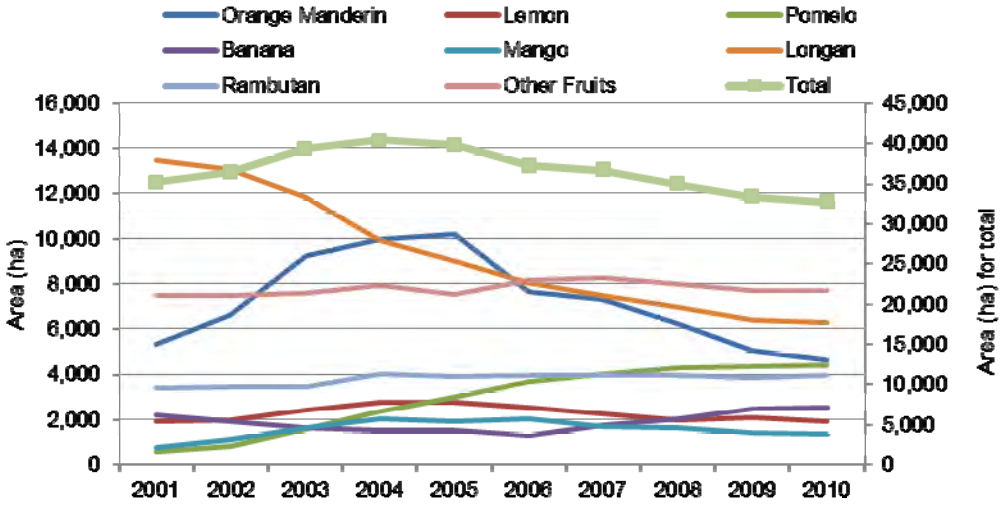

Figure 2.3.1 Trend in Planted Area of Major Fruit Crops

Source: Ben Tre Statistical Year Book of 2010 (Ben Tre Province, 2011)

Table 2.3.10 shows the planted area by fruit and by district as at 2010. For the North Ben Tre area, longan shares the largest area (28%) of total fruit area, followed by pomelo (14%), orange/mandarin (13%), banana (11%), lemon (10%), etc. For the longan, Chau Thanh district has the biggest planted area (2,665 ha), and followed by Binh Dai (1,495 ha) within the North Ben Tre. For pomelo, Chau Thanh again has the largest area (1,112 ha), followed by Gong Trom (610 ha) in the North Ben Tre.

Table 2.3.10 Planted Area by Fruit in 2010

District	Planted Area by Fruits in 2010 (ha)									
	Orange Manderin	Lemon	Pomelo	Banana	Mango	Longan	Rambutan	Durian	Mangos-teen	Total
Ben Tre city	95	53	467	157	69	46	0	0	1	888
Chau Thanh	1,005	55	1,112	411	107	2,665	1,814	726	622	8,517
Giong Trom	1,030	1,504	610	978	36	215	0	0	0	4,373
Binh Dai	23	15	46	108	273	1,495	0	0	0	1,960
Ba Tri	2	3	9	159	97	28	0	0	0	298
Sub Total	**2,155**	**1,630**	**2,244**	**1,813**	**582**	**4,449**	**1,814**	**726**	**623**	**16,036**
	13%	**10%**	**14%**	**11%**	**4%**	**28%**	**11%**	**5%**	**4%**	**100%**
Cho Lach	1,413	140	907	25	74	1,641	2,065	952	1,154	8,371
South Mo Cay	185	90	460	148	269	71	0	0	0	1,223
North Mo Cay	870	41	803	430	261	73	62	182	442	3,164
Thanh Phu	8	2	8	111	142	15	0	0	0	286
Sub Total	2,476	273	2,178	714	746	1,800	2,127	1,134	1,596	13,044
TOTAL	**4,631**	**1,903**	**4,422**	**2,527**	**1,328**	**6,249**	**3,941**	**1,860**	**2,219**	**29,080**
	16%	**7%**	**15%**	**9%**	**5%**	**21%**	**14%**	**6%**	**8%**	**100%**

Source: Ben Tre Statistical Year Book of 2010 (Ben Tre Province, 2011)

Table 2.3.11 shows production by fruit and by district as at 2010. In terms of production, longan shows the biggest yield of 42,017 tons sharing 25% of what the North Ben Tre area has produced in total, followed by rambutan (32,303 tons), banana (27,636 tons), lemon (18,495 tons), and so on so forth. By district, as expected Chau Thanh (North Ben Tre) and Cho Lach (South Ben Tre), located at the most upstream side, produce much more than other districts. Chau Thanh's production shares 52% of the total North Ben Tre area's production and that of Cho Lach does as much as 73% of the total South

Ben Tre area's production.

Table 2.3.11 Production by Fruit in 2010

District	Production by Fruits in 2010 (ton)									
	Orange Manderin	Lemon	Pomelo	Banana	Mango	Longan	Rambutan	Durian	Mangos-teen	**Total**
Ben Tre city	782	618	3,534	1,635	508	430	0	0	0	7,507
Chau Thanh	8,328	559	7,425	4,661	912	23,985	32,303	5,994	2,683	86,850
Giong Trom	7,437	17,199	5,500	17,114	313	2,200	0	0	0	49,763
Binh Dai	162	101	300	1,347	2,078	15,243	0	0	0	19,231
Ba Tri	13	18	62	2,879	786	159	0	0	0	3,917
Sub Total	**16,722**	**18,495**	**16,821**	**27,636**	**4,597**	**42,017**	**32,303**	**5,994**	**2,683**	**167,268**
	10%	**11%**	**10%**	**17%**	**3%**	**25%**	**19%**	**4%**	**2%**	**100%**
Cho Lach	12,541	1,227	8,510	349	639	18,735	34,811	8,597	7,208	92,617
South Mo Cay	1,333	829	4,097	1,950	1,978	542	0	0	0	10,729
North Mo Cay	4,960	395	4,468	5,625	1,944	648	488	1,092	1,310	20,930
Thanh Phu	12	13	25	1,319	1,028	90	0	0	0	2,487
Sub Total	18,846	2,464	17,100	9,243	5,589	20,015	35,299	9,689	8,518	126,763
TOTAL	**18,859**	**2,482**	**17,162**	**12,122**	**6,375**	**20,174**	**35,299**	**9,689**	**8,518**	**130,680**
	14%	**2%**	**13%**	**9%**	**5%**	**15%**	**27%**	**7%**	**7%**	**100%**

Source: Ben Tre Statistical Year Book of 2010 (Ben Tre Province, 2011)

2.3.3 Shrimp Culture

Area of water surface for shrimp culture is shown in Table 2.3.12 by district. Among all the districts, Thanh Phu (South Ben Tre) and Binh Dai (North Ben Tre) districts shared 87% of the total surface area of the province (47% and 40% respectively); shrimp culture is concentrated in those two districts. As for the trend from 2005 to 2010, there had been not much change but slightly increased by 2008 (7% of the year 2005) and decreased to be 97% of the year 2005 by 2010.

Table 2.3.12 Area of Water Surface for Shrimp (ha)

District	Area of Water Surface for Shrimp (ha)						
	2005	**2007**	**2008**	**2009**	**2010**	**Average**	**Share**
Ben Tre city	100	77	66	69	81	79	0%
Chau Thanh	309	280	345	344	351	326	1%
Giong Trom	170	75	223	193	197	172	1%
Binh Dai	13,245	13,230	14,931	12,869	13,523	13,560	40%
Ba Tri	3,195	3,165	3,946	2,685	3,104	3,219	9%
Sub Total	17,019	16,827	19,511	16,160	17,256	17,355	51%
Cho Lach	13	16	3	4	6	8	0%
South Mo Cay	963	949	902	545	544	*545*	2%
North Mo Cay				277	267	*272*	1%
Thanh Phu	16,280	16,159	16,236	16,071	15,158	15,981	47%
Sub Total	17,256	17,124	17,141	16,897	15,975	16,879	49%
TOTAL	**34,275**	**33,951**	**36,652**	**33,057**	**33,231**	**34,233**	**100%**
	(1.00)	**(0.99)**	**(1.07)**	**(0.96)**	**(0.97)**	**(1.00)**	

Source: Ben Tre Statistical Year Book of 2010 (Ben Tre Province, 2011)

Note: Average of Mo Cay is calculated based only on the 2009-2010 data.

Total production in North Ben Tre is 22,022 tons in year 2010 and the production in South Ben Tre is 7,185 tons, totaling to 29,207 tons as the provincial production as at 2010. Though Thanh Phu district shares 47% of the water surface for shrimp culture, the share in the production is only 25%, suggesting low yield in this district. Five districts in the North Ben Tre area together shares 73% of the total production of the province.

Different from relatively fluctuating size of area of water surface for shrimp culture, production of shrimp was comparatively stable. Especially during 2008 when area of water surface had increased to be more than 36,000 ha (more than 19,000 ha in North Ben Tre only), production of shrimp had rather

decreased in the same period. On the other hand, while the area had decreased to be around 33,000 ha (17,000 ha for North Ben Tre area only) during 2009-2010, production had increased. For the production of shrimp, therefore, there might be other factors much more associated such as amount of inputs, and especially the occurrence of diseases.

Table 2.3.13 Production of Shrimp (ton)

District	Production of Shrimp (ton)						
	2005	2007	2008	2009	2010	Average	Share
Ben Tre city	61	34	19	46	16	35	0%
Chau Thanh	241	182	91	231	129	175	1%
Giong Trom	81	40	79	130	216	109	0%
Binh Dai	13,055	14,110	12,858	10,633	16,410	13,413	55%
Ba Tri	3,789	4,023	3,676	3,707	5,251	4,089	17%
Sub Total	17,227	18,389	16,723	14,747	22,022	17,822	73%
Cho Lach	7	8	1	3	3	4	0%
South Mo Cay	443	512	448	367	367	*367*	1%
North Mo Cay				187	179	*183*	1%
Thanh Phu	7,412	6,453	5,669	5,034	6,636	6,241	25%
Sub Total	7,862	6,973	6,118	5,591	7,185	6,746	27%
TOTAL	**25,089**	**25,362**	**22,841**	**20,338**	**29,207**	**24,567**	**100%**
	(1.00)	**(1.01)**	**(0.91)**	**(0.81)**	**(1.16)**	**(0.98)**	

Source: Ben Tre Statistical Year Book of 2010 (Ben Tre Province, 2011)

Note: Average of Mo Cay is calculated based only on the 2009-2010 data.

To make sure, productivity of shrimp in terms of production per area of surface water for shrimp is estimated as shown in Table 2.3.14. Although it seems far smaller than what is usually reported as a productivity of shrimp per unit of shrimp pond, it shows a comparative trend. Generally, it had fluctuated year by year. For example, the productivity had increased by 2% from 2005 to 2007 then decreased to 85% of the original level in 2008 and 84% in 2009. However, in 2010, it had gained again to be 20% more than the level of 2005. After all, an average productivity of shrimp was around 0.7 ton/ha, ranging from 0.4 ton/ha of Ben Tre and Thanh Phu to 1.3 ton/ha of Ba Tri.

It should be noted that two major shrimp producing districts, Thanh Phu (South Ben Tre) and Binh Dai (North Ben Tre), had shown a total different productivities on average. Thanh Phu, the first ranked district, had performed only 0.4 ton/ha, while Binh Dai district in the North Ben Tre area had demonstrated 1.0 ton/ha, implying the difference in the types of shrimp culture in the two districts. Probably, extensive or improved extensive culture is more common in Thanh Phu district, while semi-intensive or intensive culture is popular in Binh Dai district and also Ba Tri district.

Table 2.3.14 Productivity of Shrimp (ton/ha)

District	Production of Shrimp/ Area of Water Surface (ton/ha)					
	2005	2007	2008	2009	2010	Average
Ben Tre city	0.6	0.4	0.3	0.7	0.2	0.4
Chau Thanh	0.8	0.7	0.3	0.7	0.4	0.5
Giong Trom	0.5	0.5	0.4	0.7	1.1	0.6
Binh Dai	1.0	1.1	0.9	0.8	1.2	1.0
Ba Tri	1.2	1.3	0.9	1.4	1.7	1.3
Sub Total	1.0	1.1	0.9	0.9	1.3	1.0
Cho Lach	0.5	0.5	0.3	0.8	0.5	0.5
South Mo Cay	0.5	0.5	0.5	0.7	0.7	0.7
North Mo Cay				0.7	0.7	0.7
Thanh Phu	0.5	0.4	0.3	0.3	0.4	0.4
Sub Total	0.5	0.4	0.4	0.3	0.4	0.4
TOTAL	**0.7**	**0.7**	**0.6**	**0.6**	**0.9**	**0.7**
	(1.00)	**(1.02)**	**(0.85)**	**(0.84)**	**(1.20)**	**(0.98)**

Source: Ben Tre Statistical Year Book of 2010 (Ben Tre Province, 2011)

Note: Average of Mo Cay is calculated based only on the 2009-2010 data.

2.4 Impact by Climate Change

2.4.1 Past Trend in Temperature and Sea-level Rise

Climate change is caused mainly by global warning associated with green house gas emission, raising the globe's temperature over period. In fact, there is already a fact that the temperature in Mekong Delta has been rising over years as shown in Figure 2.4.1. Figure 2.4.1 shows long term trend of annual mean temperature recorded at the 4 stations of Vung Tau, Can Tho, Ca Mau, and Rach Gia.

Annual mean temperature ranges approximately from 26.5 ^{o}C to 27.5 ^{o}C by station and sometimes goes up over to 28.0 ^{o}C. One of the obvious observations from the long term trend is the increase in all the temperatures for the 4 stations. Though these annual mean temperatures fluctuate by year, it is obvious that there is an increase trend over years for all the 4 station. The rate of increase can be said to be about 0.5 Celsius degree over the period of about 30 years. This increase trend could be corresponding to global warming.

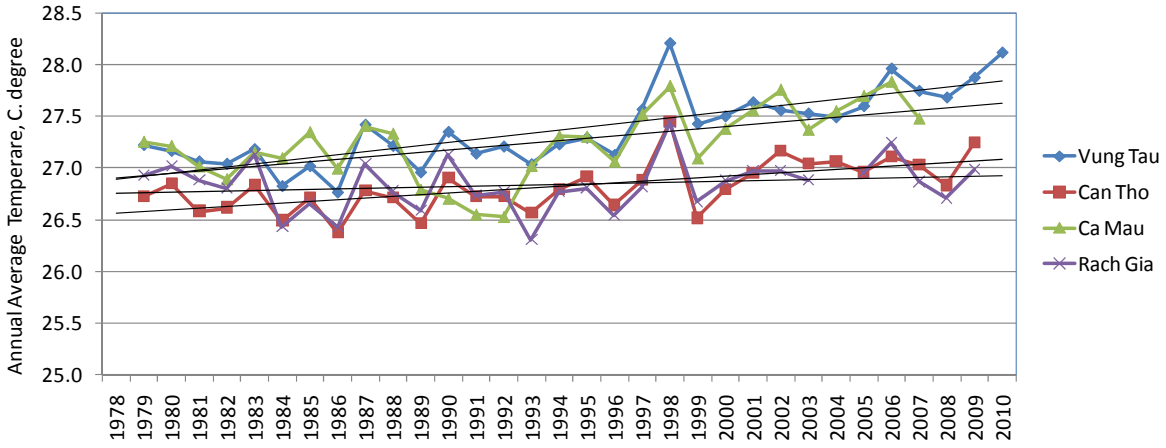

Figure 2.4.1 Annual Mean Temperature at 4 Major Locations in Mekong Delta

Source: Southern Institute for Water Resources, Sub-Institute of Hydrometeorology and Environment

The global warming raises sea-water level, and in fact the sea-level has been rising over years. Figure 2.4.2 shows the long term trend of sea-level rise recorded at Vung Tau station located at about 45 km north-eastward from the coastal line of North Ben Tre. The recorded period covers from 1982 to 2011, 30 years. As is shown, the record shows continuous increasing trend approximately by 15 cm over the recorded period of 30 years. It means that the sea level of the East Sea has been rising approximately by 5 cm per decade.

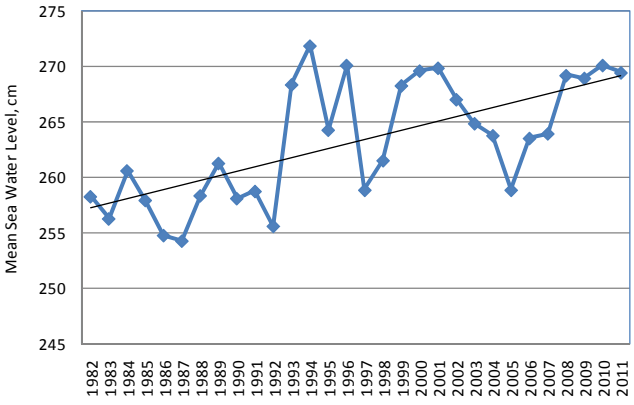

Figure 2.4.2 Sea Water Level at Vung Tau (East Sea)

Source; Department of Hydro-meteorology

2.4.2 Future Trend in Temperature and Sea-level Rise

Given the fact that there has been continuous sea-level rise, climate change simulation was carried out, based on which temperature, rainfall and sea-level rise in future were estimated. Of them, future temperature and sea-level are expected to rise as shown in Figure 2.4.3 and Figure 2.4.4. Figure 2.4.3 shows change of mean annual temperature for overall average of Mekong Delta simulated under three CC scenarios of B1, B2, and A2. The temperature rise was estimated in percentage against the average temperature of the period from 1980 to 1999. The mean temperature increases continuously though the

increase for scenario B1 seems to curve down toward year 2100. The mean annual temperature is expected to rise by about 1 °C in year 2050 for the 3 scenarios and by 1.4 °C to as much as 2.7 °C in year 2100 depending on the scenario.

Figure 2.4.4 shows the sea level rise of Mekong Coastal area including Ben Tre area by climate change scenario. It is shown that high green gas emission scenario, A2, shows the biggest sea level rise as 31 cm at year 2050 and as much as 103 cm at year 2100. Scenario B1 shows the lowest seas level rise; 27 cm at year 2050 and 70 cm at year 2100. The trend is somewhat exponential for all the scenarios, meaning that increase ratio becomes higher towards 2100. Note that sea level rise by province was also examined for the 3 scenarios respectively, and it was found that the rise by province did not differ much and the difference between provinces was only 5 cm even at the year 2100.

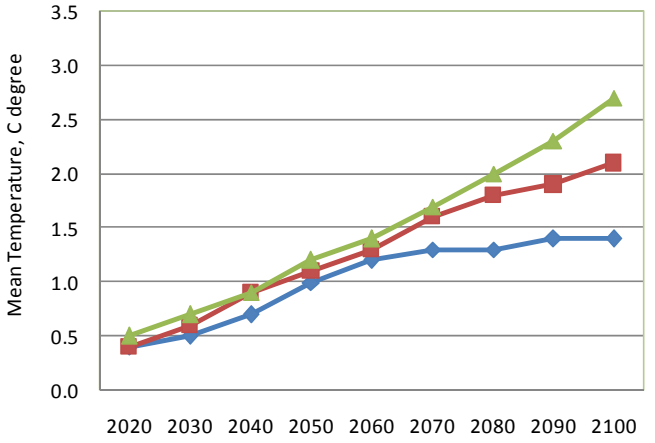

Figure 2.4.3 Mean Annual Temperature Change in Mekong Delta with 3 Scenarios, Source; PRECIS simulation

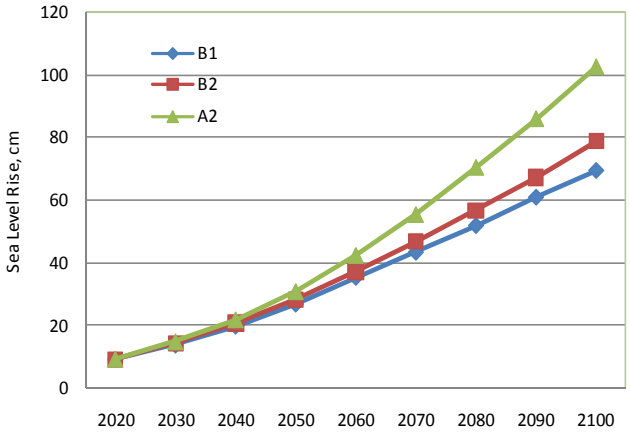

Figure 2.4.4 Sea Level Rise of Mekong Coastal Area under 3 Scenarios, Source; PRECIS simulation

2.4.3 Saline Intrusion under Sea-level Rise

Saline intrusion was simulated with different sea-level rise scenarios. Figure 2.4.5 shows the isolines of salinity level as at February (left), the beginning of dry season, and as at April (right), the severest month for the saline intrusion, under CC scenario B2 where about 30 cm sea-level rise is expected in year 2050. In addition, Figure 2.4.6 shows the saline area by salinity level as well as by each month.

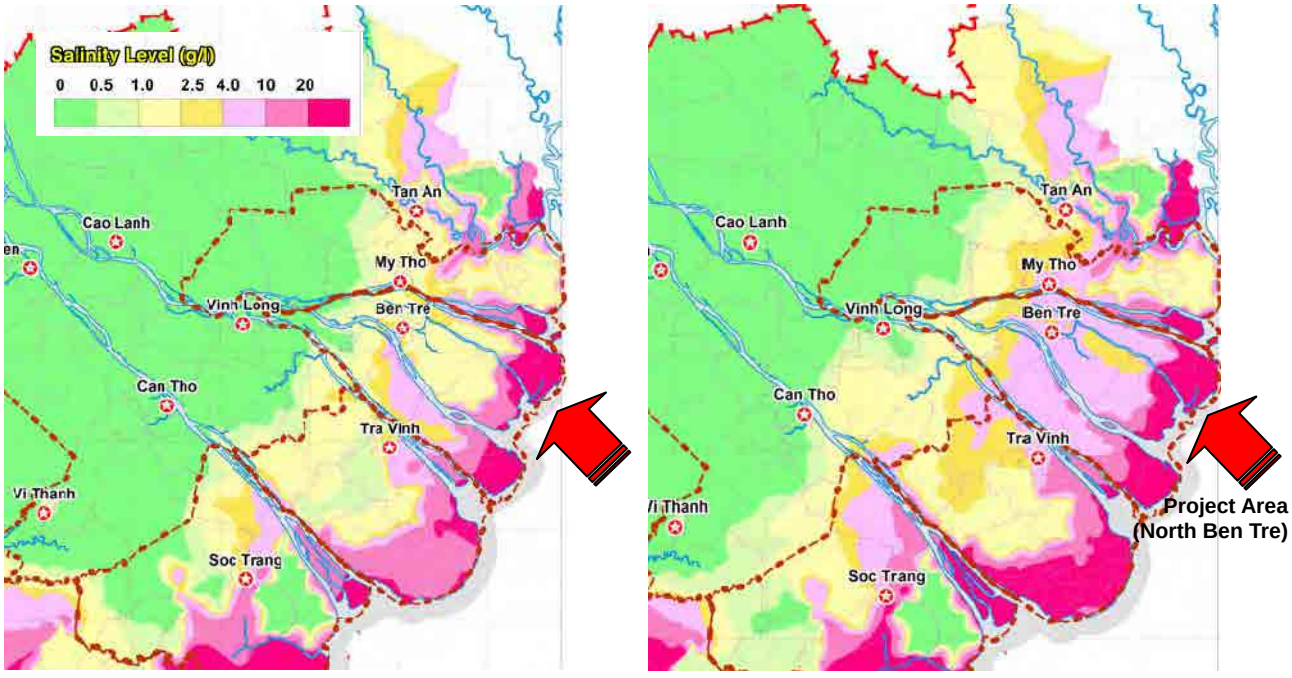

Figure 2.4.5 Saline Intrusion under Sea-level Rise 30cm (corresponding to B2 Scenario at year 2050)

Source: Southern Institute of Water Resources Planning

As obviously shown in the figures, salinity level near coastal area reaches even over 20 g/l (20,000 PPM) already from the beginning of dry season. Central parts of the North Ben Tre area shows the salinity level ranging between 1 g/l (1,000 PPM) and 2.5 g/l (2,500 PPM) in February, and the level goes up in the range of 4 – 10 g/l (4,000 – 10,000 PPM) in May leaving a small area of 2.5 – 4.0 g/l salinity level at almost the central area. Thus, without measures preventing salinity intrusion, there will be disastrous damage to the agricultural production as well as to the people's life.

