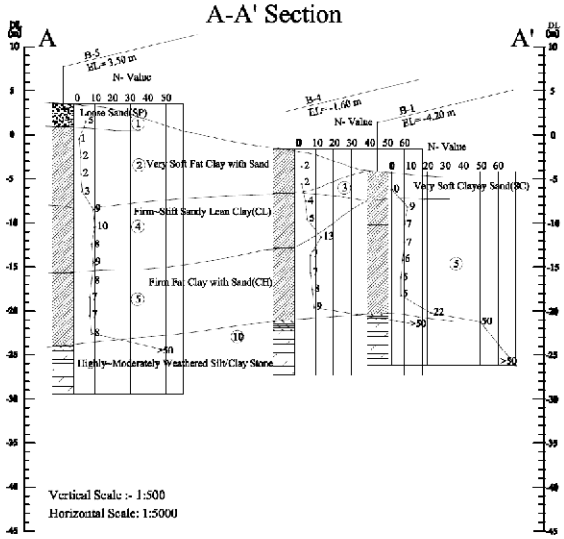
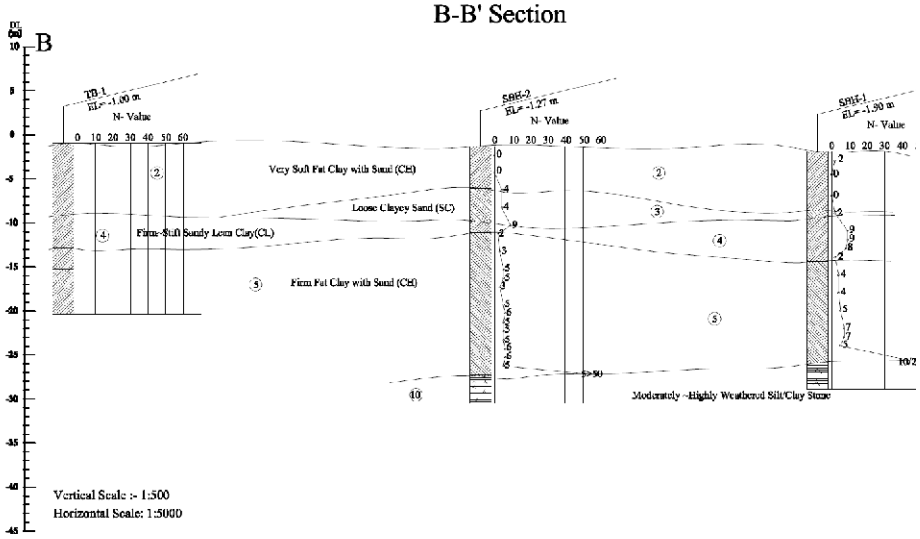
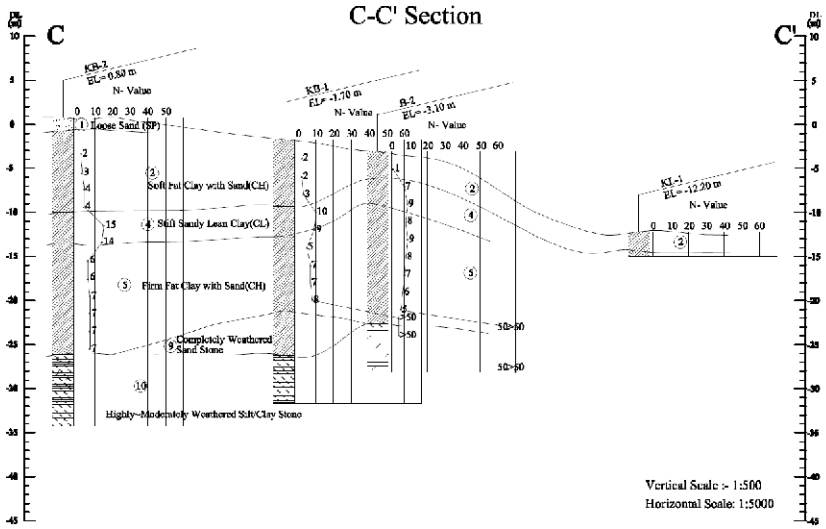
Appendix7-1

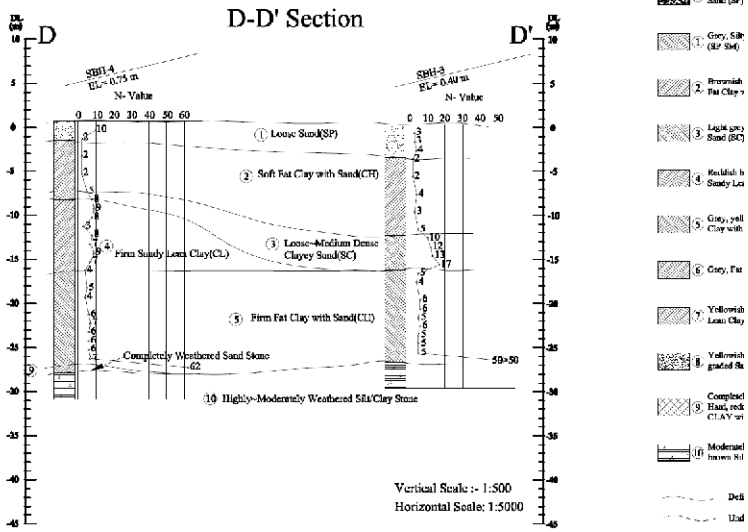
成層断面図

成層断面図　(A-A', B-B', C-C', D-D' Section)

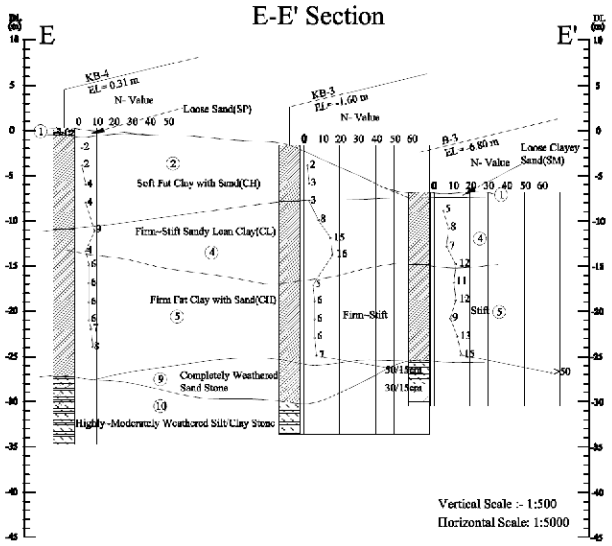


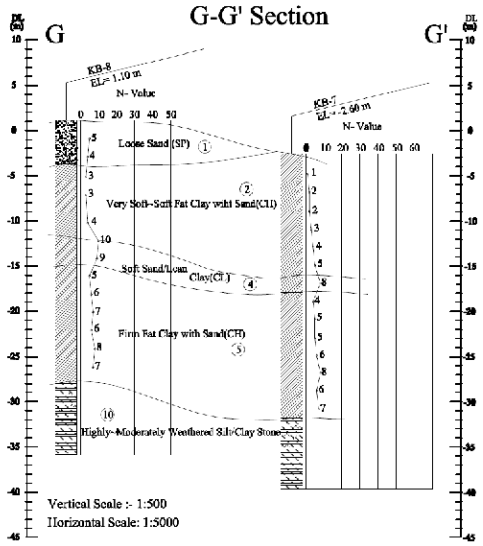


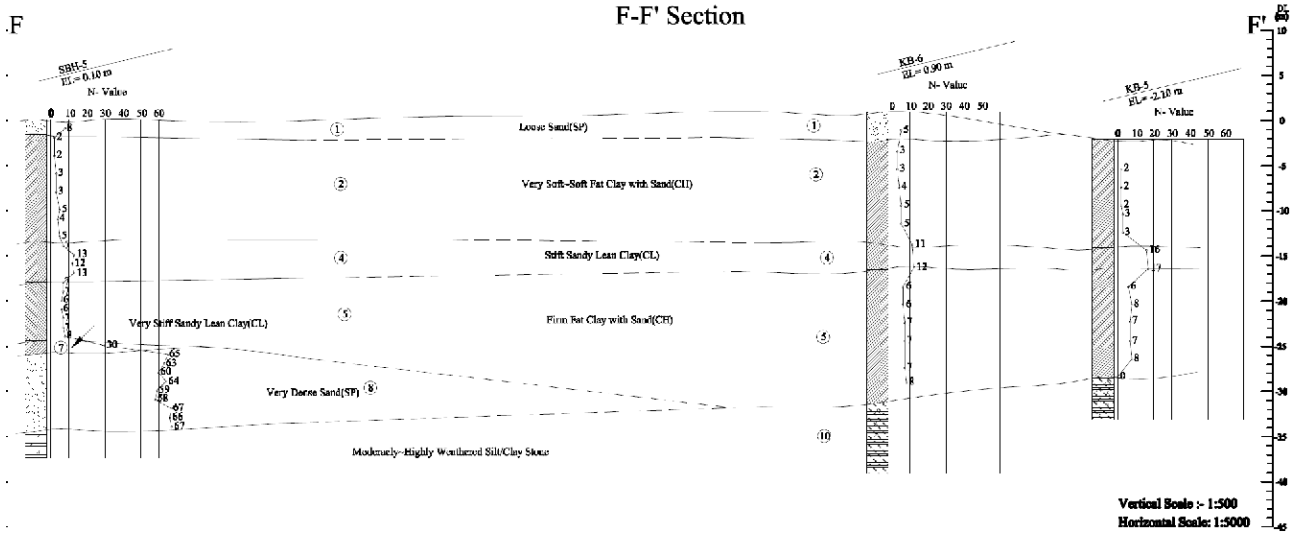




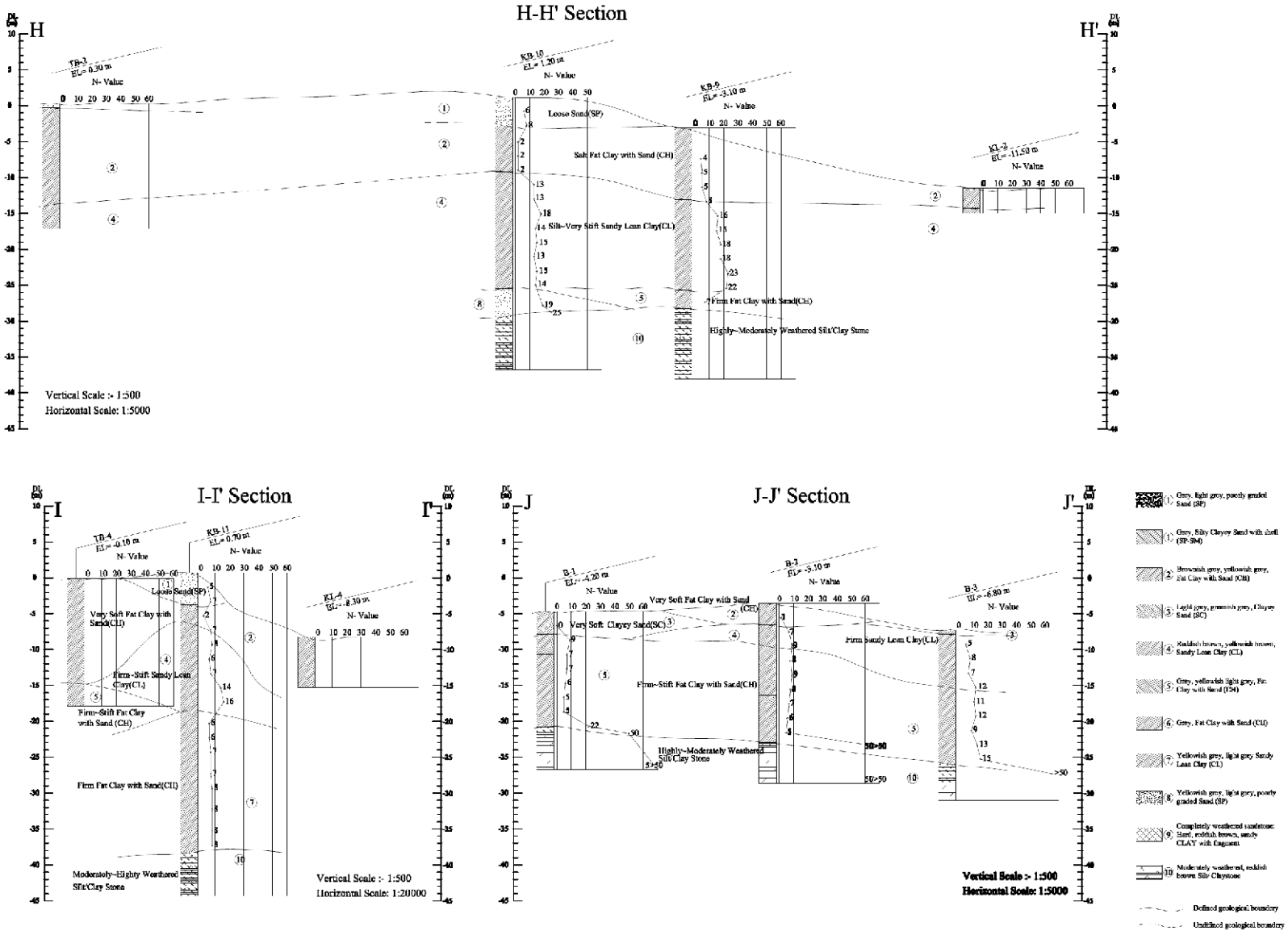
成層断面図 (E-E', F-F',G-G' Section)



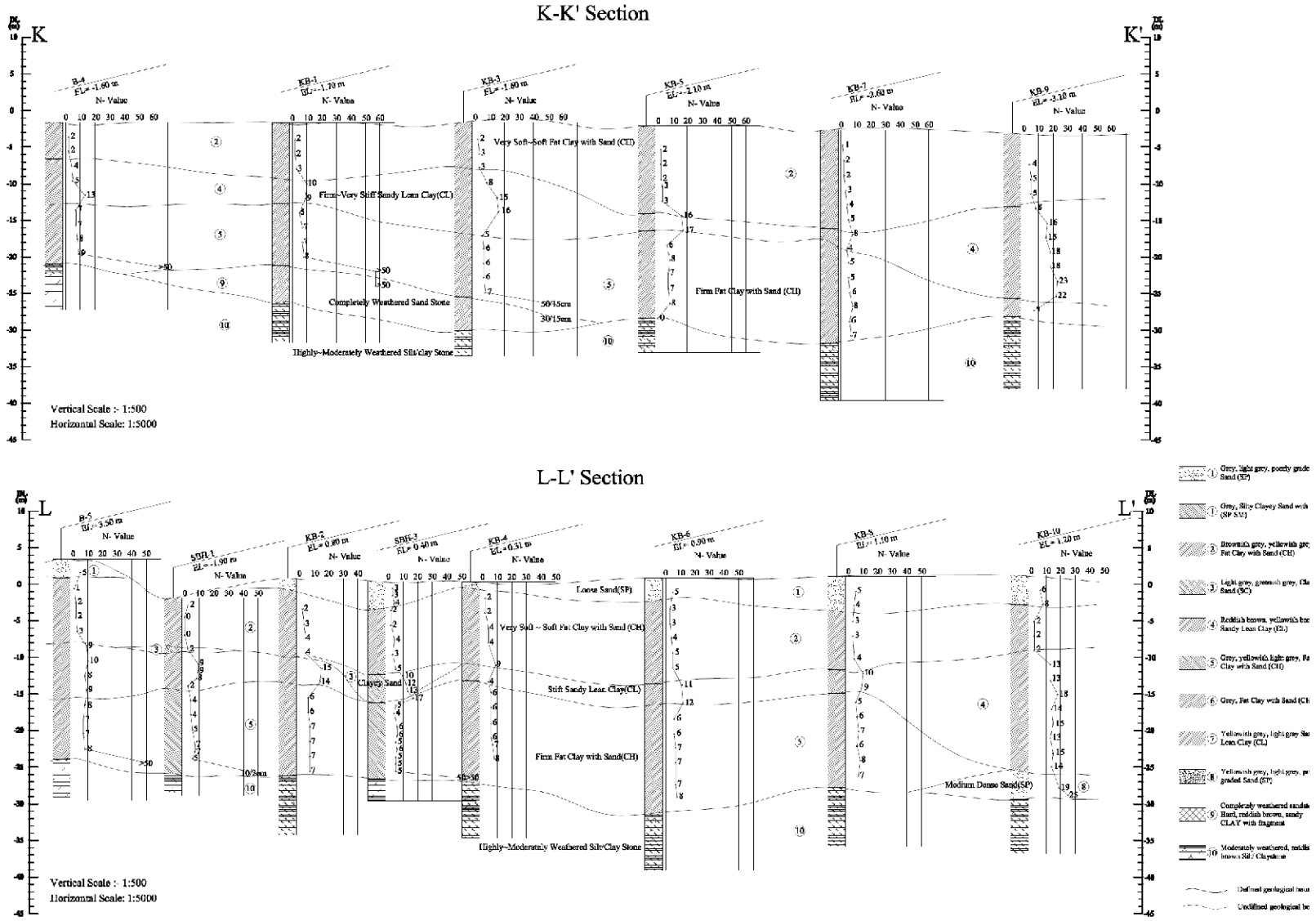




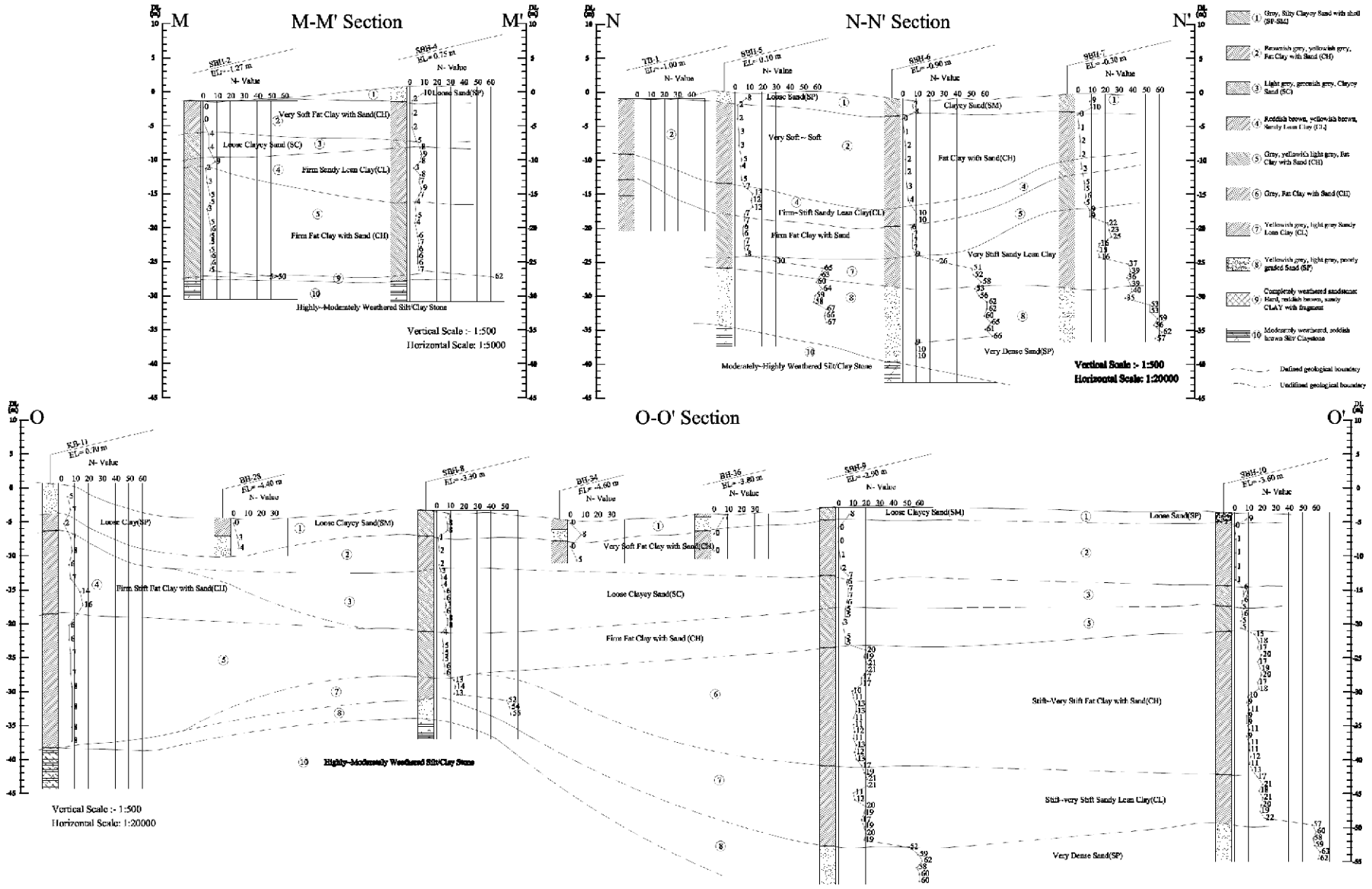
成層断面図　(H-H', I-I', J-J' Section)



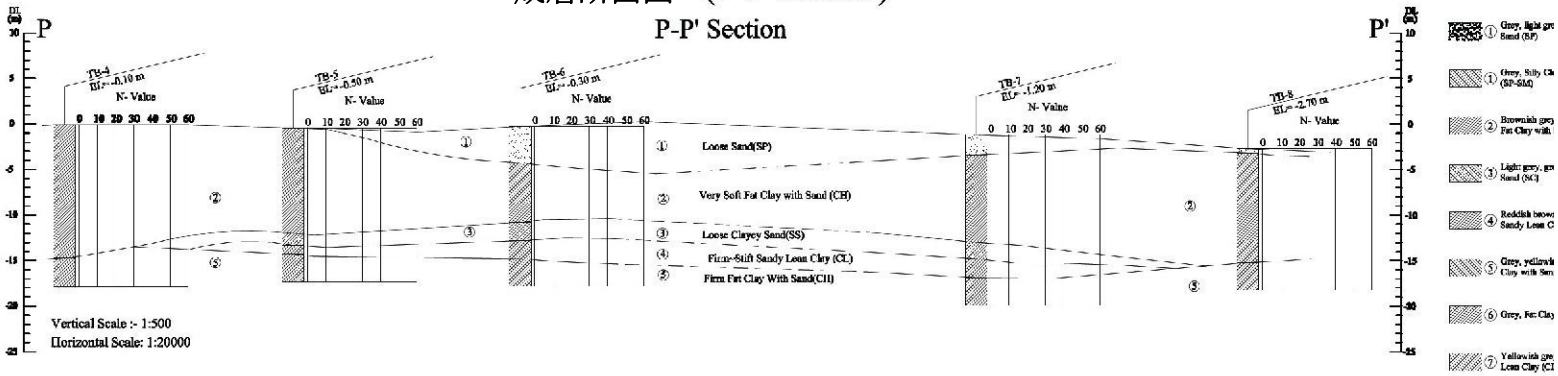
成層断面図　(K-K', L-L' Section)

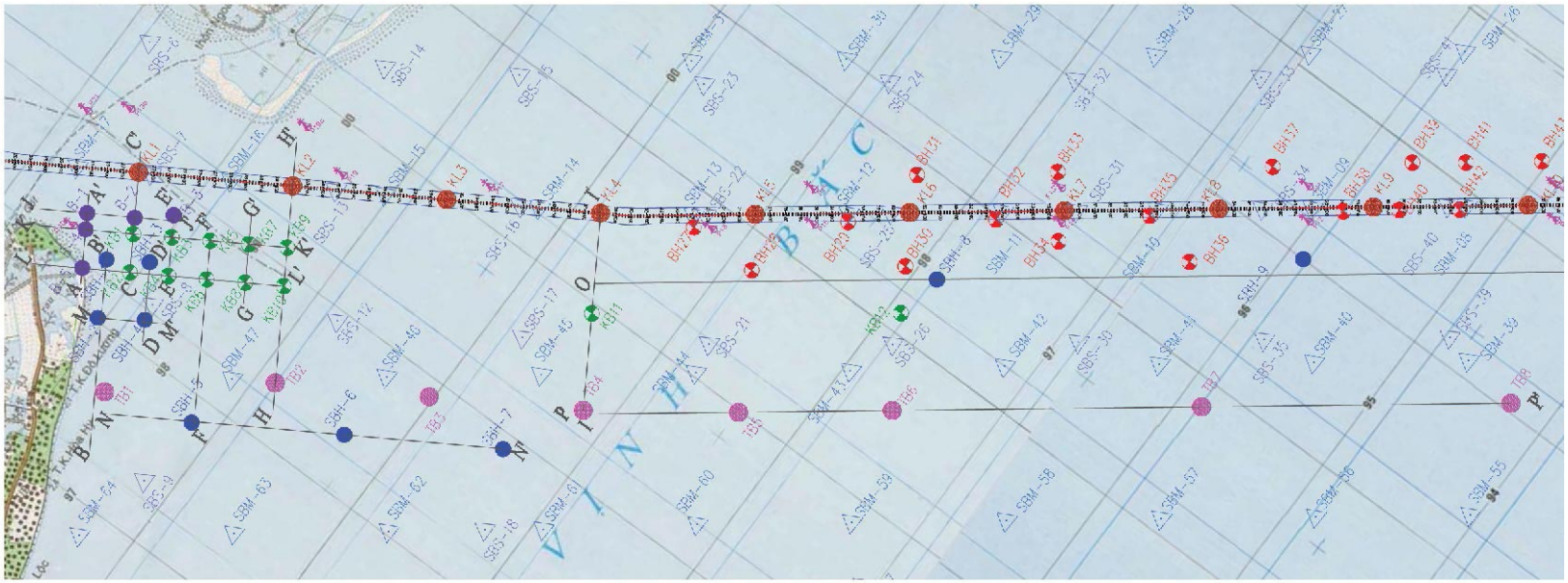


成層断面図　(M-M', N-N', O-O' Section)



成層断面図　(P-P' Section)