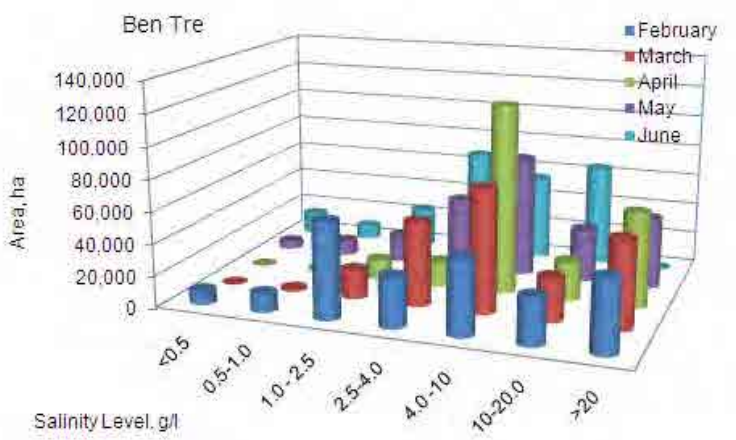

Figure 2.4.6 Saline Area for Ben Tre Province
(DY1998 MR Discharge with 30cm SLR (B2), 2050)

2.4.4 Economic Loss by the Saline Intrusion

Figure 2.4.7 shows the change in production/area in terms of percentage by province given the DY1998 Mekong River discharge with different sea-level rises. Likewise, Figure 2.4.8 indicates the change (damage) in terms of monetary value by province. These changes (damages) are of course caused by saline intrusion under different sea level rises. Note that commodities considered in this estimation are; paddy, fruit, vegetables, and tree (forest) only. Converting the change of production/area into monetary value referred to the prevalent farm gate prices in 2011.

As shown in these figures, in terms of percentage change (loss), Ca Mau province comes first till year 2050. However, after that, the change (loss) in Ben Tre province becomes bigger. In terms of monetary change (damage), Ben Tre province shows the biggest loss, which is due to the loss of valuable fruit and coconut production. Note that since such commodity areas of paddy, fruit, vegetable and tree are very limited in Ca Mau, the change in terms of percentage showed up very much, yet in terms of monetary value it is not. According to the simulation result, the loss of the commodities by saline intrusion in Ben Tre province is the severest, whereby the Project is strongly needed.

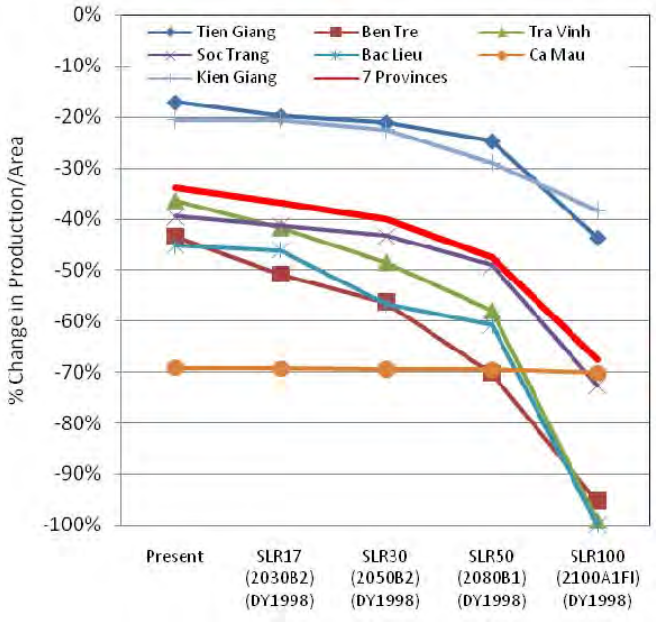

Figure 2.4.7 Production Loss(%) by Province
(DY1998 MR Discharge with Different SLR)

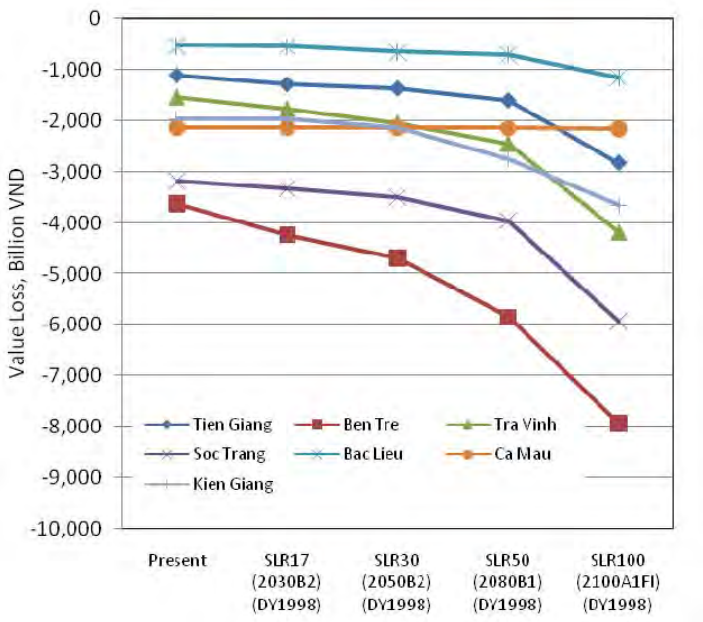

Figure 2.4.8 Production Loss(VND) by Province
(DY1998 MR Discharge with Different SLR)

CHAPTER 3 THE PROJECT COMPONENTS

3.1 Overall Project Component and Implementation Staging

The Project area is surrounded by two tributaries of Mekong River; Tien-My Tho River and Ham Luong River, and there will be 200 and over sluices expected to be constructed in this region. Most of the sluices are meant to prevent saline water from coming into the agricultural lands while there are some sluices to be put in place in order to recruit fresh water from almost top upstream area of the North Ben Tre. In addition to these sluices, canal dredging and widening are also required to distribute fresh water as designed. Further, river dike construction is required in order to prevent flood inundation especially coupled with high tide.

Thus, in terms of project components such 3 major categories are identified under the project; 1) sluice gate construction, 2) canal dredging, and 3) dike construction. Since the number of facilities is large and it takes a long time to complete the construction of all those facilities, following implementation staging is proposed (see Figure 3.1.1 and Table 3.1.1):

Stage 1: Construction of major 2 sluice gates, An Hoa and Ben Tre sluices, in the mid places of North Ben Tre in order to prevent saline water intrusion, and also establishment of 2 new intakes of Tan Phu and Ben Ro at a top upstream area in order to recruit fresh water. In addition, canal dredging for main canals (principal canals) and level-1 canals (first level secondary canals) is included in this stage in order to facilitate the distribution of designed water,

Stage 2: Construction of minor sluice gates in mid-lower part of North Ben Tre area to prevent saline water intrusion, construction of 3 regulating sluices (Huong Diem, Ba Tri and Sau Chiem), and construction of river dykes in the mid-lower part in order to prevent flood inundation especially associated with high tide together with the said minor sluices (including drainages), and

Stage 3: Construction of minor sluice gates in upstream part of North Ben Tre to prevent saline water intrusion, and construction of river dykes in the upstream in order to prevent flood inundation especially associated with high tide.

On the Stage 1 work, there are total 4 sluice gates; 2 for the purpose of saline intrusion prevention and another 2 for the purpose of fresh water recruitment, aside from the canal dredging. An Hoa sluice is located at the inlet of one of the biggest canals in the area, Gia Hoa canal, and Ben Tre sluice is located at the Ben Tre River, both of which are for the saline water prevention. It is quite obvious that the construction of these 2 sluices is given highest priority by the provincial government. In fact, some of the sluices in this region are now under preparation for the implementation by the government budget since salinity intrusion around these areas are progressing and damage caused by saline water is now taking place.

Besides the construction of the two sluices of An Hoa and Ben Tre, additional 2 upstream sluices such as Tan Phu and Ben Ro should also be constructed at the same time of Stage 1. This is because these sluices play an important role for taking and supplying freshwater to the whole beneficiary area of North Ben Tre. All these priority sluices having been completed, farmlands in the area can be protected from the saline intrusion as well as provided fresh water whereby economic benefit is to be expected. In addition, by operating these gates, flood inundation can be minimized and further keeping freshwater within the area can be done as well.

Figure 3.1.1 shows the location of major and medium scale gates together with 3 regulating sluices of Huong Diem, Ba Tri and Sau Chiem. Of them, in fact, Thu Cuu sluice, Son Doc2 sluice and Dinh Trung sluice are now under preparation of implementation by the government budget since these are

urgently required in order to prevent saline intrusion already taking place. Table 3.1.1 summarizes the woks divided into 3 stages, of which the Stage 1 work is meant to be assisted by an ODA loan for its realization.

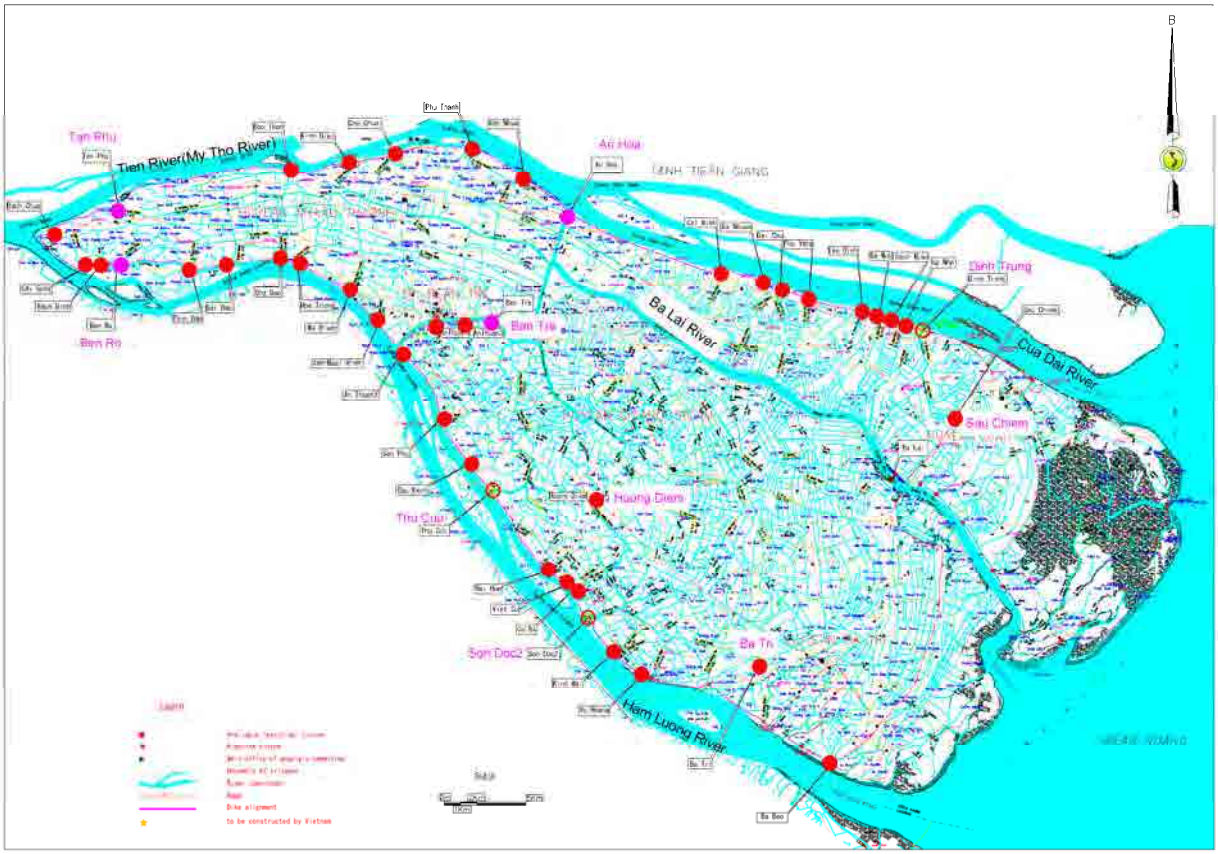

Figure 3.1.1 Location map of Major Sluices and Medium Scale Sluices

Table 3.1.1 Summery of Works under 3 Stages

Stage 1		Stage 2		Stage 3	
1.Major sluices	Q'ty	1.Medium scale sluices in downstream area	Q'ty	1.Medium scale sluices in upstream area	Q'ty
1)An Hoa sluice	1	1)Huong Diem sluice	1	1)Sluice B= 7.5m×2	1
2)Ben Tre sluice	1	2)Ba Tri sluices	1	2)Sluice B= 7.5m×1	2
3)Ben Ro sluice	1	3)Sau Chiem sluices	1	3)Sluice B= 5.0m×1	5
4)Tan Phu sluice	1	4)Sluice B= 7.5m×2	1	4)Sluice B= 3.0m×1	6
2.Management Buildings	4	5)Sluice B=10.0m×1	2	2.Minor sluices(Box culvert)	109
3.Dredging of canals	1LS	6)Sluice B= 7.5m×1	1	3.Management Buildings	14
		7)Sluice B= 5.0m×1	8	4.River dike	1LS
		8)Sluice B= 3.0m×1	7		
		2.Minor sluices(Box culvert)	63		
		3.Management Buildings	22		
		4.River dike	1LS		

3.2 Major Sluices and Medium Scale Sluices (Under Stage 1 and Stage 2)

An Hoa, Ben Tre, Tan Phu and Ben Ro sluice are regarded as the major sluices in this project from the view point of their sizes and impact they are to give in terms of preventing salinity intrusion as well as supplying fresh water from the upstream area. Table 3.2.1 shows the size of sluices represented by total span length and sill elevation including those of medium scale sluices. In addition, following the summary table, structural dimensions of each major sluice are summarized:

Table 3.2.1 List of Major and Medium Scale Sluices

No	Name of sluice	Total span B(m)	Sill level Zđ(m)	Implementation stage recommended		
				Stage 1	Stage 2	Stage 3
Major Sluices						
1	An Hoa	130.0	-5.0	X		
2	Ben Tre	70.0	-5.0	X		
3	Tan Phu	20.0	-4.0	X		
4	Ben Ro	20.0	-4.0	X		
Medium Scale Sluices						
(a)Tien River upper area						
8	Rach Chua	3.0	-2.5			X
9	Bon Thon	15.0	-3.0			X
10	Kinh Dieu	3.0	-2.5			X
11	Cai Chuoi	5.0	-2.5			X
12	Phu Thanh	3.0	-2.5			X
13	Vam Nhua	5.0	-2.5			X
(b)Ham Luong River upper area						
14	Cai Cung	3.0	-2.5			X
15	Rach Dinh	5.0	-2.5			X
16	Thuc Dao	3.0	-2.5			X
17	Bai Dac	5.0	-2.5			X
18	Ong Doc	7.5	-3.0			X
19	Hoa Trung	5.0	-2.5			X
20	Ma River	7.5	-3.0			X
21	Vam Ngai Hiem	3.0	-2.5			X
(c)Tien River lower area						
22	Cai Bich	5.0	-2.5		X	
23	Ba Nhuom	5.0	-2.5		X	
24	Cai Cau	10.0	-3.0		X	
25	Phu Vang	5.0	-2.5		X	
26	Tan Dinh	15.0	-3.0		X	
27	Ba Mu	3.0	-2.5		X	
28	Thanh Nien	3.0	-2.5		X	
29	Ca Nho	7.5	-3.0		X	
(d)Ham Luong River lower area						
30	An Thuan3	3.0	-2.5		X	
31	An Thuan1	5.0	-2.5		X	
32	An Thuan2	5.0	-2.5		X	
33	Son Phu	5.0	-2.5		X	
34	Cau Kenh	10.0	-3.0		X	
35	Hai Hue	3.0	-2.5		X	
36	Viet Su	3.0	-2.5		X	
37	Co Ba	3.0	-2.5		X	
38	Kinh Moi	3.0	-2.5		X	
39	Vu Hoang (Long Ong)	5.0	-2.5		X	
40	Ba Beo	5.0	-2.5		X	
Regulating sluices						
41	Huong Diem	20.0	-3.5		X	
42	Ba Tri	10.0	-3.0		X	
43	Sau Chiem	10.0	-3.0		X	
Total number of sluices				4	22	14

1) An Hoa Sluice

Automatic swing gates (10 gates):

- Open channel type made of reinforced concrete M300.
- The width of sluice B = 105 m, including 10 gates with B = 10.5 m/ gate

- Water clearing width B = 100m, including 10 gates with B=10m
- Sluice sill altitude: Z= -5.00 m
- The length of sluice body L = 22 m
- The thickness of sluice bottom slab d = 1.2 m
- Altitude of pier crest: Z= + 3.5 m
- Automatic two-direction open/close valve gates with the valve gate crest altitude Z= +3.5 m, rectangular shape, made of stainless steel. Equipped with one repairing and accident-preventing stop log set made of zinc-coated steel.
- The sluices have standard traffic bridges H13 made of reinforcing concrete M300. The altitude of bridge girder bottom Z=+9.0m, with of bridge surface B = 6.0 m.
- The hoisting platform to lift gate and stop log is made of reinforcing concrete M300 equipped with 50 ton gantry crane opened and closed by electricity engine and manual manner.

Vertical lift gate (1 gate):

- Open channel type made of reinforced concrete M300.
- The width of sluice B = 30 m, including 1 gate
- Water clearing width :B = 30m, including 1 gate
- Sluice sill altitude: Z= -5.00 m
- The length of sluice body: L = 22 m
- The thickness of sluice bottom slab: d = 1.5 m
- Altitude of pier crest: Z= + 3.5 m
- The sluices have standard traffic bridge H 13 made of reinforcing concrete M300. The altitude of bridge girder bottom Z=+9.0m, with of bridge surface B = 6.0 m.

2) Ben Tre Sluice

Automatic swing gate (4 gates)

- Open channel type made of reinforced concrete M300.
- The width of sluice B = 42 m, including 4 gates with B = 10.5 m/ gate
- Water clearing width:B = 40m, including 4 gates with B=10m
- Sluice sill altitude: Z= -5.00 m
- The length of sluice body L = 26 m
- The thickness of sluice bottom slab d = 1.2 m
- Altitude of pier crest: Z= + 3.5m
- Automatic two-direction open/close valve gates with the valve gate crest altitude Z= +3.5 m, rectangular shape, made of stainless steel.
- The sluices have standard traffic bridge H 13 made of reinforcing concrete M300. The altitude of bridge girder bottom Z=+9.0m, with of bridge surface B = 12.0 m (9+ 2x1.5)
- The hoisting platform to lift gate and stop log is made of reinforcing concrete M300 equipped with 50 ton gantry crane opened and closed by electricity engine and manual manner.

Vertical lift gate (1 gate)

- Open channel type made of reinforced concrete M300.
- The width of sluice B = 30 m, including 1 gate
- Water clearing width: B = 30m, including 1 gate
- Sluice sill altitude: Z= -5.00 m
- The length of sluice body: L = 26 m
- The thickness of sluice bottom slab: d = 1.5 m
- Altitude of pier crest: Z= + 3.5 m
- The sluices have standard traffic bridge H 13 made of reinforcing concrete M300. The altitude of bridge girder bottom Z=+9.0 m, with of bridge surface B = 12.0 m (9+ 2x1.5).

Lock

- Upstream and downstream dock: by reinforcing concrete M300
- Length of the lock :28.0m
- Width :14.6m
- Ship open width : 14.0m
- Bottom altitude :(-)4.50 - (-)5.00m
- Thickness of bottom slab:1.1 - 1.5m
- Altitude of wall crest :+3.50m
- Wall thickness :1.5 - 2.3m
- The base of dock is treated by reinforced concrete Colum M300.
- Lock gate: the dock gate is in rectangular shape, made of stainless steel including 2 sets (4 wings) installed in the downstream lock end. The open/close operation of lock gate is carried out by hydraulic cylinder system.

Lock chamber: Ship circulating length of the lock chamber is 150.0m

- Ship opening length of lock chamber is 150.0m
- Made of reinforced concrete M300
- Length of the dock :137.5m
- Width :14.6m
- Ship open width :14.0m
- Bottom altitude :-5.00m
- Thickness of bottom slab: 1.0m
- Altitude of wall crest :+3.50m
- Wall thickness :1.0 m

3) Tan Phu and Ben Ro Sluice (Vertical +Lift Gate, 2 Gates Each)

- Open channel type made of reinforced concrete M300.
- The width of sluice B = 21 m, including 2 gates with B = 10.5 m/ gate
- Water clearing width: B = 20m, including 2 gates with B=10m
- Sluice sill altitude: Z= -4.00 m
- The length of sluice body L = 17 m
- The thickness of sluice bottom slab d = 1.0 m
- Altitude of pier crest: Z= + 3.5 m
- Fixed wheel gate with the gate crest altitude Z= +3.5 m, rectangular shape, made of stainless steel.
- The sluices have standard traffic bridge H 13 made of reinforcing concrete M300. The altitude of bridge girder bottom Z=+6.0m, with of bridge surface B = 6.0 m.

4) Huong Diem Regulating Sluice (Vertical Lift Gate, 2 Gates Each)

- Open channel type made of reinforced concrete M300.
- The width of sluice B = 21 m, including 2 gates with B = 10.5 m/ gate
- Water clearing width: B = 20m, including 2 gates with B=10m
- Sluice sill altitude: Z= -3.50 m
- The length of sluice body L = 17 m
- The thickness of sluice bottom slab d = 1.0 m
- Altitude of pier crest: Z= + 3.5 m
- Fixed wheel gate with the gate crest altitude Z= +3.5 m, rectangular shape, made of stainless steel.
- The sluices have standard traffic bridge H 13 made of reinforcing concrete M300. The altitude of bridge girder bottom Z=+6.0m, with of bridge surface B = 6.0 m.

5) Ba Tri and Sau Chiem Regulating Sluices (Vertical Lift Gate, 1 Gate Each)

- Open channel type made of reinforced concrete M300.
- The width of sluice B = 10.5 m, including 1 gate
- Water clearing width: B = 10m, including 1 gate
- Sluice sill altitude: Z= -3.00 m
- The length of sluice body L = 17 m
- The thickness of sluice bottom slab d = 1.0 m
- Altitude of pier crest: Z= + 3.5 m
- Fixed wheel gate with the gate crest altitude Z= +3.5 m, rectangular shape, made of stainless steel. The sluices have standard traffic bridge H 13 made of reinforcing concrete M300. The altitude of bridge girder bottom Z=+6.0 m, with of bridge surface B = 6.0 m.

6) The sluices with the clear span of– B=15m (Automatic Swing Gate)

- Open chamber type made of reinforced concrete M300.
- The width of sluice B = 16 m, including 2 gates with B = 8.0 m/ gate
- Water clearing width: B = 15m, including 2 gates with B=7.5 m
- Sluice threshold altitude: Z= -3.00 m
- The length of sluice body L = 17 m
- The thickness of sluice bottom slab d = 1.0 m
- Altitude of edge post crest: Z= + 3.5m
- Automatic two-direction open/close valve gates with the valve gate crest altitude Z= +3.5 m, rectangular shape, made of stainless steel. Equipped with one repairing and accident-preventing plank set made of zinc-coated steel.
- The sluices have standard traffic bridge H 13 made of reinforcing concrete M300. The altitude of bridge girder bottom Z=+6.0m, with of bridge surface B = 6.0 m.
- The hoisting platform to lift gate and plank is made of reinforcing concrete M300 equipped with 40 ton gantry crane opened and closed by electricity engine and manual manner.

7) Sluices with the clear span of B=10m (Automatic Swing Gate)

- Open chamber type made of reinforced concrete M300.
- The width of sluice B = 10.5 m, including 1 gate
- Water clearing width: B = 10m, including 1 gate
- Sluice threshold altitude: Z= -3.00 m
- The length of sluice body L = 17 m
- The thickness of sluice bottom slab d = 1.0 m
- Altitude of edge post crest: Z= + 3.5 m
- Automatic two-direction open/close valve gates with the valve gate crest altitude Z= +3.5 m, rectangular shape, made of stainless steel. Equipped with one repairing and accident-preventing plank set made of zinc-coated steel.
- The sluices have standard traffic bridge H 13 made of reinforcing concrete M300. The altitude of bridge girder bottom Z=+6.0m, with of bridge surface B = 6.0 m.
- The hoisting platform to lift gate and plank is made of reinforcing concrete M300 equipped with 40 ton gantry crane opened and closed by electricity engine and manual manner.

8) The sluices with the clear span of B=7.5m (Automatic Swing Gate)

- Open chamber type made of reinforced concrete M300.
- The width of sluice B = 8 m, including 1 gate
- Water clearing width: B = 7.5 m, including 1 gate

- Sluice threshold altitude: Z= -3.00 m
- The length of sluice body L = 17 m
- The thickness of sluice bottom slab d = 1.0 m
- Altitude of edge post crest: Z=+ 3.5 m
- Automatic two-direction open/close valve gates with the valve gate crest altitude Z= +3.5 m, rectangular shape, made of stainless steel. Equipped with one repairing and accident-preventing plank set made of zinc-coated steel.
- The sluices have standard traffic bridge H 13 made of reinforcing concrete M300. The altitude of bridge girder bottom Z=+6.0m, with of bridge surface B = 6.0 m.
- The hoisting platform to lift gate and plank is made of reinforcing concrete M300 equipped with 40 ton gantry crane opened and closed by electricity engine and manual manner.

9) The sluices with the clear span of B=5m (Automatic Swing Gate)

- Open chamber type made of reinforced concrete M300.
- The width of sluice B = 5.5 m, including 1 gate
- Water clearing width: B = 5 m, including 1 gate
- Sluice threshold altitude: Z== -2.50 m
- The length of sluice body L = 17 m
- The thickness of sluice bottom slab d = 0.8 m
- Altitude of edge post crest: Z= + 3.5 m
- Automatic two-direction open/close valve gates with the valve gate crest altitude Z= +3.5 m, rectangular shape, made of stainless steel. Equipped with one repairing and accident-preventing plank set made of zinc-coated steel.
- The sluices have standard traffic bridge H 13 made of reinforcing concrete M300. The altitude of bridge girder bottom Z=+5.5m, with of bridge surface B = 6.0 m.
- The hoisting platform to lift gate and plank is made of reinforcing concrete M300 equipped with 20 ton gantry crane opened and closed by electricity engine and manual manner.
- Open chamber type made of reinforced concrete M300.
- The width of sluice B = 3.5 m, including 1 gate
- Water clearing width: B = 5 m, including 1 gate
- Sluice threshold altitude: ∇= -2.50 m
- The length of sluice body L = 15 m
- The thickness of sluice bottom slab d = 0.65 m
- Altitude of edge post crest: Z=+ 3.5m
- Automatic two-direction open/close valve gates with the valve gate crest altitude Z= +3.5 m, rectangular shape, made of stainless steel. Equipped with one repairing and accident-preventing plank set made of zinc-coated steel.
- The sluices have standard traffic bridge H 13 made of reinforcing concrete M300. The altitude of bridge girder bottom Z=+6.0m, with of bridge surface B = 6.0 m.
- The hoisting platform to lift gate and plank is made of reinforcing concrete M300 equipped with V15 on/off machine and chain.
- Open chamber type made of reinforced concrete M300.

3.3 Minor Sluices (Under Stage 2 & Stage 3)

There are as many as 172 sluices which are needed to construct at the position of small canals, composed of 63 sluices required under stage 2 and 109 under stage 3. The 63 sluices are further categorized into 28 on the Tien River and Cua Dai River and 35 sluices on the Ham Luong River while 109 sluices composed of 58 on the Ten River and Cua Dai River and 51 sluices on the Ham Luong River. The width of sluices falls in a range of 1.5 to 3.0m and they are of culvert type sluices to

be constructed under the river dike.

Table 3.3.1 List of minor sluices on river dike (stage 2)

Tien (My Tho) River & Cua Dai River				Ham Luong River			
No.	Positions	Scale of sluices		No.	Positions	Scale of sluices	
		B(m)	H (m)			B(m)	H (m)
T-1	K38+496	1.5	3.5	H-1	K2+269	3.0	4.0
T-2	K39+300	2.0	3.5	H-2	K2+515	2.0	3.5
T-3	K41+790	2.0	3.5	H-3	K2+950	3.0	4.0
T-4	K42+790	1.5	3.5	H-4	K5+867	2.0	3.5
T-5	K42+919	2.0	3.5	H-5	K6+270	1.5	3.0
T-6	K43+678	1.5	3.5	H-6	K8+178	2.0	3.5
T-7	K43+975	1.5	3.5	H-7	K8+533	2.0	3.5
T-8	K44+944	1.5	3.5	H-8	K8+533	2.0	3.5
T-9	K46+750	1.5	3.5	H-9	K8+783	2.0	3.5
T-10	K47+392	1.5	3.5	H-10	K9+412	2.0	3.5
T-11	K47+725	2.0	3.5	H-11	K9+554	3.0	4.0
T-12	K48+678	1.5	3.5	H-12	K10+192	2.0	3.5
T-13	K48+782	1.5	3.5	H-13	K10+575	2.0	3.5
T-14	K50+520	1.5	3.5	H-14	K10+802	2.0	3.5
T-15	K50+675	1.5	3.5	H-15	K11+105	2.0	3.5
T-16	K50+961	2.0	3.5	H-16	K11+433	1.5	3.0
T-17	K52+14	1.5	3.5	H-17	K11+652	2.0	3.5
T-18	K53+778	1.5	3.5	H-18	K12+34	2.0	3.5
T-19	K54+485	2.0	3.5	H-19	K12+248	1.5	3.5
T-20	K56+172	2.0	3.5	H-20	K12+491	1.5	3.5
T-21	K56+880	3.0	3.5	H-21	K12+526	1.5	3.5
T-22	K57+706	1.5	3.5	H-22	K13+174	2.0	3.5
T-23	K58+142	3.0	3.5	H-23	K13+696	2.0	3.5
T-24	K62+44	1.5	3.5	H-24	K14+486	2.0	3.5
T-25	K62+149	1.5	3.5	H-25	K14+615	1.5	3.5
T-26	K62+252	1.5	3.5	H-26	K14+729	2.0	3.5
T-27	K62+900	1.5	3.5	H-27	K14+831	3.0	3.5
T-28	K63+470	3.0	3.5	H-28	K15+442	1.5	3.5
				H-29	K16+185	1.5	3.5
				H-30	K16+587	1.5	3.5
				H-31	K17+630	2.0	3.5
				H-32	K19+672	2.0	3.5
				H-33	K29+945	1.5	3.5
				H-34	K33+868	3.0	3.5
				H-35	K40+647	2.0	3.5
Number of sluices (Stage 2)		Tien (My Tho) River & Cua Dai River				28	
		Ham Luong River				35	
		Total				63	

Table 3.3.2 List of minor sluices on river dike (stage 3)

Tien (My Tho) River & Cua Dai River				Ham Luong River			
No.	Positions	Scale of sluices		No.	Positions	Scale of sluices	
		B(m)	H (m)			B(m)	H (m)
T-29	K0+840	3.0	4.0	H-36	K2+45	1.5	3.0
T-30	K1+725	1.5	3.0	H-37	K2+364	1.5	3.0
T-31	K2+428	2.0	3.5	H-38	K2+520	2.0	3.5
T-32	K3+3	2.0	3.5	H-39	K4+633	2.0	3.5
T-33	K3+226.5	2.0	3.5	H-40	K7+45	2.0	3.5
T-34	K3+483.4	1.5	3.0	H-41	K7+194	1.5	3.0
T-35	K3+850.7	2.0	3.5	H-42	K7+470	2.0	3.5
T-36	K4+243	3.0	4.0	H-43	K7+665	1.5	3.0
T-37	K4+596	2.0	3.5	H-44	K7+813	1.5	3.0
T-38	K4+833.4	3.0	4.0	H-45	K7+890	1.5	3.0
T-39	K5+67.6	3.0	4.0	H-46	K7+950	1.5	3.0

Tien (My Tho) River & Cua Dai River				Ham Luong River			
No.	Positions	Scale of sluices		No.	Positions	Scale of sluices	
		B(m)	H (m)			B(m)	H (m)
T-40	K5+246.1	3.0	4.0	H-47	K8+185	2.0	3.5
T-41	K6+105.2	3.0	4.0	H-48	K8+405	2.0	3.5
T-42	K6+653.7	2.0	3.5	H-49	K8+636	1.5	3.0
T-43	K7+158.1	3.0	4.0	H-50	K8+750	2.0	3.5
T-44	K8+990.8	3.0	4.0	H-51	K8+858	1.5	3.0
T-45	K10+152	1.5	3.0	H-52	K8+945	2.0	3.5
T-46	K11+497.5	2.0	3.5	H-53	K9+130	1.5	3.0
T-47	K15+610.6	3.0	4.0	H-54	K9+250	2.0	3.5
T-48	K16+7.2	2.0	3.5	H-55	K9+461	1.5	3.0
T-49	K16+411.9	1.5	3.0	H-56	K9+695	3.0	4.0
T-50	K16+590	2.0	3.5	H-57	K10+368	2.0	3.5
T-51	K16+953.2	2.0	3.5	H-58	K10+927	1.5	3.0
T-52	K17+300.2	1.5	3.0	H-59	K11+387	2.0	3.5
T-53	K17+623	1.5	3.0	H-60	K11+685	2.0	3.5
T-54	K18+0.8	2.0	3.5	H-61	K12+225	2.0	3.5
T-55	K18+433.5	2.0	3.5	H-62	K12+366	1.5	3.5
T-56	K18+917.5	1.5	3.0	H-63	K12+554	3.0	3.5
T-57	K20+963.5	1.5	3.0	H-64	K12+818	1.5	3.5
T-58	K21+293	1.5	3.0	H-65	K13+25	2.0	3.5
T-59	K22+180	2.0	3.5	H-66	K13+134	3.0	3.5
T-60	K25+205	2.0	3.5	H-67	K13+391	2.0	3.5
T-61	K27+283	3.0	4.0	H-68	K13+709	1.5	3.5
T-62	K29+954	1.5	3.0	H-69	K13+820	2.0	3.5
T-63	K30+229	2.0	3.5	H-70	K14+603	2.0	3.5
T-64	K30+676	2.0	3.5	H-71	K15+450	3.0	3.5
T-65	K30+763	2.0	3.5	H-72	K16+460	3.0	3.5
T-66	K31+93	2.0	3.5	H-73	K16+750	3.0	3.5
T-67	K31+204	1.5	3.0	H-74	K17+643	3.0	3.5
T-68	K31+392	2.0	3.5	H-75	K18+106	2.0	3.5
T-69	K32+76	1.5	3.0	H-76	K18+244	1.5	3.5
T-70	K32+474	1.5	3.0	H-77	K18+629	2.0	3.5
T-71	K32+738	2.0	3.5	H-78	K19+ 36	1.5	3.5
T-72	K33+25	2.0	3.5	H-79	K19+927	3.0	3.5
T-73	K33+866	1.5	3.5	H-80	K21	2.0	3.5
T-74	K33+912	1.5	3.5	H-81	K21+695	3.0	3.5
T-75	K35+724	3.0	3.5	H-82	K22+264	3.0	3.5
T-76	K35+932	2.0	3.5	H-83	K22+500	1.5	3.5
T-77	K35+984	1.5	3.5	H-84	K23+170	1.5	3.5
T-78	K36+70	1.5	3.5	H-85	K24+651	2.0	3.5
T-79	K36+110	1.5	3.5	H-86	K25+166	2.0	3.5
T-80	K36+183	1.5	3.5				
T-81	K36+209	2.0	3.5				
T-82	K36+244	1.5	3.5				
T-83	K36+259	1.5	3.5				
T-84	K36+471	2.0	3.5				
T-85	K36+719	1.5	3.5				
T-86	K36+1011	2.0	3.5				
Number of sluices (Stage 3)		**Tien (My Tho) River & Cua Dai River**				**58**	
		Ham Luong River				**51**	
		Total				**109**	

3.4 New Intake Canal (Under Stage 1)

According to a simulation result carried out under JICA Mater Plan (Project for Climate Change Adaptation for Sustainable Agriculture and Rural Development in the Coastal Mekong Delta in Vietnam), construction of Ben Ro and Tan Phu sluices was proved to be effective to recruit fresh water

from the upstream area free from saline intrusion. Those gates can provide fresh water from the most upstream area whereby keeping water head at a certain level even during the time other sluices are closed to prevent saline intrusion.

In order to supply water demand to whole project area, intake canals from Tan Phu and Ben Ro should be extended and/or widened as shown in the following tables. In fact, these improvement works are under progressing by Vietnamese government budget, and expected to complete by 2013.

Table 3.4.1 Dimensions of New Intake Canals

Name of canal	Width (m)	Canal bed elevation(m)	Length (km)
Ba Lai upstream canal	30.0	-4.0	13.8
Tan Phu canal	15.0	-4.0	5.5
Ben Ro canal	15.0	-4.0	5.3
Total			24.5

Source: Ben Tre DARD

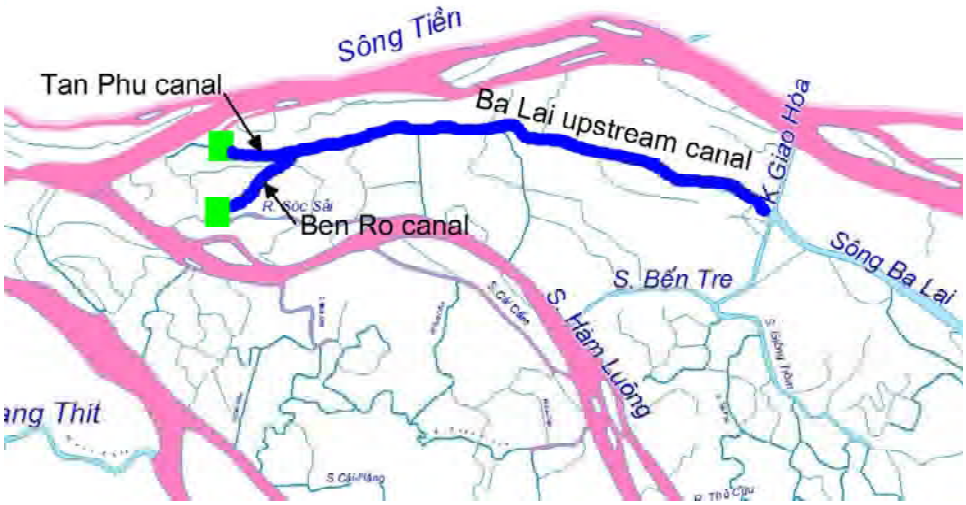

Figure 3.4.1 Location Map of New Intake Canals (under Construction)

3.5 Canal System Improvement (Under Stage 1 for Dredging)

Many existing irrigation channels, principal canals and level-1 canals (first level secondary canals), have been used effectively to date. However, due to the silt and sand sedimentation delivered through the Mekong River flow, following canals need dredging, and should be shaped neatly in order to ensure the tasks of North Ben Tre Irrigation System. Note that only dredging and minor shaping are planned, and no canal widening is to be carried out, so that no resettlement is expected. Total length of canals necessary for the improvement comes to as long as 418.6 km.

Table 3.5.1 List of canals necessary for improvement

No	Name of canals	B (m)	Zn (m)	Length (km)	No	Name of canals	B (m)	Zn (m)	Length (km)
1	Cai Cung small canal	5.0	-2.5	2.5	26	Thu Cuu – Cai Coi small canal	7.5	-2.5	17.0
2	Thuc Dao small canal	5.0	-2.5	4.5	27	Son Phu-Cai Son small canal	7.5	-2.5	8.5
3	Bai Dac canal	7.5	-2.5	7.5	28	Tai Phu small canal	10.0	-3.0	9.0
4	Ong Doc canal	7.5	-2.5	6.0	29	Heo canal	10.0	-3.0	7.0
5	Hoa Trung	7.5	-2.5	2.0	30	Cau Duc small canal	10.0	-3.0	8.5
6	Luong Cat canal	10.0	-3.0	10.5	31	Chau Binh – Ben Than small canal	10.0	-3.0	25.0
7	Thuong Binh canal	12.0	-3.0	12.5	32	Quang Canal (enough MC)	7.5	-2.5	4.5
8	Ma river canal – Kinh Dieu	10.0	-3.0	11.0	33	Cho Moi – Tu Chay canal	15.0	-3.0	22.0
9	Cai Hien canal	5.0	-2.5	5.5	34	Ben Mieu – 2B – Cau Dap canal	10.0	-3.0	16.0
10	Cai Rang small canal – Nho river	5.0	-2.5	11.0	35	Hai Hue canal	5.0	-2.5	3.0
11	Ruot Ngua small canal	7.5	-2.5	7.0	36	Viet Su canal	5.0	-2.5	3.0
12	Phu Thanh small canal	5.0	-2.5	5.5	37	Co Ba	5.0	-2.5	2.5
13	Cai Xep small canal	5.0	-2.5	3.5	38	Moi canal	5.0	-2.5	2.5
14	An Hoa canal	5.0	-2.5	4.0	39	Xeo Sau canal	7.5	-3.0	3.0
15	Cai Chuoi	7.5	-2.5	3.5	40	Cai Mit – Long Ong small canal	7.5	-3.0	12.5

16	Moi canal – Canal No.2	7.5	-2.5	14.0	41	Dia Bao canal – ring dyke	7.5	-3.0	13.0
17	Cai Bich small canal	7.5	-2.5	6.5	42	9A Canal	7.5	-3.0	15.0
18	Cau Cong small canal	7.5	-2.5	6.0	43	9B Canal	15.0	-3.0	26.5
19	Cai Cau small canal	7.5	-2.5	6.5	44	Cau Sap small canal	12.0	-3.0	11.0
20	Phu Vang small canal – Cai Muong	7.5	-2.5	6.0	45	Cai Bong small canal	10.0	-3.0	12.5
21	Ba Mu small canal	5.0	-2.5	5.5	46	Muong Dao small canal	10.0	-3.0	7.0
22	Thanh Nien small canal	5.0	-2.5	5.0	47	Dieu small canal	5.0	-2.5	8.0
23	Ca Nho small canal – Ao Vuong	10.0	-3.0	6.0	48	Vu Hoang small canal	3.0	-2.0	3.0
24	Binh Trung small canal– Cau Sat – Hai Ho	15.0	-3.0	20.0	49	Thom small canal	5.0	-2.5	2.0
25	Canal No.1	10.0	-3.0	4.6		Total			418.6

3.6 Embankment (River) Dike (Stage 2 and Stage 3)

Saline preventing embankment dike is combined with traffic road and work management road. The dike is banked by soil and laid with aggregate or mountain sand. This part f the project is to be carried out by Vietnamese government under Stage 2 and Stage 2 works. The length and main dimensions of river bank dikes are as follows.

- Ham Luong river bank dike (dike on left bank of Ham Luong river): Total length=68.42km
- My Tho river bank dike (Dike on right bank of My Tho river): Total length=63.49km
- Crest elevation: Z=+3.50 (m)
- Gradient of side slopes: m = 2.0

3.7 Management Buildings (Stage 1, Stage 2 and Stage 3)

Office of the Water Resources Division under Ben Tre DARD is used as a central management building for all projects within the province. It is also the place to keep documents and monitor all the works. In addition, management buildings are required to conduct frequent monitoring especially during rainy season and to keep necessary materials, etc. Those management building are all attached with major-mid sluices, so that the construction should be done together with the sluices.

Table 3.7.1 Number of Management Buildings

Building Area (m^2)	Grade	Number	Subject Sluices
300	II	2	An Hoa, Ben Tre
60	III	3	Ben Ro, Tan Phu, Huong Diem
45	III	35	Other medium scale sluices

3.8 Design of the Sluice Gates for Saline Intrusion Prevention

Functions required for the sluice gate in this Project are as follows; 1) To intercept river water above predetermined salinity concentration; namely preventing saline water intrusion, 2) To take river water below predetermined salinity concentration into canal, 3) To drain water of the canal out to the river, 4) To prevent intrusion of high tide or flood, and 5) Not to impede the passing of ships.

Swing gate with non power type is spread widely in Mekong Delta area as the type of tide gate. On the other side, not only the vertical lift gate but flap gate, hinged gate such as miter type, swing type and sector type are used for tide gate worldwide. The advantages and disadvantages of a swing gate and a vertical lift gate are briefed below:

Table 3.8.1 Advantage and Disadvantages by Gate Type

Gate type	Characteristics	
Swing gate （non power)	Advantages	1) Both construction cost and maintenance cost such as fuel cost is cheaper. 2) Since gate is movable both sides of canal, intake and drainage is possible by rough management. 3) If the necessary under clearance of the maintenance bridge of the sluice is secured, navigation of ships is possible.
	Disadvantages	1) Since the gate is open or close by the difference of water level namely flow

		direction, optional operation according to the salinity concentration or emergency operation on a sudden swollenness of the river are not applicable. 2) Because quick and artificial control is not possible, some amount of saline intrusion is inevitable. 3) Incomplete closing or impossibility of open-close is easy to occur by a slight amount of garbage. 4) Maintenance is difficult since the gate is installed under the water. Spare gate used during repairing and hoisting equipments are usually equipped. 5) Long span gate is difficult to apply by structural reason.（Under the width of 10m gate is common in Mekong delta area)
Vertical lift gate (Electric power)	Advantages	1) It is reliable as a structure which closes certainly in the time of a flood, etc. and protects the inside of dike. It can descend by self weight at the time of mechanical failure with hoist. 2) Regulation of a water level or the amount of discharge is possible by adjustment of optional openings, and when it is an electromotive type, opening-and-closing time is short. 3) If the gate is wound up, maintenance check and repair gate it is possible at the spot. 4) Application of the long span gate is possible structurally.
	Disadvantages	1) Since it is necessary to lift up a gate at the time of vessel passing, it becomes the structure of having a gatepost of necessary height, and, generally civil works expenses become high compared with a swing type. 2) In an electromotive type, operation and maintenance costs including electricity is required.

There are various kind of gate classified in the category of vertical lift gate. For example, a double leaf gate is one of the vertical lift gates, consisting of two gate leaves and whereby they operate on different guide frames (see Figure 3.8.1). Capability in controlling discharge and also reduced height of piers are the significant features of this gate. For this gate, 4-motor 4-drum type is suitable for its hoisting equipment which drives two leaves independently or simultaneously from both ends of the leaves. Electric synchronizer is equipped in the hoisting device on either side, forming a system that can operate a certain speed in a range of a fixed error.