Appendix7-2

土質試験結果

全体エリアにおける各土層の土質特性

層番号	土質名	試験値の種類	N値	土粒子の密度 D (g/cm³)	細粒分含有率 (%)	自然 含水比 Wn(%)	アッターベルグ限界			単位体積重量 γ(g/cm³)		間隙比 eo	圧密試験						一軸圧縮試験		岩の圧縮試験 Rn (KG/cm²)	
							液性限界 W_L(%)	塑性限界 Wp(%)	塑性指数 Ip (%)	自然状態	乾燥状態		圧密係数 Cv (x 10^{-3} cm²/s) (1-2kgf/cm2)	圧縮指数 Cc	膨潤指数 Cr	圧縮比 CR = Cc/(1+e0)	膨潤比 RR = Cr/(1+e0)	圧密降伏応力Pc (KG/cm²)	圧縮強度q_u (KG/cm²)	破壊歪 εf (%)	自然状態	飽和状態
1a	緩い砂(SP)	最大値	10	2.68	22.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	3	2.65	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	5.9	2.66	8.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1b	粘土質砂(SC)	最大値	10	2.66	39.0	-	37.0	30.6	8.7	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	7	2.65	26.4	-	30.8	25.2	5.6	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	8.1	2.66	29.9	-	34.1	27.7	6.3	-	-	-	-	-	-	-	-	-	-	-	-	-
2	砂混じり粘土(CH)	最大値	8	2.73	99.7	84.8	86.0	36.1	52.6	1.91	1.46	2.31	1.92	0.90	0.196	0.68	0.088	1.57	0.80	12.8	-	-
		最小値	0	2.67	35.2	25.5	25.2	14.6	6.9	1.50	0.81	0.83	0.24	0.09	0.013	0.05	0.007	0.28	0.05	2.0	-	-
		平均値	2.4	2.69	90.4	52.5	56.7	27.1	29.6	1.69	1.12	1.46	0.68	0.54	0.121	0.22	0.046	0.85	0.28	7.2	-	-
3	粘土質砂(SC)	最大値	17	2.69	66.1	35.3	40.9	21.5	23.5	1.99	1.60	0.96	1.86	0.47	0.058	0.25	0.031	1.74	0.43	7.0	-	-
		最小値	0	2.65	23.1	20.5	22.3	14.4	6.3	1.85	1.37	0.67	0.93	0.14	0.019	0.07	0.011	1.06	0.43	7.0	-	-
		平均値	6.4	2.67	41.8	25.7	31.2	16.6	14.6	1.91	1.47	0.82	1.27	0.26	0.033	0.14	0.018	1.38	0.43	7.0	-	-
4	固い砂質粘土(CL)	最大値	23	2.74	99.4	40.0	53.4	27.1	28.7	2.08	1.96	1.03	4.71	0.91	0.063	0.47	0.036	3.48	1.08	9.5	-	-
		最小値	2	2.66	31.4	18.5	25.3	14.1	9.4	1.62	1.32	0.56	0.60	0.10	0.016	0.06	0.010	0.62	0.33	6.3	-	-
		平均値	10.7	2.70	82.0	27.9	39.8	20.3	19.6	1.95	1.55	0.76	2.36	0.28	0.030	0.15	0.017	1.39	0.62	7.9	-	-
5	砂混じり粘土(CH)	最大値	15	2.73	99.4	52.8	67.6	33.5	45.1	1.94	1.51	1.49	2.09	0.74	0.198	0.32	0.091	2.97	0.97	11.2	-	-
		最小値	0	2.67	51.7	20.3	25.9	12.3	12.3	1.65	1.09	0.77	0.75	0.16	0.023	0.09	0.013	0.61	0.09	4.4	-	-
		平均値	6.3	2.70	93.2	42.7	50.9	24.0	26.9	1.76	1.23	1.21	1.26	0.51	0.109	0.23	0.049	1.77	0.64	7.3	-	-
6	砂混じりの固い粘土(CH)	最大値	21	2.70	99.6	58.0	70.7	33.3	39.6	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	9	2.67	61.9	21.7	26.0	17.5	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	14.0	2.68	84.4	41.9	52.3	25.5	26.8	-	-	-	-	-	-	-	-	-	-	-	-	-
7	固い砂質粘土(CL)	最大値	50	2.70	98.4	36.0	45.6	21.2	28.2	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	9	2.65	48.0	18.8	20.9	13.7	4.9	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	22.5	2.68	65.1	23.6	29.8	16.4	13.5	-	-	-	-	-	-	-	-	-	-	-	-	-
8	非常に密な砂(SP)	最大値	50	2.66	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	9	2.64	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	46.6	2.66	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	強風化土（砂岩）	最大値	50	2.77	86.0	27.3	42.2	21.9	20.2	2.36	1.56	0.76	-	-	-	-	-	-	-	-	-	-
		最小値	50	2.73	52.4	15.1	33.2	21.3	12.0	1.99	1.56	0.76	-	-	-	-	-	-	-	-	-	-
		平均値	50.0	2.74	68.8	21.2	37.5	21.6	15.9	2.18	1.56	0.76	-	-	-	-	-	-	-	-	-	-
10	強～中風化のシルト岩/泥岩	最大値	-	2.83	-	-	-	-	-	2.72	-	-	-	-	-	-	-	-	-	-	1081	686
		最小値	-	2.70	-	-	-	-	-	2.40	-	-	-	-	-	-	-	-	-	-	71	61
		平均値	-	2.76	-	-	-	-	-	2.60	-	-	-	-	-	-	-	-	-	-	395	350

港湾エリアにおける各土層の土質特性

層番号	土質名	試験値の種類	N値	土粒子の密度 D (g/cm³)	細粒分含有率 (%)	自然 含水比 Wn(%)	アッターベルグ限界			単位体積重量 γ(g/cm³)		間隙比 eo	圧密試験						一軸圧縮試験		岩の圧縮試験 Rn (KG/cm²)	
							液性限界 W_L(%)	塑性限界 Wp(%)	塑性指数 Ip (%)	自然状態	乾燥状態		圧密係数 Cv (x 10^{-3} cm²/s) (1-2kgf/cm2)	圧縮指数 Cc	膨潤指数 Cr	圧縮比 CR = Cc/(1+e0)	膨潤比 RR = Cr/(1+e0)	圧密降伏応力Pc (KG/cm²)	圧縮強度 q_u (KG/cm²)	破壊歪 εf (%)	自然状態	飽和状態
1a	緩い砂(SP)	最大値	10	2.68	22.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	3	2.65	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	5.6	2.66	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1b	粘土質砂(SC)	最大値	10	2.66	39.0	-	36.3	30.6	8.7	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	7	2.65	27.3	-	32.4	25.5	5.7	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	8.5	2.66	31.8	-	34.3	27.7	6.5	-	-	-	-	-	-	-	-	-	-	-	-	-
2	砂混じり粘土(CH)	最大値	8	2.73	99.7	84.8	85.3	35.5	52.6	1.91	1.46	2.31	1.92	0.90	0.194	0.68	0.088	1.57	0.80	12.8	-	-
		最小値	0	2.67	35.2	25.5	25.2	14.6	6.9	1.50	0.81	0.83	0.27	0.09	0.013	0.05	0.007	0.36	0.05	2.0	-	-
		平均値	2.6	2.69	90.9	50.1	54.0	26.4	27.6	1.71	1.14	1.41	0.77	0.52	0.119	0.22	0.047	0.93	0.32	6.7	-	-
3	粘土質砂(SC)	最大値	17	2.68	66.1	35.3	40.9	21.5	23.5	1.99	1.60	0.96	1.86	0.47	0.058	0.25	0.031	1.74	0.43	-	-	-
		最小値	0	2.67	31.3	21.4	22.3	14.5	6.3	1.85	1.37	0.67	0.93	0.14	0.019	0.07	0.011	1.06	0.43	-	-	-
		平均値	7.0	2.67	49.9	27.3	31.0	17.0	13.9	1.91	1.47	0.82	1.27	0.26	0.033	0.14	0.018	1.38	0.43	-	-	-
4	固い砂質粘土(CL)	最大値	23	2.74	99.4	40.0	53.4	27.1	28.7	2.08	1.96	1.03	4.71	0.91	0.063	0.47	0.036	3.48	1.08	9.5	-	-
		最小値	2	2.66	31.4	18.5	25.3	14.1	9.4	1.62	1.32	0.56	0.60	0.10	0.016	0.06	0.010	0.62	0.33	6.3	-	-
		平均値	10.5	2.69	81.9	28.0	39.9	20.2	19.6	1.95	1.55	0.76	2.36	0.28	0.030	0.15	0.017	1.39	0.62	7.9	-	-
5	砂混じり粘土(CH)	最大値	15	2.73	99.4	52.8	65.6	33.2	45.1	1.90	1.45	1.49	2.09	0.74	0.198	0.32	0.091	2.97	0.97	10.2	-	-
		最小値	0	2.67	51.7	20.3	25.9	12.3	12.3	1.65	1.09	0.87	0.75	0.26	0.033	0.13	0.016	0.61	0.09	4.4	-	-
		平均値	6.5	2.70	93.8	42.9	50.8	23.9	26.9	1.76	1.22	1.23	1.26	0.52	0.110	0.23	0.050	1.80	0.66	6.9	-	-
6	砂混じりの固い粘土(CH)	最大値	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	固い砂質粘土(CL)	最大値	50	2.68	98.4	36.0	45.6	17.9	28.2	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	9	2.65	49.1	18.8	20.9	13.8	4.9	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	28.9	2.67	66.0	24.0	30.6	16.6	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-
8	非常に密な砂(SP)	最大値	50	2.66	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	9	2.64	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	43.9	2.66	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	強風化土（砂岩）	最大値	50	2.77	86.0	27.3	42.2	21.9	20.2	2.36	1.56	0.76	-	-	-	-	-	-	-	-	-	-
		最小値	50	2.73	52.4	15.1	33.2	21.3	12.0	1.99	1.56	0.76	-	-	-	-	-	-	-	-	-	-
		平均値	50.0	2.74	68.8	21.2	37.5	21.6	15.9	2.18	1.56	0.76	-	-	-	-	-	-	-	-	-	-
10	強～中風化のシルト岩/泥岩	最大値	-	2.83	-	-	-	-	-	2.72	-	-	-	-	-	-	-	-	-	-	1081	686
		最小値	-	2.70	-	-	-	-	-	2.40	-	-	-	-	-	-	-	-	-	-	71	61
		平均値	-	2.76	-	-	-	-	-	2.60	-	-	-	-	-	-	-	-	-	-	388	341

沖合エリアにおける各土層の土質特性

層番号	土質名	試験値の種類	N値	土粒子の密度 D (g/cm³)	細粒分含有率 (%)	自然 含水比 Wn(%)	アッターベルグ限界			単位体積重量 γ(g/cm³)		間隙比 eo	圧密試験						一軸圧縮試験		岩の圧縮試験 Rn (KG/cm²)	
							液性限界 W_L(%)	塑性限界 Wp(%)	塑性指数 Ip (%)	自然状態	乾燥状態		圧密係数 Cv (x 10^{-3} cm²/s) (1-2kgf/cm2)	圧縮指数 Cc	膨潤指数 Cr	圧縮比 CR = Cc/(1+e0)	膨潤比 RR = Cr/(1+e0)	圧密降伏応力Pc (KG/cm²)	圧縮強度q_u (KG/cm²)	破壊歪 εf (%)	自然状態	飽和状態
1a	緩い砂(SP)	最大値	7	2.66	10.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	5	2.66	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	6.0	2.66	8.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1b	粘土質砂(SC)	最大値	8	2.66	30.3	-	37.0	30.6	6.7	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	7	2.65	26.4	-	30.8	25.2	5.6	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	7.8	2.66	28.0	-	33.9	27.8	6.2	-	-	-	-	-	-	-	-	-	-	-	-	-
2	砂混じり粘土(CH)	最大値	2	2.71	99.7	76.0	86.0	36.1	50.0	1.85	1.36	2.09	0.52	0.82	0.196	0.28	0.066	0.83	0.42	10.5	-	-
		最小値	0	2.67	63.9	36.1	38.9	21.4	17.5	1.53	0.87	0.99	0.24	0.39	0.056	0.15	0.020	0.28	0.05	5.3	-	-
		平均値	1.1	2.69	88.3	62.0	67.5	29.7	37.8	1.61	0.99	1.74	0.35	0.62	0.127	0.22	0.044	0.57	0.16	8.5	-	-
3	粘土質砂(SC)	最大値	8	2.69	45.5	27.2	36.6	18.2	21.2	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	3	2.65	23.1	20.5	25.1	14.4	10.1	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	6.1	2.67	33.8	24.2	31.4	16.2	15.2	-	-	-	-	-	-	-	-	-	-	-	-	-
4	固い砂質粘土(CL)	最大値	16	2.74	94.6	31.2	46.6	24.8	21.8	2.01	1.60	0.91	-	-	-	-	-	-	-	-	-	-
		最小値	9	2.71	54.3	22.4	27.3	14.7	12.6	1.88	1.43	0.71	-	-	-	-	-	-	-	-	-	-
		平均値	12.8	2.73	83.0	27.2	39.4	20.9	18.5	1.94	1.51	0.82	-	-	-	-	-	-	-	-	-	-
5	砂混じり粘土(CH)	最大値	7	2.71	99.4	50.7	67.6	33.5	38.0	1.94	1.51	1.39	1.86	0.60	0.171	0.25	0.071	2.02	0.14	11.2	-	-
		最小値	3	2.67	62.8	28.4	37.2	18.2	19.0	1.68	1.12	0.77	0.86	0.16	0.023	0.09	0.013	0.86	0.14	11.2	-	-
		平均値	5.3	2.69	86.9	40.6	51.8	25.2	26.6	1.83	1.34	1.03	1.36	0.38	0.097	0.17	0.042	1.44	0.14	11.2	-	-
6	砂混じりの固い粘土(CH)	最大値	21	2.70	99.6	58.0	70.7	33.3	39.6	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	9	2.67	61.9	21.7	26.0	17.5	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	14.0	2.68	84.4	41.9	52.3	25.5	26.8	-	-	-	-	-	-	-	-	-	-	-	-	-
7	固い砂質粘土(CL)	最大値	22	2.70	76.4	27.1	35.8	21.2	19.9	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	11	2.67	48.0	22.1	25.4	13.7	7.4	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	17.9	2.69	64.2	23.3	29.1	16.1	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-
8	非常に密な砂(SP)	最大値	50	2.66	2.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	50	2.65	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	50.0	2.66	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	強風化土（砂岩）	最大値	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		最小値	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		平均値	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	強～中風化のシルト岩/泥岩	最大値	-	-	-	-	-	-	-	2.68	-	-	-	-	-	-	-	-	-	-	659	593
		最小値	-	-	-	-	-	-	-	2.61	-	-	-	-	-	-	-	-	-	-	230	194
		平均値	-	-	-	-	-	-	-	2.65	-	-	-	-	-	-	-	-	-	-	503	444

各エリアにおける各土層の土質特性（平均値）

層番号	土質名	試験値の種類	N値	土粒子の密度 D (g/cm^3)	細粒分含有率 (%)	自然 含水比 Wn(%)	アッターベルグ限界			単位体積重量 γ(g/cm^3)		間隙比 eo	圧密試験						一軸圧縮試験		岩の圧縮試験 Rn (KG/cm^2)	
							液性限界 W_L(%)	塑性限界 Wp(%)	塑性指数 Ip (%)	自然状態	乾燥状態		圧密係数 Cv ($\times 10^{-3}$ cm^2/s) (1-2kgf/cm2)	圧縮指数 Cc	膨潤指数 Cr	圧縮比 CR = Cc/(1+e0)	膨潤比 RR = Cr/(1+e0)	圧密降伏応力Pc (KG/cm^2)	圧縮強度 q_u (KG/cm^2)	破壊歪 εf (%)	自然状態	飽和状態
1a	緩い砂(SP)	港湾エリア	5.6	2.66	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		沖合エリア	6.0	2.66	8.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		全体エリア	5.9	2.66	8.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1b	粘土質砂(SC)	港湾エリア	8.5	2.66	31.8	-	34.3	27.7	6.5	-	-	-	-	-	-	-	-	-	-	-	-	-
		沖合エリア	7.8	2.66	28.0	-	33.9	27.8	6.2	-	-	-	-	-	-	-	-	-	-	-	-	-
		全体エリア	8.1	2.66	29.9	-	34.1	27.7	6.3	-	-	-	-	-	-	-	-	-	-	-	-	-
2	砂混じり粘土(CH)	港湾エリア	2.6	2.69	90.9	50.1	54.0	26.4	27.6	1.71	1.14	1.41	0.77	0.52	0.119	0.22	0.047	0.93	0.32	6.7	-	-
		沖合エリア	1.1	2.69	88.3	62.0	67.5	29.7	37.8	1.61	0.99	1.74	0.35	0.62	0.127	0.22	0.044	0.57	0.16	8.5	-	-
		全体エリア	2.4	2.69	90.4	52.5	56.7	27.1	29.6	1.69	1.12	1.46	0.68	0.54	0.121	0.22	0.046	0.85	0.28	7.2	-	-
3	粘土質砂(SC)	港湾エリア	7.0	2.67	49.9	27.3	31.0	17.0	13.9	1.91	1.47	0.82	1.27	0.26	0.033	0.14	0.018	1.38	0.43	-	-	-
		沖合エリア	6.1	2.67	33.8	24.2	31.4	16.2	15.2	-	-	-	-	-	-	-	-	-	-	-	-	-
		全体エリア	6.4	2.67	41.8	25.7	31.2	16.6	14.6	1.91	1.47	0.82	1.27	0.26	0.033	0.14	0.018	1.38	0.43	7.0	-	-
4	固い砂質粘土(CL)	港湾エリア	10.5	2.69	81.9	28.0	39.9	20.2	19.6	1.95	1.55	0.76	2.36	0.28	0.030	0.15	0.017	1.39	0.62	7.9	-	-
		沖合エリア	12.8	2.73	83.0	27.2	39.4	20.9	18.5	1.94	1.51	0.82	-	-	-	-	-	-	-	-	-	-
		全体エリア	10.7	2.70	82.0	27.9	39.8	20.3	19.6	1.95	1.55	0.76	2.36	0.28	0.030	0.15	0.017	1.39	0.62	7.9	-	-
5	砂混じり粘土(CH)	港湾エリア	6.5	2.70	93.8	42.9	50.8	23.9	26.9	1.76	1.22	1.23	1.26	0.52	0.110	0.23	0.050	1.80	0.66	6.9	-	-
		沖合エリア	5.3	2.69	86.9	40.6	51.8	25.2	26.6	1.83	1.34	1.03	1.36	0.38	0.097	0.17	0.042	1.44	0.14	11.2	-	-
		全体エリア	6.3	2.70	93.2	42.7	50.9	24.0	26.9	1.76	1.23	1.21	1.26	0.51	0.109	0.23	0.049	1.77	0.64	7.3	-	-
6	砂混じりの固い粘土 (CH)	港湾エリア	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		沖合エリア	14.0	2.68	84.4	41.9	52.3	25.5	26.8	-	-	-	-	-	-	-	-	-	-	-	-	-
		全体エリア	14.0	2.68	84.4	41.9	52.3	25.5	26.8	-	-	-	-	-	-	-	-	-	-	-	-	-
7	固い砂質粘土(CL)	港湾エリア	28.9	2.67	66.0	24.0	30.6	16.6	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-
		沖合エリア	17.9	2.69	64.2	23.3	29.1	16.1	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-
		全体エリア	22.5	2.68	65.1	23.6	29.8	16.4	13.5	-	-	-	-	-	-	-	-	-	-	-	-	-
8	非常に密な砂(SP)	港湾エリア	43.9	2.66	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		沖合エリア	50.0	2.66	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		全体エリア	46.6	2.66	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	強風化土（砂岩）	港湾エリア	50.0	2.74	68.8	21.2	37.5	21.6	15.9	2.18	1.56	0.76	-	-	-	-	-	-	-	-	-	-
		沖合エリア	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		全体エリア	50.0	2.74	68.8	21.2	37.5	21.6	15.9	2.18	1.56	0.76	-	-	-	-	-	-	-	-	-	-
10	強～中風化のシルト岩/泥岩	港湾エリア	-	2.76	-	-	-	-	-	2.60	-	-	-	-	-	-	-	-	-	-	388	341
		沖合エリア	-	-	-	-	-	-	-	2.65	-	-	-	-	-	-	-	-	-	-	503	444
		全体エリア	-	2.76	-	-	-	-	-	2.60	-	-	-	-	-	-	-	-	-	-	395	350

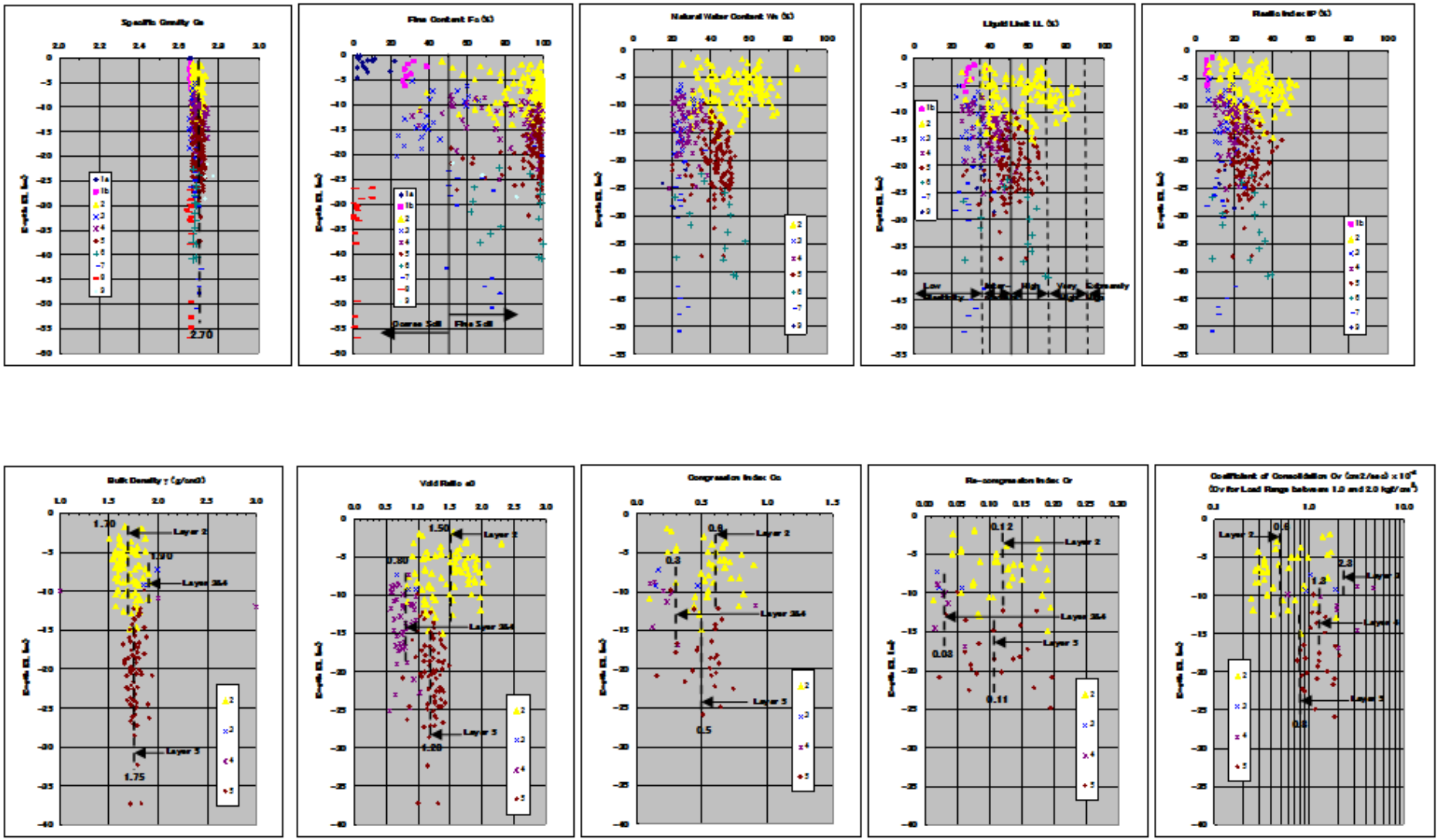


Figure 1　土質試験結果 (全エリア: 既往調査結果を含む)