Since this double leaf gate has a complex mechanism for the sealing, guide frame and operation, and Height(H)/Length(L) ratio of gate leaves has to be smaller than that of other types, stability and accurate operation in these mechanisms should highly be achieved and maintained. Therefore, advanced technology as well as high accuracy of installation technique, as exampled in Japan, shall be expected to achieve the desirable benefit on this gate.

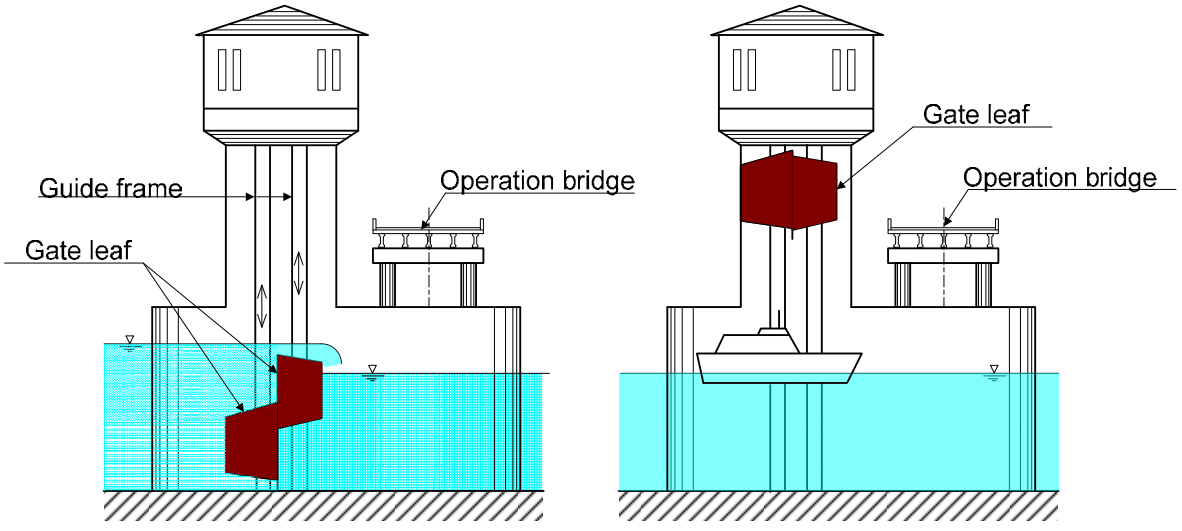

Figure 3.8.1 Schematic Figure of Double Leaf gate

Type of gate, such as swing type and vertical lift type including the above double leaf gate, should be decided in consideration of its purpose, installation location, readiness of operation and maintenance, safety and also in terms of economy. From these points of view, following gate types are recommended to apply by each sluice:

3.8.1 Intake Gate of Tan Phu Sluice and Ben Ro Sluice (Double Leaf Vertical)

Both sluices are intake gates located in the upper stream of the Project area and meant to supply freshwater into the area. In order to secure a flow demand as much as possible for a long time, it is necessary to operate the gate according to the water level situation of the sides of river and canal continuously even in dry season. Therefore, accurate adjustment of openings, high water tightness, steady and smooth operational workability are required for its function.

In these respects, vertical lift gates with double leaves are the most appropriate gate type for the 2 intake gate. Furthermore, introduction of advanced management systems such as automation of operation linked to water level to be observed and monitoring and operation from a remote place can also be applied under the vertical lift gates with double leaves.

3.8.2 Lock Gate of An Hoa Sluice and Ben Tre Sluice (Double Leaf Vertical)

Lock gates are planned for both sluices of An Hoa and Ben Tre in order to secure the passing of ships during the period of preventing saline intrusion or restoring freshwater within the canal. These gates are as large scale as 30m in width and 8.5m in height. If flap gate, one of a hinged type gate, is applied to these sluices, steady and smooth operation will possibly be prevented due to sedimentation, and moreover, maintenance is difficult since almost all the part of this gate is submerged.

For these reasons, the vertical lift gate should be applied, and especially the double leaf type is suitable to lower the gate pier height. In order for a vessel to pass even during high tide, it is necessary to ensure enough clearance below the gate leaf under its full-opened condition. In this context, the double leaf type gate realizes that the elevation of lower end of gate leaf when lifted up can be same as the beam seat height of the operation bridge, whereby enough clearance for ship passing can easily be maintained.

3.8.3 Regulating Gate of Huong Diem sluice, Ba Tri Sluice and Sau Chiem Sluice (Vertical)

These sluices are located on the way of main canals in the downstream basin and function in regulating water level in order to distribute irrigation water throughout the area. In this point, vertical lift gate with electric motor is more suitable than automatic swing gate.

3.8.4 Saline Intrusion Prevention Gate for Other Sluices (Swing)

Except for above mentioned gates, automatic swing gate shall be adopted for other sluices since they are not required artificial or frequent gate operation, and they are superior in terms of investment cost as well as easiness of operation and maintenance.

3.8.5 Gate Crest Elevation and Freeboard under Climate Change

Gate crest elevation must ensure the height against design outside water level and design wave height. Design outside water level means the maximum tide level which is intended for protection by tidal sluice gate. For the North Ben Tre area, 1.97m which is the tidal level with 1% frequency at My Thuan Station, probability once in 100 years, is selected according to the Vietnamese criteria of 14TCN130-2002 Design Guide as the design outside water level. In this case, the required gate crest elevation is calculated as follows.

$H=TL + d$

$d = h_{s1} + a$

$h_{s1} = 3.2K \times \tan\alpha \times hs$

$hs=0.0208V^{5/4}D^{1/3}$

where,

H : Design gate crest elevation (m)

TL : Design tidal level ; 1.97m (at My Thuan Station corresponding with frequency 1%)

d : Safety height (m)

h_{s1} : Design Wave height (m)

K : Coefficient depending on the ragged characteristics of dike roof; 1.0

α : Inclination angle of dike(°)

when the slope gradient =1:2, $\tan\alpha = 0.5$

hs : Wave height by AndoreIanop's formula (m)

V : Wind velocity; 15m/s (the maximum wind velocity at Ba Tri Station)

D : Wave propagation length ; $D=0.5 \times B$

B : Average river width; 2.0 km

a : Freeboard ; 0.3-0.5m depending on work grade (here 0.5 m is applied taking into account the importance of the facilities as well as the sea level rise effect under climate change)

$hs=0.0208 \times 15^{5/4} \times (0.5 \times 2.0)^{1/3}=0.61m$

$h_{s1} = 3.2 \times 1.0 \times 0.5 \times 0.614=0.98m$

$d = 0.98 + (0.3\text{-}0.5)=1.28\text{-}1.48m$

H=1.97+(1.28-1.48)=3.25-3.45m, say rounded at 3.5 m

Although freeboard is defined within the rage of 0.3-0.5 m according to the scale of project or an importance of the facility by the Vietnamese criteria (14TCN130-2002 Design Guide), maximum value of 0.5m is employed for safety in this project. As a result, it is decided that gate crest elevation shall be H= 3.50 m. Even if a change of water level by climate change takes place in future, it can be said that the function as a tide gate would be kept since the increase is considered within the limits of freeboard value (e.g. sea level rise in 2050 is 30cm under B2 scenario and 33 cm under A1FI scenario which are within the freeboard). This crest elevation should be applied to all the sluice gate for the North Ben Tre project in order to keep the top elevation same.

3.8.6 Gate Material

In Vietnam, steel gate has been widely used for sluice gates. Most of the gates had been installed in fresh water areas for the purpose of controlling water distribution in irrigation and drainage system. However, under this project, the gates are to confront high content of saline water since they are constructed in saline water intrusion areas. Therefore, stainless material gate is recommended rather than steel material gate. Though the stainless material gate is higher in cost than the steel gate, the cost difference is not so much nowadays, and there are several advantages pertinent to the stainless material gate.

As summarized in the following table, stainless gate is in fact maintenance free while steel gate requires periodical painting in order to prevent rust and corrosion. In most cases, paintings shall be done at least once in every 5 years according to the existing practice in Mekong delta. Further, when comparing the total costs between the 2 gates over 30 years, the aggregated cost for stainless steel gate is a little smaller than that of steel gate. Note that in estimating the 30 years cost, discount rate of 12%, equal to the opportunity cost in Vietnam, was employed to the total cost of painting. Therefore, this project proposes to adopt stainless material gate for the sluices.

Table 3.8.2 Comparison between Carbon Steel Gate and Stainless Gate

Item	Carbon Steel	Stainless Steel
Strength	Both strength and stiffness are excellent.	Both strength and stiffness are excellent.
Corrosion resistance	Inferior in corrosion resistance, hence painting is required.	Excellent in corrosion residence is.
Appearance	Various colors available by painting.	Gloss is kept for long.
Productivity	Easy to weld and fabricate.	Easy to weld and fabricate.
Maintenance	Repeated painting is required.	Painting is not necessary.
Total Cost for 30 years (M. VND)	13,574 (refer to Table 3.2.2)	13,150 (refer to Table 3.2.2)
Conclusion	Not apply	To be applied

Source: JICA Project Team

Table 3.8.3 Cost Estimation of the Gates over 30 years

Particulars			Carbon Steel	Stainless Steel
Representative Dimensions			B=10.5m, H=7.5m (common size in MD)	
Weight of gate leaf(ton):A			49.5	50.0
Unit cost for fabrication(1,000VND/ton):B			202,000	263,000
Area for painting(m^2):C			200	-
Unit painting cost(1,000VND/m^2):D			8,000	-
Painting cost per one time(1,000VND):E=CxD			1,600,000	-
Initial Cost(1,000VND):F=AxB+E			11,599,000	13,150,000
Running cost for painting (1,000VND)	Passed years	Discount Rate (12%)	Running cost	
	5	0.567	907,883	-
	10	0.322	515,157	-
	15	0.183	292,314	-
	20	0.104	165,867	-
	25	0.059	94,117	-
Total painting cost for 30 years(1,000VND):G			1,975,338	0
Initial cost +running cost(1,000VND):F+G			13,574,338	13,150,000

Source: JICA Project Team

3.9 Project Summary and Works applied for Loan Request

Project component is summarized in Table 3.9.1 with the quantity by work and also the resettlement to be required (number of houses to be relocated). Under this project, Stage 1 is expected to be covered by an ODA loan; namely 4 major sluices together with the management buildings and also canal dredging. For the Stage 1 work, a total of 42 households are needed to relocate.

Table 3.9.1 Project Component and Works applied for Loan Request

Stage 1(for loan proposal) (3 years)			Stage 2(not included in this proposal) (4 years)			Stage 3(not included in this proposal) (4 years)		
Category	**Number**	**Resettlement (houses)**	**Category**	**Number**	**Resettlement (houses)**	**Category**	**Number**	**Resettlement (houses)**
1.Major sluices			**1.Medium scale sluices in downstream area**			**1.Medium scale sluices in upstream area**		
1)An Hoa sluice Tidal gate B=10.0m×10(Swing gate) Lock gate B=30.0m× 1(Vertical lift gate)	1	30	1)Huong Diem sluice B=10.0m×2(Vertical lift gate)	1	6	1)Sluice B= 7.5m×2(Swing gate)	1	6
			2)Ba Tri sluices B=10.0m×1(Vertical lift gate)	1	6	2)Sluice B= 7.5m×1(Swing gate)	2	12
			3)Sau Chiem sluices B=10.0m×1(Vertical lift gate)	1	6	3)Sluice B= 5.0m×1(Swing gate)	5	30
2)Ben Tre sluice Tidal gate B=10.0m×4(Swing gate) Lock gate B=30.0m×1(Vertical lift gate)	1	1	4)Sluice B= 7.5m×2(Swing gate)	1	6	4)Sluice B= 3.0m×1(Swing gate)	6	36
			5)Sluice B=10.0m×1(Swing gate)	2	12	**2.Minor sluices(Box culvert) in upstream area**		
			6)Sluice B= 7.5m×1(Swing gate)	1	6	1)Sluice B=3.0m×1(Swing gate)	21	126
3)Ben Ro sluice B=10.0m×2(Vertical lift gate)	1	3	7)Sluice B= 5.0m×1(Swing gate)	8	48	2)Sluice B=2.0m×1(Swing gate)	47	282
4)Tan Phu sluice B=10.0m×2(Vertical lift gate)	1	8	8)Sluice B= 3.0m×1(Swing gate)	7	42	3)Sluice B=1.5m×1(Swing gate)	41	246
2.Management Buildings for sluices			**2.Minor sluices(Box culvert) in downstream area**			**2.Management Buildings for sluices**		
1)Building area A=300m^2	2		1)Sluice B=3.0m×1(Swing gate)	8	48	2)Building area A=45m^2	14	
2)Building area A=60m^2	2		2)Sluice B=2.0m×1(Swing gate)	27	162	**3.River dike in upstream area**	1LS	
3.Dredging of canals :Total length:L=418.6km	1LS		3)Sluice B=1.5m×1(Swing gate)	28	168	1)Dike along the Tien river	1LS	240
			3.Management Buildings for sluices			2)Dike along the Ham Luong river	1LS	304
			1)Building area A=60m^2	1				
			2)Building area A=45m^2	21				
			4.River dike in downstream area	1LS				
			1)Dike along the Tien river		360			
			2)Dike along the Ham Luong river		456			
Total of resettlement		42	Total of resettlement		1,326	Total of resettlement		1,282

CHAPTER 4 PROJECT IMPLEMENTATION ARRANGEMENT

4.1 Institutional Framework

MARD is the lead agency in the implementation of the Project. The Project will be implemented as one of those ODA assisted projects under the MARD, whereby the implementation responsibility is delegated to the Central Project Office (CPO). It means that CPO will be responsible in the overall project management and coordination as the executing agency.

The Project will be implemented employing the regular officials and staff of the MARD/CPO, and whenever necessary additional work force to the regular staff for the Project implementation may be allowed based on the regulations/policies of the MARD/CPO. Overall administrative framework is as follows;

1) The Project Steering Committee (PSC) headed by a Deputy Minister of MARD will be established and maintained as the highest policy-making and direction-setting body for the Project implementation. The members are from the directors of key departments under MARD, director of CPO, representatives from Ben Tre Provincial People's Committee (PPC), and the donor representatives as the major financier.,

2) A North Ben Tre Project liaison office is set up based at CPO, which serves as coordinator with the donor and relevant Vietnamese oversight agencies related to budgeting, disbursements and technical backstopping.,

3) There shall be the Project Management Office (PMO), headed by the representative from CPO as the Project Manager. The PMO shall be in charge of managing and supervising all the operation and implementation of the Project. The implementation of the Project will be localized such that its PMO office will be located at the provincial level instead of national level, i.e., it will be located in Ben Tre City.

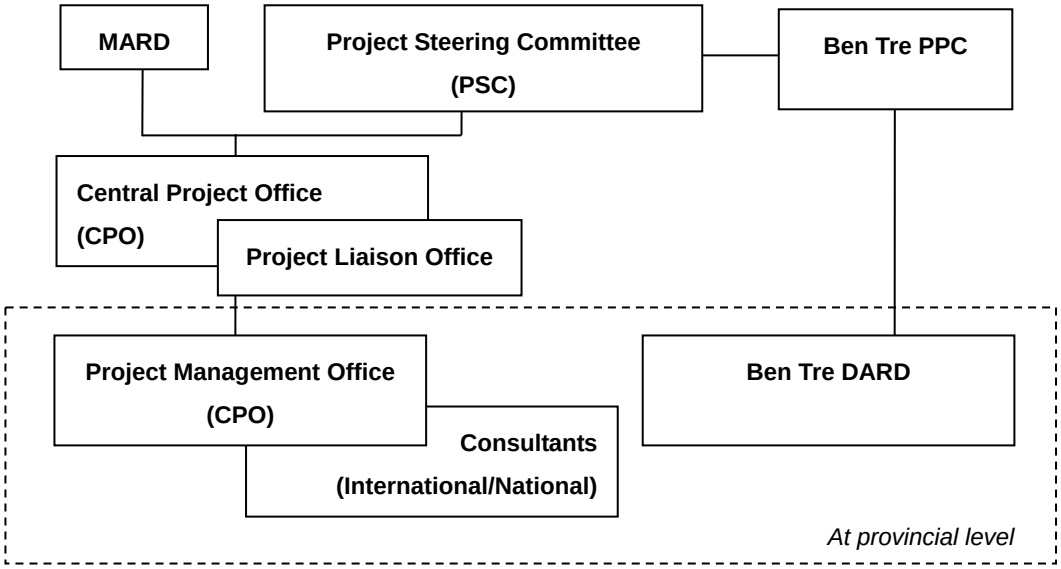

Figure 4.1.1 Project Implementation Setting-up

4.2 Specific Functions of Relevant Offices

The specific functions of the PSC shall be;

i) Setting of overall policy directions, and

ii) Management guidance relative to the Project implementation

The specific functions of the Project liaison office shall;

i) Prepare regular update on the status of the Project, e.g. physical and financial reports, among others for MARD management through CPO, cooperating and partner agencies, oversight agencies, the donor and other interested bodies,

ii) Review the annual and overall Project work and financial plans, facilitate timely release and replenishment of project funds, and track project progress, programs and process of disbursement,

iii) Maintain a project database containing all data and information which is common to the database in MARD,

iv) Provide technical and administrative backstopping to the PMO, and

v) Assist oversight agencies, the donor agency and donor missions during site visits,

The specific functions of the Project Management Office shall;

i) Conduct pre-qualification of consultants and contractors to be contracted in the Project implementation,

ii) Review and approve plans, engineering studies, technical documents and drawings,

iii) Facilitate and recommend approval/disapproval of the construction works for implementation,

iv) Conduct regular construction monitoring at the project level, and

v) Consolidate physical and financial progress and accomplishment reports submitted by contractors, consultants, etc.,

4.3 Fund Flow

Funds to finance the North Ben Tre Project will come from the donor and partly from the Government of Vietnam. The third source may be the equity of the Provincial government (PPC). From the donor, the funds, specifically the proceeds of the loan, will flow to the Government of Vietnam through a special account procedure, direct payment and transfer procedure. Passing through a designated bank, the proceeds of the loan will be transferred to the Project depository bank in the same manner the Government of Vietnam counterpart fund will be deposited to same depository bank with distinct account numbers and account names.

4.4 Results Monitoring and Evaluation

Logical framework (LogFrame) will be established pointing out key indicators per major component for the attainment of the objective of the Project at an early stage of detail design. The Logfram logically shows detail activities/input and outputs, leading all of them together to the outputs and further to the Project objective.

A baseline survey will be undertaken at an earlier stage of the Project implementation. The information that will be generated from this activity will serve as basis in order to measure the impact of interventions in the Project area. In the exercise of objectively, a third party evaluator will be commissioned for this study.

Periodic monitoring of the Project shall be undertaken by the PMO. This will be the basis of the decision on issues and concerns that may arise during the project implementation. Using the data and information gathered from the baseline survey, along with other materials generated from carious monitoring activities, results evaluation will be conducted by a third party. This activity will determine whether or not the expected outputs were attained.

CHAPTER 5 PROJECT COST AND DISBURSEMENT SCHEDULE

5.1 Project Cost

Project cost for Stage 1 is summarized in Table 5.1.1, which is meant to implement by an ODA loan. The table further specifies the expected loan coverage by work. Basically, all the works but land acquisition compensation, project management, other expenses and tax are to be covered by loan. The total project cost of Stage 1 arrives at 2,577 Billion VND (9,793 million yen), of which 2,280 billion VND (8,665 million yen, 88%) is requested for the ODA loan.

Table 5.1.2 further elaborates the project cost covering not only Stage 1 but also Stages 2 & 3. Total project cost for the Stage 2 comes to 2,360 billion VND (8,969 million yen), and that of Stage 3 arrives at 2,199 billion VND (8,357 million yen) totaling to 7,137 billion VND (27,119 million yen) including the cost of Stage 1.

Table 5.1.1 Cost Breakdown for Stage 1 Works for North Ben Tre Polder Area Improvement Project

Category	Government	Loan	Total cost
	VND	VND	VND
1. Construction cost		**1,894,487,000,000**	**1,894,487,000,000**
1-1 Major sluices			
An Hoa B=(10×10＋30)m		596,474,000,000	596,474,000,000
Ben Tre B=(10×4＋30)m		394,844,000,000	394,844,000,000
Ben Ro B=(10×2)m		63,034,000,000	63,034,000,000
Tan Phu B=(10×2)m		60,635,000,000	60,635,000,000
1-2 Management buildings for sluices			
Management Building (S=300m^2)		5,455,000,000	5,455,000,000
Management Building (S=60m^2)		1,091,000,000	1,091,000,000
1-3 Dredging of canals		772,954,000,000	772,954,000,000
2. Land acquisition and compensation	**31,624,000,000**		**31,624,000,000**
3. Project management cost	**18,944,870,000**		**18,944,870,000**
4. Consulting services cost		**151,558,960,000**	**151,558,960,000**
5. Other expenses	**37,889,740,000**		**37,889,740,000**
6. Tax	**208,393,570,000**		**208,393,570,000**
7. Contingency		**234,289,814,000**	**234,289,814,000**
Total	**296,852,180,000**	**2,280,335,774,000**	**2,577,187,954,000**
(Yen converted, 1VND=0.0038 Yen)	1,128,038,284	8,665,275,941	9,793,314,225
Ratio	12%	88%	100%

Conditions in estimating project cost are as follows:

- ✓ Exchange rate from local currency to Japanese Yen is based on the rate of November 2012, referring to the actual market exchange rate (VND1 =0.0038 Yen).
- ✓ Consultancy service cost includes expenses for geological survey, topographic survey, environmental assessment, detail design and so on. This cost is assumed to be 8% of construction cost according to similar projects in Vietnam.
- ✓ Project management cost is assumed at 1% of construction cost according to actual similar project cases in Vietnam.
- ✓ 10% is employed as the rate of physical contingency for the project according to actual similar project cases in Vietnam.
- ✓ Other expenses include basic design evaluation cost, investment project evaluation cost, insurance cost, audit cost, cost for verification, approval of settlement, etc.

Table 5.1.2 Overall Project Cost by Stage

Stage1				Stage2				Stage3				Grand Total (Stage1-3)
Category	Unit	Quantity	Total cost VND	Category	Unit	Quantity	Total cost VND	Category	Unit	Quantity	Total cost VND	
1.Construction cost	set		**1,894,487,000,000**	**1.Construction cost**			**1,159,242,000,000**	**1.Construction cost**			**1,088,611,000,000**	**4,142,340,000,000**
1-1Major sluices				**1-1Medium scale sluices in downstream area**				**1-1Medium scale sluices in upstream area**				
An Hoa B=(10×10＋30)m	set	1	596,474,000,000	Huong Diem B=(10×2)m	set	1	67,914,000,000	Sluice B=(7.5×2)m	set	1	45,303,000,000	
Ben Tre B=(10×4＋30)m	set	1	394,844,000,000	Ba Tri B=10m	set	1	40,556,000,000	Sluice B=7.5m	set	2	61,284,000,000	
Ben Ro B=(10×2)m	set	1	63,034,000,000	Sau Chiem B=10m	set	1	40,556,000,000	Sluice B=5m	set	5	124,994,000,000	
Tan Phu B=(10×2)m	set	1	60,635,000,000	Sluice B=(7.5×2)m	set	1	45,303,000,000	Sluice B=3m	set	6	95,378,000,000	
1-2Management buildings for sluices				Sluice B=10m	set	2	68,437,000,000	**1-2Minor sluices in upstream area**				
Management Building (S=300m	set	2	5,455,000,000	Sluice B=7.5m	set	1	30,641,000,000	Small sluices (box culvert)	set	109	638,222,000,000	
Management Building (S=60m	set	2	1,091,000,000	Sluice B=5m	set	8	199,990,000,000	**1-3Management buildings for sluices**				
1-3Dredging of canals	set	1	772,954,000,000	Sluice B=3m	set	7	111,273,000,000	Management Building (S=45m	set	14	5,727,000,000	
				1-2Minor sluices in downstream area				**1-4River dike in upstream are**	set	1	117,703,000,000	
				Small sluices (box culvert)	set	63	368,881,000,000					
				1-3Management buildings for sluices								
				Management Building (S=60m^2)	set	1	545,000,000					
				Management Building (S=45m^2)	set	21	8,591,000,000					
				1-4River dike in downstream area			176,555,000,000					
2.Land acquisition and compensation			**31,624,000,000**	**2.Land acquisition and compensation**			**731,423,252,380**	**2.Land acquisition and compensation**			**671,124,927,620**	**1,434,172,180,000**
3.Project management cost	%	1.0	**18,944,870,000**	**3.Project management cost**	%	1.0	**11,592,420,000**	**3.Project management cost**	%	1.0	**10,886,110,000**	**41,423,400,000**
4.Consulting services cost	%	8.0	**151,558,960,000**	**4.Consulting services cost**	%	8.0	**92,739,360,000**	**4.Consulting services cost**	%	8.0	**87,088,880,000**	**331,387,200,000**
5.Other expenses	%	2.0	**37,889,740,000**	**5.Other expenses**	%	2.0	**23,184,840,000**	**5.Other expenses**	%	2.0	**21,772,220,000**	**82,846,800,000**
6.Tax	%	10.0	**208,393,570,000**	**6.Tax**	%	10.0	**127,516,620,000**	**6.Tax**	%	10.0	**119,747,210,000**	**455,657,400,000**
7.Contingency	%	10.0	**234,289,814,000**	**7.Contingency**	%	10.0	**214,569,849,238**	**7.Contingency**	%	10.0	**199,923,034,762**	**648,782,698,000**
Total			**2,577,187,954,000**	**Total**			**2,360,268,341,618**	**Total**			**2,199,153,382,382**	**7,136,609,678,000**
(Yen converted)		0.0038	9,793,314,225	(Yen converted)		0.0038	8,969,019,698	(Yen converted)		0.0038	8,356,782,853	27,119,116,776
O&M(1,000VND/year)			**18,945,000**	**O&M(1,000VND/year)**			**11,592,000**	**O&M(1,000VND/year)**			**10,886,000**	**41,423,000**

5.2 Disbursement Schedule for the Stage 1 Construction

Proposed implementation terms are 4 years for the Stage 1 construction, 4 years for the Stage construction and another 4 years for the last Stage 3 construction. Of them, implementation schedule of the Stage 1 is elaborated in Table 5.2.1 and also the disbursement schedule of the Stage 1 cost is in Table 5.2.2. First year of the Stage 1 is meant to implement relocation of the 42 households and also detail design sharing 40% of the consultancy services. Actual construction starts from year 2 and takes total 3 years.

Table 5.2.1 Proposed Implementation Schedule of the Project

Activities	Year 0				Year 1				Year 2				Year 3				Year 4			
	QI	QII	QIII	QIV	QI	QII	QIII	QIV	QI	QII	QIII	QIV	QI	QII	QIII	QIV	QI	QII	QIII	QIV
	Preparation								Construction											
I Project preparation																				
Finalization of FS																				
Field Work																				
Project Appraisal																				
Negotiation, exchange of note verbale																				
Signing of Loan Agreement (LA)																				
Finalization of implementation																				
II Detailed Design(DD)																				
Selection of consultant																				
Implementation																				
Survey																				
Detailed Design																				
III Consultancy serveices for project implementation																				
Selection of consultant																				
Implementation																				
IV Site clearance and compensation																				
Implementation																				
V Project implementation																				
Tendering for construction works																				
Construction works																				

Table 5.2.2 Disbursement Schedule of the Project Cost (Loan Portion Only)

Year	Year 1	Year 2	Year 3	Year 4	Total
'000 VND total	92,247,584	745,482,111	993,976,148	745,482,111	2,577,187,954
'000 JP total	3,505,408	28,328,320	37,771,094	28,328,320	97,933,142
'000 VND (loan portion)	60,623,584	665,913,657	887,884,876	665,913,657	2,280,335,774
'000 JP total (loan portion)	2,303,696	25,304,719	33,739,625	25,304,719	86,652,759
Share, %	4	29	39	29	100

5.3 Operation and Maintenance Costs

Annual operation and maintenance cost includes such main items as salaries and allowances for operation management staff, materials required, energy for operation, regular repairing cost, depreciation of fixed asset, management cost of enterprise in charge of its operation and maintenance and others. The annual required cost of the operation and maintenance is assumed at 1 percentage of the construction cost, which is estimated as below:

Table 5.3.1 Operation and Maintenance cost (Unit, 1,000 VND/pear)

Item	Stage 1	Stage 2	Stage 3	Total
'000 VND/year	18,945,000	11,592,000	10,886,000	41,423,000
Yen/year	71,991,000	44,049,600	41,366,800	157,407,400

Note: 1 VND = 0.0038 yen

CHAPTER 6 SOCIAL AND ENVIRONMENTAL CONSIDERATION

Ben Tre Province is one of provinces which have been affected by saline water intrusion severely in the Mekong Delta and most of the provincial area has an experience being damaged due to the climate change. During village level workshops, drought and saline water intrusion were identified as critical issues for the province. Main farm products in the province are fruits and coconut while paddy field area accounts for only 27% of the total land.

In fact, fruit production is more profitable as compared with paddy production. In this case, however, damage to orchard by saline water intrusion is more significant; therefore, construction of four major sluice gates, namely, Ben Tre Sluice, An Hoa Sluice, Tan Phu Sluice and Ben Ro Sluice is proposed in the North Ben Tre province. This chapter discusses environmental impacts to be anticipated by the project.

6.1 Framework of Compensation Policy, Land Clearance and Resettlement

Following law, regulations and decrees are to be referred and applied in compensating the items required under the Project:

6.1.1 Legal and Regulation Documents of the Vietnamese Government

- ✓ Constitution of the Socialist Republic of Vietnam dated April 15th, 1992.
- ✓ New land law of Vietnam passed by the National Assembly on November 26th, 2003 for replacement of the Land law 1993.
- ✓ Decree No. 64/CP dated September 27th, 1993 on delivering agricultural land to individual households to use for long-term agricultural production.
- ✓ Circular No. 05-BXD/DT dated…/2/1993 on decentralizing houses.
- ✓ Decree No. 181/2004/ND-CP dated November 29th, 2004 on guiding implementation of the new land law 2003.
- ✓ Decree No. 182/2004/ND-CP dated November 29th, 2004 on giving penalty on administrative breaches in land use.
- ✓ Decree No. 188/2004/ND-CP dated November 16th, 2004 on determining price and price frame of types of land.
- ✓ Circular No. 114/2004/TT-BTC dated November 26th, 2004 of the Ministry of Finance guiding implementation of Decree No. 188/2004/ND-CP dated November 16th, 2004 of the Government on method of defining price and price frame of types of land.
- ✓ Decree No. 197/2004/ND-CP dated December 3rd, 2004 of the Government on compensating aid and resettlement when the state withdraws land (in replacement of the Decree No. 22/CP).
- ✓ Circular No. 116/2004/TT-BTC dated December 7th, 2004 of the Ministry of Finance on guiding implementation of the Decree No. 197/2004/ND-CP dated December 3rd, 2004 of the Government on compensating aid and resettlement when the state withdraws land.
- ✓ Decree No. 198/2004/ND-CP dated December 3rd, 2004 of the Government on collecting land tax and guiding enforcement of the Circular No. 117/2004/TT-BTC of the Ministry of Finance.
- ✓ Decree No. 69/2009/ND-CP dated August 13th, 2009 of the Government additionally stipulating plan of land use, land price, land withdrawal, compensation, and resettlement aid.

- ✓ Decision No. 02/2008/QD-UBND of Ben Tre Provincial People's Committee dated January 11th, 2008 on promulgating new price list of newly built buildings, and architectural objects.
- ✓ Decision No. 27/2008/QD-UBND dated December 23rd, 2008 of Ben Tre Provincial People's Committee on promulgating price of types of land in 2008.

6.1.2 New Land Law 2003

The new law was promulgated in November 26th, 2003 and has been effective since July 1st, 2004 in replacement of the land law 1993.

6.1.3 Decree No. 197/CP dated December 03rd, 2004

The Government of Vietnam has promulgated Decree No. 197/ND-CP on policy of compensation, aid and resettlement when the State withdraws land in replacement of the Decree No. 22/CP. In addition, the Government has promulgated instructions to implement this Decree (116/2004/TT-BTC). Along with the land law 2003, the Decree No. 197/CP is one of the next steps to nearly approach to the World Bank's objectives, policies on involuntary resettlement.

6.1.4 Resettlement Policy of Vietnam

Articles 6, 9, 18, 19, 20, 26, 28, 29 according to the Decree No. 197/CP.

Articles 33 - 38 according to the Decree No. 197/CP.

6.2 Responsibilities for Land Clearance, Compensation & Resettlement

Since North Ben Tre Project includes 4 districts and 1 city, itis required to establish a district and city level Resettlement Council according to the regulations of the Decree No. 197/2004/CP. In the provincial level, the Provincial Verification Council will play a role as a consultancy agency of the Provincial People's Committee for issues related to compensation, resettlement in the scope of the province, including North Ben Tre irrigation system. Implementation of resettlement compensation of the subproject requires close coordination among relevant organizations, agencies, departments of provincial, district, and communal levels. Policies and articles of this resettlement plan after there is approval from the Provincial People's Committee will be official legal base for implementing compensation, resettlement of North Ben Tre Project.

6.2.1 Ben Tre Provincial People's Committee

Ben Tre Provincial People's Committee is the highest competent authority in the provincial level. With the support of the Provincial Compensation Verification Council, the Provincial Resettlement Council will be responsible for:

- ✓ Verifying and approving the resettlement plan of Ben Tre North Project,
- ✓ Making a decision on compensation unit price, recovery assistance levels as well assistance policies for recovering the affected households' lives in accordance with the policies and articles of this resettlement plan as well as general policy framework of the Project,
- ✓ Making a decision on withdrawing land for the project, and
- ✓ Guiding coordination between agencies, departments participating in implementing the resettlement plan.

6.2.2 North Ben Tre Project Management Unit

The Unit under Ben Tre Department of Agriculture & Rural Development is the Employer of the Project. Therefore, North Ben Tre Project Management Unit is responsible for implementing the

resettlement plan of the Project. North Ben Tre Project Management Unit's obligation to execute the resettlement work includes:

- ✓ To manage and monitor resettlement and compensation activities on behalf of the Provincial People's Committee, within the scope of the province's project and under the province's management,
- ✓ To implement or sign contracts for direct implementation of resettlement activities,
- ✓ To guide implementation of all the resettlement activities of the Project in accordance with the policies and instructions of the resettlement plan of the Project,
- ✓ To coordinate with relevant departments, agencies of the province, check and consult the Province's People Committee on compensation price of land and other assets; draft procedures regarding land acquisition and allocation based on principles of this resettlement plan,
- ✓ To coordinate to monitor and supervise implementation of resettlement activities of the Project including detailed measurement and inventory, formulation and completion of compensation alternatives, preparation of compensation summary tables (if signing contracts for implementation of resettlement for the local government),
- ✓ To pay compensation and support money to the affected households or to supervise if signing contracts for assigning these tasks to the local authority, and
- ✓ To assign the plan for agencies to implement.

6.2.3 District and City Levels

People's Committees of Districts and Towns are responsible for defining legal status of land and assets, the works on the withdrawn land, appointing members of District, Town Compensation, Resettlement and Land Clearance Council to assign duties to this Council. District compensation and land clearance council is responsible for:

- ✓ Preparing the resettlement implementation plan of the subproject within the scope of districts and city,
- ✓ Signing contracts with North Ben Tre Project Management Unit to implement the settlement relevant works within the scope of districts. Applying compensation price to land, affected assets and calculating assistance for recovery, formulation of compensation alternatives for households and summarizing compensation alternatives in order that the Provincial People's Committee approves and pays compensation according to the alternative approved by the province after receiving compensation capital or supervising payment of compensation if this work is directly implemented by North Ben Tre Project Management Unit,
- ✓ Appointing conciliators to solve claims of the people affected by the project on compensation policies and rights, and
- ✓ Giving special interest in demand and aspiration of special people groups (ethnic minority groups) and the vulnerable people (children, old people, and female householders/singles).

6.2.4 Communal Level

Communal People's Committee is responsible for:

- ✓ Assigning duties for communal cadres to participate in implementing resettlement activities in their commune,
- ✓ Supporting other organizations including the project management unit to popularize information, organize community meetings and collect opinions of the affected people,

- ✓ Supporting other organizations including project management unit in demographic survey, expense/replacement price survey, detailed measurement and other resettlement activities,
- ✓ Participating in land acquisition and allocation, resettlement, recovery support and other social support activities,
- ✓ Supporting affected objects in all the resettlement activities and recovering living standards,
- ✓ Informing the affected people of schedule of compensation and supervision of compensation,
- ✓ Agreeing to sign compensation documents with the affected people,
- ✓ Ensuring full implementation of claim mechanisms for the affected people, and
- ✓ Recording claims and saving documents on them, ands upporting and consulting the affected objects to quickly solve claims.

6.3 Environmental and Social Consideration

6.3.1 Current Environmental and Social Conditions

Northern part of Ben Tre province is surrounded by two big Mekong tributaries, namely, Cua Dai River and Ham Luong River. GDP in the Province is categorized into low class in the Mekong Delta, and its primary industry in the province accounts for 49% of total GDP. Since the area has been already affected by saline water intrusion, aquaculture of brackish water shrimp has been taking place in the downstream of the province. On the other hand, in the upstream of the province, fruit trees are planted to large extent, which are severely damaged under saline water intrusion. The area adjacent to the construction sites is of rural area.

6.3.2 Project Components which Cause Environmental Impacts

In the project, construction of four major sluice gates, aside from small scale sluices, is proposed to prevent saline intrusion into the agricultural areas. Proposed sluice gates are located on Gian River, Ben Ro canal, Con Doi River and Ben Tre River. Proposed structures and those scales are as shown below:

Table 6.3.1 Structures of Proposed Constructions

Sluice gate	Scale	Location	Notes
An Hoa	10 sluice gates with 10m width and 8.5m height (in total 100m width)	In Gian River of around 600m upstream from the connection point of Gian Hoa River and Tien River	Swing gate (powerless) Vertical lift gate (electric motor)
Ben Ro	4 sluice gates with 10m width and 8.5m height (in total 40m width)	In Ben Ro Canal, 100m upstream of connection point with Soc Sai River	Swing gate (powerless) Vertical lift gate (electric motor)
Tan Phu	2 sluice gates with 10m width and 7.5m height (in total 20m width)	In Con Doi River of around 60m upstream from the diverging point into Ba La River and Bu canal	Vertical lift gate (electric motor)
Ben Tre	2 sluice gates with 10m width and 7.5m height (in total 20m width)	In Ben Tre River, 1000m upstream of diverging point into Ben Tre River and Giong Trom River	Vertical lift gate (electric motor)

Source: JICA Project Team

The construction will results in some negative impacts on surrounding environment. The affected areas are located in rural area and thinly populated. However, there are some houses along the rivers and it is very difficult to avoid resettlement and land recovery. The affected areas are to be Giao Hoa Commune, Long Dinh Commune, Tien Long Commune, Tan Phu Commune and Nhon Thanh Commune, all of which are within in Ben Tre Province. The locations of those sluice gates are illustrated as shown below:

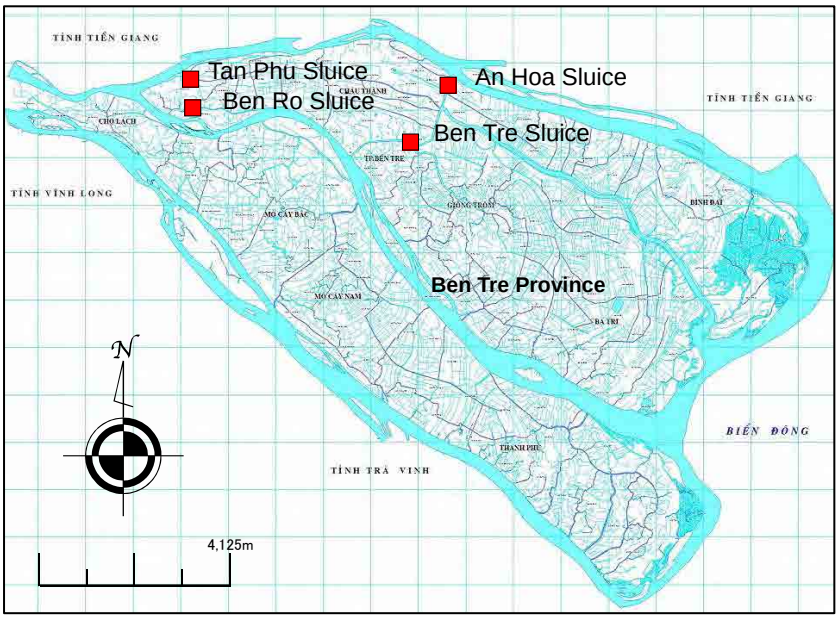

Figure 6.3.1 Location Map of Proposed Sluice Gates in North Ben Tre

6.3.3 Examination of Alternatives

In terms of geographic conditions, convenience/easiness of construction, necessity of resettlement, local people's request, budgetary issue and so on, suitable construction sites are to be examined. For the An Hoa and Ben Tre sluice gates, two options, namely, 1) construction on the shore and 2) construction across the river are examined for each of them. In general, construction in water way is more difficult than that on the shore in terms of construction technique while adverse environmental impacts is relatively small as shown in the following tables.

To reduce the adverse impacts especially from the view point of reducing the resettlement to the maximum extent, construction in the water is recommended for all the proposed sluice gates. Regarding Ben Ro and Tan Phu sluice gates, in fact, there is not enough space to compare the two kinds of options. Only one option which constructs in the water ways is therefore proposed for both of them. Those construction points are illustrated in the following figures.

Table 6.3.2 Examination of Proposed Construction Sites (1) An Hoa Sluice

Environmental items	Option 0 (no project)	Option 1 Sluice construction on the shore	Option 2 Sluice construction in water
Construction site	-	700m upstream from connection point of Bong Bot River and Hau River	600m upstream from connection point of Bong Bot River and Hau River
Resettlement and land acquisition (land recovery)	-	XX	X
Transportation	-	XX	X
Protection of farmland from high tide	XX	+++	+++
Possibility to be regrettable project	None	None	None
Project cost	Zero	High	Medium
Selection	-	-	○

X : small-scale negative impact, XX: middle-scale negative impact, XXX: large-scale negative impact
+ : small-scale positive impact, ++: middle-scale positive impact, +++: large-scale positive impact

Table 6.3.3 Examination of Proposed Construction Sites (2) Ben Ro Sluice

Environmental items	Option 0 (no project)	Option 2 Sluice construction in water
Construction site	-	100m away from connection point of Bong Bot River and Hau River
Resettlement and land acquisition (land recovery)	-	X

Transportation	-	X
Protection of farmland from high tide	XX	+++
Possibility to be regrettable project	None	None
Project cost	Zero	Medium
Selection	-	○

X : small-scale negative impact, XX: middle-scale negative impact, XXX: large-scale negative impact
+ : small-scale positive impact, ++: middle-scale positive impact, +++: large-scale positive impact

Table 6.3.4 Examination of Proposed Construction Sites (3) Tan Phu Sluice

Environmental items	Option 0 (no project)	Option 2 Sluice construction in water
Construction site	-	100m upstream from connection point of Bong Bot River and Hau River
Resettlement and land acquisition (land recovery)	-	X
Transportation	-	X
Protection of farmland from high tide	XX	+++
Possibility to be regrettable project	None	None
Project cost	Zero	Medium
Selection	-	○

X : small-scale negative impact, XX: middle-scale negative impact, XXX: large-scale negative impact
+ : small-scale positive impact, ++: middle-scale positive impact, +++: large-scale positive impact

Table 6.3.5 Examination of Proposed Construction Sites (4) Ben Tre Sluice

Environmental items	Option 0 (no project)	Option 1 Sluice construction on the shore	Option 2 Sluice construction in water
Construction site	-	1km away from the connection point of Ben Tre River and Giong Trom River	1km away from the connection point of Ben Tre River and Giong Trom River
Resettlement and land acquisition (land recovery)	-	XX	X
Transportation	-	XX	X
Protection of farmland from high tide	XX	+++	+++
Possibility to be regrettable project	None	None	None
Project cost	Zero	High	Medium
Selection	-	-	○

X : small-scale negative impact, XX: middle-scale negative impact, XXX: large-scale negative impact
+ : small-scale positive impact, ++: middle-scale positive impact, +++: large-scale positive impact

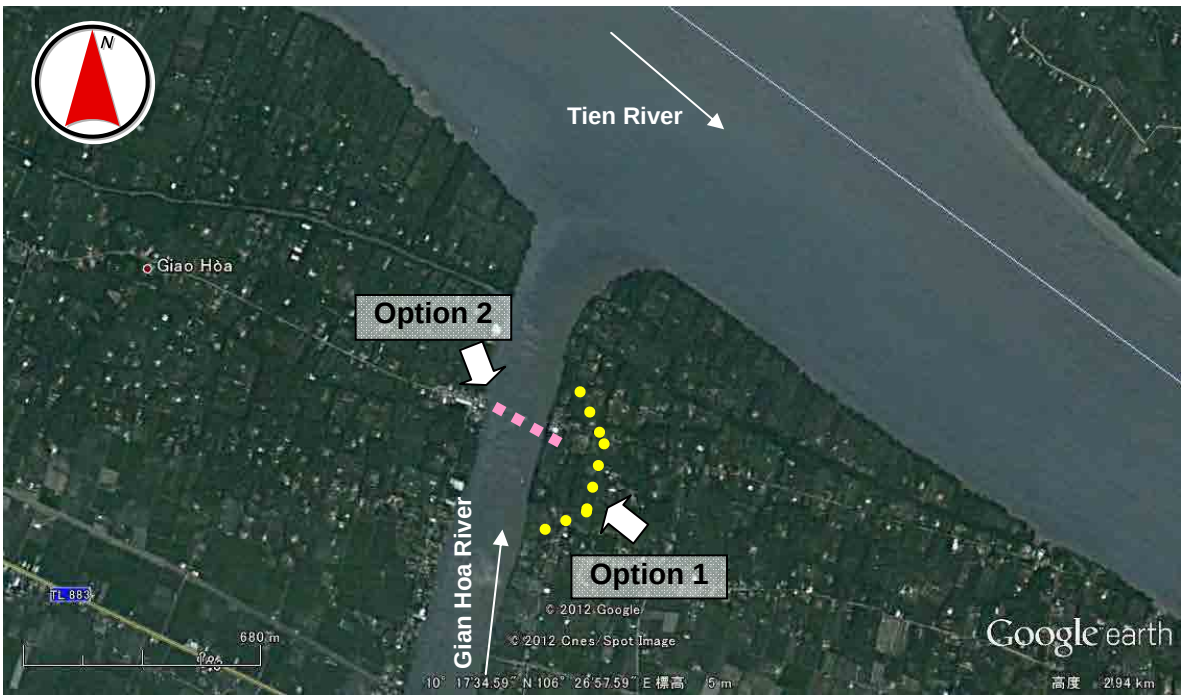

Figure 6.3.2 Location Map of An Hoa Sluice Construction Site

Figure 6.3.3 Location Map of Ben Ro Sluice Construction Site

Figure 6.3.4 Location Map of Tan Phu Sluice Construction Site

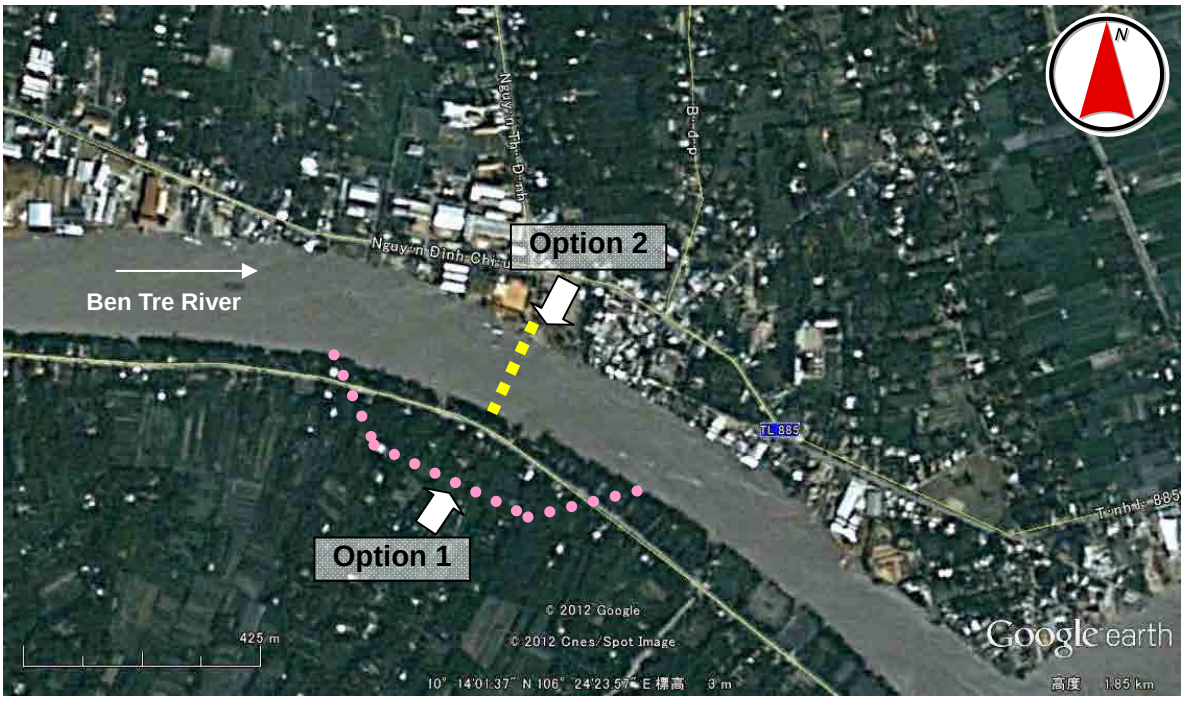

Figure 6.3.5 Location Map of Ben Tre Sluice Construction Site

6.3.4 Scoping and Terms of Reference

Prior to environmental impact assessment, it is needed to examine degrees of environmental impacts by those constructions; so called "Scoping" shall be done. If some negative impacts are anticipated, terms of reference (TOR) to identify study method of EIA shall be described. Scoping of those constructions and TOR are presented in the following table.