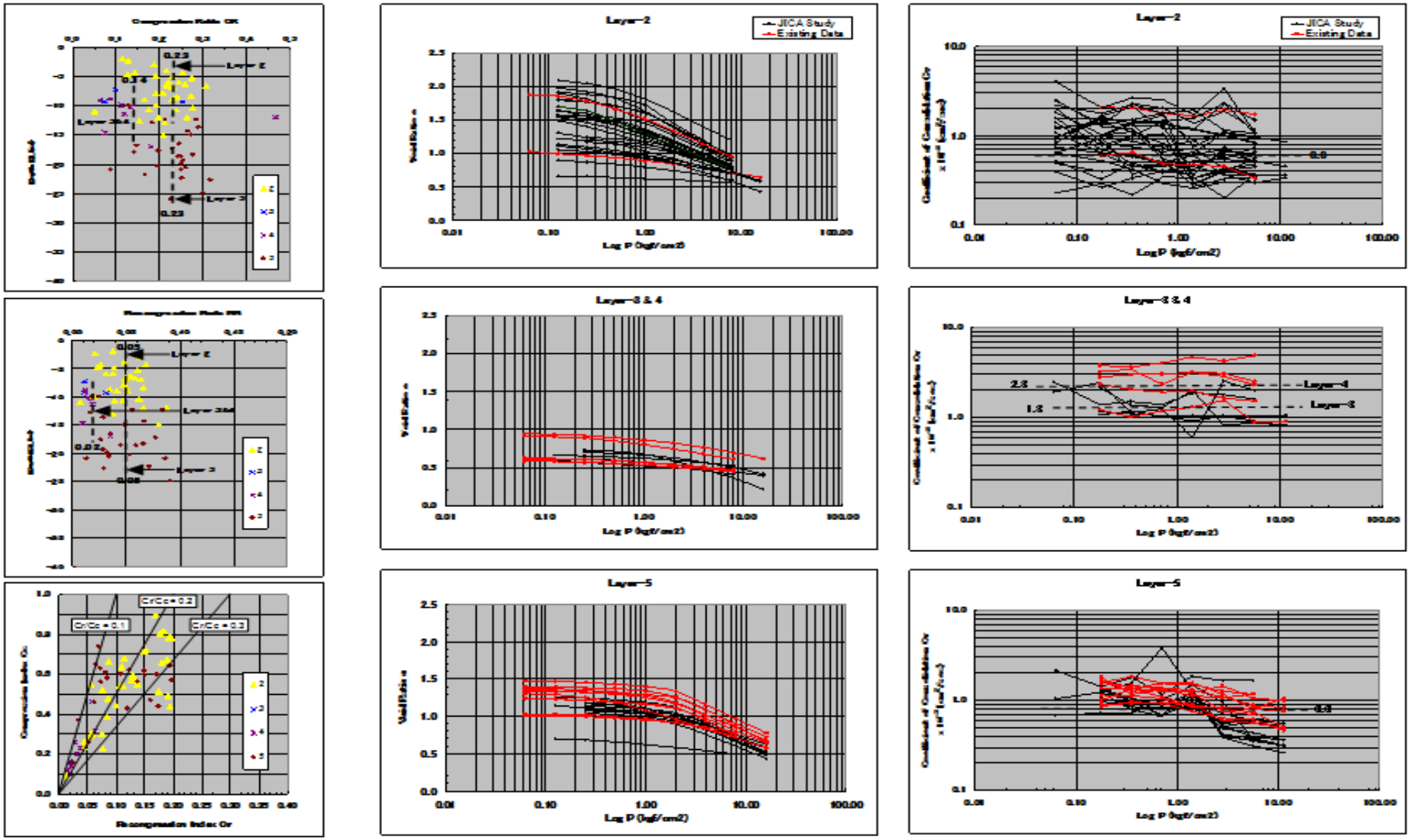


Figure 2　土質試験結果 (全エリア: 既往調査結果を含む)

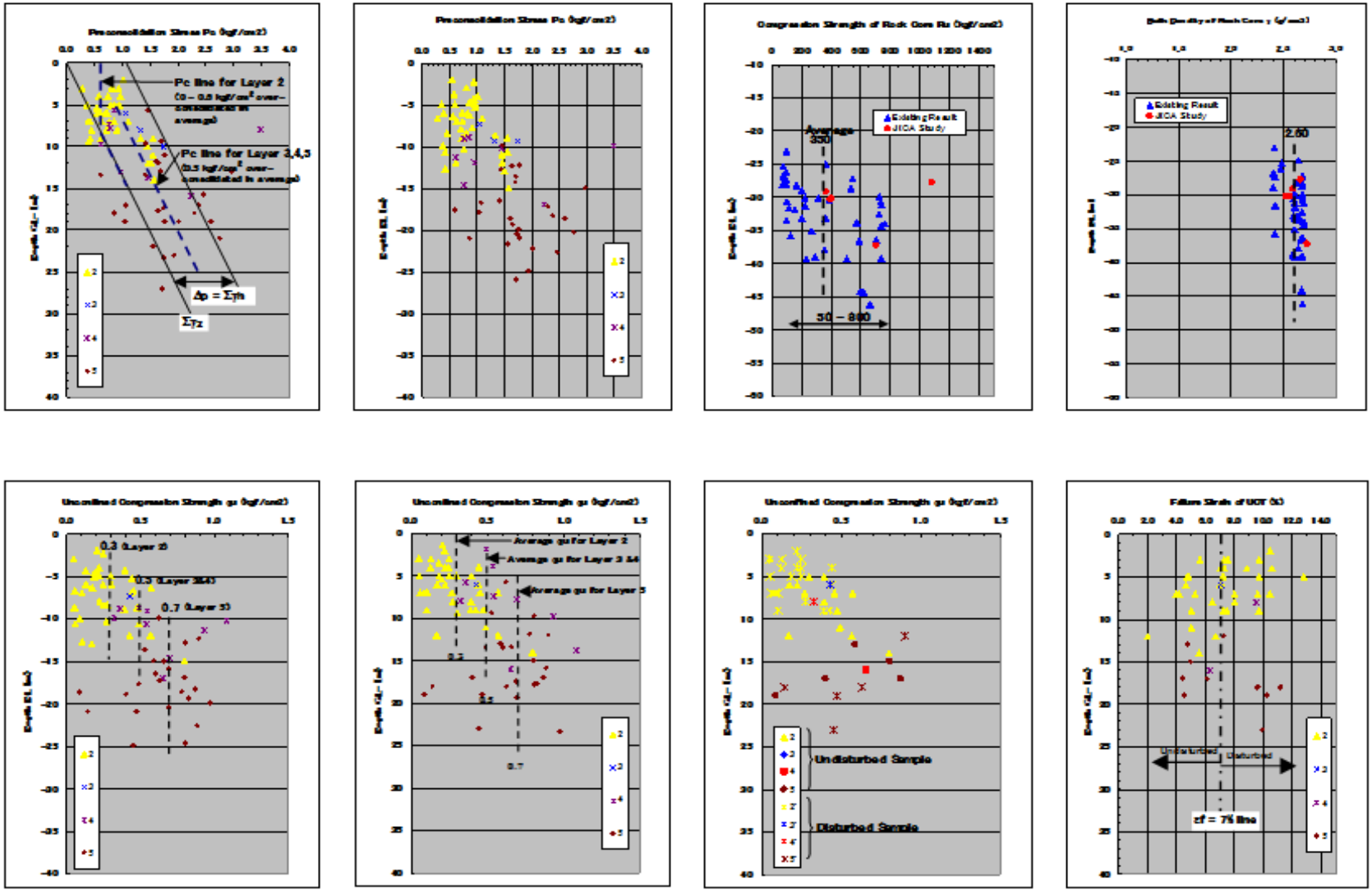


Figure 3 土質試験結果 (全エリア: 既往調査結果を含む)

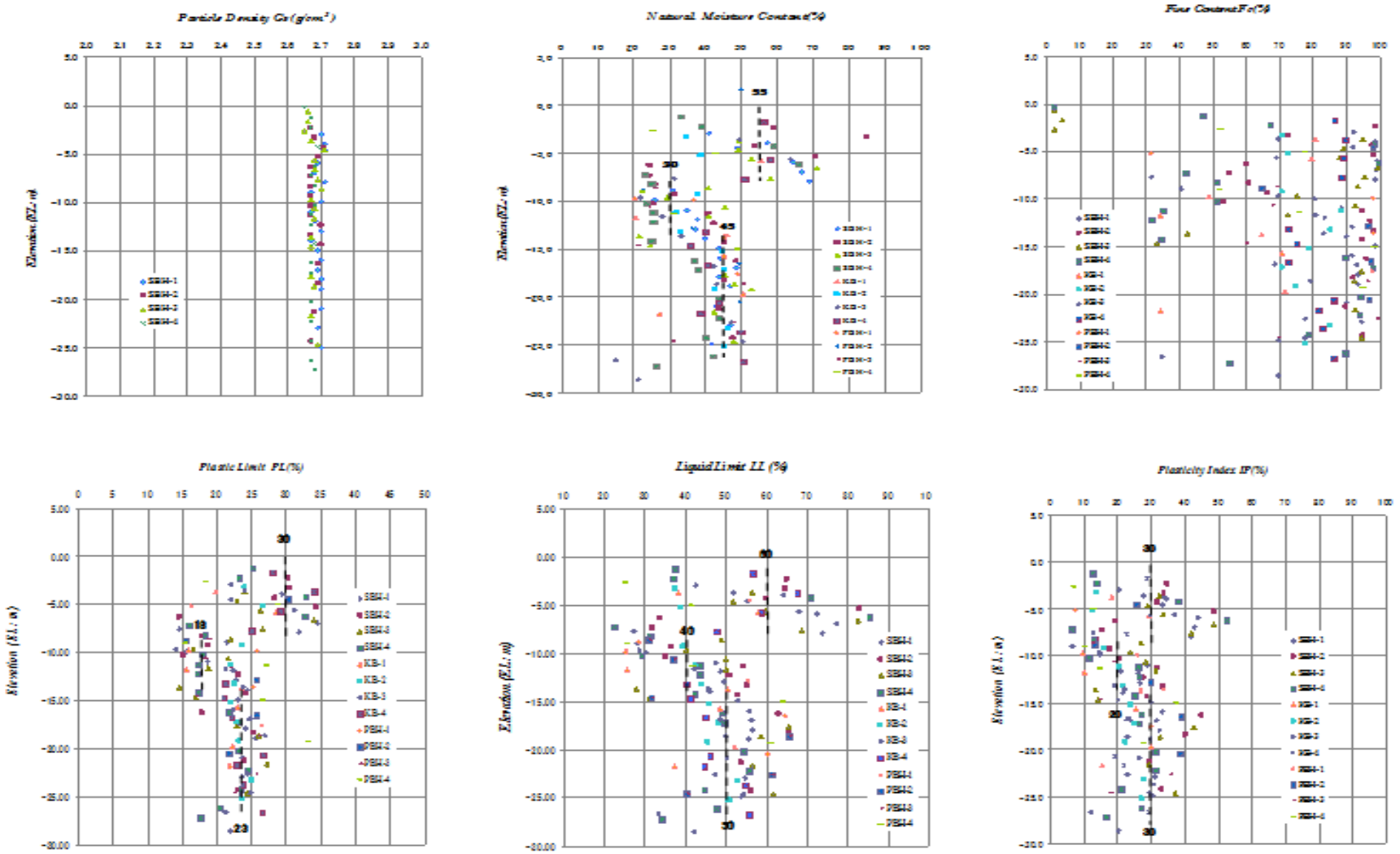


Figure 4　土質試験結果 (第一期の埋立計画エリア: 既往調査結果を含む)

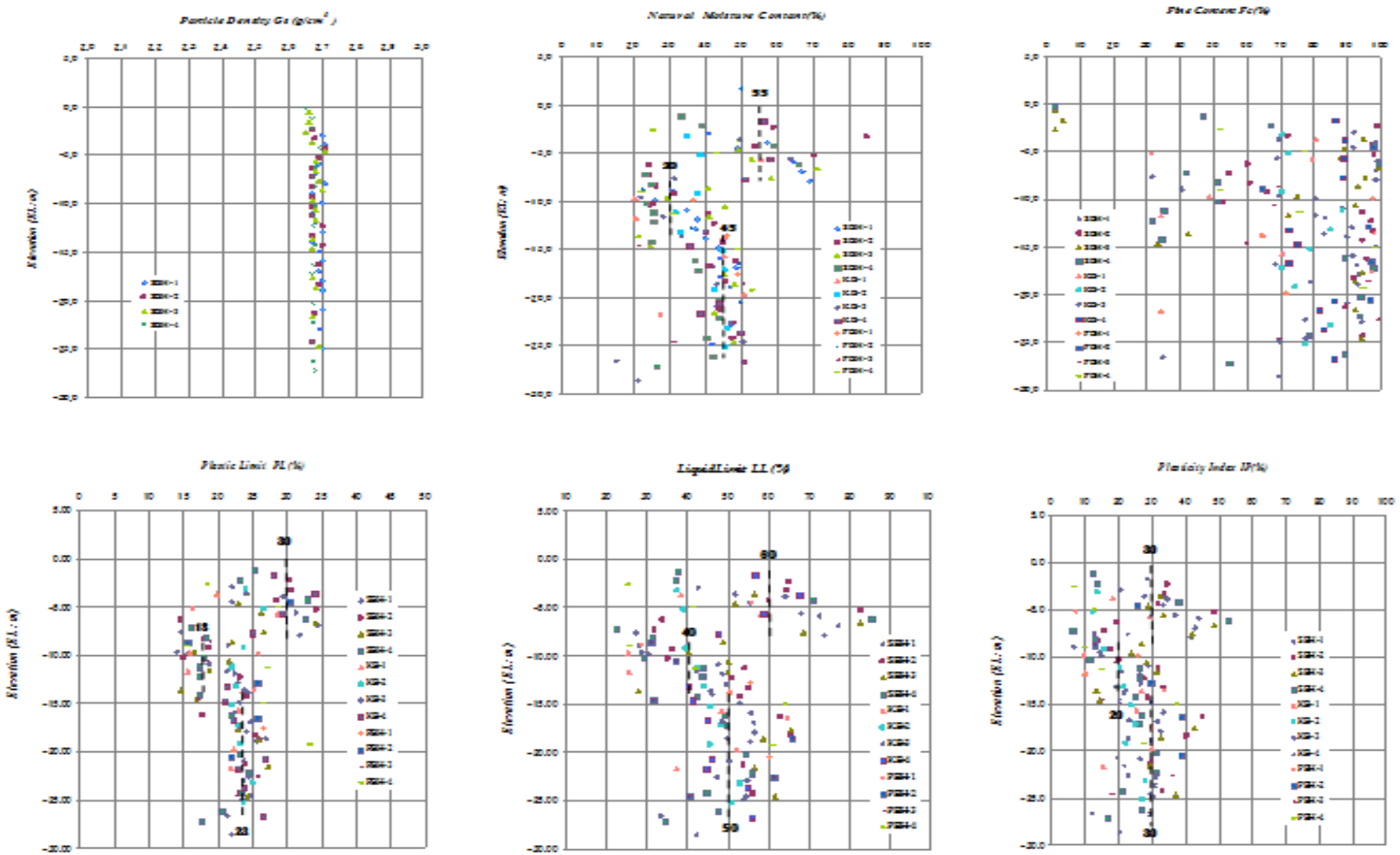


Figure 5 土質試験結果 (第一期の埋立計画エリア: 既往調査結果を含む)

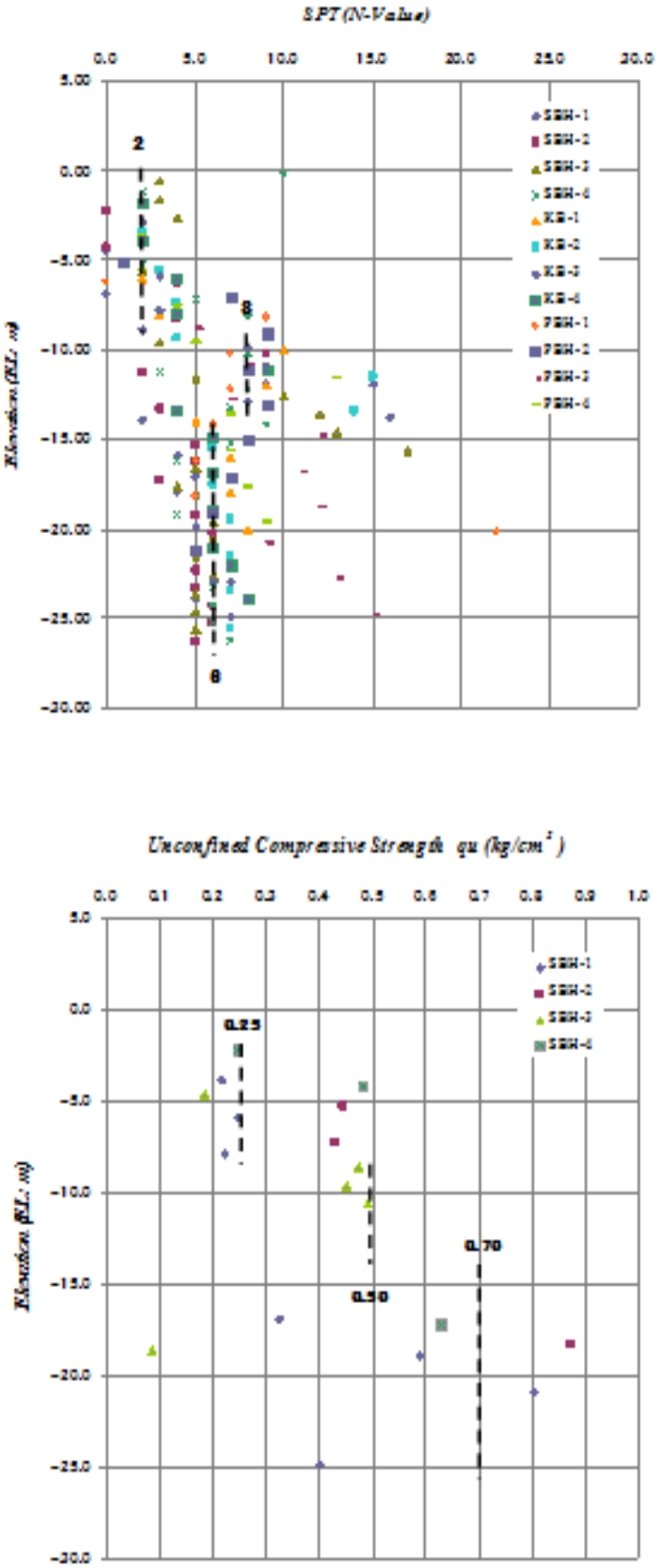


Figure 6 土質試験結果 (第一期の埋立計画エリア: 既往調査結果を含む)

Appendix7-3

土質特性間の相関図

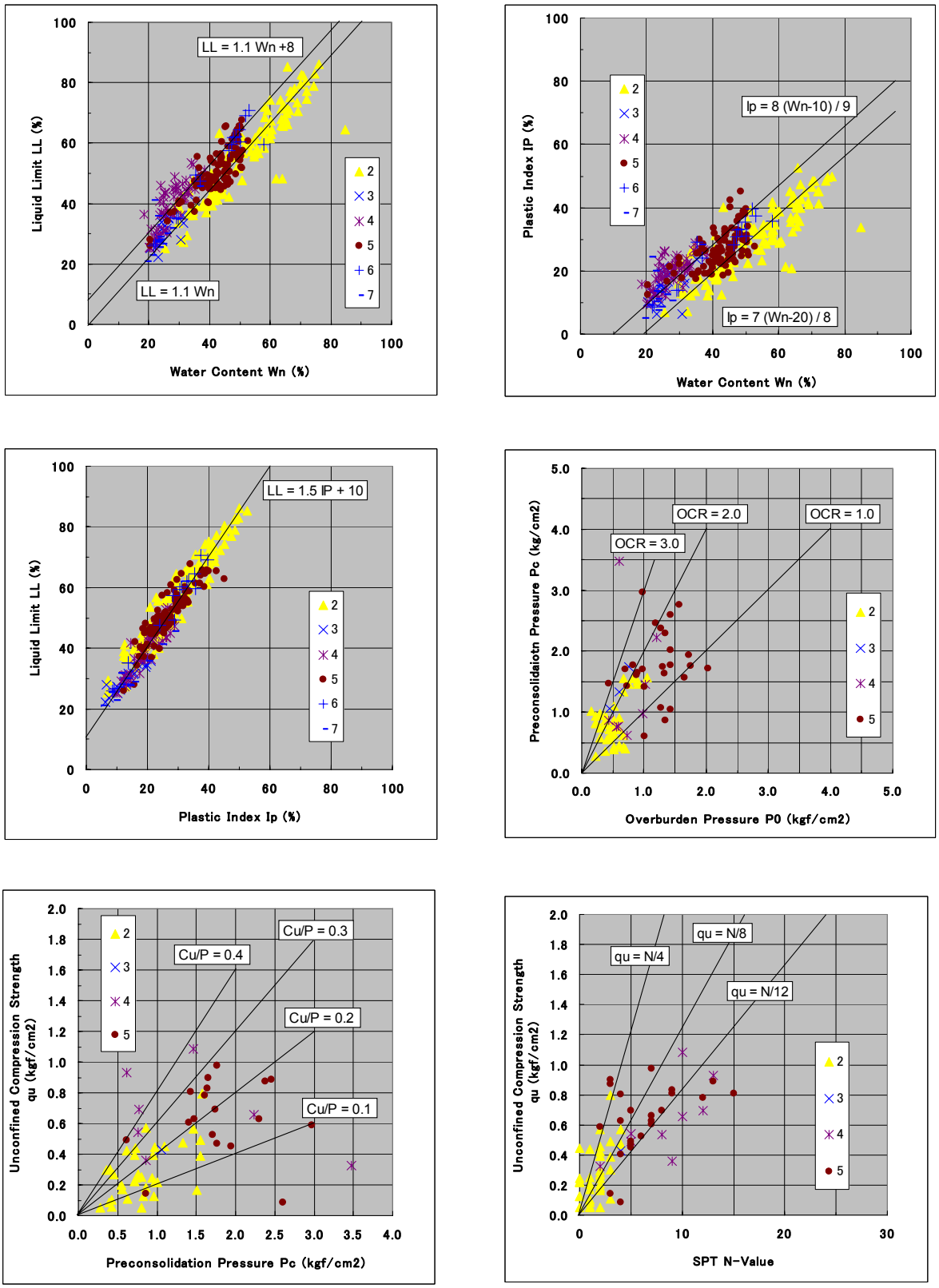
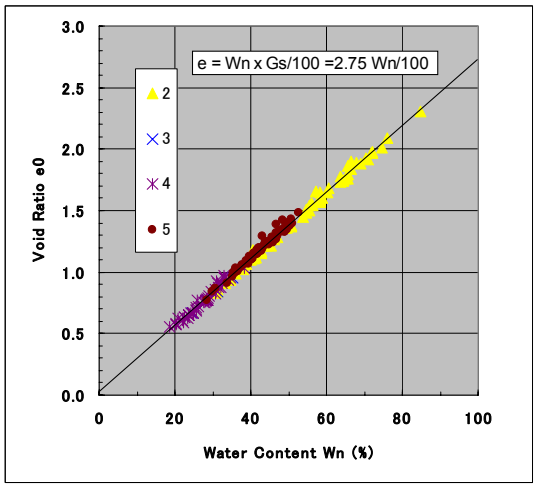
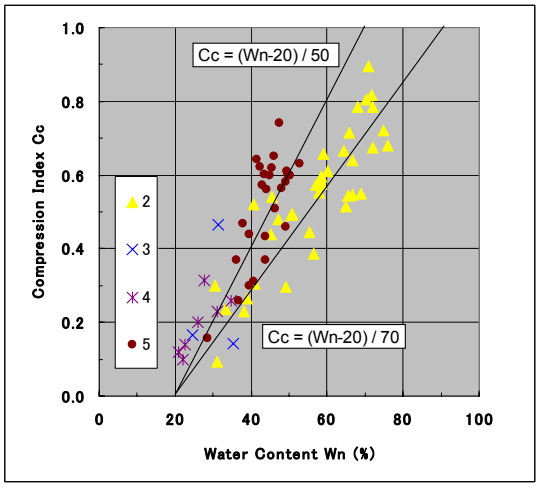
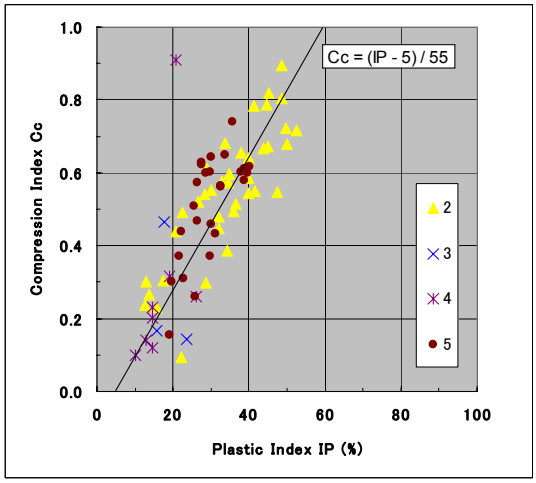
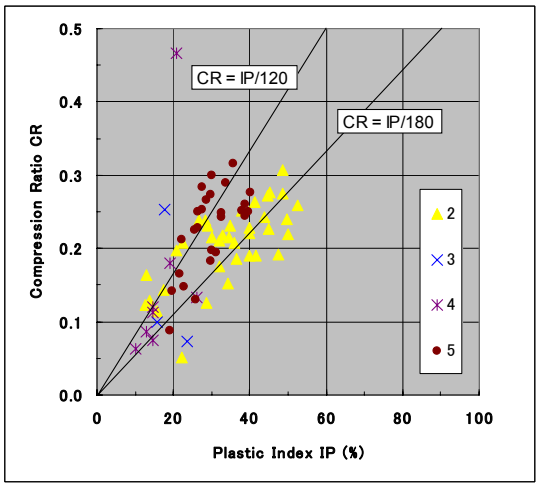


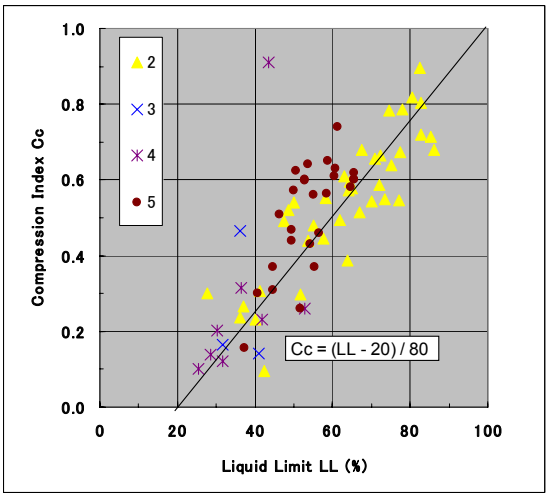
Figure 1　土質特性間の相関図 (全エリア: 既往調査結果を含む)











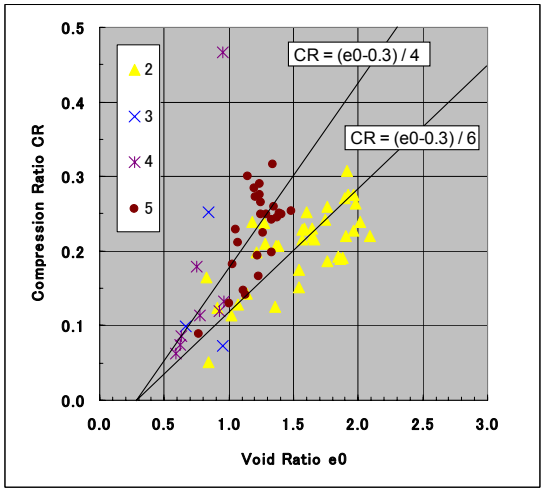


Figure 2　土質特性間の相関図 (全エリア: 既往調査結果を含む)