Table 6.3.6 Scoping

Environmental Parameters	Evaluation		Reasons
	Construction phase	Operational phase	
1. Air Pollution	B	D	Due to the construction works, air quality deterioration such as dust generation and gas emission from construction vehicles is expected, however, it will be temporally. After the completion of works, no air pollution is anticipated.
2. Water Pollution	B	D	Drainage from construction sites, heavy industrial machines, vehicles and so on is expected. However, the period water is polluted is limited.
3. Waste	B	D	Construction waste will be dumped during construction phase.
4. Soil Contamination/ salinization	B	D	Oil leakage from construction vehicles can be caused, however, its scale is limited to construction phase.
5. Noise and Vibration	B	D	Noise due to construction works and transportation of construction vehicles is anticipated. However, it is temporary.
6. Ground Subsidence	D	D	Ground subsidence is not expected both during and after works.
7. Offensive Odor	D	D	Offensive odor is not expected both during and after works.
8. Bottom sediment	D	D	Bottom sediment is not expected both during and after works.
9. Protected area	D	D	There is no protected area which is located adjacent to the construction sites.
10. Ground water	D	D	The works does not give any impacts on ground water.

Environmental Parameters	Evaluation		Reasons
	Construction phase	Operational phase	
11. Hydrological Situation	D	D	Due to construction works to prevent from saline water intrusion, hydrological situations will be changed, however, it will be positive. In addition, the project will not prevent flow of main Mekong subsidiaries.
12. Topography and Geographical features	D	D	No topographical and geographical impacts by the works will be caused.
13. Involuntary Resettlement	B	D	Some household are requested to resettle for the works.
14. Land Acquisition	B	D	Some land is recovered for construction works.
15. Cultural heritage	D	D	There is no cultural heritage in and around sites.
16. Landscape	D	D	No adverse effect on landscape is anticipated.
17. The indigenous and ethnic people	D	D	There is no ethnic minority in and around construction sites.
18. Livelihood	D	D	Although some households are requested to resettle.
19. Local economy	D	D	The scale of resettlement and land recovery is not big and prevention of saline water intrusion will give positive impacts on local economy in general.
20. Existing social infrastructures and services	B	B	During construction works, traffic jam can be caused by the increase of traffic volume. Shipment can be affected in and after construction.
21. Misdistribution of benefit and damage	D	D	Except those who to be resettled, the people can enjoy decrease of damage by saline water intrusion.
22. Social institutions	D	D	Since the number of resettlement is not very big, negative impact on social institution will be negligible.
23. Water Usage or Water Rights and Rights of Common	D	D	Due to the prevention of saline water intrusion, the local people can access to fresh water more than present.
24. Gender	D	D	No negative impact in terms of gender is expected.
25. Children rights	D	D	Damage to children rights is not anticipated.
26. Hazards (Risk), Infectious diseases such as HIV/AIDS	D	D	No hazard or infectious disease is expected both during and after works.
27. Accidents	B	D	During construction, there is a possibility that number of accident will be increased due to increase of traffic for construction works.
28. Global Warming	D	D	No global warming by the works is anticipated.

A: Significant negative impact, B: Small to medium negative impact,
C: Unknown, D: Positive or negligible negative impact

Table 6.3.7 Terms of Reference

Environmental Parameters	Study Contents	Study Method
Air Pollution	• General situations in the adjacent area of construction sites	• Confirmation of construction period, construction sites, number of construction vehicles
Water Pollution	• Information collection of other similar cases	• Examination of drainage from construction sites
Waste	• Waste disposal method	• Confirmation of existing data and information • Data collection in other similar projects
Soil Contamination/ salinization	• Oil leakage from construction vehicles	• Confirmation of situations in other similar projects
Noise and Vibration	• General situations in the adjacent area of construction sites	• Confirmation of location of hospital, school, residential areas and so on

Environmental Parameters	Study Contents	Study Method
Involuntary Resettlement	• Number of households to be relocated • Extent of affected area	• Interview to local people • Confirmation of general conditions in and around the construction sites • Cost estimation for resettlement
Land Recovery	• Area to be recovered	• Confirmation of land recovery area • Cost estimation of compensation for land recovery
Existing social infrastructures and services	• Traffic jam due to the project	• Confirmation of situations in other similar plans
Accidents	• Possibility of accident	• Confirmation of situations in other similar plans

Source: JICA Project Team

6.3.5 Results of Environmental Examination

The sites are located in rural area, there is no school or hospital near the sites and there is no habitat of rare flora and fauna such as protected area in and around the sites. Given that the proposed constructions will not close main tributaries of Mekong River but basically canals, and the endangered species are rarely observed in the main and small tributaries in the Mekong Delta, significant nagative impacts on fish spicies are not anticiapted.

Aside from the threatened fish species, the Riverine Irrawaddy Dolphin (*Orcaella brevirostris*) is very famous as a flagship endangered wildlife in the Mekong River. The freshwater sub-population ranges in the Mekong River. It is said that oil from boats, blast fishing, gillnet entanglement and so on have damaged the species[1] and recently the sighting of dolphin within Vietnam is very rare. The sub-population in the Mekong River is designated as critically endangered by IUCN in 2004 and the population numbers is estimated at 127 minimally (WCS, 2007)[2]. The project constructs gates in the tributaries only, and not on the Mekong River itself, and therefore the project will not give negate impact to the flagship.

With respects to land acquisition, total 42 households have to be relocated, and farmland, orchard garden and residential area will have to be recovered. In addition, 33 power poles, one temple and 31 graves will also be relocated. Other impacts such as air pollution are limited to only construction period and will not be very severe. Transportation by water during construction phase will be affected to some extent. However, it is possible to mitigate the impact by application of modified construction method, which closes water way half-and-half for the construction. In operation phase, if the sluices are equipped with lock gate, the adverse effect on shipping will not be significant.

Therefore taking into account above examination, the main issues caused by the constructions by the project are resettlement and land recovery.

6.3.6 Evaluation

Based on the examination discussed above, anticipated environmental impacts are presented in the following table:

Table 6.3.8 Environmental Evaluation

Environmental parameters	Evaluation at Scoping		Evaluation based on IEE		Reasons
	Construction phase	Operation phase	Construction phase	Operation phase	
1. Air Pollution	B	D	B	D	Due to the construction works, air quality deterioration such as dust generation and gas emission from construction vehicles is expected,

[1] IUCN, 2011, The IUCN Red List of Threatened Species, http://www.iucnredlist.org/apps/redlist/details/44555/0

[2] Wildlife Conservation Society (WCS), 2007, Status and Conservation of Freshwater Populations of Irrawaddy Dolphins, Working Paper No. 31

Environmental parameters	Evaluation at Scoping		Evaluation based on IEE		Reasons
	Construction phase	Operation phase	Construction phase	Operation phase	
					however it will be temporally. After the completion of works, no air pollution is anticipated.
2. Water Pollution	B	D	B	D	Drainage from construction sites, heavy industrial machines, vehicles and so on is expected. However, the period water is polluted is limited.
3. Waste	B	D	B	D	Construction waste will be dumped during construction phase.
4. Soil Contamination/ salinization	B	D	B	D	Oil leakage from construction vehicles can be caused, however, its scale is negligible and limited to construction phase.
5. Noise and Vibration	B	D	B	D	Noise due to construction works and transportation of construction vehicles is anticipated. However, it is temporary, there is no hospital nor school.
6. Ground Subsidence	D	D	D	D	Ground subsidence is not expected both during and after works.
7. Offensive Odor	D	D	D	D	Offensive odor is not expected both during and after works.
8. Bottom sediment	D	D	D	D	Bottom sediment is not expected both during and after works.
9. Protected area	D	D	D	D	There is no protected area which is located adjacent to construction sites.
10. Ground water	D	D	D	D	The works does not give any impacts on ground water.
11. Hydrological Situation	D	D	D	D	Due to construction works to prevent from saline water intrusion, hydrological situations will be changed, however, it will be positive. In addition, the project will not prevent flow of main Mekong subsidiaries.
12. Topography and Geographical features	D	D	D	D	No topographical and geographical impacts by the works will be caused.
13. Involuntary Resettlement	B	D	B	D	42 household are requested to resettle for the works.
14. Land Acquisition	B	D	B	D	Farmland, orchard garden and residential area will be recovered temporarily and permanently for construction works.
15. Cultural heritage	D	D	D	D	No cultural heritage in and around construction site.
16. Landscape	D	D	D	D	No adverse effect on landscape is anticipated.
17. The indigenous and ethnic people	D	D	D	D	There is no ethnic minority in and around construction sites.
18. Livelihood	D	D	D	D	Although some households are requested to resettle have to restart their livelihood in new area, others will not be affected negatively.
19. Local economy	D	D	D	D	The scale of resettlement and land recovery is not big and prevention of saline water intrusion will give positive impacts on local economy.
20. Existing social infrastructures and services	B	B	B	B	During construction works, traffic jam can be caused by the increase of traffic volume and transportation by water can be affected. Half-and-half construction method is to be applied to minimize impacts on shipment. If the sluices are equipped with lock gate, shipment

Environmental parameters	Evaluation at Scoping		Evaluation based on IEE		Reasons
	Construction phase	Operation phase	Construction phase	Operation phase	
					will not be affected after the construction works.
21. Misdistribution of benefit and damage	D	D	D	D	Those who stay around construction sites can enjoy decrease of damage by saline water intrusion
22. Social institutions	D	D	D	D	Since the number of resettlement is not very big, negative impact on social institution will be negligible.
23. Water Usage or Water Rights and Rights of Common	D	D	D	D	Due to the prevention of saline water intrusion, the local people can access to fresh water more than present.
24. Gender	D	D	D	D	No negative impact in terms of gender is expected.
25. Children rights	D	D	D	D	Damage to children rights is not anticipated.
26. Hazards (Risk), Infectious diseases such as HIV/AIDS	D	D	D	D	No hazard or infectious disease is expected both during and after works.
27. Accidents	B	D	B	D	During construction, there is a possibility that number of accident will be increased due to increase of traffic for construction works.
28. Global Warming	D	D	D	D	No global warming by the works is anticipated.

Source: JICA Project Team

6.3.7 Mitigation Measure

Some adverse effects by the project are anticipated, and in general they are limited to construction phase only; namely, the damages are temporary and recoverable, e.g. air pollution, water pollution and noise. Those mitigation measures are to be covered by construction companies. It is possible to minimize such impacts by some mitigation measures as shown in the following table. DARD and DONRE is to monitor whether those mitigation measures are taken as planned. For operation phase, internal and external monitoring will be implemented to check the resettled households and their living conditions, and the monitoring cost shall be included in the management cost for resettlement.

Table 6.3.9 Mitigation Measures

Environmental Parameters	Mitigation measures	
	Construction phase	Operation phase
Air Pollution	• Setting of temporary enclosure • Utilization of construction machines equipped with reduction of gas emission reduction system • Regular check and full maintenance of construction vehicles • Water spray in and around entrances of construction sites	-
Water Pollution	• Waste water treatment before discharge into rivers	-
Waste	• Classification waste dumping, recycle, reduction of waste • Entrustment of Proper disposal of waste which can not be reused to dismantling operator	-
Soil Contamination/ salinization	• Ditto	-
Noise and Vibration	• Setting of temporary enclosure • Utilization of construction machines with less noise and vibration • Not to work during nighttime and to use detour in the residential area	-
Existing social infrastructures and services	• Half-and-half construction method is to be applied to minimize impacts on shipment for construction phase. • To set lock gate for no disturb of shipment after construction works	

Environmental Parameters	Mitigation measures	
	Construction phase	Operation phase
Involuntary Resettlement	• to keep residential area from construction roads and material storage sites	Monitoring
Land Recovery	Ditto	Monitoring
Existing social infrastructures and services	• To ensure enough width of road and to prepare turnout according to necessity • Decentralization of construction vehicles by disperse traveling route	-
Accidents	• Proper management of construction vehicle operation to minimize centralization • Instruction on compliance with prescribed routes, speed, to drivers of construction vehicles	-

6.3.8 Monitoring Plan

Anticipated environmental impacts are limited to construction phase, monitoring will be implemented during the period. Since the environmental parameters which can be affected by the construction works are air pollution, water pollution, waste and noise, those items will be monitored. Although there is no standard of water quality of effluent from sites of construction for water resource in Vietnam, according to MONRE, it is possible to apply QCVN 08/2008 National Technical Regulation on Surface Water Quality, Class 2B[3] for water quality monitoring. The responsible organization for the monitoring activities is DARD and DONRE. Regarding monitoring of resettlement, details are discussed in next sub-chapter. The proposed monitoring plan is as shown below:

Table 6.3.10 Recommended Monitoring Plan (Construction Phase)

Environmental Parameter	Monitoring Item	Survey point	Standard	Frequency	Responsible Organization
Air pollution	NOx SOx Ozone CO TSP	Construction site	200μg/m^3/hour 350μg/m^3/hour 180μg/m^3/hour 30,000μg/m^3/hour 300μg/m^3/hour	Once per month	DARD and DONRE
Water pollution	pH TSS Total oil and grease	Drainage outlet	6.5-8.5 <100mg/l <0.3mg/l (QCVN-38/2011)	Once per month	DARD and DONRE
Noise and vibration	Noise (dB)		70 dB	Once per month	DARD and DONRE
Waste	Volume of waste		-	Once per month	DARD and DONRE
Safety	Working environment	-	-	Once per month	DARD and DONRE

6.4 Resettlement

At the stage of alternative examination as mentioned above, attention to minimize land recovery and resettlement was paid considering the natural conditions, budget and people's opinions. Still, however, proposed four sluice gate constructions will have to accompany involuntary resettlement and land recovery.

6.4.1 Scope of Resettlement

1) Project Affected Persons

The affected area is located in Ben Tre Province, Giao Hoa Commune, Long Dinh Commmune, Nhon Thanh Commune, Tien Long Communs and Tan Phu Commune. The total number of affected households arrives at 42 as follows:

[3] Class 2B: water quality limitation for traffic by water and other purposes with requirements of low water quality

Table 6.4.1 Distribution of Affected Households

Sluice's Name	Province	Communes which affected houses are located	No. of households
An Hoa	Ben Tre	Giao Hoa	18
		Long Dinh	12
Ben Tre	Ben Tre	Nhon Thanh	1
Ben Ro	Ben Tre	Tien Long	3
Tan Phu	Ben Tre	Tan Phu	8
Total			42

Source: JICA Project Team

As mentioned before, 42 households are to be relocated by the construction works. According to a household survey by the JICA Team (2012), one household, which depends on labor, does not have official certificate of land use for residential area. In addition, two stores are to be relocated and they have rented the land from the government for their business and they have to return the lands for the project. The number of project affected unit and affected persons by each site is shown in the following table:

Table 6.4.2 Number of Project Affected Units and Affected Persons

Type of loss	No. of Project Affected Units			No. of Project Affected Persons		
	Legal	Illegal	Total	Legal	Illegal	Total
Private household (structure on private land)	41	1	42	196	3	199
Temple*1	1	0	1	Not Countable	0	Not countable
Stone shop (for construction)*2	2	0	2	Around 10	0	Around 10

Source: JICA Project Team, 2012

*1: Nobody stays in the structures at this moment.

*2: Only workers stay in the shop during business hours. The stone shops lend governmental land, therefore, they are eligible for only transportation based on actual expense instead of regulated one.

2) Land and Structures to be recovered

In addition to the relocated 42 households, one temple, 33 electric poles and 31 graves are to be relocated. Temporary and permanent land losses of orchard garden and farmland is also expected, and in addition permanent land loss of residential area is anticipated. The detail affected lands, structures and other properties are as follows:

Table 6.4.3 Properties and lands to be Affected

No	Items	Unit	An Hoa	Ben Tre	Ben Ro	Tan Phu	Total
1	House of local resident		30	1	3	8	42
	・Thatched house	Unit	4	0	1	0	5
	・Tile house	Unit	3	0	0	1	4
	・Iron sheet house	Unit	7	0	0	1	8
	・Brick house	Unit	16	1	2	6	25
2	Grave	Unit	19	12	-	-	31
3	Temple	Unit	1	0	-	-	1
4	Relocation of power pole	Poles	17	12	-	4	33
5	Temporary land loss area						
	. Residential land	ha	0.00	0.00	0.00	0.00	0.00
	. Agricultural land (not specified)	ha	7.09	2.91	0.75	2.10	12.85
6	Permanent land loss						
	. Residential land	ha	0.56	0.49	0.06	0.16	1.27
	. Garden land	ha	0.84	1.96	3.15	1.50	7.46
	. Farmland	ha	1.40	0.00	0.00	0.00	1.40
7	Tree uprooting						
	. Coconut-palm	Tree	1,200	600	1,200	700	3,700
	. Other trees	Tree	800	400	800	500	2,500

Source: JICA Team, 2012 for number of households and temporary agricultural land area, and HEC II, 2004 for other items

3) Income Source

In the affected area, main income source is fruit production, and 25 households out of 42 households, who have to be resettled, depend on production of coconut, rambutan, longan, etc. to make their living. The second main income source is labor, which 10 households are engaged in. Concerning other households, income sources are various such as livestock, driver, shipping, supported by their children and woodwork. The main income sources of affected houses by sluice constructions are summarized below:

Table 6.4.4 Main Income Source of Affected Households in Ben Tre (Unit: number of households)

Main income source	An Hoa Sluice	Ben Ro Sluice	Tan Phu Sluice	Ben Tre	Total
Fruit production	15	3	6	1	25
Paddy	0	0	0	0	0
Labor	8	0	2	0	10
Livestock	1	0	0	0	1
Others	6	0	0	0	6
Total	30	3	8	1	42

Source: Household survey by the JICA Team, 2012

Annual income of farm households is a little higher than that of other households, 73 million VND and 51 million VND, respectively. It is probably because that fruit production is more profitable than other jobs such as labor. Concerning educational background, one person holds bachelor of degree, and five interviewees have finished grade 12 (excluding the bachelor). Average education level is around 7/12, and all interviewees have been to primary school. All of them can access to electrical power, while only seven households can access to piped water supply system.

Table 6.4.5 Annual Income of Affected Households in Ben Tre (Unit: million VND/year)

Item	Agricultural household	Nonagricultural household	Average
Farm income	61	4	38
Other income	12	47	26
Total	73	51	64

Source: Household survey by the JICA Team, 2012

4) Consideration for Marginalized People

One household does not have the official certificate and nor is qualified as land user since they have stayed for only 15 years[4]. Even though there was a case that if they had reclaimed the land by themselves, they were to be compensated at 50% of full compensation for land loss in Ben Tre Province in 2012. The households can not be satisfied with the condition, neither, which makes it difficult to support the household. It is said that commune level PC pays consideration to such marginalized people even though they are not qualified as official land user. It is in any case recommended to take consideration to the household.

5) Entitlement

Depending on the type of loss and entitlement, supports to the affected persons will have to be provided. Details of support for resettlement such as duration of job training are, however, not specified in the relevant decree and therefore those matters will be directed by PPC (refer to Decree 69/2009-ND-CP). Entitlement matrix is shown as below:

[4] According to Article 51 of Low on Land (2003), if a household does not have the certificates, but the land has been occupied since prior to 15 October 1993, the household is qualified to be issued certificate.

Table 6.4.6 Entitlement Matrix

Type of loss	Definition of entitlement person	Entitlement
Permanent land loss	Land user who satisfy the conditions of the compensation according to the law	1) Cash compensation for acquired land, or 2) Land provision
Temporary land loss	Land user who satisfy the conditions of the compensation according to the law	Cash compensation for acquired land, or
Loss of house/structure	User of the house/structure	1) Compensation for affected constructions with 100% of replacement price, or 2) Compensation price being calculated on real affected area
Loss of standing crops and trees	Lost crop	Compensation for lost crop based on regulation
Assistance for restoration (1)	Households to be resettled	Support for transportation to the resettled area (4.5 million VND/household based on Decision 19/2011/QD-UBND of PPC of Ben Tre)
Assistance for restoration (2)	Households to be resettled	Support for life and production stabilization, and support for job-change training and job creation in case of recovery of agricultural land (Cash support equal to 1.5-5 times the agricultural land price) based on Decree No.69/2009/ND-CP 12/2/2009
Assistance for restoration (3)	Households to be resettled	Monetary support to affected person to stabilize their livelihood (6month*30Kg rice *11000 VND per person)
Assistance for restoration (4)	Vulnerable persons	Not specified in the laws, People's Committee at commune level will decide depending on the situations of affected persons.

Source: JICA Project Team

6.4.2 Compensation Measures

1) Compensation for Loss and Support

Since unit prices are determined depending on the conditions of provinces, unit prices of Ben Tre is applied for the cost estimation of compensation. Estimated compensation cost is as follows

Table 6.4.7 Compensation for Loss

No	Items	No.	Quantity	Unit	Unit price (VND)	Amount (million VND)	Source
I	House of local resident					-	
	・Thatched house	5	300	m^2	300,000	90	*1
	・Tile house	4	240	m^2	2,000,000	480	*1
	・Iron sheet house	8	480	m^2	600,000	288	*1
	・Brick house	25	1,500	m^2	2,500,000	3,750	*1
II	Standing crop and other structures					-	
1	Grave		31	Unit	3,000,000	93	*2
2	Temple		1	Unit	20,000,000	20	*2
3	Relocation of power pole		33	Unit	15,000,000	495	*3
4	Paddy		-	m^2	-	0	-
5	Coconut-palm		3,700	Tree	300,000	1,110	*2
6	Other trees		2,500	Tree	150,000	375	*2
III	Land loss						
1	Temporary land loss						
	. Residential land		-	ha	300,000,000	0	*4
	. Agricultural land (not specified)		12.85	ha	300,000,000	3,855	*4
2	Permanent land loss					0	
	. Residential land		1.35	ha	2,000,000,000	2,700	*2
	. Garden land		8.88	ha	500,000,000	4,440	*2
	. Farmland		2.90	ha	400,000,000	1,160	*2
IV	Support						
1	Support of transportation of affected houses		42	Unit	4,500,000	189	*2

No	Items	No.	Quantity	Unit	Unit price (VND)	Amount (million VND)	Source
2	Support to changing job		128,500	m^2	90,000	11,565	*5
3	Support to stabilize livelihood		199	Person	1,980,000	394	*6
V	Sub-total					31,004	
VI	Cost for the Board of Compensation, Support and Resettlement (2%)					620	
VII	Grand Total					31,624	

*1: Decision 18/2011/QD-UBND of PPC of Ben Tre, 27th July 2011
*2: Decision 19/2011/QD-UBND of PPC of Ben Tre, 4th August 2011
*3: There is no regulation for electric pole, however, this unit price has been applied so far.
*4: Since there is no regulation, this amount is set based on conventional ways
*5: Generally, twice to three times of unit price of agricultural land has been applied for cost estimation of support to job change, moreover, based on their traditional way in the past, the 90,000 VND for square meter is applied.
6:Cash payment which is equal to 30kg rice to each affected person: 6 months*30kg*11,000 VNG (=1,980,000VND)
*The lands which two stores are located on belong to government and it is regulated to construct only temporary house, which are out of target of compensation except for transportation.

There is a gap between official land unit price and market price in Ben Tre Province. As an average, market price is two times higher than that of governmental rate as shown in following table. According to the Article 56 of Law on Land, those prices must be adjusted for conformity. It is therefore recommended to pay consideration to offset the difference depending on the situations.

Table 6.4.8 Comparison of Official Prices and Market Prices of Land

Sluice's Name	Commune	Province	Governmental Price (1,000 VND/m^2) *1		Market Price (1,000 VND/m^2)*2	
			Residential area	Paddy and Farmland	Residential area	Paddy and Farmland
An Hoa	Giao Hoa	Ben Tre	200	100-120	250-400	250-400
	Long Dinh	Ben Tre	200	100-120	250-400	250-400
Ben Ro	Tien Long	Ben Tre	250	80-110	150-200	150-200
Tan Phu	Tan Phu	Ben Tre	250	80-110	200-300	200-300
Ben Tre	Nhon Thanh	Ben Tre	500*3	320*3	1,000*3	1,000*3

Source *1: No. 36/2011/QĐ-UBND, Decision on Price of Land in Ben Tre
*2: Land management official who manages land in each commune, 2012
*3: Actual compensation unit price which was applied for embankment construction project in 2011 in Ben Tre

2) Restoration of Livelihood

There is a tendency that the affected people prefer cash payment to new land provision as compensation for land recovery, since they like to remain in their hometowns. Out of 25 farm households, only two households hope to receive compensation as land while others prefer monetary compensation, and only four households want to continue farming after the relocation.

Probably, it is because that their places are located near Ho Chi Minh City and they have enough chances to choose various occupations in the urban area. Five farm households and two ones hope to take vocational training and livestock training as a support. The support for job change is considered based on the agricultural area owned by the affected farm homes. In addition, cash payment to stabilize livelihood to each affected person is also included in the cost for compensation described above.

6.4.3 Handling of Complaints

According to No.181/2004, ND-CP/2004 and Decree No.69/2009/ND-CP, anybody who does not agree with presented resettlement plan and compensation, he/she can submit to the "Board of Compensation, Support and Resettlement" chaired by a DPC leader to settle the complaint of individuals and organizations under the Law for complaints and denunciations within thirty (30) working days after receiving the application. If persons, whose land are recovered, do not agree with

the decision of DPC, he/she may initiate lawsuits at people's court or complain to the relevant PPC.

6.4.4 Implementation Structure

There is no big difference among projects depending on scale or category. At first, Project Management Unit (PMU)[5], which is responsible for overall project management, namely, project design, implementation and monitoring is established, and this PMU plays an important role in resettlement, too. Moreover, "Board of Compensation, Support and Resettlement" shall be established prior to resettlement. It is directly responsible organization for a series of resettlement activities. In addition to them, various organizations are concerned to the resettlement; namely, PPC, DPC, Provincial Department of Natural Resources and Environment, Department of Finance, Project Management Unit and so on. Those organizations' tasks are summarized in the following table based on the 197/2004/ND-CP:

Table 6.4.9 Major Tasks of Organizations Concerned

No.	Organization	Task
1	Project Management Unit (PMU)	To design the detailed project to determine the exact boundaries of land acquisition To train staffs joined in the resettlement activities To survey and investigate the population in detail To Present the draft plan for compensation and resettlement to the authorities. After approved, this plan will be reported at the public meeting To relocate the affected people To monitor project progress, the performance analysis, synthesis, evaluation and reporting performance results and propose solutions to solve difficult problems during project implementation to ensure project implementation schedule, proper technical requirements, economic.
2	Board of Compensation and Resettlement Support	To make, submit for approval and organize the implementation of, the compensation, support and resettlement plan; To check accuracy and rationality of inventory statistics, the legality of land and property eligible or ineligible for compensation, supports in the compensation, support and resettlement plans. To receive complaints from affected persons and submit it to DPC
3	PPC	To direct, organize, propagate and mobilize all organizations and individuals concerning compensation, support and resettlement policies and ground clearance according to the land recovery decisions of competent state bodies; To direct the provincial/municipal services, departments, branches and district-level People's Committees: To approve or assign the district-level People's Committees to approve compensation, support and resettlement plans; To approve land prices; promulgate the property price tables for compensation calculation; prescribe support levels and supporting measures according to their competence; resettlement arrangement plans, job change training plans according to their assigned competence; To direct the concerned agencies to settle citizens' complaints, denunciations related to compensation, support and resettlement according to their law-prescribed competence; To guarantee impartiality and equity when considering and deciding on the compensation, support and resettlement when land is recovered by the State according to their competence prescribed in this Decree; To decide or assign the district-level People's Committees to apply coercion to cases of deliberately failing to abide by the State's land recovery decisions according to their competence; To direct the examination and handling of violations in the compensation, support and resettlement domain.
4	DPC	To direct, organize, communicate and mobilize all organizations and individuals on policies of compensation, support, resettlement and site clearance that are done in accordance with the land revoking decision of State competent agencies. To direct board of compensation and resettlement support for setting up and organizing methods for compensation, support and resettlement, implement approved plan of compensation, support and resettlement.

[5] PMU is an organization which has responsibilities for management and implementation of projects including resettlement activities. It can be formed from personnel of the investor or as an organization hired by the investors.

		To settle complaints and denunciation for compensation To coordinate with provincial Departments, institutions and Investor in implementation of project construction, plans for creating a resettlement area locally as assigned by PPC
5	People's Committees of communes	To coordinate with the compensation, support and resettlement boards in certifying land and property of persons who have land recovered; To join in, and create conditions for, the payment of compensation and support money to, and arrange resettlement for, persons who have land recovered, and create conditions for the ground clearance.
6	Department of Natural Resources and Environment	To guide the determination of land area, soil type, land position, land area and conditions for compensation, land without compensation when the State revokes land. To guide the determination of the size of land that is eligible for compensation or no compensation, the amount of compensation or support for each of revoked land users as the basis for the calculation of compensation and support for each object. To guide for uniform inventory forms, using price for compensation and resettlement, support for Board of Compensation, support and resettlement of districts, cities in the province.
7	Department of Planning and Investment	To guide and supervise the establishment and implementation of resettlement projects.
8	Construction Department	To guide the determination of the size, area, legitimacy, illegality of the construction works associated with the revoked land as the basis for the calculation of compensation and support for each object. To make price list for housing, new construction projects and submit to PPC for issuing decision as a basis for calculating the value of compensation.
9	Department of Finance and Provincial Inspector	To check the payment of compensation, support and costs for works of organizing compensation payment and resettlement support locally.
10	Working group*	To advise and assist PC of Districts to inspect and supervise the implementation of regulation on compensation, support and resettlement

*Working group is established if a project covers plural districts.

The resettlement system in Vietnam is very complicated, however, an organization which plays a central role is Board of Compensation, Resettlement and Support, which is chaired by official personnel of DPC. Main implementation organizations of resettlement can be illustrated as follows and the system is applied in any projects in general in the country:

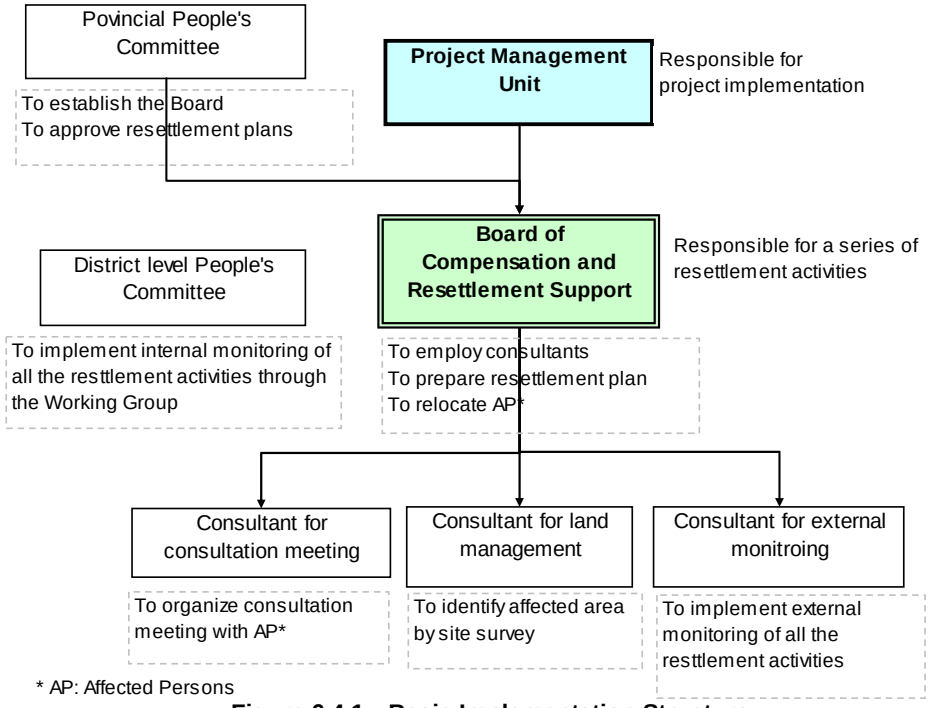

Figure 6.4.1 Basic Implementation Structure

6.4.5 Implementation Schedule

After the approval of the program, a series of resettlement activities will be implemented based on

following procedure:

1) Establish of Board of Compensation, Support and Resettlement

Board of Compensation, Support and Resettlement will be established by means of initiative of PPC and the board shall include 1) a DPC leader as its chairman; 2) a finance agency's representative as its vice chairman; 3) the investor as a standing member; 4) a natural resources and environment agency's representative as member; 5) a representative of the commune-level People's Committee of the place where land is recovered as member; 6) one or two representatives of households having land recovered. Staff who join in the resettlement planning and implementation will be trained by the PMU.

2) Announcement

The approved plan shall be informed to the public by PMU before detailed design of the projects. A meeting for announcement will be held in affected wards in order to hear opinions from the people: (i) scope of the project, (ii) impacts, (iii) inherited rights for types of losses and damages, (iv) operation schedule staring with study of detailed design, (iv) responsibilities of organization, and (v) mechanism of complaint and grievance.

3) Resettlement Plan Preparation

Board of Compensation, Support and Resettlement prepares a draft resettlement plan in collaboration with other organization concerned to resettlement. The draft version shall be approved by PPC.

4) Consultation Meeting

A consultation meeting, which the affected persons, the board, PPC, DPC, PMU and so on participate, is organized. At the meeting, the draft resettlement plan is presented to the attendants and the affected persons can lodge complaints against the drafted document.

5) Site Investigation and Cost Estimation for Resettlement

The board implements a household survey covering all of displaced persons to identify their houses, farmlands and so on to estimate of resettlement cost with the support of representatives of affected persons. Based on the result and the resettlement policy mentioned above, the latest unit price for resettlement and land recovery including transportation, vocational support and monitoring will be estimated by the board. The revised resettlement plan and cost estimation will be approved by the PPC.

6) Publication of the Proposed Resettlement Plan

Revised resettlement plan will be publicized at headquarter of Commune People's Committee for 20 days and the affected persons have a chance to complain the revised once again.

7) Finalization of the Resettlement Plan

Based on the opinions acquired through the publication, the draft resettlement plan is finalized. The board sends the final resettlement plan and the decision, which mentions level of compensation, support, locations of house/land to be relocated, and timing of compensation and resettlement, to each affected person in collaboration with Commune People's Committee.

8) Compensation

Prior to resettlement and land recovery, compensation shall be implemented following the resettlement plan.

9) Resettlement

Resettlement is implemented, according to need, vocational support or monetary support to stabilize livelihood of affected persons will be organized under the supervision of the PMU and Board.

10) Social Support

Handover of land or property in resettlement area, income restoration and social supports for the affected people is to be completed by the PMU and Board.

11) Monitoring

There are two kinds of monitoring system, namely, internal and external ones. The Board of Compensation, Support and Resettlement is responsible for internal monitoring in collaboration with Working Group of District while PMU employs consultants for external monitoring. The overall implementation schedule regarding resettlement is shown as below:

Table 6.4.10 Implementation Schedule

Work	Work schedule (month)											
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
Approval of project implementation	▲											
1. Establish of Board of compensation, support and resettlement	↔											
2. Announcement to the affected people	↔											
3. Resettlement plan preparation	↔	↔										
4. Consultation meeting		↔	↔									
5.Site investigation and Cost estimation for resettlement			↔	↔								
6. Publication				↔								
7. Finalization of the resettlement plan				↔	↔							
8. Compensation					↔	↔						
9. Resettlement						↔	↔	↔				
10. Social supports such as job training						↔	↔	↔				
11. Monitoring	←	―	―	―	―	―	―	―	―	―	―	→

Source: JICA Project Team

6.4.6 Cost and Fund

The total estimated cost for resettlement is 31,624 million VND as shown in following the table. This cost is used for compensation for project affected persons, transportation, support for restoration, external monitoring, administrative costs and contingency. The cost is covered by the investor.

Table 6.4.11 Cost for Resettlement

No	Items of Compensation	Cost (million VND)	Notes
1	Houses	4,608	
2	Standing crops and other structures	2,093	
3	Land loss	12,155	
4	Support	12,148	

5	Sub-total	31,004	
6	Cost for management related to resettlement (2%)*	620	According to 69/2009 ND-CP, it is specified at 2%.
7	Total cost	31,624	

Source: JICA Project Team

6.4.7 Monitoring Structure and Monitoring Form

The monitoring of resettlement is to be organized during and after the construction in order to ensure that resettlement and land recovery shall be conducted in accordance with the rules and specific resettlement plan. These activities will provide feedbacks for the implementation to all the stakeholders. It is expected that likelihood of success and risks could be timely detected and solved during the operational phase of the project. A series of resettlement monitoring is categorized into two systems, namely, internal and external ones.

1) Internal Monitoring

Board of Compensation, Resettlement and Support, and working group are entirely responsible for internal monitoring, as well as for the resettlement plan with the assistance of the project consultants. The monitoring will be based on the monitoring format as shown below. The monitoring indicators include; 1) Information dissemination and community consultation, 2) The complaint procedures, especially the involved problems in management, 3) payment for affected households in accordance with the compensation plan, 4) support for stabilizing their lives; 5) restoration for income, and 6) progress of land acquisition. PMU shall acquire the information from the Board. The database collected in the resettlement plan will be kept and updated monthly.

2) External Monitoring

External monitoring is an activity of a research organization or consultant to ensure the monitoring. This organization or consultant must have the experience for monitoring the resettlement, and is normally appointed by PMU. The external monitoring should be started when the Board of Compensation, Support and Resettlement is established. Same monitoring format can be used for both internal and external monitoring for cross-check. The proposed monitoring format is as shown below:

Table 6.4.12 Recommended Monitoring Format

Work	Planned in total	Progress in quantity	Progress in percentage	Responsible organization
Announcement to the affected people				
Draft resettlement plan preparation and site investigation (socio-economic survey)				
Cost estimation for resettlement				
Consultation meeting				
Revise of the resettlement plan and signing based on the feedback at the consultation meeting				
Compensation in cash				
Compensation by land				
Resettlement				
Social supports such as job training				

Announcement to the affected people		
Date:	Province/District:	Commune
Date:	Province/District:	Commune
Date:	Province/District:	Commune
Consultation meeting with the affected people		
Date:	Province/District:	Commune

Date:	Province/District:	Commune
Date:	Province/District:	Commune
Date:	Province/District:	Commune

6.4.8 Consultation Meeting

Consultation meeting will be organized after the approval of the program; at this moment, it has yet to be done. According to the current law, only two representatives of affected persons can join in the consultation meeting. However, it is proposed to invite all the affected persons to collect various opinions and to let the affected persons understand the impacts.

At the meeting, it is recommended to present not only amount of compensation for land loss, resettlement and livelihood restoration but also the process related to the resettlement. In such case, the affected people can understand the resettlement frame more, which makes it easy for them to accept the project. Their opinions presented at the meeting shall be reflected for the revise of the draft resettlement plan and minutes of discussions shall be documented with a name list of all the participants.

6.5 Conclusion and Recommendation

It can be said that the proposed project does not give severe adverse effects on surrounding environment except for resettlement and land recovery. Even though temporary impacts such as air pollution are to be caused, it is temporary and possible to mitigate them by some measures mentioned above. On the resettlement and land recovery, the project is to pay enough attention to the affected persons, and conduct necessary measures according to the Law, decrees, and regulations related

The legal frame of resettlement is well organized and developed in Vietnam. On top of this, there are some additional measures to improve the procedure. The project is to involve the affected persons at an earlier stage and to fill the gap between market price and compensation price mentioned above based on the real conditions. There is a case that commune level PC in Ben Tre Province paid special attention to some persons e.g. ones without the official land certificate. Such case will be applied widely.

CHAPTER 7 PROJECT EVALUATION

7.1 Condition of Economic Evaluation of the Project

North Ben Tre area is famous for a variety of fruit production such as mango, coconuts, citrus, and star apple. There are also some paddy fields in this area. However, agricultural production of these crops is now and will be damaged seriously by high level salinity water. Saline intrusion has already affected agricultural production in wide area of Ben Tre Province. The Government has constructed saline intrusion prevention sluice gates; yet, these seem not to be enough for protecting agricultural production from the saline intrusion.

The result of the vulnerability assessment shows that Ben Tre Province will be affected by high level of saline water, more than 4,000 PPM, in April. This assessment also reveals that the damage cost by saline intrusion in Ben Tre Province was estimated the highest among 7 coastal Mekong Delta Provinces. Coping with this situation, it is necessary to implement further intervention in North Ben Tre area in terms of preventing saline intrusion.

The proposed Project is to protect fruit as well as paddy production from saline intrusion in North Ben Tre area by constructing saline water prevention sluice gates. The Project components are; sluice gates along the river lines including 2 big sluice gates at the intake point of Giao Hoa canal and Giong Trom river and 2 new intake sluices at the most upstream area of the province, canal excavation from the upstream point of the area we well as canal dreading over the target area, and rehabilitation and new construction of river dykes along the 2 Mekong tributaries. The last component is for flood inundation mitigation while the others are primarily for saline intrusion prevention.

Damage cost caused by future saline intrusion is estimated as economic benefit of constructing sluice gates. In addition, damage recovery from the present saline intrusion will also be counted as a major benefit. This is because yield of paddy and fruit has already been damaged by the present saline intrusion at this present moment, and therefore productivity of these crops is expected to recover after installing the sluice gates.

The economic evaluation of the Project is conducted to estimate the Economic Internal Rate of Return (EIRR), the B/C ratio, and the Net Present Value (NPV). Also, as a financial analysis of the Project, a farm budget analysis is carried out to estimate the Project impact on farm income. The following are the basic assumptions of the economic evaluation:

1) Referring to other similar projects in the sector, the economic life of the Project is designed at 30 years.
2) Prices employed in the evaluation refer to the prevalent market ones in year 2011.
3) The opportunity cost of capital in Vietnam is considered at 12% based on National Standard for Project evaluation in Vietnam, and it is judged that the Project is economically feasible when the EIRR of the Project exceeds it.
4) A Standard Conversion Factor (SCF) of 0.9 is applied for converting the financial price to the economic price while conversion factors for specific items are shown in Table 7.1.1.
5) Transfer cost such as tax is eliminated from the economic cost, and also price (inflation) contingency cost is not counted in the economic evaluation.
6) Regarding climate change impact, sea level rise estimated under B2 scenario (mid greenhouse gas emission scenario) is applied for the calculation of saline intrusion impact on yield as a base case. This is because B2 scenario is one of the most frequently referred by other climate change relate projects in Vietnam.
7) Average discharge of Mekong River between 1991 and 2000 is applied with the

above-mentioned sea level rise for the calculation of saline intrusion impact. Mekong River Commission has predicted an increase of Mekong River flow at some years; however, the future discharge is predicted under uncertain situation. Hence, the Project evaluation will be carried out under conservative assumptions with average discharge of Mekong River between 1991 and 2000.

8) Although the river dykes are included in the proposed Project, project cost and benefit of these dykes are excluded in this economic evaluation. The main purpose of the Project is to prevent saline intrusion; while the main role of the dykes is to prevent flood inundation. From this point view, the proposed Project is evaluated economically without the cost and benefit of these dykes, centering only on the economic benefit from preventing the saline intrusion.

Table 7.1.1 Applied Conversion Factors[1]

Standard Conversion Factor	0.9
Rice	1.128
Fertilizer	0.95
Skilled Labor	1.0
Unskilled Labor	0.8
Agricultural Inputs	0.9
Fruit	1.057
Land acquisition and Compensation	0.265

Source: the World Bank and Others. Refer to the footnote

7.2 Project Cost

Implementation of the Project is divided into three stages. Stage 1 is to construct four major sluice gates, namely An Hoa, Ben Tre, Ben Ro, and Tan Phu Sluice gates. In addition, the Stage I includes canal dreading for the principal and level-1 canals (primary secondary canals) over the project area. Stage 2 and Stage 3 include medium and minor sluice gates such as 3m to 20m width gates, and further include river dike construction (though this is not counted in the project economic evaluation).