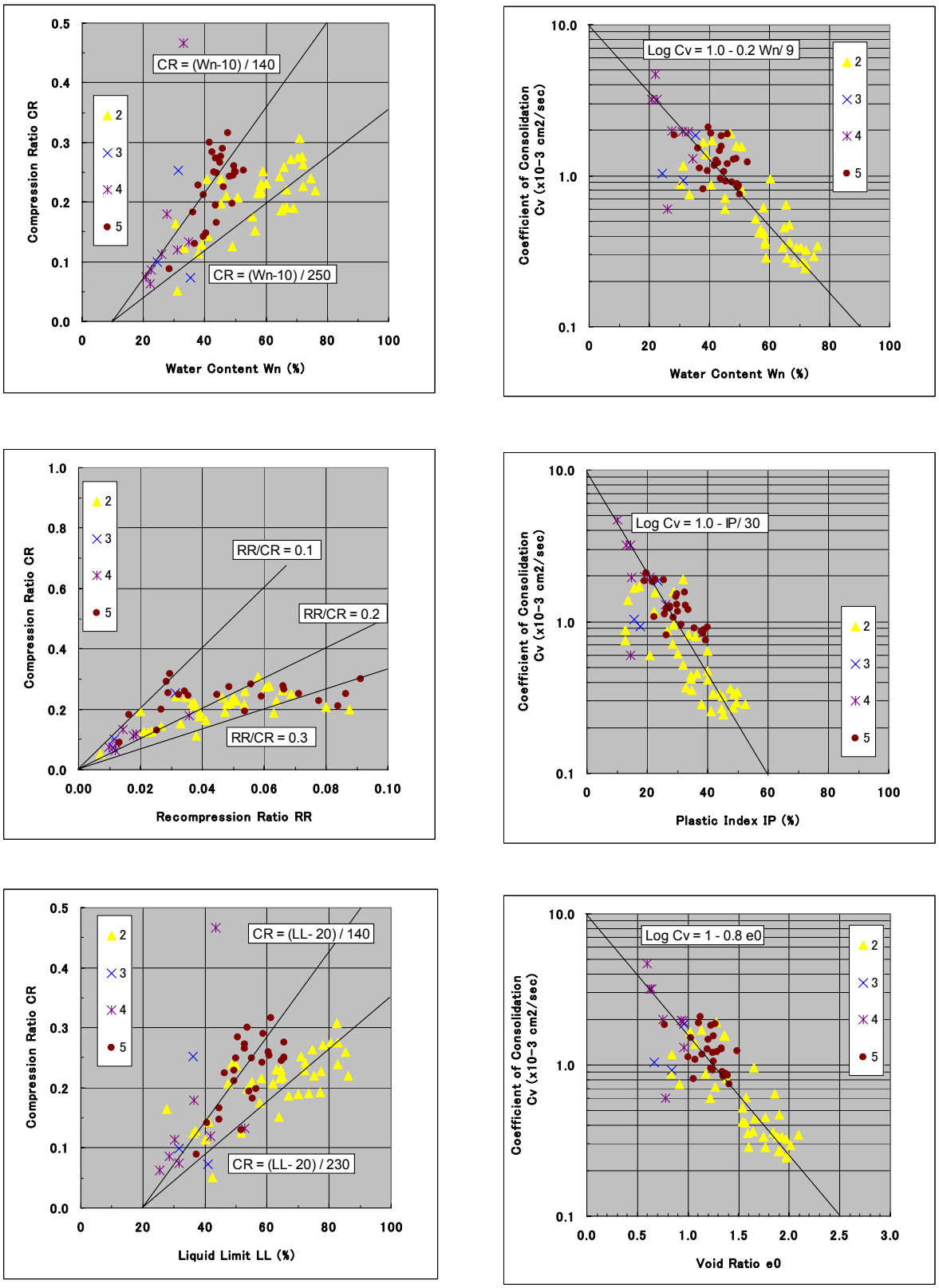


Figure 3　土質特性間の相関図 (全エリア: 既往調査結果を含む)

Appendix7-4

海底底質の試験結果

Table 1 底質の化学試験結果 - 1

Table-1.8.4.6 Chemical Test Result of Seabed Materials (Content unit ; mg/kg dry)

Sample No.	Copper (Cu)	Lead (Pb)	Zinc (Zin)	Cadmium (Cd)	Arsenic (As)	Mercury (Hg)	Chromium (Cr)	Nickel (Ni)	Organic Substance	COD	Cyanide (CN)	Total Oil	Sulphate (SO_4^{2-})	Iron II (Fe^{2+})	IronIII (Fe^{3+})	Manganese (Mn)
01	37.52	70.92	147.27	1.86	1.59	1.08	64.00	35.13	1588	1250	0.25	59.93	4099	0.2	0.58	0.034
02	31.25	75.68	135.24	1.02	2.68	0.45	75.48	30.29	2325	1399	0.29	29.99	4085	0.17	0.67	0.032
03	69.06	85.42	200.38	1.10	3.48	1.15	62.00	47.05	7268	2553	0.21	149.81	4074	0.19	0.78	0.054
04	33.56	79.39	132.00	0.95	4.01	0.39	69.54	33.65	4089	2292	0.21	99.89	3621	0.15	0.61	0.031
05	39.59	65.68	152.25	0.78	1.72	0.65	55.00	44.30	7682	2218	0.26	99.99	3901	0.25	0.73	0.037
06	29.15	64.12	141.20	0.89	5.68	0.42	21.25	36.15	2835	1622	0.19	29.97	3826	0.21	1.08	0.034
07	18.48	85.11	239.88	0.98	6.38	0.70	67.10	38.20	6837	2887	0.25	99.98	3259	0.24	0.92	0.066
08	20.36	79.85	158.98	0.79	4.56	0.36	60.23	29.96	5925	2590	0.09	30.00	3245	0.32	0.77	0.039
09	10.00	38.90	59.90	1.26	1.74	0.35	89.31	43.00	4978	2367	0.21	49.95	3992	0.30	0.82	0.014
10	15.68	35.64	35.69	0.88	3.72	0.40	77.89	28.78	3247	2069	0.25	49.99	3871	0.48	1.24	0.003
11	24.75	48.79	181.04	0.88	1.77	0.54	78.56	25.34	3801	2067	0.22	29.96	4699	0.19	0.55	0.047
12	19.65	41.69	133.62	0.69	2.00	0.29	69.68	30.21	1647	1027	0.19	89.90	4515	0.18	0.52	0.031
13	45.92	69.87	234.42	0.76	2.56	0.82	46.68	39.00	8844	3111	0.16	499.82	4568	0.42	1.10	0.064
14	30.21	55.98	145.21	0.78	3.45	0.33	54.26	32.12	3320	2106	0.14	69.98	4498	0.35	0.88	0.001
15	42.47	71.44	164.91	1.44	2.09	0.61	59.05	36.39	6066	2925	0.22	30.00	5127	0.15	0.54	0.041
16	29.87	65.36	139.02	1.12	4.15	0.24	50.12	40.15	5950	2515	0.14	69.98	5019	0.39	0.75	0.033
17	27.53	54.98	183.32	1.39	1.78	0.65	80.59	50.60	4586	2255	0.21	169.98	4420	0.11	0.19	0.048
18	25.46	49.95	128.72	1.08	2.65	0.26	75.45	33.68	5682	3260	0.26	59.94	4395	0.27	0.52	0.029
19	56.81	84.00	120.14	0.80	2.52	0.95	72.58	39.11	2448	1771	0.21	229.67	5572	0.17	0.35	0.027
20	39.91	71.25	105.61	0.71	3.46	0.45	65.35	35.02	8305	3594	0.22	39.94	5412	0.21	0.32	0.022
21	7.62	56.29	194.98	0.65	1.54	1.03	26.57	39.24	5841	2739	0.21	179.62	5119	0.21	0.42	0.051
22	15.24	62.34	160.24	0.89	5.67	0.36	36.64	32.15	6811	2478	0.18	49.98	5065	0.22	0.29	0.042
23	20.71	43.65	152.29	0.23	1.49	0.60	77.44	52.90	6401	2255	0.16	109.97	4403	0.18	0.47	0.037
24	16.35	41.56	125.42	0.36	3.65	0.34	64.12	30.65	5754	2367	0.26	69.91	4501	0.20	0.46	0.029
25	40.95	59.70	170.40	0.91	1.92	0.73	42.50	37.00	4190	2627	0.22	19.98	4181	0.20	0.39	0.044
26	22.70	34.40	56.23	0.23	0.92	0.13	31.00	12.25	2226	878	0.04	59.96	1778	0.13	0.09	0.005
27	19.47	36.67	77.85	0.55	1.25	0.39	39.65	26.56	5169	2255	0.25	79.04	1812	0.32	0.75	0.012
28	26.95	29.98	156.98	0.61	1.19	0.33	45.68	22.39	6458	2590	0.15	29.29	1925	0.27	0.69	0.039
29	21.09	30.48	49.17	0.22	0.90	0.96	26.62	17.00	13464	990	0.07	169.64	6140	0.14	0.39	0.003
30	12.79	26.32	46.49	0.18	0.72	0.13	31.00	14.20	2339	1027	0.05	129.27	321	0.09	0.10	0.002
31	16.35	39.78	44.65	0.62	0.96	0.24	39.96	19.65	10726	4301	0.17	69.16	1569	0.15	0.36	0.003
32	21.45	45.68	71.45	0.55	1.26	0.19	55.64	15.69	6996	2069	0.26	19.76	258	0.08	0.16	0.012
33	21.95	41.94	52.73	0.78	0.70	0.37	70.90	18.72	7697	2143	0.16	149.65	8880	0.28	0.24	0.004
34	24.78	29.87	66.58	0.44	0.87	0.18	80.12	25.54	8761	2627	0.22	59.27	6530	0.22	0.29	0.008
35	5.39	17.43	37.40	0.37	0.91	0.14	27.35	10.04	1938	767	0.03	49.40	346	0.05	0.088	0.001

Table 2 底質の化学試験結果 - 2

Table-1.8.4.6 Chemical Test Result of Seabed Materials (Continued) (Content unit ; mg/kg dry)

Sample No.	Copper (Cu)	Lead (Pb)	Zinc (Zin)	Cadmium (Cd)	Arsenic (As)	Mercury (Hg)	Chromium (Cr)	Nickel (Ni)	Organic Substance	COD	Cyanide (CN)	Total Oil	Sulphate (SO_4^{2-})	Iron II (Fe^{2+})	IronIII (Fe^{3+})	Manganese (Mn)
36	7.15	25.64	51.29	0.49	3.02	0.21	59.69	25.65	13431	3483	0.11	49.36	4256	0.21	0.50	0.005
37	26.12	48.41	132.63	0.35	2.16	0.75	60.00	42.80	7830	3111	0.25	59.87	3366	0.26	0.60	0.039
38	22.19	40.35	92.65	0.54	2.96	0.28	69.54	29.69	6317	2478	0.21	59.95	3219	0.38	0.77	0.018
39	8.26	36.42	44.67	0.67	0.58	0.15	28.00	10.00	2070	841	0.05	29.97	1835	0.35	0.92	0.003
40	9.65	51.10	39.98	0.62	0.87	0.17	45.10	19.65	9137	3855	0.22	29.96	1800	0.37	0.76	0.003
41	42.80	67.48	141.21	1.11	0.67	0.60	60.84	30.19	4851	1994	0.25	109.89	5695	0.19	0.32	0.037
42	9.62	21.88	39.90	0.12	1.09	0.13	22.70	11.80	2575	878	0.03	19.76	535	0.06	0.11	0.002
43	15.42	15.89	65.25	0.38	1.98	0.25	65.59	26.69	1992	915	0.18	29.93	4912	0.26	0.52	0.009
44	14.68	35.64	49.69	0.71	2.65	0.16	45.67	29.12	1061	878	0.19	69.99	4568	0.22	0.39	0.003
45	21.45	51.95	93.87	0.93	0.67	0.41	28.00	20.00	556	432	0.26	29.64	8570	0.15	0.17	0.017
46	18.27	33.67	68.71	0.64	2.25	0.19	42.10	18.59	760	580	0.24	19.75	8211	0.14	0.22	0.009
47	18.26	54.51	76.96	0.71	1.16	0.35	55.25	21.16	2245	1250	0.21	19.48	7794	0.32	0.36	0.012
48	14.38	45.65	65.59	0.49	1.68	0.25	60.21	18.95	3247	1548	0.32	40.00	7502	0.28	0.39	0.009
49	25.47	50.02	124.16	0.91	1.15	0.56	57.92	16.13	6060	2887	0.19	19.96	5317	0.17	0.42	0.028
50	22.19	40.12	92.56	0.68	2.34	0.24	51.24	25.64	1768	1250	0.20	29.96	5029	0.27	0.44	0.017
51	10.50	34.67	61.33	0.88	0.88	0.27	44.71	19.33	1603	1027	0.22	19.76	4683	0.26	0.50	0.009
52	9.68	32.16	55.85	0.50	0.94	0.19	39.65	25.68	5080	2664	0.30	59.93	4544	0.35	0.56	0.005
53	20.34	37.45	99.23	0.48	1.04	0.48	19.11	27.50	2919	1622	0.22	29.93	3695	0.42	0.71	0.017
54	16.74	35.12	74.56	1.24	1.65	0.30	32.12	24.82	3136	1511	0.23	9.98	3591	0.25	0.52	0.012
55	20.84	81.73	89.07	1.17	1.34	0.46	62.00	44.73	7223	3818	0.16	59.66	3868	0.40	0.60	0.015
56	15.68	60.58	105.21	0.67	1.56	0.26	54.12	30.69	6449	3148	0.16	79.79	3825	0.29	0.63	0.021
57	17.46	28.84	56.08	0.42	1.74	0.39	36.83	27.00	2276	1511	0.22	29.83	3062	0.39	0.80	0.005
58	21.22	25.12	91.25	0.56	3.01	0.33	30.29	33.84	2691	1622	0.22	39.91	2895	0.41	0.82	0.018
59	25.00	46.76	113.51	0.81	1.35	0.38	38.83	34.37	2138	1399	0.14	49.87	3736	0.36	0.68	0.023
60	18.65	30.68	85.64	1.00	2.56	0.24	45.36	37.12	3815	2143	0.08	59.78	3656	0.25	0.57	0.015
61	30.55	77.85	142.23	1.10	0.99	0.55	67.49	45.88	1443	1027	0.22	29.93	8304	0.24	0.29	0.054
62	25.65	56.98	78.89	0.78	0.87	0.31	55.69	38.00	5700	2367	0.22	39.95	8125	0.22	0.22	0.012
63	20.37	43.89	82.84	1.30	1.59	0.39	32.51	31.40	2492	1250	0.21	20.00	6650	0.29	0.38	0.016
64	16.87	37.84	69.95	0.91	1.69	0.30	37.38	29.56	5261	2143	0.21	29.70	6425	0.18	0.40	0.009
65	17.61	56.51	100.86	0.66	0.91	0.39	57.40	39.30	6149	2813	0.13	49.98	3399	0.26	0.52	0.020
66	25.65	45.98	79.65	0.75	1.54	0.20	60.08	30.00	13677	4004	0.12	59.92	3512	0.19	0.42	0.012
67	28.34	49.90	116.11	0.63	0.92	0.70	62.80	21.67	7624	2887	0.27	39.90	3967	0.17	0.48	0.023
68	21.84	55.69	65.89	0.81	1.72	0.54	54.25	25.46	9296	3855	0.21	78.92	3856	0.09	0.32	0.009
69	16.71	62.92	75.86	0.79	0.82	0.45	48.53	17.68	6812	3111	0.14	49.94	4214	0.19	0.35	0.012
70	14.12	57.45	70.12	0.62	0.96	0.41	49.69	19.65	8587	2962	0.13	39.95	4018	0.21	0.42	0.012

Table 3 底質の化学試験結果 - 3

Table-1.8.4.6 Chemical Test Result of Seabed Materials (Continued) (Content unit ; mg/kg dry)

Sample No.	Copper (Cu)	Lead (Pb)	Zinc (Zin)	Cadmium (Cd)	Arsenic (As)	Mercury (Hg)	Chromium (Cr)	Nickel (Ni)	Organic Substance	COD	Cyanide (CN)	Total Oil	Sulphate (SO_4^{2-})	Iron II (Fe^{2+})	IronIII (Fe^{3+})	Manganese (Mn)
71	26.47	36.31	112.85	0.75	0.51	0.54	60.70	25.98	4762	1920	0.21	19.95	4362	0.25	0.29	0.028
72	22.59	35.10	80.20	0.49	0.78	0.39	71.28	21.03	6885	1846	0.19	129.78	4215	0.29	0.52	0.013
73	24.76	56.23	111.46	0.83	0.68	0.41	58.90	16.32	8264	2180	0.15	29.94	4526	0.21	0.36	0.027
74	21.02	45.69	79.98	0.61	0.79	0.33	60.39	19.85	7867	2106	0.14	39.95	4259	0.19	0.32	0.012
75	14.62	95.46	249.35	1.48	1.28	1.47	50.40	37.27	6938	1994	0.22	29.94	6897	0.24	0.40	0.034
76	20.65	67.78	150.65	0.51	1.24	0.38	59.69	25.69	9728	3185	0.21	19.93	6711	0.16	0.25	0.038
77	27.02	48.30	123.21	0.95	1.16	0.46	33.86	29.20	5556	2255	0.13	69.91	6971	0.11	0.26	0.029
78	19.97	51.29	126.65	0.45	2.00	0.40	45.36	32.65	8981	2925	0.20	29.93	7014	0.25	0.23	0.027
79	28.82	39.81	67.61	0.47	1.05	1.32	46.64	29.80	6648	2739	0.13	19.97	4321	0.32	0.31	0.009
80	20.34	41.52	115.98	0.60	1.34	0.50	40.12	33.12	9030	3185	0.16	49.94	4212	0.27	0.20	0.024

Table 4 底質の化学試験結果(総括)

項目			最小値	最大値	平均値 (mg/kg dry)
銅	Cu	:	5.39	69.06	22.96
鉛	Pb	:	15.89	95.46	49.56
亜鉛	Zin	:	35.69	249.35	106.41
カドミウム	Cd	:	0.12	1.86	0.75
ヒ素	As	:	0.51	6.38	1.88
水銀	Hg	:	0.13	1.47	0.45
クロム	Cr	:	19.11	89.31	52.47
ニッケル	Ni	:	10.00	52.90	29.03
有機物		:	556	13,677	5,439
COD		:	432	4,301	2,195
シアン	CN	:	0.03	0.32	0.19
油分		:	9.98	499.82	64.57
硫酸	SO_4^{2-}	:	258	8,880	4,437
鉄 II	Fe^{2+}	:	0.05	0.48	0.24
鉄 III	Fe^{3+}	:	0.09	1.24	0.49
マグネシウム	Mn		0.00	0.07	0.02

Table 5 底質の土質試験結果 - 1

No.	サンプル番号	座標 VN2000		ふるい(mm)通過重量百分率 (%)									自然含水比 Wn(%)	アッターベルグ限界				土粒子の密度 Δ (g/cm³)	土質分類	備考
		E	N	19	9.5	4.75	2.00	0.85	0.425	0.25	0.075	< 0.005		液性限界 W_L(%)	塑性限界 Wp(%)	塑性指数 Ip (%)	コンシステンシー指数 (B)			
1	SBS 1	2304941	618222				100.00	99.8	99.32	97.93	68.00	30.72	75.86	34.32	18.87	15.45	3.69	2.68	CL	茶灰色の砂質粘土
2	SBS 2	2303493	618276				100.0	99.90	99.80	99.68	97.67	20.35	55.80	28.44	18.16	10.28	3.66	2.69	CL	茶灰色の貝殻混じり粘土
3	SBS 3	2303780	619704				100.0	99.96	99.88	99.78	97.56	47.07	95.74	56.02	26.62	29.40	2.35	2.67	CH	茶灰色の塑性に富む粘土
4	SBS 4	2302449	619374				100.0	99.76	99.62	99.42	94.27	38.82	92.99	50.21	23.50	26.71	2.60	2.67	CH	茶灰色の塑性に富む粘土
5	SBS 5	2302673	620461				100.0	99.7	99.24	98.05	78.34	34.33	87.04	51.63	24.41	27.22	2.30	2.68	CH	茶灰色の塑性に富む砂混じり粘土
6	SBS 6	2301889	621357				100.0	99.5	99.00	95.00	54.34	16.69	54.88	34.64	19.37	15.27	2.33	2.68	CL	茶灰色の砂質粘土
7	SBS 7	2301382	620674		100.0	81.4	64.6	57.8	51.19	39.82	31.59	6.63	33.86	24.51	17.23	7.28	2.28	2.70	SC	茶灰色の礫、貝殻混じり粘土質砂
8	SBS 8	2300876	619992				100.0	99.9	99.50	97.89	88.24		88.25	53.92	26.46	27.46	2.25	2.68	CH	茶灰色の塑性に富む粘土
9	SBS 9	2300251	619037				100.0	99.9	99.50	97.47	91.21		81.08	40.42	21.51	18.91	3.15	2.68	CL	茶灰色の粘土
10	SBS 10	2299847	616832				100.0	99.8	98.60	97.57	57.74	9.41	47.84	28.60	18.76	9.84	2.96	2.67	CL	茶灰色の砂質粘土
11	SBS 11	2299390	614639				100.0	99.8	99.28	97.63	61.47	8.59	33.29	25.03	18.41	6.62	2.25	2.70	CL	茶灰色の砂質粘土
12	SBS 12	2299846	620607				100.0	96.1	92.56	86.25	60.31	17.24	55.62	35.49	19.44	16.05	2.25	2.67	CL	茶灰色の貝殻混じり砂質粘土
13	SBS 13	2300352	621289				100.0	99.2	98.86	98.21	88.37		99.50	63.66	27.10	36.56	1.98	2.67	CH	茶灰色の塑性に富む粘土
14	SBS 14	2300560	622118				100.0	98.3	97.40	96.21	52.22	22.27	58.10	32.35	18.59	13.76	2.87	2.68	CL	茶灰色の砂質粘土
15	SBS 15	2299828	622588				100.0	99.2	98.80	98.27	89.58		91.90	60.68	26.36	34.32	1.91	2.68	CH	茶灰色の塑性に富む粘土
16	SBS 16	2299321	621905				100.0	99.6	98.98	97.48	85.84	32.82	94.30	56.58	25.98	30.60	2.23	2.67	CH	茶灰色の塑性に富む粘土
17	SBS 17	2298814	621223				100.0	99.9	99.56	98.43	47.80	23.08	67.35	34.41	19.35	15.06	3.19	2.67	SC	茶灰色の粘土質砂
18	SBS 18	2298281	620072					100.0	99.94	99.82	86.70	37.01	82.22	46.30	22.81	23.49	2.53	2.69	CL	茶灰色の粘土質
19	SBS 19	2297854	617759				100.0	99.8	99.42	98.51	88.86	37.32	75.03	51.95	22.63	29.32	1.79	2.69	CH	茶灰色の塑性に富む粘土
20	SBS 20	2297399	615498				100.0	99.9	99.84	99.48	85.81	33.40	95.70	58.11	25.07	33.04	2.14	2.71	CH	茶灰色の塑性に富む粘土
21	SBS 21	2297812	621879				100.0	99.8	99.56	98.82	48.42	24.91	66.47	33.59	20.00	13.59	3.42	2.68	SC	茶灰色の粘土質砂
22	SBS 22	2298318	622561				100.0	100.0	99.82	99.32	88.93	30.48	95.32	59.59	22.67	36.92	1.97	2.71	CH	茶灰色の塑性に富む粘土
23	SBS 23	2298825	623244				100.0	99.6	99.16	98.62	88.90	36.56	93.81	51.09	25.16	25.93	2.65	2.67	CH	茶灰色の塑性に富む粘土
24	SBS 24	2297862	623958				100.0	100.0	99.92	99.76	98.42	29.53	84.52	45.10	21.89	23.21	2.70	2.68	CL	茶灰色の粘土
25	SBS 25	2297355	623275				100.0	99.7	99.66	99.50	96.16	32.30	95.11	65.88	27.47	38.41	1.76	2.67	CH	茶灰色の塑性に富む粘土
26	SBS 26	2296848	622593				100.0	98.9	98.77	97.68	0.81							2.66	SP	茶灰色の均一粒度の砂
27	SBS 27	2296090	621213					100.0	99.82	99.58	77.37	27.33	73.63	36.55	20.34	16.21	3.29	2.68	CL	茶灰色の砂混じり粘土
28	SBS 28	2295699	619024				100.0	99.8	99.60	98.70	45.22	21.29	64.28	46.96	23.65	23.31	1.74	2.67	SC	茶灰色の粘土質砂
29	SBS 29	2295256	616811				100.0	99.6	99.46	99.26	97.35	34.24	96.63	58.43	24.83	33.60	2.14	2.67	CH	茶灰色の塑性に富む粘土
30	SBS 30	2295884	623309				100.0	99.6	98.82	97.06	1.42							2.66	SP	茶灰色の均一粒度の砂

Table 6 底質の土質試験結果 - 2

No.	サンプル番号	座標 VN2000		ふるい(mm)通過重量百分率 （%）									自然含水比 Wn(%)	アッターベルグ限界				土粒子の密度 Δ (g/cm³)	土質分類	備考
		E	N	19	9.5	4.75	2.00	0.85	0.425	0.25	0.075	< 0.006		液性限界 W_L(%)	塑性限界 Wp(%)	塑性指数 Ip (%)	コンシステンシー指数 (B)			
31	SBS 31	2296391	623991				100.0	99.9	99.82	99.70	87.58	33.53	87.87	47.57	25.22	22.35	2.80	2.68	CL	茶灰色の粘土
32	SBS 32	2296898	624674				100.0	99.8	99.72	99.56	87.55		91.25	46.48	24.72	21.76	3.06	2.68	CL	茶灰色の粘土
33	SBS 33	2295935	625390				100.0	99.7	99.50	98.25	48.32	20.01	57.01	36.23	19.76	16.47	2.26	2.67	SC	茶灰色の粘土質砂
34	SBS 34	2295428	624707				100.0	99.8	99.72	99.48	88.66		97.31	40.15	21.40	18.75	4.05	2.68	CL	茶灰色の粘土
35	SBS 35	2294921	624025				100.0	99.6	98.35	96.27	2.16							2.66	SP	茶灰色の均一粒度の砂
36	SBS 36	2292847	618388				100.0	99.3	99.24	99.10	98.90	34.51	92.39	52.53	24.26	28.27	2.41	2.68	CH	茶灰色の塑性に富む粘土
37	SBS 37	2293314	620566				100.0	99.8	99.64	99.26	84.51	18.58	60.58	36.38	19.44	16.94	2.43	2.68	CL	茶灰色の砂混じり粘土
38	SBS 38	2293713	622753				100.0	100.0	99.74	99.42	87.87	17.30	60.51	37.60	20.45	17.15	2.34	2.69	CL	茶灰色の粘土
39	SBS 39	2293958	624741				100.0	99.2	99.10	96.97	3.12							2.65	SP	茶灰色の均一粒度の砂
40	SBS 40	2294465	625423				100.0	99.7	99.44	99.12	68.41	27.70	72.83	35.14	18.62	16.52	3.28	2.71	CL	茶灰色の砂質粘土
41	SBS 41	2294972	626106				100.0	99.5	98.60	96.98	83.52	21.72	59.92	31.01	16.93	14.08	3.05	2.67	CL	茶灰色の砂質粘土
42	SBS 42	2294008	626820				100.0	99.4	99.00	97.22	1.96							2.65	SP	茶灰色の均一粒度の砂
43	SBS 43	2293501	626138				100.0	99.9	99.78	99.40	71.93	17.68	80.40	34.69	19.15	15.54	3.94	2.68	CL	茶灰色の砂質粘土
44	SBS 44	2292995	625456				100.0	99.8	99.66	99.42	45.55	11.16	44.21	24.82	19.58	5.24	4.70	2.67	SC	茶灰色の砂質粘土
45	SBS 45	2290397	619922				100.0	99.6	99.06	98.60	63.40	16.00	45.20	30.66	18.06	12.60	2.15	2.70	CL	茶灰色の砂質粘土
46	SBS 46	2290810	622111				100.0	99.5	98.98	98.62	67.87	19.94	46.96	33.00	18.65	14.35	1.97	2.70	CL	茶灰色の砂質粘土
47	SBS 47	2291195	624298				100.0	99.8	99.34	98.94	65.80	19.97	49.65	28.87	18.81	10.06	3.07	2.71	CL	茶灰色の砂質粘土
48	SBS 48	2292032	626171				100.0	96.4	93.37	84.95	49.81	27.56	60.03	35.82	20.18	15.64	2.55	2.67	SC	茶灰色の粘土質砂
49	SBS 49	2292538	626853				100.0	100.0	99.84	99.64	98.01	15.97	94.39	47.47	20.78	26.69	2.76	2.68	CL	茶灰色の粘土
50	SBS 50	2293045	627536				100.0	99.7	99.22	98.72	66.44	22.36	46.86	29.66	17.17	12.49	2.38	2.69	CL	茶灰色の砂質粘土
51	SBS 51	2292082	628251				100.0	100.0	99.92	99.82	98.70	19.02	39.08	23.62	19.08	4.54	4.41	2.71	CL	茶灰色の粘土
52	SBS 52	2291575	627568				100.0	100.0	99.88	99.74	97.86	14.90	92.53	45.73	22.76	22.97	3.04	2.70	CL	茶灰色の粘土
53	SBS 53	2291068	626887					100.0	99.96	99.86	98.68	19.28	48.27	34.42	17.91	16.51	1.84	2.71	CL	茶灰色の粘土
54	SBS 54	2290105	627602				100.0	99.2	98.37	97.23	77.36	26.19	65.51	34.48	19.51	14.97	3.07	2.68	CL	茶灰色の砂混じり粘土
55	SBS 55	2290611	628284				100.0	99.9	99.74	99.64	97.59		89.06	48.98	22.84	26.14	2.53	2.69	CL	茶灰色の粘土
56	SBS 56	2291118	628967				100.0	99.9	99.74	99.62	99.36		93.60	73.54	28.77	44.77	1.45	2.67	CH	茶灰色の塑性に富む粘土
57	SBS 57	2290126	629704				100.0	99.7	99.04	97.32	85.16	29.11	74.65	38.13	20.43	17.70	3.06	2.68	CL	茶灰色の粘土
58	SBS 58	2289619	629021				100.0	99.6	99.14	98.45	64.05	30.65	72.73	38.40	20.13	18.27	2.88	2.69	CL	茶灰色の砂質粘土
59	SBS 59	2289112	628340				100.0	99.6	99.14	98.45	64.05	30.65	76.12	41.74	20.28	21.46	2.60	2.70	CL	茶灰色の砂質粘土
60	SBS 60	2288614	626577				100.0	99.7	99.52	99.38	97.23	38.48	96.85	56.98	26.18	30.80	2.29	2.69	CH	茶灰色の塑性に富む粘土
61	SBS 61	2288229	624389				100.0	99.8	99.52	99.48	97.03	38.77	96.09	57.40	23.96	33.44	2.16	2.68	CH	茶灰色の塑性に富む粘土

Table 7 底質の土質試験結果 - 3

No.	サンプル番号	座標 VN2000 E	座標 VN2000 N	ふるい(mm)通過重量百分率（%） 19	9.5	4.75	2.00	0.85	0.425	0.25	0.075	< 0.005	自然含水比 Wn(%)	アッターベルグ限界 液性限界 W_L(%)	塑性限界 Wp(%)	塑性指数 Ip (%)	コンシステンシー指数 (B)	土粒子の密度 Δ (g/cm^3)	土質分類	備考
62	SBS 62	2287776	622199				100.0	99.8	99.44	99.34	96.24	41.29	95.88	54.78	25.18	29.62	2.39	2.69	CH	茶灰色の塑性に富む粘土
63	SBS 63	2288164	629044				100.0	99.4	98.57	97.03	82.38	29.21	84.07	42.90	21.22	21.68	2.90	2.70	CL	茶灰色の砂混じり粘土
64	SBS 64	2288670	629726				100.0	99.5	98.98	97.91	79.80	30.24	79.57	38.54	19.59	18.95	3.17	2.68	CL	茶灰色の砂混じり粘土
65	SBS 65	2289177	630409				100.0	99.8	99.36	98.51	91.67		88.25	60.82	23.09	37.73	1.75	2.68	CH	茶灰色の塑性に富む粘土
66	SBS 66	2288214	631124				100.0	99.7	99.56	99.46	99.24		95.93	54.77	24.59	30.18	2.36	2.68	CH	茶灰色の塑性に富む粘土
67	SBS 67	2287707	630441				100.0	99.8	99.64	99.60	99.42		95.45	61.33	28.16	33.17	2.03	2.68	CH	茶灰色の塑性に富む粘土
68	SBS 68	2287200	629759				100.0	99.9	99.82	99.70	99.38	35.14	98.18	56.70	27.02	29.68	2.40	2.70	CH	茶灰色の塑性に富む粘土
69	SBS 69	2286477	627933				100.0	99.9	99.62	99.56	99.52		95.28	63.08	22.30	40.78	1.79	2.67	CH	茶灰色の塑性に富む粘土
70	SBS 70	2286079	625745				100.0	99.9	99.70	99.56	99.54	38.09	93.92	62.13	25.13	37.00	1.98	2.67	CH	茶灰色の塑性に富む粘土
71	SBS 71	2285629	623487				100.0	99.9	99.86	99.66	98.64	29.39	94.67	64.05	25.25	37.80	1.81	2.68	CH	茶灰色の塑性に富む粘土
72	SBS 72	2284080	624137				100.0	100.0	99.54	99.46	99.22	28.38	95.82	65.24	25.79	39.45	1.78	2.68	CH	茶灰色の塑性に富む粘土
73	SBS 73	2284416	626552				100.0	99.2	98.41	98.23	80.56	38.89	93.56	60.19	26.58	33.61	1.99	2.70	CH	茶灰色の塑性に富む砂混じり粘土
74	SBS 74	2285813	630789				100.0	100.0	99.04	98.88	98.84	37.68	97.16	60.95	26.47	34.48	2.05	2.67	CH	茶灰色の塑性に富む粘土
75	SBS 75	2286319	631471				100.0	99.8	99.38	99.30	99.20	43.82	94.72	59.54	21.67	37.87	1.93	2.69	CH	茶灰色の塑性に富む粘土
76	SBS 76	2286826	632154				100.0	99.6	98.88	97.81	94.82	37.00	95.81	61.45	22.90	38.55	1.89	2.68	CH	茶灰色の塑性に富む粘土
77	SBS 77	2284555	631944				100.0	99.3	97.53	93.45	87.51	45.43	95.64	69.70	29.51	40.19	1.85	2.68	CH	茶灰色の塑性に富む粘土
78	SBS 78	2284724	635723				100.0	100.0	99.94	99.88	99.86	45.03	96.80	55.79	27.73	28.06	2.45	2.70	CH	茶灰色の塑性に富む粘土
79	SBS 79	2287590	635520				100.0	100.0	99.62	99.50	99.42	46.91	93.52	56.62	25.30	31.32	2.18	2.68	CH	茶灰色の塑性に富む粘土
80	SBS 80	2286690	635533					100.0	99.96	99.94	99.82		97.78	63.84	28.85	34.99	1.97	2.70	CH	茶灰色の塑性に富む粘土

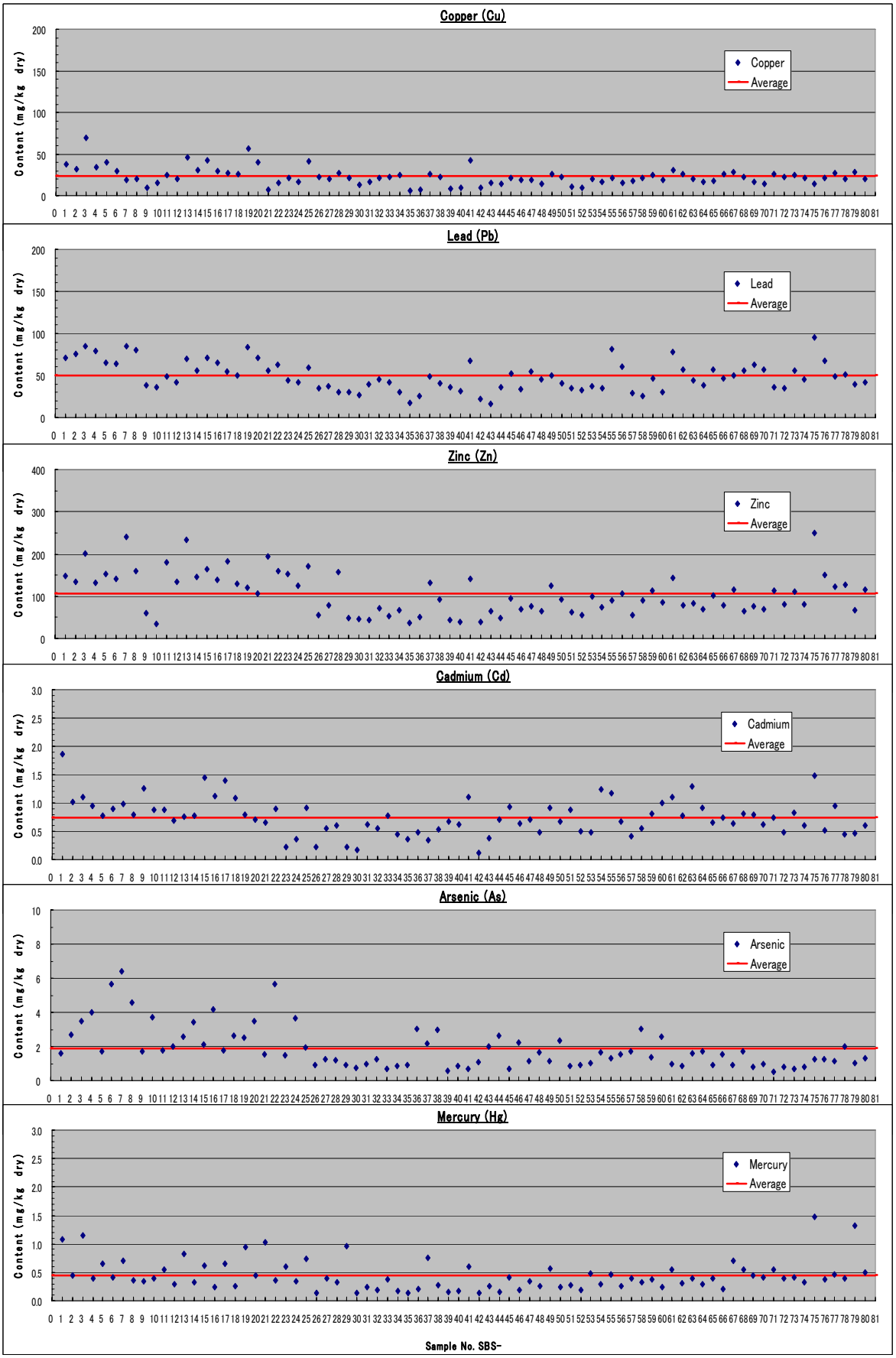


Figure 1 底質の化学成分含有量試験結果 (1)

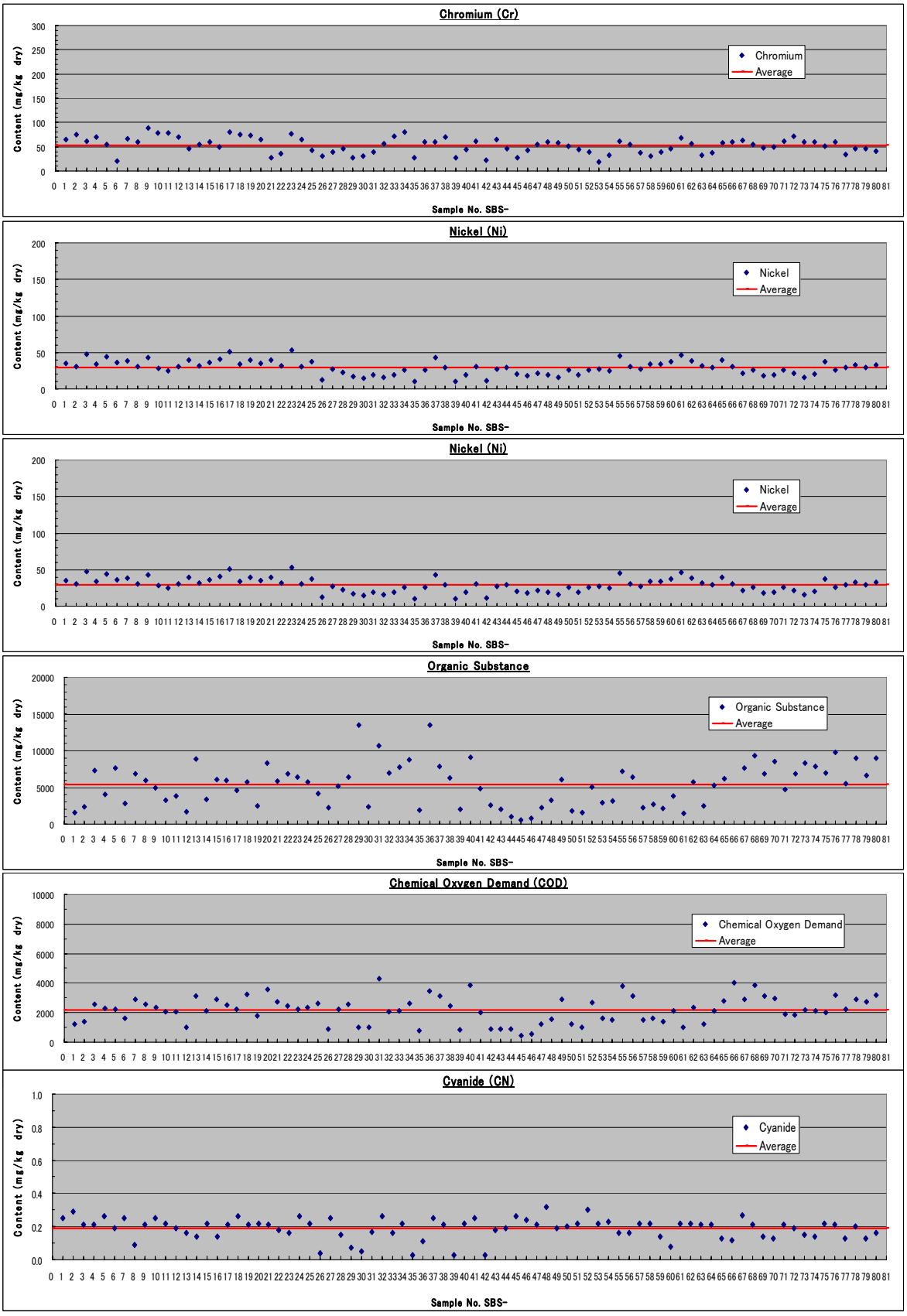


Figure 2　底質の化学成分含有量試験結果 (2)

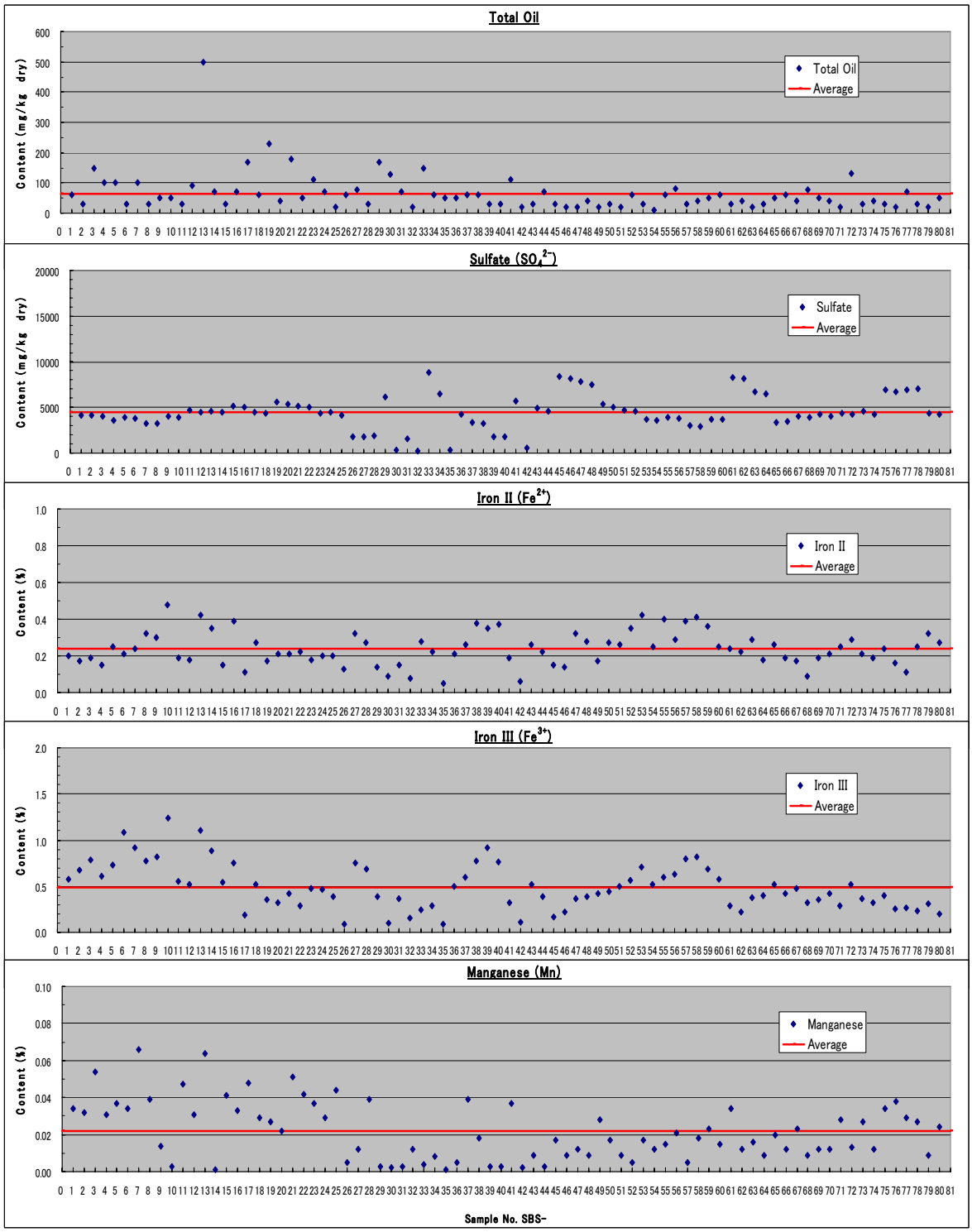


Figure 3 底質の化学成分含有量試験結果 (3)