Total Project cost is estimated at VND 6,010 billion at financial price (US$ 293 million) and VND 4,749 billion at economic price (US$ 231 million). Stage 1 costs VND 2,577 billion at financial price (US$ 125 million) and VND 2,216 million at economic price. Stage 2 is estimated at VND 1,684 billion at financial cost (US$ 82 million) and VND 1,257 billion at economic price. Stage 3 is estimated at VND 1,748 billion at financial price (US$ 85 million) and VND 1,257 economic price. Project cost also includes physical contingency price which is 10% of the project cost.

Table 7.2.1 Total Project Cost

	Financial Price			Economic Price		
	F/C '000VND	L/C '000VND	Total '000VND	F/C '000VND	L/C '000VND	Total '000VND
Stage 1	1,249,151,311	1,328,036,643	2,577,187,954	1,249,151,311	967,137,066	2,216,288,377
	48%	52%	100%	56%	44%	100%
Stage 2	639,860,359	1,044,632,739	1,684,493,098	639,860,359	617,755,857	1,257,616,215
	38%	62%	100%	51%	49%	100%
Stage 3	658,848,960	1,089,788,040	1,748,637,000	658,848,960	616,925,515	1,275,774,475
	38%	62%	100%	52%	48%	100%
Total	2,547,860,629	3,462,457,423	6,010,318,052	2,547,860,629	2,201,818,438	4,749,679,068
	42%	58%	100%	54%	46%	100%
US$			$293,046,870			$231,581,519
O&M			38,480,820			36,210,856

Source: JICA Study Team
Note: US$= VND 20,509.75 (Exchange rate: World Bank Official Exchange rate in 2011 (LCU per US$, period average)

[1] Note: Major conversion factors refer to appraisal documents prepared by the World Bank "Mekong Delta Water Resource Management for Rural Development Project".
Conversion factors for Fruit and Vegetable are estimated based on the Project "Restore, Upgrading North Nghe An Irrigation System"

Operation and Maintenance (O&M) cost is estimated at 1% of the construction cost of each sluice gate and the canal. This cost is calculated based on the O&M cost estimated by other similar projects in Mekong delta. Considering simplicity of the proposed gates, 1% of the construction cost is applied for O&M cost. Annual O&M cost is VND 38 billion at financial price and VND 36 billion at economic price. The detailed Project cost of each stage is shown as Table 7.2.2, Table 7.2.3, and Table 7.2.4.

Table 7.2.2 Stage 1 Project Cost

Stage 1	Financial Price			Economic Price		
	F/C '000VND	L/C '000VND	Total '000VND	F/C '000VND	L/C '000VND	Total '000VND
1. Construction cost	994,605,675	899,881,325	1,894,487,000	994,605,675	789,432,733	1,784,038,408
	53%	48%	100%	56%	44%	100%
2. Land acquisition and Compensation	0	31,624,000	31,624,000	0	8,380,360	8,380,360
3. Project management Cost	1,894,487	17,050,383	18,944,870	1,894,487	15,345,345	17,239,832
	10%	90%	100%	11%	89%	100%
4. Consulting services cost	136,403,064	15,155,896	151,558,960	136,403,064	13,640,306	150,043,370
	90%	10%	100%	91%	9%	100%
5. Other expenses	3,788,974	34,100,766	37,889,740	3,788,974	30,690,689	34,479,663
	10%	90%	100%	11%	89%	100%
6. Tax	0	208,393,570	208,393,570	0	0	0
7. Contingency	112,459,111	121,830,703	234,289,814	112,459,111	109,647,633	222,106,744
	42%	58%	100%	44%	56%	100%
Stage 1 Total	1,249,151,311	1,328,036,643	2,577,187,954	1,249,151,311	967,137,066	2,216,288,377
	42%	58%	100%	53%	47%	100%
US$			$125,656,722			$108,060,234
Stage 1 O&M cost			18,944,870			17,840,384

Source: JICA Study Team
Note: US$= VND 20,509.75 (Exchange rate: World Bank Official Exchange rate in 2011 (LCU per US$, period average)

Table 7.2.3 Stage 2 Project Cost

Stage 2	Financial Price			Economic Price		
	F/C '000VND	L/C '000VND	Total '000VND	F/C '000VND	L/C '000VND	Total '000VND
1. Construction cost	523,280,828	459,406,173	982,687,000	523,280,828	399,462,266	922,743,093
	53%	47%	100%	57%	43%	100%
2. Land acquisition and Compensation	0	332,479,222	332,479,222	0	88,106,994	88,106,994
3. Project management Cost	982,687	8,844,183	9,826,870	982,687	7,959,765	8,942,452
	10%	90%	100%	11%	89%	100%
4. Consulting services cost	70,753,464	7,861,496	78,614,960	70,753,464	7,075,346	77,828,810
	90%	10%	100%	91%	9%	100%
5. Other expenses	1,965,374	17,688,366	19,653,740	1,965,374	15,919,529	17,884,903
	10%	90%	100%	11%	89%	100%
6. Tax	0	108,095,570	108,095,570	0	0	0
7. Contingency	42,878,006	110,257,730	153,135,736	42,878,006	99,231,957	142,109,963
	28%	72%	100%	30%	70%	100%
Stage 2 Total	639,860,359	1,044,632,739	1,684,493,098	639,860,359	617,755,857	1,257,616,215
	38%	62%	100%	51%	49%	100%
US$			$82,131,333			$61,317,969
Stage 2 O&M cost			19,043,632			18,159,966

Source: JICA Study Team
Note: US$= VND 20,509.75 (Exchange rate: World Bank Official Exchange rate in 2011 (LCU per US$, period average)

Table 7.2.4 Stage 3 Project Cost

Stage 3	Financial Price			Economic Price		
	F/C '000VND	L/C '000VND	Total '000VND	F/C '000VND	L/C '000VND	Total '000VND
1. Construction cost	509,726,700	461,181,300	970,908,000	509,726,700	404,577,364	914,304,064
	53%	48%	100%	56%	44%	100%
2. Land acquisition and Compensation	0	405,162,240	405,162,240	0	107,367,994	107,367,994
3. Project management Cost	970,908	8,738,172	9,709,080	970,908	7,864,355	8,835,263
	10%	90%	100%	11%	89%	100%
4. Consulting services cost	69,905,376	7,767,264	77,672,640	69,905,376	6,990,538	76,895,914
	90%	10%	100%	91%	9%	100%
5. Other expenses	1,941,816	17,476,344	19,418,160	1,941,816	15,728,710	17,670,526
	10%	90%	100%	11%	89%	100%
6. Tax	0	106,799,880	106,799,880	0	0	0
7. Contingency	76,304,160	82,662,840	158,967,000	76,304,160	74,396,556	150,700,716
	48%	52%	100%	51%	49%	100%
Stage 3 Total	658,848,960	1,089,788,040	1,748,637,000	658,848,960	616,925,515	1,275,774,475
	38%	62%	100%	52%	48%	100%
US$			$85,258,816			$62,203,317
Stage 3 O&M cost			9,709,080			9,143,041

Source: JICA Study Team
Note: US$= VND 20,509.75 (Exchange rate: World Bank Official Exchange rate in 2011 (LCU per US$, period average)

Disbursement of the Project cost is divided over 10 years, and each stage will take 4 years to complete the construction. The first year of each stage is for land acquisition, compensation and a part of consultancy services, and following 3 years are spent on construction work. Land acquisition and compensation of Stage 1 is expected to start in 2014 and whole the investment will be finished by 2017.

Table 7.2.5 Disbursement of the Project Cost at Financial Price

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Stage I:Land acquisition & Compensation	92,248									
Construction		745,482	993,976	745,482						
Stage II: Land acquisition &				363,925						
Construction					396,170	528,227	396,170			
Stage III: Land acquisition &							436,231			
Construction								393,722	524,962	393,722
Total	92,248	745,482	993,976	1,109,407	396,170	528,227	832,402	393,722	524,962	393,722

Source: JICA Study Team

7.3 Project Benefit

7.3.1 Basic Concept of the Project Benefit

As a Climate Change Adaptation Project, the proposed project has two main aspects considering as monetary value for the Project benefit; namely, 1) damage recovery and 2) damage prevention from saline intrusion.

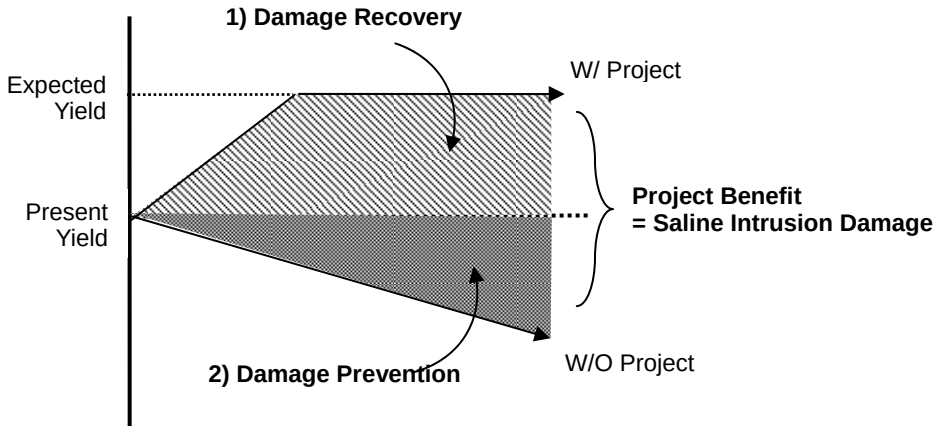

Figure 7.3.1 Basic Concept of the Project Benefit

1) Damage Recovery

Yield of paddy and fruit is expected to recover after the implementation of the Project. This is because crop yield in North Ben Tre area has already been affected by saline intrusion. It is found that present crop yield is lower than the expected yield under less salinity water environment. Salinity level will decrease in the Project area upon the installation of the gates, so that yield of paddy and fruit is expected to recover. Thus, the value of damage recovery is counted as a major economic benefit of the Project

Yield of paddy is assumed to recover by 10% from the present yield. This 10% recovery is calculated by the difference between average yield of five targeted districts in North Ben Tre and the highest yield among these five districts. According to the statistical yearbook, average paddy yield in these five districts is 5,781 kg/ha. The highest yield among these five districts is 6,366 kg/ha in Giong Trom district.

Constructing sluice gate is expected to narrow this gap because average yield of the targeted area has already been damaged by saline intrusion at some degree, whereas it is though that the district with the highest yield has not seriously been affected by saline intrusion yet. From this point of view, installing sluice gates will contribute to increasing the area average yield (5,781kg/ha) to the area highest yield (6,366kg/ha). The difference between average yield and the highest yield is 10.12%. Therefore, yield of paddy is expected to recover by at least 10%

Fruit yield is assumed to recover by 12% from the present yield. Basically, calculation of fruit yield recovery is the same as paddy. Average yield of orange, lemon, pomelo, and mongo in the whole five districts is 8,568kg/ha. The highest yield of these fruits among the districts is 9,576kg/ha in Giong Trom district. The reason for focusing on these four fruits is that these four crops are produced in all the five targeted districts. Also, the yields of these crops are not fluctuated much among the districts,so that the average yield of these crops is counted to be comparable.

The present area average yield, 8,568kg/ha, is expected to recover to at least 9,576kg/ha; namely, 11.77% increase. In addition, the vulnerability assessment carried out under a JICA funded Master Plan Study, 'Project for Climate Change Adaptation for Sustainable Agriculture and Rural Development in the Coastal Mekong Delta in Vietnam', revealed that fruit is more susceptible to salinity water than paddy. Considering these facts, yield of fruit is assumed to recover by 12%. Table 7.3.1 shows the expected yield recovery for both paddy and fruit:

Table 7.3.1 Expected Yield Recovery with Project

	Yield (kg/ha)		Increase
	Present	With Project	%
Winter -Spring Paddy	5,781	6,359	10%
Fruit	8,568	9,596	12%

Source: Provincial Statistics Office (2011)

2) Damage Prevention from Saline Intrusion

Preventing damage by saline intrusion is one of the main roles of constructing sluice gates. Saline intrusion damage is estimated based on the predicted trend of paddy and fruit yield examined under the vulnerability assessment carried out by the Master Plan. Based on this data, expected yield during the project life period (2014-2043) is calculated. Yield of paddy and fruit is expected to drop to 5,038 kg/ha and 7,509 kg/ha respectively in year 2050. Both paddy and fruit are decreased by approximately 12-13% from the present yield. Expected yield without the Project is shown in Table 7.3.2.

Table 7.3.2 Expected Yield in Representative Years (kg/ha)

	Yield Trend Without Project (kg/ha)			Decrease (%)		
	Paddy	Vegetable	Fruit	Paddy	Vegetable	Fruit
2012 (Present)	5,781	4,450	8,568	-	-	-
2020	5,596	4,308	8,296	3.2%	3.2%	3.2%
2030	5,364	4,130	7,957	7.2%	7.2%	7.1%
2040	5,201	4,006	7,733	10.0%	10.0%	9.7%
2050	5,038	3,883	7,509	12.9%	12.7%	12.4%

Source: JICA Study Team.

7.3.2 Economic Value of the Project Benefit

1) Damage Recovery from Saline Intrusion

As mentioned, yield of paddy and fruit is assumed to recover by 10% and 12% respectively. Production cost and agricultural gate price are assumed the same in "With" and "Without" cases. Annual net income of paddy will increase to VND 74 billion which is 21% increase of "Without Project". Fruit will increase to VND 731 billion which is 18% increase of "Without Project". In total, damage recovery is valued at VND 806 billion that is 18% increase of the present situation.

Table 7.3.3 Annual Value of Damage Recovery in Financial Price

		Without Project		With Project		Damage Recovery (increment % from W/O)
	Area (ha)	Yield (kg/ha)	Net Income ('000VND)	Yield (kg/ha)	Net Income ('000VND)	('000VND)
Paddy	20,239	5,781	364,072,125	6,359	438,929,787	74,857,661 (21%)
Fruit	43,365	8,568	4,095,008,554	9,596	4,826,578,241	731,569,687 (18%)
Total	63,604	-	4,459,080,680	-	5,265,508,028	806,427,348 (18%)

Source: JICA Study Team
Note: Net Income is calculated based on the results of the Household Economic Survey, JICA Study Team (2011)

2) Damage Prevention from Saline Intrusion

Expected saline intrusion damage will reach to 18,309 billion during the project life period. Damage cost of paddy accounts for 7% (VND 1,266 billion) of the total expected damage cost and fruit shares 93% (VND 717 billion). Table 7.3.4 shows the expected saline intrusion damage.

Table 7.3.4 Expected Saline Intrusion Damage

	Expected Damage (VND'000)		
	Paddy	Fruit	Total
2020	23,969,887	193,275,181	217,245,068
2030	53,932,246	434,869,156	488,801,402
2040	75,098,762	594,333,940	669,432,703
Project Period Total (2014-2043)	1,444,712,665	11,531,414,442	12,976,127,107
Share in total	11%	89%	100%

Source: JICA Study Team
Note: Net Income is calculated based on financial price.

3) Total Benefit

Total accrued benefit from the 30-year Project period will be VND 34,749 billion (about US$ 1.6 billion) at financial price and VND 36,976 billion (US$ 1.8 billion) at economic price. Project benefit accrued from damage recovery accounts for 63% with VND 21,773 billion, and damage prevention shares 37% with VND 12,976 billion at financial price.

Table 7.3.5 Total Project Benefit between 2014 and 2043 (30 years), (Unit: VND million)

	Financial Price			Economic Price		
	(1) Damage Recovery	(2) Damage Prevention	Total Benefit	(1) Damage Recovery	(2) Damage Prevention	Total Benefit
Paddy	2,021,157	1,444,713	3,465,870	2,279,865	1,629,636	3,909,501
Fruit	19,752,382	11,531,414	31,283,796	20,878,267	12,188,705	33,066,972
Total	21,773,539	12,976,127	34,749,666	23,158,132	13,818,341	36,976,473
Share	63%	37%	100%	63%	37%	100%
US$ (th)	$1,061,618	$632,680	$1,694,299	$1,129,127	$673,744	$1,802,872

Source: JICA Study Team
Note: US$= VND 20,509.75 (Exchange rate: World Bank Official Exchange rate in 2011 (LCU per US$, period average)

7.4 Project Economic and Financial Evaluation

The Economic Internal Rate of Return (EIRR) is calculated based on the above economic cost and benefit. B/C and Net Present Value (NPV) are also calculated using the opportunity cost of capital in Vietnam, namely 12% as a discount rate. As shown in Table 7.4.1, EIRR for the whole Project (Stage 1, Stage 2, and Stage 3, note that river dyke is excluded from the evaluation) is estimated at 24.0%. This result exceeds the opportunity cost of capital in Vietnam, i.e. 12%. In addition, other economic indicators show positive results; B/C is calculated at 2.00 and NPV is approximately VND 2,857 billion. Therefore, it is concluded that the Project is economically feasible.

The EIRR is also calculated for two cases; the Project benefit considered only future damage prevention and the Project benefit considered only damage recovery from saline intrusion. If the Project considered only future damage prevention as a project benefit, the EIRR would drop to 5.9%. If the Project counted only damage recovery from the saline intrusion as the project benefit, the EIRR would decrease to 19.7%.

This situation indicates that even if we focus on the present damage recovery, the whole Project still be feasible from the economic point of view. On the other hand, it is difficult to find economical efficiency if the Project only focuses on future damage prevention further to be caused by future climate change. Table 7.4.1 shows the results of economic indicators.

Table 7.4.1 Results of the Economic Indicators

	EIRR	B/C	NPV '000VND	(FIRR)
The whole Project (Stage 1, 2, and 3)	**24.0%**	**2.00**	**2,857,209,501**	**18.4%**
Benefit: Only Damage Prevention Case	5.9%	0.50	-1,446,630,413	3.7%
Benefit: Only Damage Recovery Case	19.7%	1.50	1,435,270,410	14.0%
Stage 1 (Project benefit is only damage recovery)	**28.4%**	**2.55**	**2,618,527,382**	**(23.6%)**

Source: JICA Study Team

The Economic indicators are also calculated for only Stage 1. Stage 1 includes the construction of four major sluice gates and dreading of principal and primary secondary canals. Constructing four major sluice gates in Stage 1 will contribute to preventing major saline intrusion as well as taking fresh water from an upstream point. In sum, these major sluice gates will be able to prevent the present saline intrusion in a wide area of North Ben Tre. Therefore, present yield is expected to fully recover after the Stage 1 has completed. Note that under this assumption, benefit for the damage prevention is not counted since medium and small scale sluices are not yet counted in this Stage 1 work.

Thus, the EIRR only for Stage 1 is calculated with only damage recovery regarded as the project benefit. The result shows high economic efficiency. The EIRR of Stage 1 is estimated at 28.4% and B/C with 2.55. The NPV is approximately VND 2,618 billion. This situation indicates that even if an investment is made only in Stage 1, the Project would still be economically feasible.

7.5 Sensitivity Analysis

As a result of the sensibility analysis, 1) if the investment cost would increase by 10%, the EIRR would be reduced to 22.0%, and 2) if the Project benefit were decreased by 10%, the EIRR would be decreased to 21.8%. The effect of both 10% increase of the cost and 10% decrease of the benefit would result in an EIRR 19.9%. In case, the project cost would be 20% over estimated cost, the EIRR would be reduced to 20.3% and if the benefit was reduced by 20%, the EIRR would drop to 19.5%. These results indicate that the Project is strong enough to overcome adverse circumstances.

Table 7.5.1 Results of Sensibility Analysis

	EIRR	B/C	NPV '000VND	(FIRR)
Base Case	24.0%	2.00	2,857,209,501	18.4%
1) 10% increase of cost	22.0%	1.81	2,570,352,551	16.7%
2) 10% decrease of benefit	21.8%	1.80	2,284,631,601	16.6%
3) 1)+2)	19.9%	1.63	1,997,774,650	15.0%
4) 20% increase of cost	20.3%	1.66	2,283,495,600	15.3%
5) 20% decrease of benefit	19.5%	1.60	1,712,053,700	14.7%

Source: JICA Study Team

7.6 Farm Budget Analysis

A farm budget representing typical rural household in Project area is modeled as shown in Table 7.6.1. Total net income with the Project will increase by 15% compared to the present net income. An increase of fruit production will be a big part of total net income increase that is about 11.5%. This is because fruit production gives higher economic return than that of paddy. Contrary, net income increase of paddy shares only 3.5% of the total increment. The proposed project would allow not only damage prevention from saline intrusion, but also contribute to approximately 15% increases in

household income.

Table 7.6.1 Farm Budget Analysis

			Present (Without)		With Project		Net Income Increase
	Area (ha)	Unit Price (VND/kg)	Yield (kg/ha)	Total Value (VND)	Yield (kg/ha)	Total Value (VND)	
SA Paddy	0.65	6,365	4,314		4,314		
(A) Gross Income				17,848,097		17,848,097	
(B) Production Cost				12,348,827		12,348,827	
(C) Net Income				5,499,269		5,499,269	0.0%
AW Paddy	0.71	6,591	4,612		4,612		
(A) Gross Income				21,582,361		21,582,361	
(B) Production Cost				13,488,719		13,488,719	
(C) Net Income				8,093,642		8,093,642	0.0%
WS Paddy	0.69	6,398	5,781		6,359		
(A) Gross Income				25,520,918		28,072,569	
(B) Production Cost				13,108,755		13,108,755	
(C) Net Income				12,412,163		14,963,813	3.5%
Fruit (Coconuts)	0.5	16,408	8,568		9,596		
(A) Gross Income				70,291,872		78,725,584	
(B) Production Cost				23,076,277		23,076,277	
(C) Net Income				47,215,595		55,649,307	11.5%
Total	2.55			73,220,669		84,206,032	15.0%

Source: Household Economic Survey, JICA Study Team (2011) and Statistical Yearbook 2010, Ben Tre Province

7.7 Project Indirect Benefit

1) Fresh Water Recruitment

One of the indirect benefits of constructing sluice gates is to make fresh water available for the rural population. In fact, saline intrusion causes not only the damage to agricultural production, but also to drinking water, particularly canal water and shallow ground water. There are still lots number of people who have to depend on canal water for their domestic use during latter part of dry season[2]. The Project is to prevent saline intrusion as well as recruit fresh water from the upstream area, and therefore keeping fresh water for domestic use is expected to be an indirect benefit.

2) Enhancement of Mobility

Enhancing mobility is also expected as another indirect benefit from the Project. Most of the sluice gates have a function as a bridge besides saline intrusion prevention. People who usually take a long way around will be able to save time by using the bridge attached to the gate. Thus, the Project will contribute to enhancing the mobility of people's daily life.

3) Narrowing Disparities between Urban and Rural

The Project will contribute to narrowing disparities between urban and rural areas. This is because the Project is expected to increase farm income as a result of recovering crop productivity. This makes farm income level in rural area higher; hence, the Project will contribute to narrowing income disparities between urban and rural people.

[2] Rural population who do not have piped water usually use stored rainwater for their domestic use during rainy and dry seasons. However, the stored water often run shortage towards the end of dry season, by which they have no other option but to go to canal water for the domestic use.

4) Promoting high value added crops

The Project will encourage farmers to cultivate high value added crops such as fruit. This is because the Project is to protect agricultural production from saline intrusion damage. Constructing sluice gates will play a role of promoting value added crops by preventing one of the major farming risks. Therefore, farmers will be able to cultivate more high value added crops.