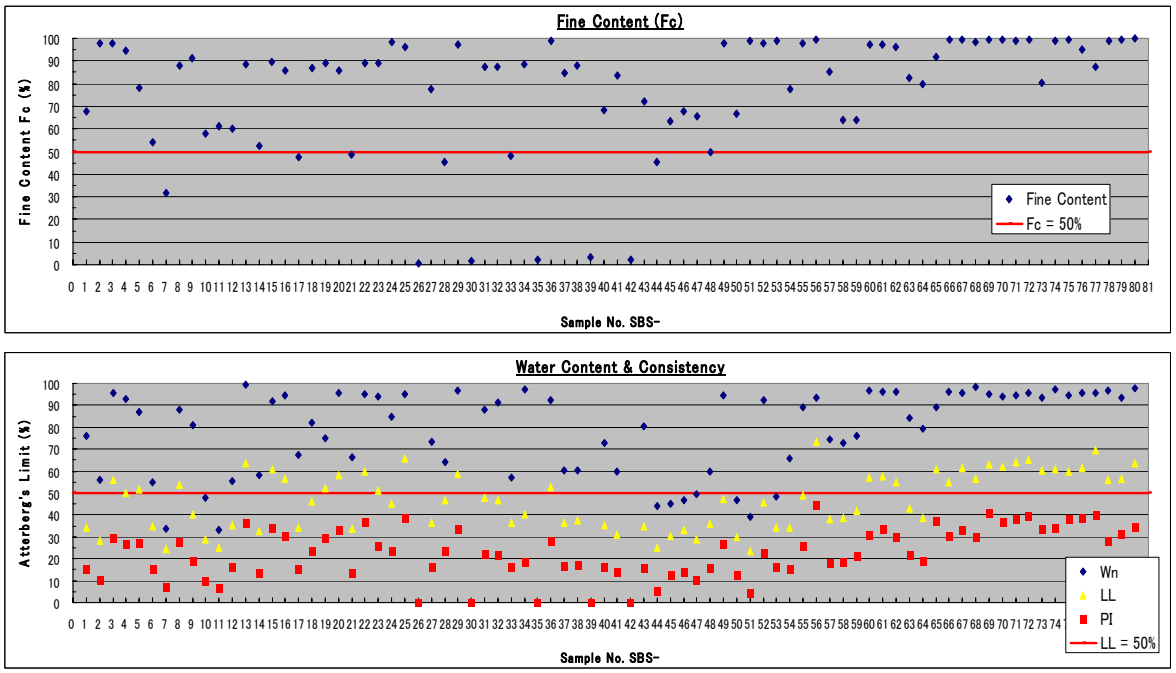


Figure 4　底質の物理試験結果

Appendix7-5

深浅測量結果

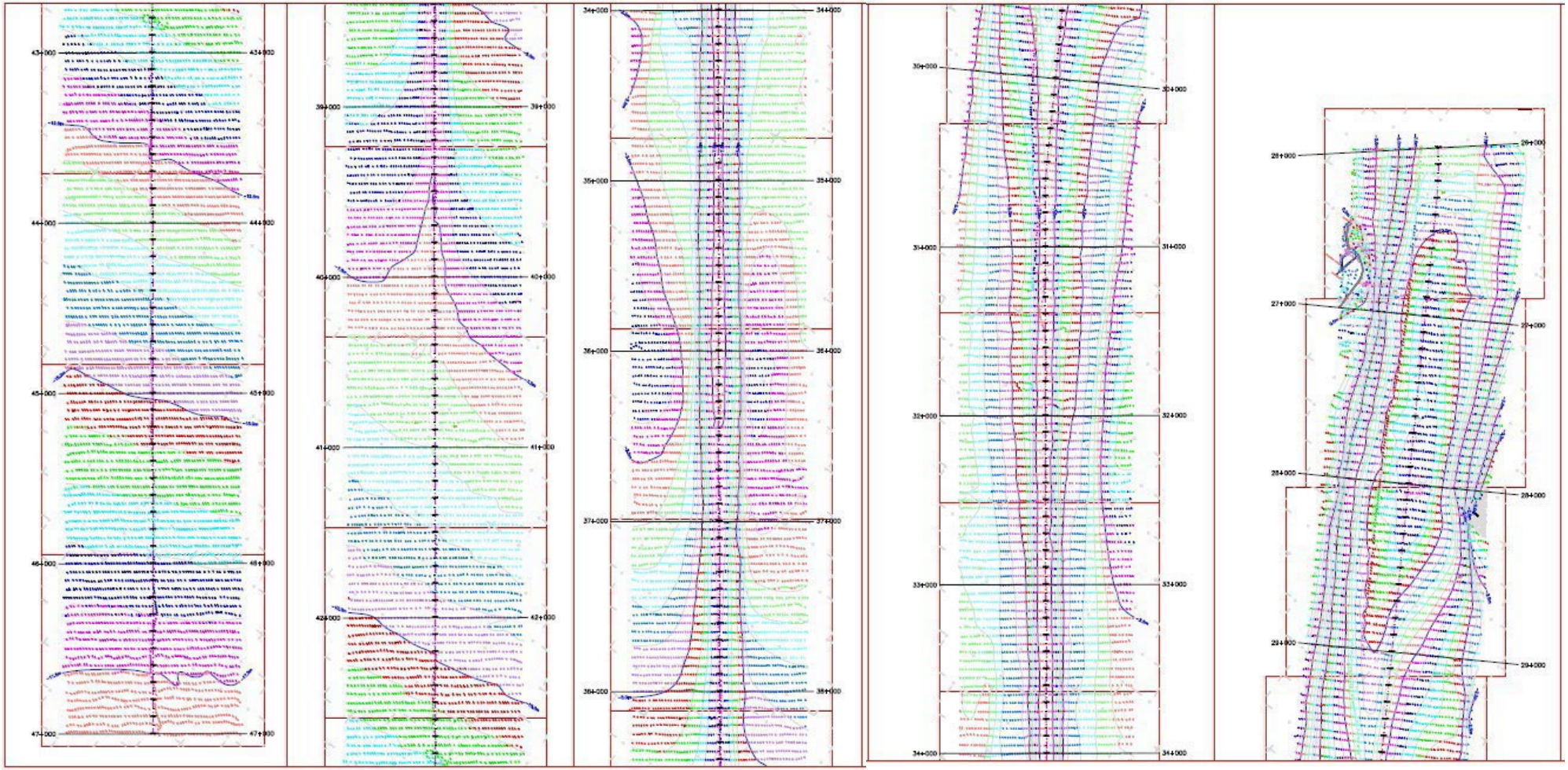


Figure 1 高周波音源(200 kHz)による深浅測量結果（コンター図）

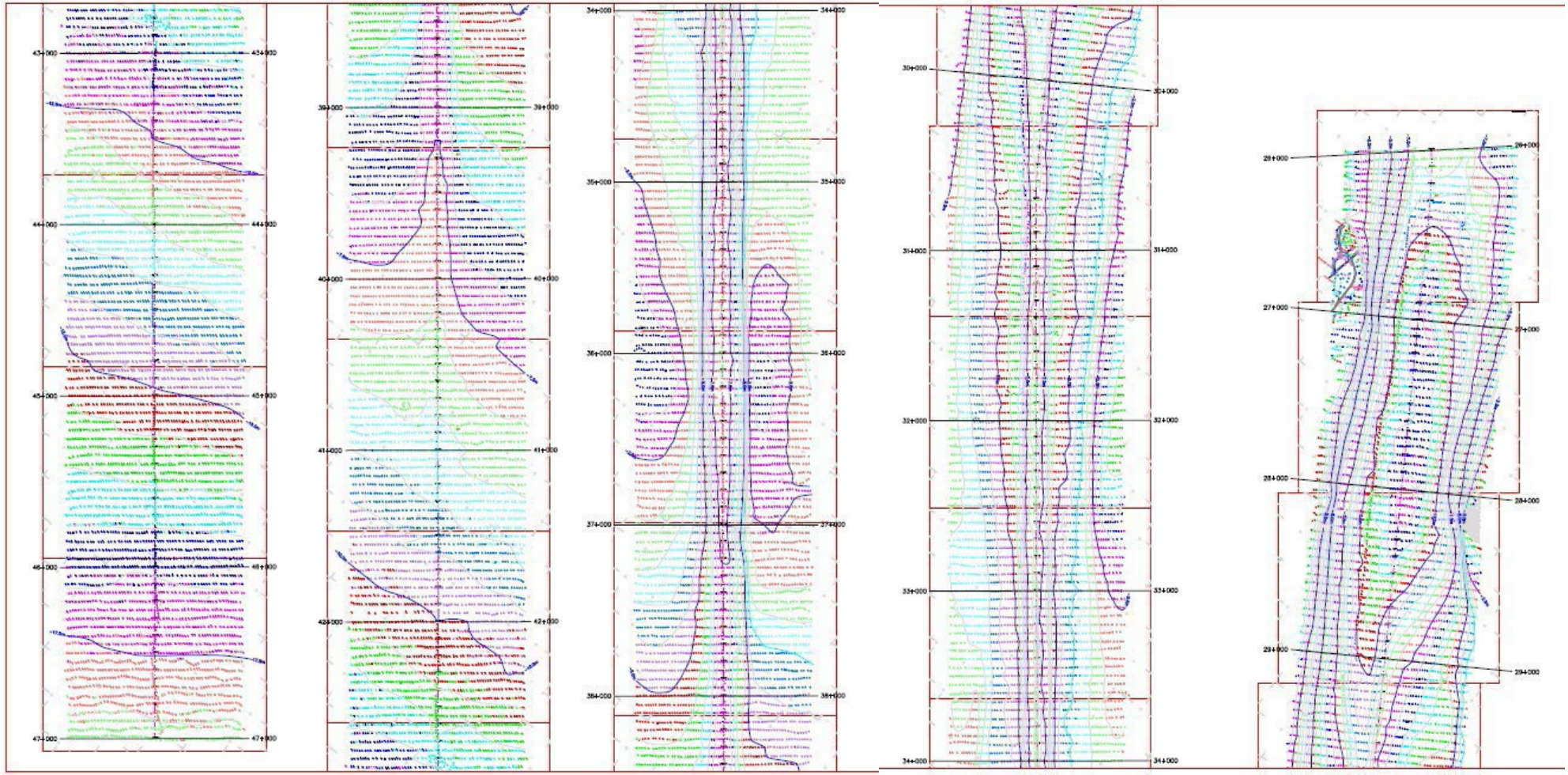


Figure 2 低周波音源(30 kHz)による深浅測量結果（コンター図）

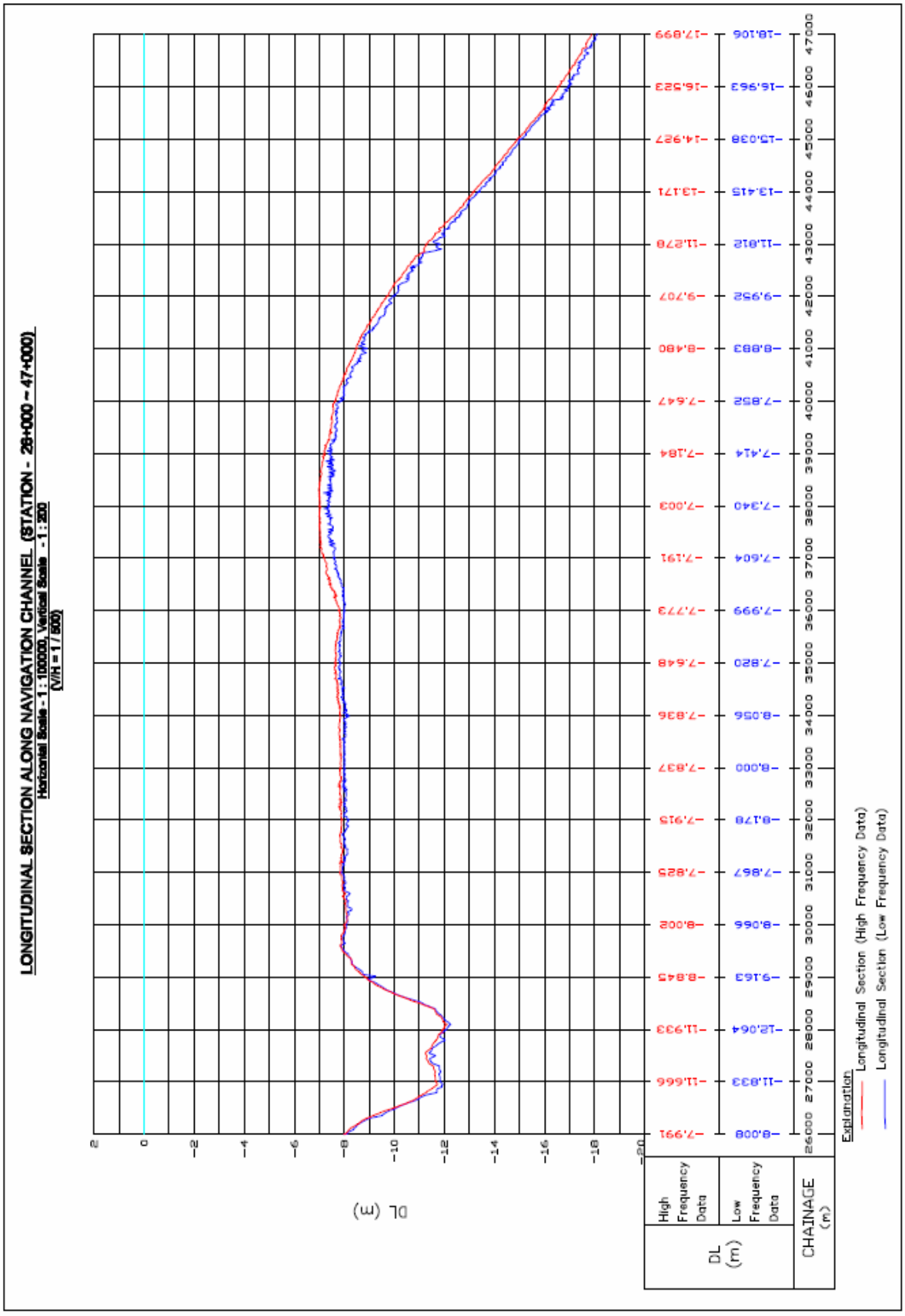
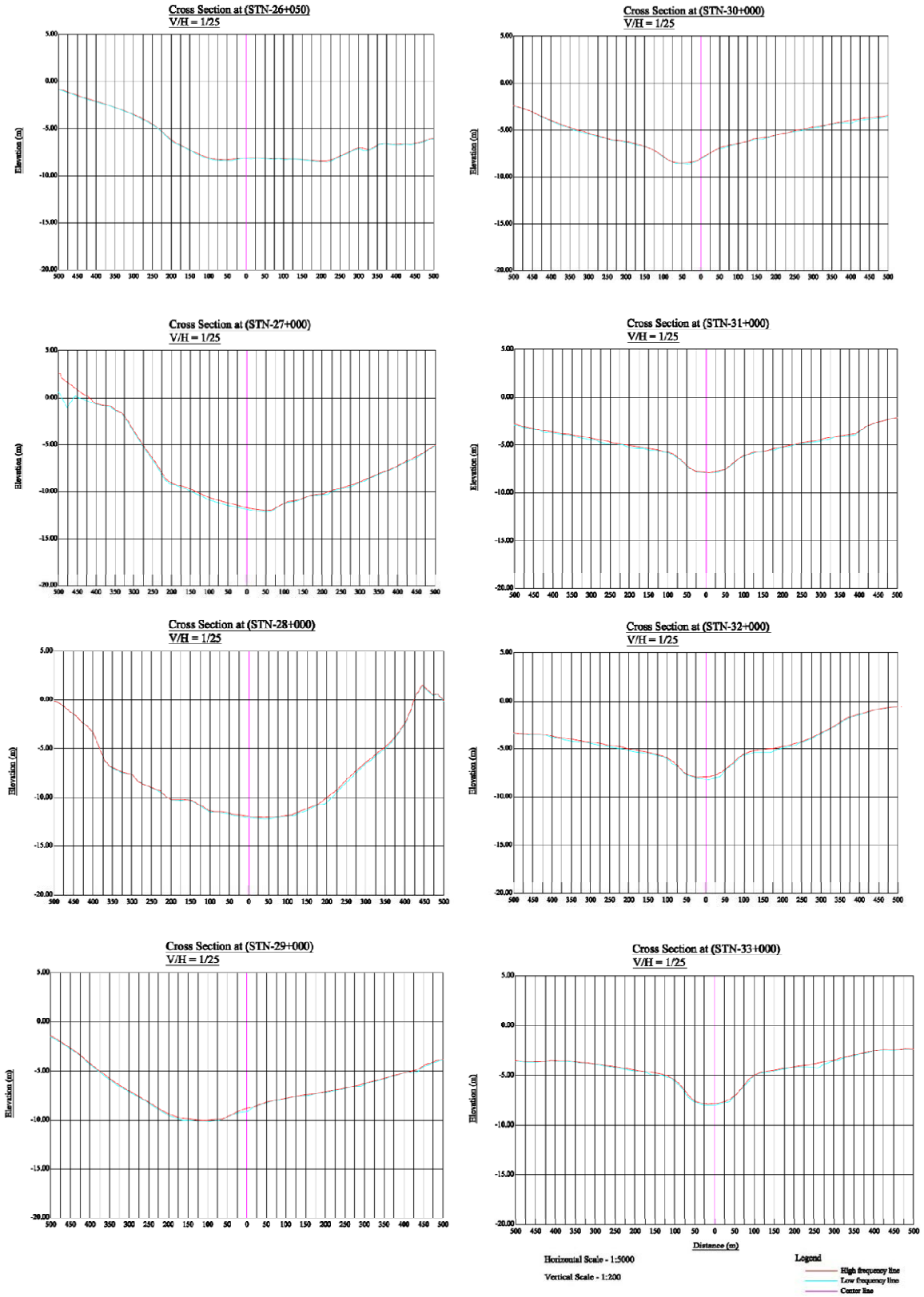
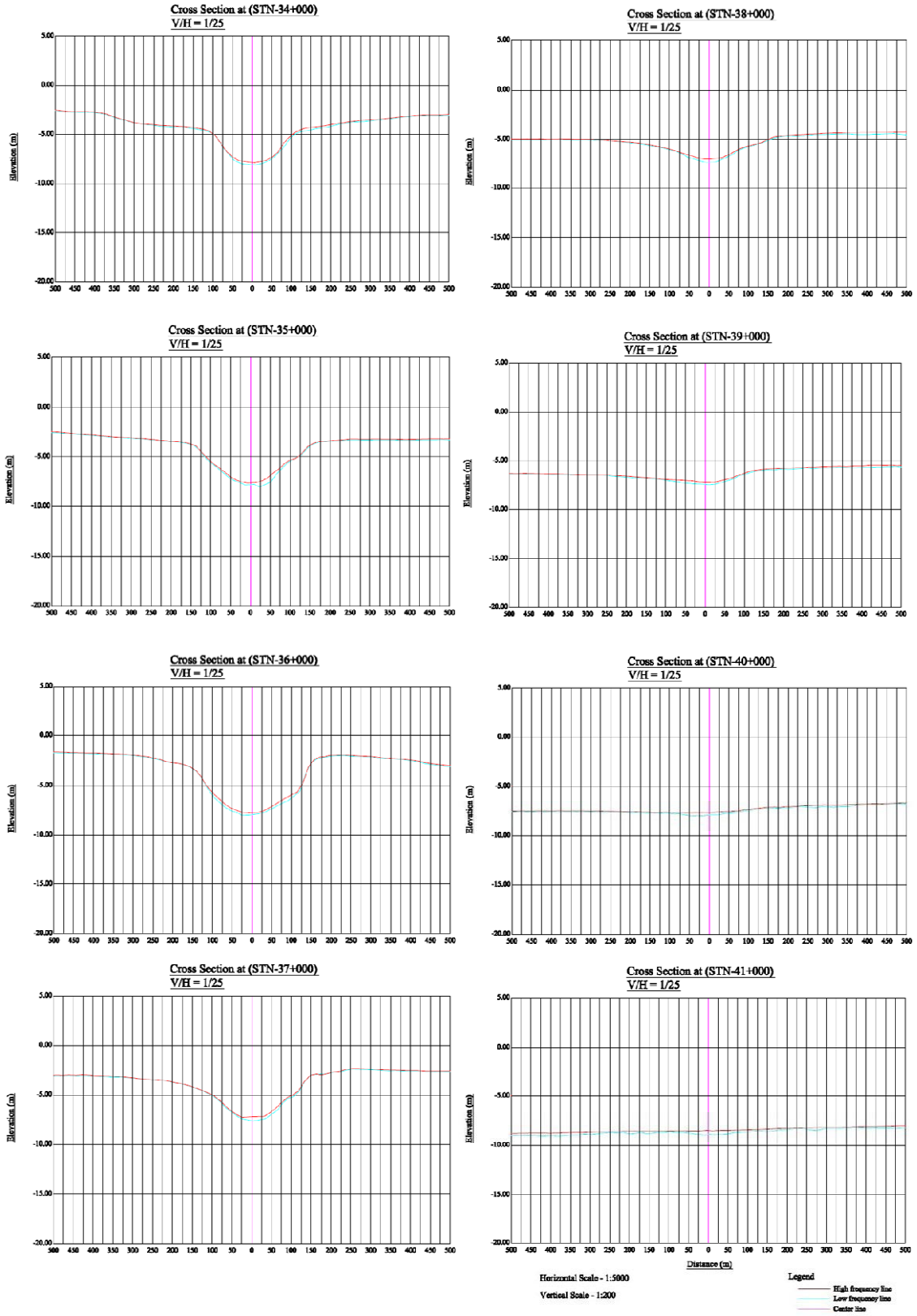


Figure 3 航路中心線沿いの縦断面図



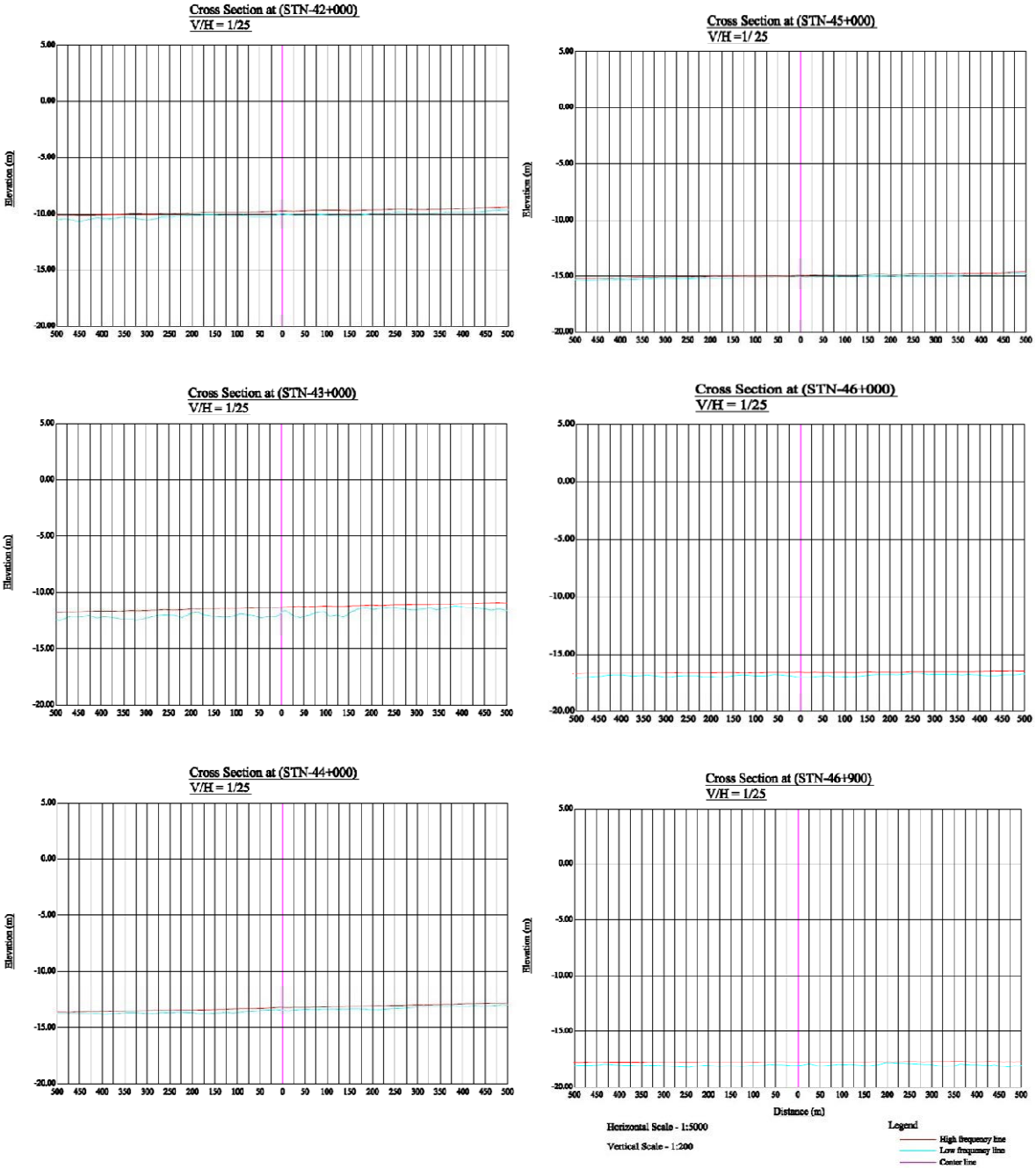
注：横軸の 0 は航路中心を表す

Figure 4 航路直角方向の横断面図 (1)



注：横軸の 0 は航路中心を表す

Figure 5 航路直角方向の横断面図 (2)



注：横軸の 0 は航路中心を表す

Figure 6 航路直角方向の横断面図 (3)

Appendix7-6

潮流観測結果

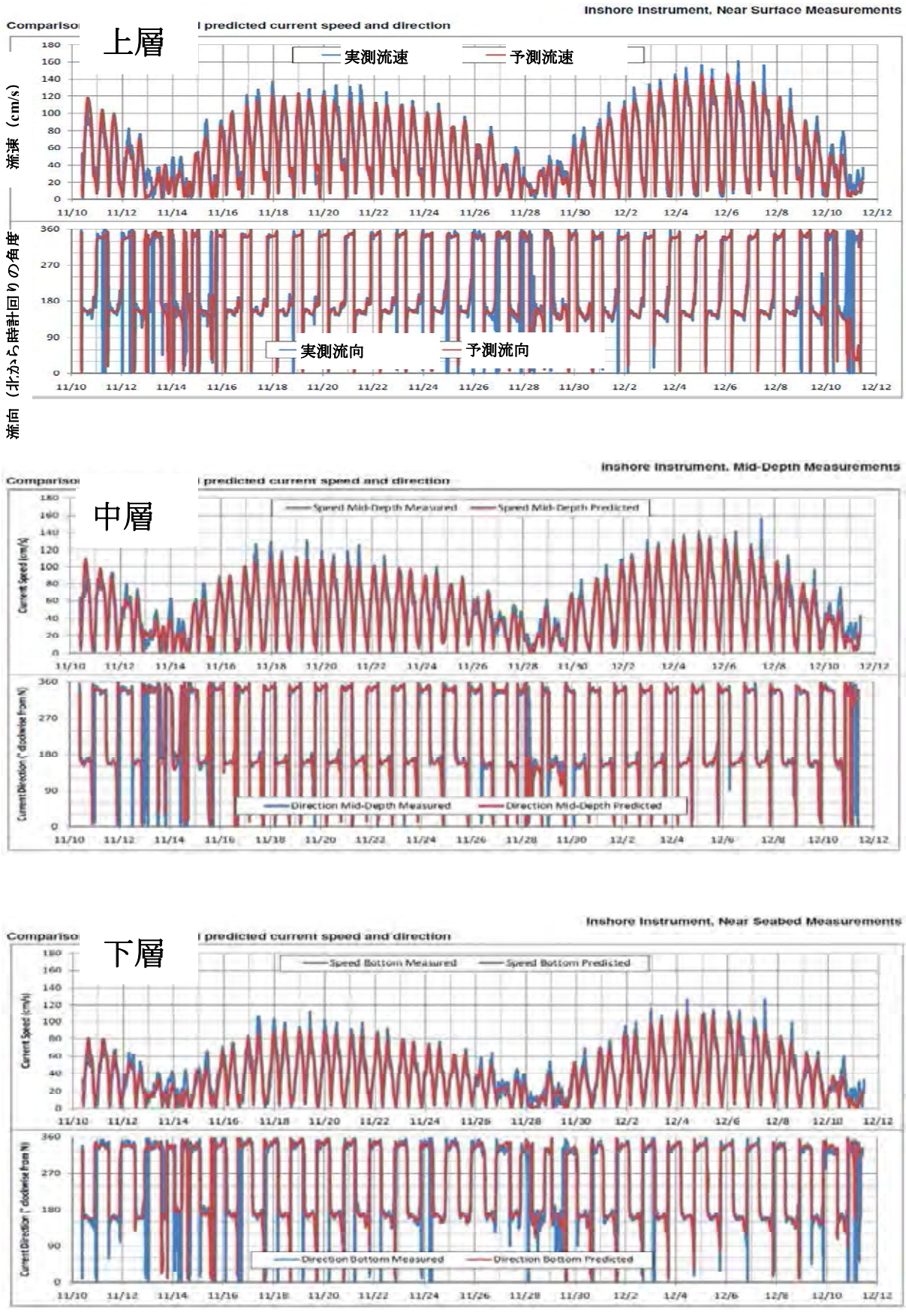


Figure 1　観測地点 V1 における潮流観測結果

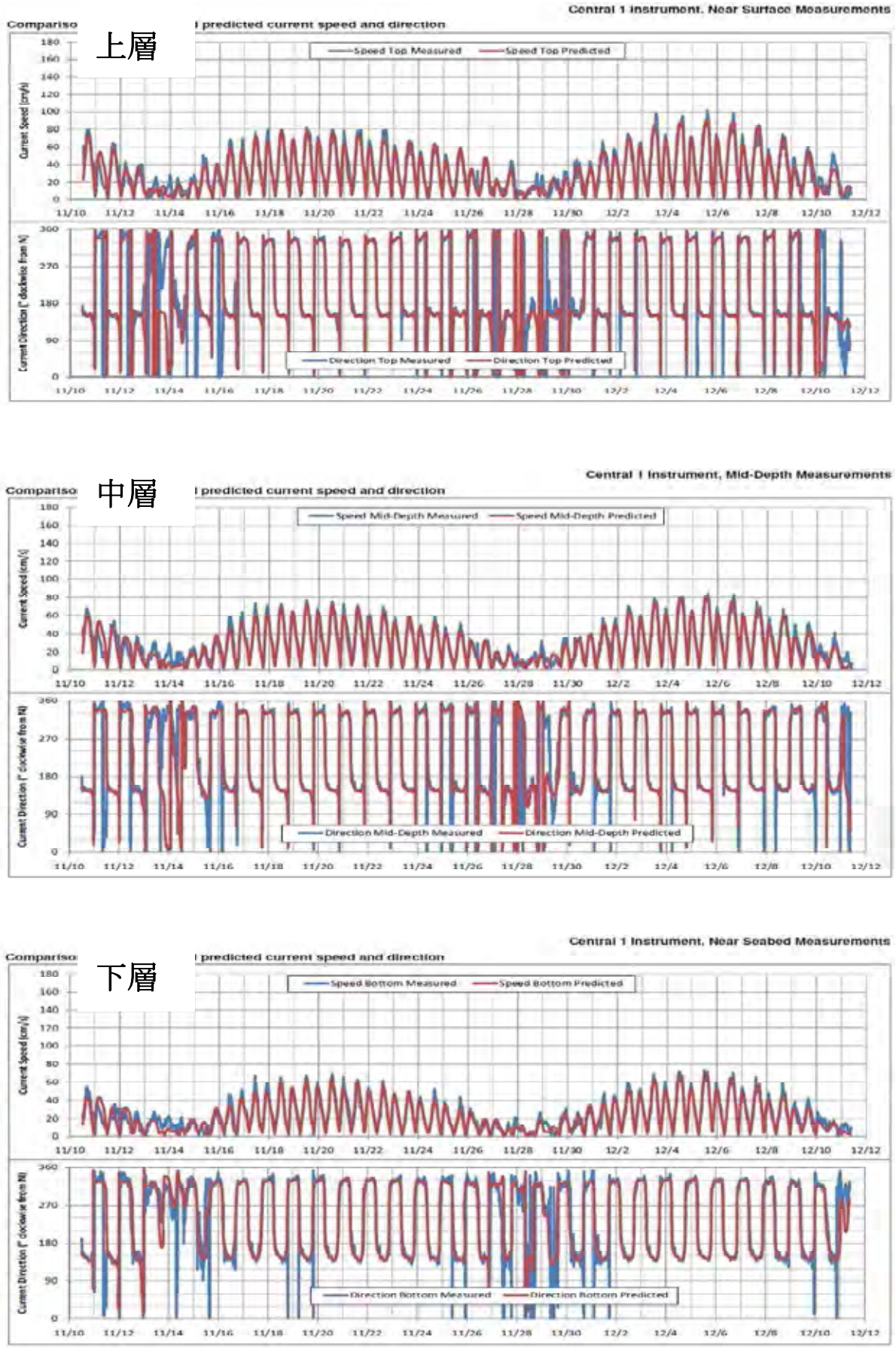


Figure 2 観測地点 V2 における潮流観測結果

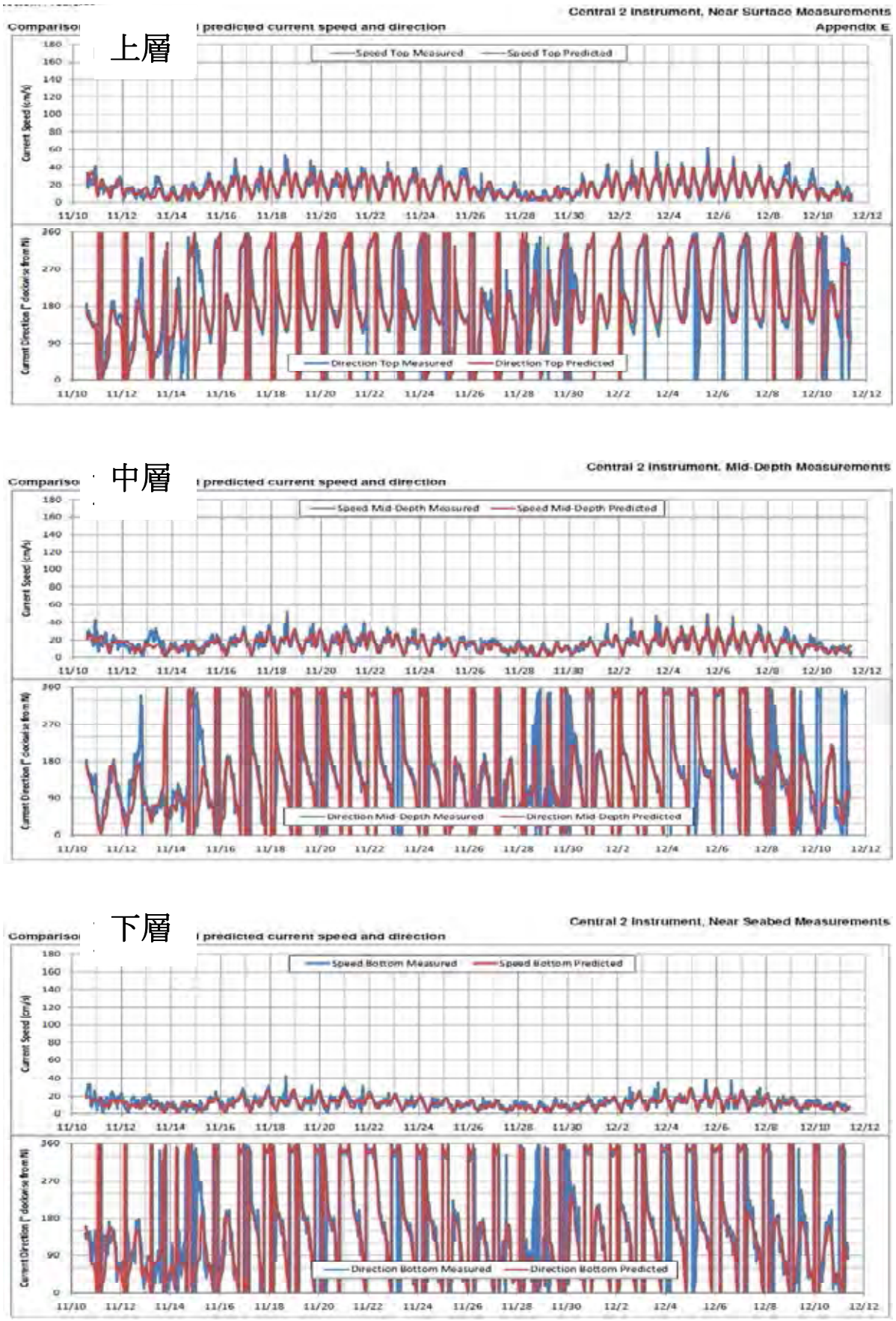


Figure 3 観測地点 V3 における潮流観測結果

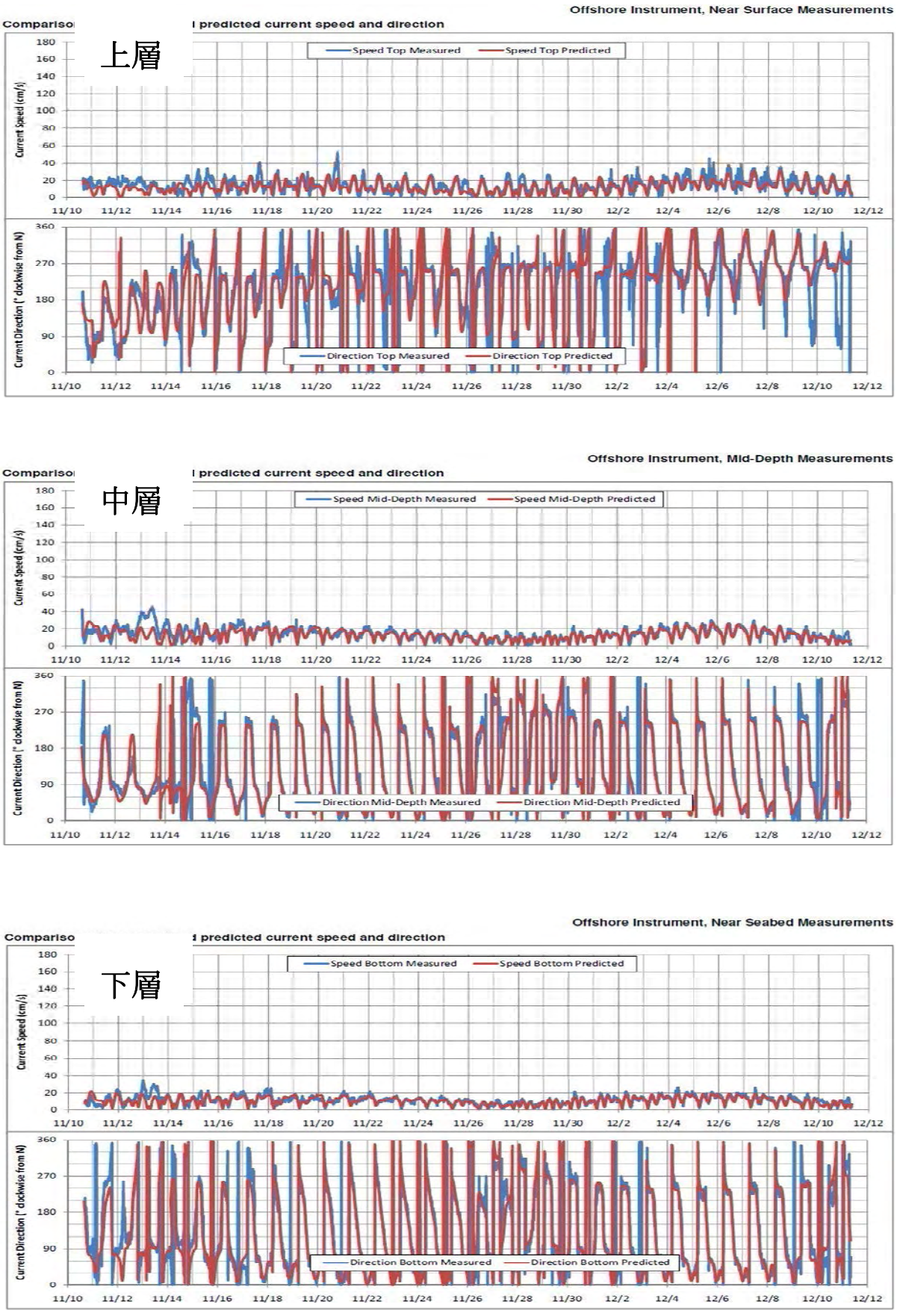


Figure 4 観測地点 V4 における潮流観測結果

Appendix 9-1

JBIC ガイドラインの原則（抜粋）

JBIC ガイドラインの原則（抜粋）

Principles	JBIC Policy
Underlying Principles	· Environmental impact which may be caused by a project must be assessed and examined from the earliest planning stage possible. Alternative proposals or minimization measures to prevent or reduce adverse impact must be examined and incorporated into the project plan: · Such examination must include analysis of environmental costs and benefits in as quantitative terms as possible and be conducted in close harmony with economic, financial, institutional, social and technical analysis of the project; · The findings of the examination of environmental and social considerations must include alternative proposals, mitigation measures and be recorded as separate documents or as a part of other documents. Environmental Impact Assessment (EIA) reports must be produced for projects in which there is a reasonable expectation of particularly large adverse environmental impact; and · For projects that have particularly large potential adverse impact or are highly contentious, a committee of experts may be formed to seek their opinions, in order to increase accountability.
Examination of Measures	· Multiple alternative proposals must be examined to prevent or minimize adverse impact and to choose a better project option in terms of environmental and social considerations. In examination of measures, priority is to be given to the prevention of environmental impact, and when this is not possible, minimization and reduction of impact must be considered next. Compensation measures must be examined only when impact cannot be prevented by any of the aforementioned measures; and · Appropriate follow-up plans and systems, such as monitoring plans and environmental management plans, must be prepared; and costs of implementing such plans and systems, and financial methods to fund such costs, must be determined. Plans for projects with particularly large potential adverse impact must be accompanied by detailed environmental management plans.
Scope of Impact to be Examined	· Environmental impact to be investigated and examined includes factors that impact human health and safety as well as the natural environment, such as: air, water, soil, waste, accidents, water usage, ecosystems, and biota. Social concerns include: involuntary resettlement of the population, the indigenous people, cultural heritage, landscape, gender, children's rights and communicable diseases such as HIV/AIDS and impact that may lead to trans-boundary and global environmental problems; and · In addition to the direct and immediate impact of projects, derivative, secondary and cumulative impact are also to be examined and investigated to a reasonable extent. It is also desirable that the impact which can occur at any time during the duration of the project be continuously considered throughout the life cycle of the project.
Compliance with Laws, Standards and Plans	· Projects must comply with laws, ordinances and standards relating to environmental and social considerations established by the governments that have jurisdiction over the project site (including both national and local governments). They are also to conform to environmental and social consideration policies and plans of the governments that have jurisdiction over the project site; and · Projects must, in principle, be undertaken outside protected areas that are specifically designated by laws or ordinances of the government for the conservation of nature or cultural heritage (excluding projects whose primary objectives are to promote the protection or restoration of such designated areas). Projects are also not to impose significant adverse impact on designated conservation areas.
Social Acceptability	· Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which the project is planned.

Principles	JBIC Policy
and Social Impacts	For projects with a potentially large environmental impact, sufficient consultations with stakeholders, such as local residents, must be conducted via disclosure of information from an early stage where alternative proposals for the project plans may be examined. The outcome of such consultations must be incorporated into the contents of the project plan; and · Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor, and ethnic minorities, all of whom are susceptible to environmental and social impact and who may have little access to the decision-making process within society.
Involuntary Resettlement	· Involuntary resettlement and loss of means of livelihood are to be avoided where feasible, exploring all viable alternatives. When, after such examination, it is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with the people who will be affected; · People to be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by the project proponents, etc. in timely manner. The project proponents, etc. must make efforts to enable the people affected by the project, to improve their standard of living, income opportunities and production levels, or at least to restore them to pre-project levels. Measures to achieve this may include: providing land and monetary compensation for losses (to cover land and property losses), supporting the means for an alternative sustainable livelihood, and providing the expenses necessary for relocation and the re-establishment of a community at relocation sites; and · Appropriate participation by the people affected and their communities must be promoted in planning, implementation and monitoring of involuntary resettlement plans and measures against the loss of their means of livelihood.
Indigenous People	· When a project may have adverse impact on indigenous peoples, all of their rights in relation to land and resources must be respected in accordance with the spirit of the relevant international declarations and treaties. Efforts must be made to obtain the consent of indigenous peoples after they have been fully informed.
Monitoring	· It is desirable that, after a project begins, the project proponents monitor: (i) whether any situations that were unforeseeable before the project began have arisen, (ii) the implementation situation and the effectiveness of the mitigation measures prepared in advance, and that they then take appropriate measures based on the results of such monitoring; · In cases where sufficient monitoring is deemed essential for the achievement of appropriate environmental and social considerations, such as the projects for which mitigation measures should be implemented while monitoring their effectiveness, project proponents must ensure that project plans include monitoring plans which are feasible; · It is desirable that project proponents make the results of the monitoring process available to project stakeholders; and · When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, it is desirable that a forum for discussion and examination of countermeasures be established based on sufficient information disclosure and include the participation of stakeholders in the relevant project. It is also desirable that an agreement be reached on procedures to be adopted with a view to resolving the problem.

JBIC ガイドラインとベトナム国の環境社会配慮に係る制度の詳細比較

JBIC Guide Line	Vietnam Law and Regulation
JBIC Guideline for Confirmation of Environmental and Social Considerations, April 2002 **2. Appendix Illustrative Environmental Impact Assessment Report for Category A Projects NB** ● An EIA's scope and level of detail should be decided in accordance with the project's potential impacts. ● The EIA report should include the following items (not necessarily in the order shown) ● This Appendix is based on the World Bank Operational Policy - OP 4.01, Annex B.	Circular 08/2006/TT-BTNMT* of the Ministry of Natural Resources and Environment providing guidelines on strategic environmental assessment, environmental impact assessment and environmental protection undertakings **APPENDIX 4. Structure and Requirements of Contents of Environmental Impact Assessment Reports** * Circular No.05/2008/TT-BTNMT repealed Circular 08/2006/TT-BTNMT. However, the contents of the EIA report are still applicable for effective law and regulations.
● Executive Summary: Concisely discusses significant findings and recommended actions.	CONCLUSION AND PROPOSALS 1. Conclusion Making conclusions regarding issues such as whether or not impact is identified and assessed in full, unclear issues; general assessment in terms of the level and scale of defined impact; the feasibility of measures minimizing such impact; negative impact for which there is no measure to minimize the impact because it is beyond the permissible capacity of the project owner and proposal for resolution. 2. Proposal Making proposals to relevant bodies or authorities for their assistance in resolution of matters which are beyond the capacity of the project.
● Policy, legal and administrative framework: Discusses the policy, legal and administrative framework within which the EIA report is to be carried out.	FOREWORD 1. Origination of the project. 2. Legal and technical bases for implementation of the environmental impact assessment (EIA) 3. Organization of implementation of EIA
● Project description: Describes the proposed project and its geographic, ecological, social and temporal context, including any off-site investments that may be required (e.g. dedicated pipelines, access roads, power plants, water supply, housing, and raw material and product storage facilities). Indicates the need for any resettlement or social development plan. Normally includes a map showing the project site and the area affected by the project.	CHAPTER I: Summarized Description of Project 1.1 Name of the project 1.2 Project owner 1.3 Geographical location of the project 1.4 Main contents of the project
● Baseline data: Assesses the dimensions of the study area and describes relevant physical, biological and socio-economic conditions, including all changes anticipated before the project commences. Additionally, takes into account current and proposed development activities within the project area but not directly connected to the project. Data should be relevant to decisions about project site, design, operation, or mitigatory measures; the section indicates accuracy, reliability and sources of the data.	CHAPTER II: Natural, Environmental and Socio-economic Conditions 2.1 Natural and environmental conditions: Geographical and geological conditions/Meteorological - hydrographical conditions/Current status of components of the natural environment(air, water and land environment) 2.2 Socio-economic conditions: Economic conditions(industries, agriculture, communication, transportation, mining, tourism, commerce, provision of services and other sectors)/ Social conditions(cultural, social, religious or belief works, historical relicts, residential areas, urban areas

JBIC Guide Line	Vietnam Law and Regulation
	and other relevant works in the area of the project and in adjacent areas affected by the project) with referring to sources of used or reference documents and data.
● Environmental Impacts: Predicts and assesses the project's likely positive and negative impacts, in quantitative terms to the extent possible. Identifies mitigation measures and any negative environmental impacts that cannot be mitigated. Explores opportunities for environmental enhancement. Identifies and estimates the extent and quality of available data, essential data gaps and uncertainties associated with predictions, and specifies topics that do not require further attention.	CHAPTER III. Assessment of Environment Impacts 3.1 Impact causing sources Impact causing sources relating to wastes/Impact causing sources not relating to wastes/Forecasting risks regarding environmental incidents caused by the project 3.2 Effected objects and extent of impact Listing all natural, economic, cultural, social, religious or belief objects, historical relics and other objects in the area of the project and in adjacent areas which will be affected by wastes, by elements other than wastes or by risks regarding environmental incidents during implementation of the project; making a detailed or specific description of the scale of space and time to be effected. 3.3 Impact assessment 3.4 Assessment of used methods
● Analysis of alternatives: Systematically compares feasible alternatives to the proposed project site, technology, design and operation including the "without project" situation in terms of their potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training and monitoring requirements. For each of the alternatives, quantifies the environmental impacts to the extent possible, and attaches economic values where feasible. States the basis for selecting the particular project design proposed and offers justification for recommended emission levels and approaches to pollution prevention and abatement.	<Partially Applicable> CHAPTER IV: Measures to Minimize Adverse Impact and to Prevent and Deal with Environmental Incidents ● With respect to each defined type of adverse impact, there must be relevant measures to minimize it, clear explanation on advantages, weaknesses, feasibility, efficiency/effectiveness of such measures. Where no measure is available or even through there are such measures but they are unfeasible within the framework of the project, specifying causes therefore and giving specific proposals in order for relevant bodies to resolve and decide on the matter. ● Proving that after such measures are taken, the adverse impact will be reduced to a specific level which is compared with the standards, compulsory regulations on limits and regulations currently in force. In the case of failure to satisfy the stipulated requirements, specifying causes therefore and giving specific proposals in order for relevant bodies to resolve and decide on the matter. ● With respect to environmental incidents: Proposing a general plan for preventing and dealing with incidents, specifying: ● Items or measures that the project owner will take on its own initiative within its own capacity; its comments and assessment of the feasibility and effectiveness; ● Items or measures which require co-operation or assistance from State bodies and other parties; ● Force majeure and proposals for resolution. CHAPTER V: Undertakings to Take Environmental Protection Measures Specifying the project owner's undertakings to take measures to minimize the above-mentioned adverse

JBIC Guide Line	Vietnam Law and Regulation
	impact as well as undertakings to take all measures and to perform general regulations on environmental protection related to the process of commencement and implementation of the project.
● Environmental Management Plan (EMP): Describes mitigation, monitoring and institutional measures to be taken during construction and operation to eliminate adverse impacts, offset them, or reduce them to acceptable levels.	CHAPTER VI: Environmental Treatment Facilities and Programs of Environmental Management and Supervision. 6.1 List of environmental treatment facilities 6.2 Programs of environmental management and supervision 6.2.1 Program of environmental management Formulating a program to manage issues regarding environmental protection during construction and actual operation including organizational structure and personnel for environmental management; management of wastes, including hazardous waste; prevention and dealing with environmental incidents (except for the item of fire prevention and fighting which will be subject to the laws on fire prevention and fighting); and other items on environmental management related to the project. 6.2.2 Program of environmental supervision (a)Supervision of wastes, (b)Supervision of surrounding environment, (c)Other supervision CHAPTER VII: Estimated Budget for Environmental Facilities Estimated budgets for construction and operation of environmental facilities during the process of construction and operation of the project should be provided for.
● Consultation: Record of consultation meetings, including consultations for obtaining the informed views of the affected people, local non-governmental organizations (NGOs) and regulatory agencies.	CHAPTER VIII: Seeking Opinions from Communities 8.1 Opinions of people's committees at the commune level 8.2 Opinions of the Fatherland Front's committees at the commune level (Both clauses 8.1 and 8.2 will be presented in accordance with the requirements set out in Section 2 of Part III of this Circular).
● Not specified	CHAPTER IX: Reference to Sources of Figures and Data, and to Methods of Assessment 9.1 Sources of figures and data 9.2 Methods applied during EIA 9.3 Comments on the extent to which assessments are detailed or reliable

Appendix 9-2

パブリックヒアリングの記録（2010 年 4 月 21 日）

VINAMARINE
MPMU II

THE SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom – Happiness

Cat Hai, April 21, 2010

RECORD OF MEETING

Announcement and Public Consultation on EIA report for
Lach Huyen International Gateway Port Construction Project in Hai Phong

1. Date & time: 9h00 of Apr. 21, 2010
2. Venue: Meeting Hall of the Peoples Committee of Cat Hai township.
3. Participants:
    - The Peoples Committee of Cat Hai District
    - The Peoples Committee, Fatherland Front of Cat Hai Township
    - Vinamarine
    - MPMU II
    - SAPROF study team
    - Representatives of local residents in project area:

4. Meeting's Purpose: Announcement of approved EIA report and Public Consultation with local residents in project area.

4.1. Brief Explanation on Project made by MPMU II

- *Necessity of the Project*
- *Project implementation procedure and schedule and EIA report preparation after the issuance of Decision on Project Preparation issued by MOT.*
- *Brief explanation on EIA report and Announcement of EIA report which was approved by MONRE*
- *Approved EIA report will be disclosed at the Peoples Committee of Cat Hai Township for local residents' understanding, supervising and monitoring during project implementation.*

4.2. Speech of SAPROF study team:

Japanese official development assistance policy stands on the proper care on potentially affected natural environment and society/people. Without proper care, it is hardly to achieve the Viet Nam's sustainable development in many ways, particularly in stable governance and natural resources management for a long term. This public hearing is a part of Japanese verification processes to hear the real voice from potentially affected people and improve the designing of a project. We would like to consider your opinions and realize the successful project with your involvement/cooperation. Once again, please feel free to tell us about your opinion and wishes for the Lach Huyen Port project.

4.3. Speech of the Peoples Committee, the Fatherland Front of Cat Hai township:

Fully supports to project execution. It is considered that the Project will be good opportunity for the socio-economic development and living standards improvement of local peoples. The Project is welcome by the local peoples and will contribute comprehensively to Cat Hai district's development. It is expected that relevant authorities could expedite project implementation progress.

4.4. Speech of the Peoples Committee of Cat Hai district:

Fully agrees with the report made by MPMU II on project scale and EIA report. It is requested that relevant authorities and bodies to implement next steps for earlier start of the Project in order to contribute to economic development of the area and bring more jobs for local peoples.

The land acquisition and compensation task is delegated to Hai Phong Peoples Committee by the Prime Minister, and the actual works will be carried out by the Peoples Committee of Cat Hai district in accordance with current laws and regulations.

4.4. Community's opinions and comments

4.4.1 Opinions on possible negative impacts to socio-economical and natural conditions:

- *Consensus opinions with respective explained contents of Project Owner's presentation: Fully agree with the contents of approved EIA*
- *Against opinions with respective explained contents of Project Owner's presentation (with details): None*

4.4.2. Opinions on countermeasures to mitigate the possible negative impact of the project to socio-economical and natural conditions:

- *Consensus opinion with respective explained contents of Project Owner's presentation: Agree with the contents and mitigation countermeasures explained by MPMU II.*
- *Against opinions with respective explained contents of Project Owner's presentation (with details): None*

4.4.3. Proposals to Project Owner: (requests, proposals of the community to Project Owner related to commitment of countermeasures to mitigate possible negative impact of the project to socio-economical and natural conditions and other related proposals, if any):

- *Big interest on the Project because the Project will contribute to the economic development of Cat Hai district and bring new jobs for the local peoples.*
- *It is expected that the Project can start soon in order to contribute to the economic development of the area*
- *Is expected that the Project can realized soon bringing infrastructure development as well as services development and better conditions for our young generations.*
- *Please inform the starting time of the Project to keep local people's mind in their existing farming works and business.*
- *The delay of Project commencement caused bad effects to the local peoples' thinking.*

4.5. Answers to community's questions given by MPMU II
MPMU II agrees with the opinions and comments raised by the peoples. The Project is planned to be taken up by Japanese ODA Loan. It is expected to start during June of 2012. We are now tried our best to do necessary procedures in order to start construction soon to meet the expectation of local peoples.

This Record was prepared in 08 copies with the same legal value with signatures of participants.

VINAMARINE
(Science and Technology and Environment Dept.)

Tran Thi Tu Anh

The Peoples Committee of Cat Hai Township
Chairman

Nguyen Van Trong

MPMU II
Vice Director

Dang Van De

SAPROF Study Team

Nagaoka Shinya

Enclosed papers: ***List and Signature of the attendees***
List of project relevant documents to be publicly disclosed

Minutes of the Public Hearing

CỤC HÀNG HẢI VIỆT NAM
BAN QUẢN LÝ DỰ ÁN HÀNG HẢI II

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

Cát Hải, ngày 21 tháng 4 năm 2010

BIÊN BẢN HỌP

Công bố và lấy ý kiến cộng đồng về báo cáo đánh giá tác động môi trường Dự án xây dựng cảng cửa ngõ quốc tế Lạch Huyện - Hải Phòng

1. Thời gian: 9 giờ 00 phút ngày 21/4/2010.
2. Địa điểm: Hội trường UBND thị trấn Cát Hải.
3. Thành phần tham gia:
- UBND Huyện Cát Hải.
- UBND; UBMTTQ thị trấn Cát Hải.
- Cục Hàng hải Việt Nam
- Ban Quản lý dự án Hàng hải II
- Đoàn nghiên cứu Saprof của JICA, Nhật Bản
- Đại diện các hộ dân khu vực Dự án.

4. Nội dung cuộc họp: Công bố báo cáo đánh giá tác động môi trường được phê duyệt và lấy ý kiến người dân khu vực Dự án.

4.1. Ban Quản lý dự án Hàng hải II trình bày quá trình thực hiện Dự án:

- Nêu sự cần thiết đầu tư của Dự án xây dựng cảng cửa ngõ quốc tế Lạch Huyện Hải Phòng.

- Nêu trình tự thực hiện Dự án và công tác lập báo cáo đánh giá tác động môi trường cho Dự án kể từ khi có Quyết định cho phép lập Dự án đầu tư của Bộ trưởng Bộ GTVT.

- Nêu tóm tắt và công bố báo cáo đánh giá tác động môi trường đã được Bộ Tài nguyên và Môi trường phê duyệt của Dự án.

- Báo cáo đánh giá tác động môi trường của Dự án xây dựng cảng cửa ngõ quốc tế Lạch Huyện Hải Phòng sẽ được niêm yết tại phòng tiếp dân UBND thị trấn Cát Hải, để bà con nhân dân xem xét và tham gia giám sát theo dõi trong quá trình thực hiện Dự án.

4.2. Ý kiến của phía Nhật bản:

Chính sách hỗ trợ nguồn vốn ODA của Nhật Bản rất quan tâm tới ảnh hưởng của dự án mà có thể gây tác động xấu tới môi trường tự nhiên, xã hội và con người vùng dự án. Nếu những ảnh hưởng này không được quan tâm đầy đủ thì chúng ta khó có thể đạt một sự phát triển bền vững của Việt Nam, nhất là bền vững trong quản lý các nguồn lực tự nhiên và xã hội. Buổi họp lấy ý kiến cộng đồng ngày hôm nay là một trong những yêu cầu của phía Nhật Bản để nghe trực tiếp nguyện vọng của người dân sẽ bị ảnh hưởng bởi dự án nhằm hoàn thiện dự án cho phù hợp hơn. Bởi vậy, chúng tôi muốn nghe ý kiến của quý vị để có thể thực hiện dự án thành công với sự tham gia và hợp tác của nhân dân. Một lần nữa, đề nghị quý vị thẳng thắn trao đổi ý kiến và bày tỏ mong muốn đối với dự án cảng biển Lạch Huyện.

4.3. Ý kiến của UBND; UBMTTQ thị trấn Cát Hải, huyện Cát Hải, TP.Hải Phòng:

Đồng tình và nhất trí ủng hộ việc triển khai thực hiện Dự án cảng Lạch Huyện và coi đây là cơ hội để phát triển kinh tế xã hội, nâng cao mức sống của nhân dân địa phương. Đây là dự án được sự đồng tình ủng hộ của nhân dân địa phương và là cơ hội để cho địa phương phát triển về mọi mặt. Đề nghị các cấp có thẩm quyền đẩy nhanh tiến độ thực hiện Dự án.

4.4. Ý kiến của UBND huyện Cát Hải, TP.Hải Phòng:

Nhất trí với báo cáo của Ban Quản lý Dự án Hàng hải II về quy mô và báo cáo đánh giá tác động môi trường của Dự án. Đề nghị cấp có thẩm quyền triển khai các bước tiếp theo để Dự án sớm được xây dựng góp phần phát triển kinh tế khu vực và tạo công ăn việc làm cho nhân dân địa phương.

Về vấn đề đền bù và giải phóng mặt bằng Thủ tướng Chính phủ đã giao cho UBND TP. Hải Phòng thực hiện và chủ yếu công tác này là UBND huyện Cát Hải sẽ tiến hành thực hiện theo đúng chế độ chính sách của Nhà nước và theo đúng các quy định hiện hành.

4.4. Ý kiến của cộng đồng

4.4.1. Ý kiến về các tác động xấu của Dự án đến môi trường tự nhiên và kinh tế - xã hội:

- Ý kiến đồng ý với các nội dung tương ứng được trình bày trong bản thông báo nêu trên của Chủ dự án:

Nhất trí với các nội dung được trình bày trong bản thông báo về Dự án và báo cáo đánh giá tác động môi trường được Bộ Tài nguyên và Môi trường phê duyệt cho Dự án.

- Ý kiến không đồng ý với các nội dung tương ứng được trình bày trong bản thông báo nêu trên của Chủ dự án (chỉ rõ các nội dung, vấn đề cụ thể không đồng ý): *Không.*

4.4.2. Ý kiến về các giải pháp, biện pháp giảm thiểu các tác động xấu của Dự án đến môi trường tự nhiên và kinh tế - xã hội:

- Ý kiến đồng ý với các nội dung tương ứng được trình bày trong bản thông báo nêu trên của Chủ dự án:

Đồng ý với các nội dung và giải pháp, biện pháp giảm thiểu các tác động xấu được Ban quản lý dự án Hàng hải II trình bày ở trên.

- Ý kiến không đồng ý với các nội dung tương ứng được trình bày trong bản thông báo nêu trên của Chủ dự án (chỉ rõ các nội dung, vấn đề cụ thể không đồng ý): *Không.*

4.4.3. Kiến nghị đối với Chủ dự án: (các yêu cầu, kiến nghị của cộng đồng đối với Chủ dự án liên quan đến việc cam kết thực hiện các biện pháp, giải pháp giảm thiểu các tác động xấu về môi trường của Dự án và các kiến nghị khác có liên quan đến Dự án nếu có):

- Chúng tôi rất quan tâm đến Dự án vì nó mang lại sự phát triển kinh tế cho UBND huyện Cát Hải và mang lại công ăn việc làm cho bà con nhân dân. Chúng tôi mong muốn của người dân là sớm triển khai xây dựng Dự án

- Chúng tôi mong muốn Dự án sẽ được triển khai xây dựng sớm để tạo diều kiện phát triển nền kinh tế của khu vực.

- Chúng tôi rất mong Dự án sớm triển khai để tạo điều kiện cho sự phát triển về cơ sở hạ tầng cũng như các dịch vụ, để tạo điều kiện thuận lợi cho con em chúng tôi về công việc học tập được thuận lợi hơn.

- Cho biết thời gian bắt đầu thực hiện Dự án để bà con yên tâm chủ động đầu tư sản xuất.

- Do dự án triển khai trậm nên ảnh hưởng đến tư tưởng của người dân (Quyết định phê duyệt Dự án năm 2008)

4.5. Trả lời của Ban Quản lý dự án hàng hải II, UBND, và phía Nhật bản đối với những câu hỏi và ý kiến của người dân.

Chúng tôi đồng tình với các ý kiến của các hộ dân đã nêu ra. Dự án xây dựng cảng cửa ngõ quốc tế Lạch Huyện Hải Phòng được thực hiện bởi nguồn vốn vay của Nhật Bản. Dự kiến khởi công tháng 6/2012.

Vì vậy chúng tôi sẽ cố gắng triển khai các thủ tục cần thiết để sớm thi công Dự án để đáp ứng được nguyện vọng cũng như nhu cầu của địa phương.

Biên bản được lập thành 08 bản có giá trị pháp lý như nhau các bên tham gia thống nhất ký tên.

Đại diện Cục Hàng hải Việt Nam **Phòng KHCN&MT**	**Đại diện UBND thị trấn Cát Hải** **Chủ tịch**
Trần Thị Tú Anh	**Nguyễn Văn Trọng**
Đại diện Ban QLDA Hàng hải II **Phó giám đốc**	**Đại diện Tư vấn SAPROF (JICA)**
Đặng Văn Đế	**Nagaoka Shinya**

Tài liệu đính kèm:

- Chữ ký của các đại biểu và người dân tham gia dự họp (có danh sách kèm theo).

- Danh mục những văn bản liên quan được cung cấp tới người dân

Danh sách cuộc họp

Công bố và lấy ý kiến cộng đồng về báo cáo đánh giá tác động môi trường
Dự án xây dựng cảng cửa ngõ quốc tế Lạch Huyện - Hải Phòng

TT	Họ và tên	Địa chỉ	Chữ ký
1	Bùi Công Nghĩa	Phó chủ tịch UBND huyện CH	KT
2	Nguyễn mạnh Thắng	Bí thư Đảng ủy TT Cát Hải	
3	Hoàn Đồng	Phó Bí thư thường trực	
4	Lê Chí Lợi	Phó chủ tịch HĐND TT cát Hải	
5	Nguyễn Văn Dương	Chủ tịch UBND TT Cát Hải	
6	Vũ Văn Thắng	Phó chủ tịch UBND TT cát Hải	
7	Bùi Hữu Thủy	Phó chủ tịch UBND TT cát Hải	
8	Hoàng Văn Kỳ	chủ tịch UBMTTQ TT Cát Hải	
9	Nguyễn Chí Linh	chủ tịch Hội PN TT Cát Hải	
10	Bùi Hữu Ung	chủ tịch Hội CCB TT Cát Hải	
11	Phạm Viết Thành	chỉ huy trưởng QS TT Cát Hải	
12	Bùi Hồng Quân	cán bộ Tư pháp TT Cát Hải	
13	Vũ Chí Loan	cán bộ Văn phòng TT Cát Hải	
14	Phạm Quốc Lợi	cán bộ địa chính TT Cát Hải	
15	Nguyễn Thế Toàn	cán bộ văn hoá TT Cát Hải	
16	Nguyễn Thị Kim Dung	tổ dân phố Hải Sơn	
17	Nguyễn Văn Sang	tổ dân phố Lương Nông	
18	Nguyễn Quang Anh	tổ dân phố Hoà Hy	
19	Nguyễn Thắng Thủy	tổ dân phố Gia Lộc	
20	Vũ Thị Loan	tổ dân phố Đồn Lương	
21	Hoàn Thắng Hoàn	tổ dân phố Lục Bộ	
22	Nguyễn Chí Hoàn	cán bộ phòng QLMT huyện	
23	Phan Thắng Long	Lái tàu tổ Biển Phòng 50	
24	Nguyễn Văn Bình	Lái tàu tổ Biển Phòng 50	
25	Đinh Văn Hưng	tổ dân phố Đồn Lương	

26	Nguyễn Thị Hoa	Cô dân phố Hà	Hà
27	Hoàng Thị Thúy	Quyền Trưởng Quyền Trưởng	Thúy
28	Bùi Đăng Quyền	Quyền Trưởng Quyền Trưởng	Thúy
29	[illegible]	[illegible]	[illegible]
30	Nguyễn	Quyền gia mới trưởng x M JICA	[illegible]
31	[illegible]	[illegible]	[illegible]
32	[illegible]	[illegible]	[illegible]
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Appendix 13-1

補足 EIA 報告書

MINISTRY OF TRANSPORT
VIETNAM MARITIME ADMINISTRATION
.....

MARITIME PROJECT MANAGEMENT UNIT II
JAPAN INTERNATIONAL COOPERATION AGENCY

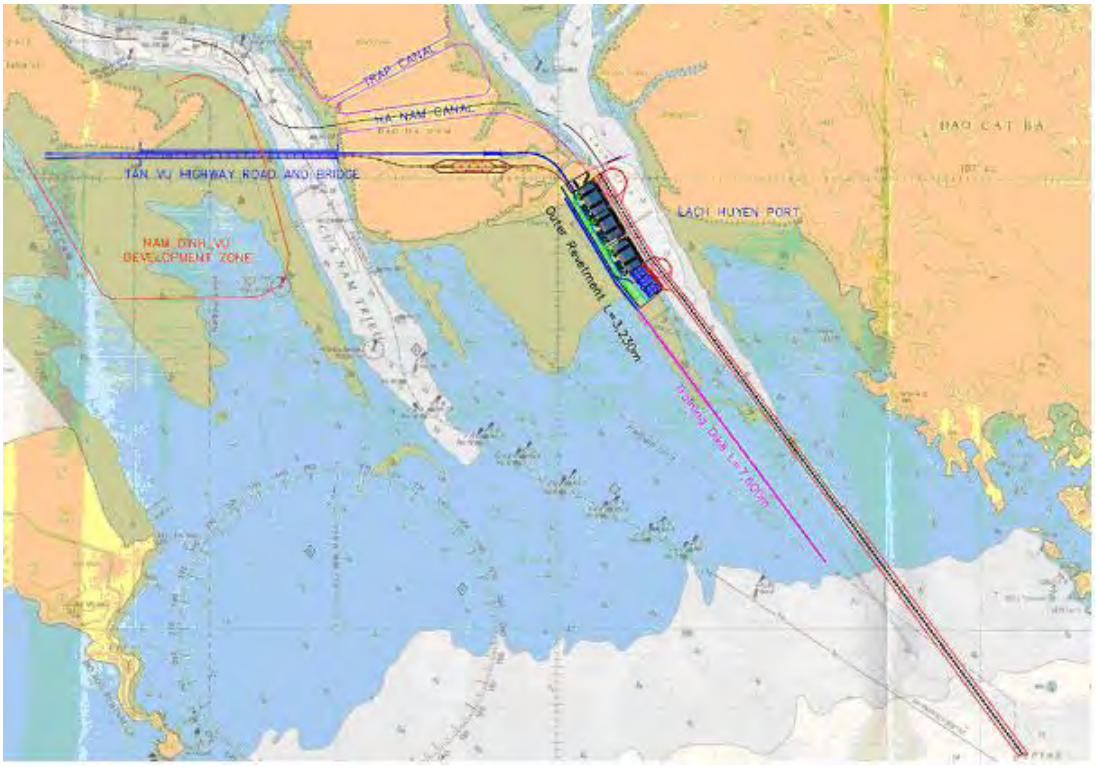
SUPPLEMENTAL REPORT

ENVIRONMENTAL IMPACT ASSESSMENT

HAI PHONG INTERNATIONAL GATEWAY PORT (LACH HUYEN GATEWAY PORT) CONSTRUCTION PROJECT

(2010-2015)

(Prepared for MOT and JICA's reference for project appraisal with change in port design by SAPROF)



Ha Noi - 5/2010

MINISTRY OF TRANSPORT
VIETNAM MARITIME ADMINISTRATION

MARITIME PROJECT MANAGEMENT UNIT II
JAPAN INTERNATIONAL COOPERATION AGENCY

SUPPLEMENTAL REPORT

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(LACH HUYEN GATEWAY PORT)

Construction Project

(2010 - 2015)

(Prepared for MOT and JICA's reference for project appraisal with change in port design by SAPROF)

ORIENTAL CONSULTANTS CO., LTD (OC)
PADECO CO., LTD. (PADECO)

Exchange Rate (As of March, 2010)
VND 1 = JPY 0.00528
USD 1 = JPY 89.60
(VND 1 = USD 0.000058928 = JPY 0.00528)

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LIST OF ABBREVIATIONS

A	ADB	Asian Development Bank
	ASEAN	Association of South East Asian Nations
B	BOD	Biological Oxygen Demand
	BOO	Build-Operate-Own
	BOT	Build-Operate-Transfer
	BT	Built – Transfer
	BTO	Build - Transfer - Operate
C	CD	Chart Datum
	CDL	Chart Datum Level
	CDM	Cement Deep Mixing
D	DO	Dissolved Oxygen
	DVIZ	Dinh Vu Industrial Zone
	DWT	Deadweight Tonnage
E	EHS	Environment, Health and Safety
	EIA	Environmental Impact Assessment
	EMP	Environmental Management Plan
F	FC	Full Container Ship
	FDI	Foreign Direct Investment
	FOB	Free On Board
	F/S	Feasibility Study
G	GL	Ground Level
	GOJ	The Government of Japan
	GOV	The Government of Socialist Republic of Viet Nam
	GDP	Gross Domestic Product
	GPS	Global Positioning System
	GSO	General Statistics Office of Vietnam
	GT	Gross Tonnage
H	HAPACO	Hai Phong Industrial Zone Joint Stock Company
	HHWL	Highest High Water Level
	HIV	Human Immunodeficiency Virus
	HP	Haiphong
	HWL	High Water Level
	HYMENET	The Center for Hydrometeorological and Environmental Station Network
I	IMO	International Maritime Organization
	IP	Industrial Park
	IZ	Industrial Zone
	IT	Information Technology
J	JBIC	Japan Bank for International Cooperation
	JCC	Joint Coordination Committee
	JETRO	Japan External Trade Organization
	JICA	Japan International Cooperation Agency

	JIS	Japanese Industrial Standards
	JPY	Japanese Yen
	JV	Joint Venture
L	LLWL	Lowest Low Water Level
	LWL	Low Water Level
M	MARPOL	Marine Pollution
	MLWL	Mean Low Water Level
	MOM	Minutes of Meeting
	MONRE	Ministry of Natural Resources and Environment
	MOT	Ministry of Transport
	MOU	Memorandum of Understanding
	MP	Multi Purpose Ship
	MPI	Ministry of Planning and Investment
	MPMU	Maritime Project Management Unit
	MSC No.1	Maritime Safety Company No.1
	MSL	Mean Sea Level
	MWL	Mean Water Level
N	N.A.	Not Applicable
O	ODA	Official Development Assistance
P	PAB	Project Affected Fishing Boats
	PAH	Project Affected Household
	PAP	Project Affected People
	PC	The People's Committee
	PM	Prime Minister
	PMB	Port Management Body
	PMU	Project Management Unit
	PPP	Public Private Partnership
Q	QGC	Quay Gantry Crane
R	RAP	Resettlement Assistance Program
S	SAPROF	Special Assistance for Project Formation
	SDVDC	South Dinh Vu Development Joint Stock Company
	SPC	Special-Purpose Company
T	TCVN	Vietnam Standards (Tiêu Chuẩn Việt Nam)
	TEDI	Transport Engineering Design Incorporated
	TEDIPORT	Port & Waterway Engineering Consultant Joint Stock Company
	TEU	Twenty-foot Equivalent Unit
	TSS	Total Suspended Solids
U	UXO	Unexploded Ordnance
V	VINALINES	Vietnam National Shipping Lines
	VINAMARINE	Vietnam National Maritime Bureau
	VMS	Vietnam Maritime Safety Agency
	VND	Vietnamese Dong

	VTS	Vessel Traffic Service
W	WB	The World Bank
	WTO	World Trade Organization

INTRODUCTION

I. Objectives of the Preparatory Survey

This SUPPLEMENTAL Environmental Impact Assessment (EIA) report was specifically prepared for Japan International Cooperation Agency's (JICA) verification of potential environmental and social impacts by the recommended change in port design of Special Assistance for Project Formation (SAPROF) team as well as the responsible authorities of Government of Vietnam - the Ministry of Transport of Vietnam (MOT), Vietnam National Maritime Bureau (VINAMARINE), Maritime Project Management Unit II (MPMU2).

This SUPPLEMENTAL EIA report also aims to aid the MPMU2's preparation of "ADDITIONAL EIA", which is required by the Vietnamese law on environmental protection, shortly followed by the SAPROF study to proceed with the construction work as well as to meet the Japanese Official Development Assistance (ODA) policy.

II. Project Rationale

Being located in the Southeast Asia region, Vietnam has its total of 3,260km coastal line which is very favor for waterway transportation from offshore to on-land together with the road transport and railway transport, has been forming up a very smooth transport network, contributing to the socio-economic development of the country.

Vietnam's big seaports such as Cai Lan, Hai Phong, Da Nang, Cam Ranh, Vung Tau, Saigon, etc has been functioning an important role connecting Vietnam to the world through waterway transport. However, none of the above-mentioned seaports are deep seaports/international container transshipment port. Currently, Van Phong deep seaport in Khanh Hoa Province is under implementation but even after its completion, the capacity is still far from the demand. Particularly, the seaport groups in the northern region are not be able to meet the demand of the economic development of the region and therefore, investment into a deep seaport is a matter of great necessity which aims at contributing and boosting the economic development of the region and the country as a whole. Among all investment alternatives, Lach Huyen Gateway Port (officially named as "Hai Phong International Gateway Port" at the approval of the port development) was chosen and considered as the most feasible one.

The Resolution No.32/NQ-BCT dated August 5th 2003 of the Politburo on constructing and developing Hai Phong city in the process of industrialization and modernization has mentioned "Ministry of Transport in collaboration with other competent authorities to study the master plan for seaports system in Hai Phong and in the Northeast region including the study of Hai Phong International Gateway Port as proposed by the city and other competent agencies and report to the Government for decision making; Develop a plan for mobilizing resources and phasing investment including construction of Hanoi – Hai Phong Expressway to Dinh Vu, upgrading Lao Cai – Ha Noi – Hai Phong Railway to Dinh Vu, constructing new bridges (or underground tunnel) connecting to islands, and upgrading/expanding Cat Bi Airport aims at boosting economic development of the city".

Hai Phong International Gateway Port is the major gateway to the sea, the most vital transport hub of the northern region – the centre of industry, commerce, services, and tourism of the region and the country, and therefore needed to be prioritized.

Being located in the most important axes of the Southeast Asia region not only in terms of economic but also defense and security, Lach Huyen is likely to play a more important role in the international transshipment and maritime services. The city Master Plan to 2020, approved by the Prime Minister, defines Lach Huyen port's location right in the waterway corridor of Cat Ba – Cat Hai – Quang Ninh.

The construction and investment of Hai Phong International Gateway Port has been agreed and determined by the Government and Ministry of Transport toward the direction of developing the city to be a modernized and industrialized city.

Hai Phong International Gateway Port plays a vital role in the northern region, not only in meeting the increasing demand of cargo throughput and calling vessels but also in attracting more investors into the region. The construction and investment of Lach Huyen Port is in line with the direction and expectedly, the port will be functioning as the international container transshipment port with the capacity of million tons per year.

On August 25th 2004, Minister of Transport has signed Decision No.2561/QD-BGTVT allowing the preparation of the Feasibility Study for the Hai Phong International Gateway Port Project.

Scope of the study covers the period 2010-2015 including first 2 berths with its total length of 600m, and -14m deep, being able to accommodate 30,000DWT, 4.000TEU, cargo throughput of 6 million tons per year in which container cargo accounts for 5.5 million tons per year.

The Ministry of Transport is the line ministry to give its approval to the project. Pursuant to the Decree No.80/2006/ND-CP (Article 19 Appendix 1, Article 9 Appendix II), Decree No.21/2008/ND-CP, this project is subjected to the implementation of EIA report and submit to the Ministry of Natural Resources and Environment for appraisal and approval.

On October 31, 2008, the Ministry of Natural Resources and Environment approved the environmental impact assessment of Hai Phong (Lach Huyen) International Gateway Port Project, Hai Phong (Decision No 2231/QD-BTNMT).

Based on the TEDI's Hai Phong International Gateway (Lach Huyen) Port Infrastructure Design, Government of Vietnam requested the Government of Japan to provide yen loan to the project in order to enforce the development plan proposed in its feasibility study stage. In accordance with the request, JICA assigned the Japanese expert team (joint venture of Oriental Consultants and Padeco) to conduct the necessary feasibility study for the Japanese official development loan from October 2009 with the special assistance for project formation (SAPROF) fund. In order to maximize the outcome of the feasibility study, the Ministry of Transport assigned VINAMARINE and MPMU2 as project owner of the new gateway port and implementation agency of the port infrastructure development respectively on January 18, 2010 (Letter No.330/BGTVT-KHDT of MOT).

After the comprehensive analysis of the demand forecast, SAPROF recommended enlarging the port design. The government of Vietnam agrees the change in TEDI's port design and adapts the SAPROF's recommended design. The new scope of the study covers the period 2010-2020 with the first 2 berths, its total length of 750m, and -16m deep, being able to accommodate 50,000DWT full load and 100,000 DWT partially load throughput of 29.5 million tons per year in which container cargo accounts for 26.7 million tons per year (Middle growth case of The SAPROF Study).

III. Legal and Technical Basis for EIA Implementation

III-1 Legal Basis

The EIA Report was prepared based on the following legal basis:

- Environment Protection Law No.52/2005/QH11 dated November 29th 2005, issued on December 12th 2005, and became full effect on July 1st 2006.
- Water Resources Law 1998 dated May 20th 1998, took effect in January 1st 1999.
- Land Law 2003 dated November 26th 2003, took effect in July 1st 2004.
- Decree No.80/2006/ND-CP dated August 9th 2006 of the Government detailing the implementation of the Environment Protection Law

- Decree No.59/2007/ND-CP dated April 9th 2007 of the Government on solid waste management.
- Decree No.88/2007/ND-CP dated May 28th 2007 of the Government on drainage for urban and industrial zones.
- Decree No.84/2007/ND-CP dated May 25th 2007 of the Government on granting land use right certificate, land collection, land use right, procedures for compensation, support, resettlement where the land acquired by the State and complain denunciation.
- Decree No.21/2008/ND-CP dated February 28th 2008 of the Government on amendment of some articles of Decree No.80/2006/ND-CP dated August 9th 2006 guiding the implementation of Environment Protection Law.
- Decree No.71/2006/ND-CP dated July 25th 2006 of the Government on seaport management and maritime navigation channel.
- Circular No.08/2006/BTNMT dated September 8th 2006 of the Ministry of Natural Resources and Environment guiding the assessment of strategic environment, environment impact assessment and environment protection commitment.
- Decision No.35/2002/QD-BKHCNMT dated June 25th 2002 of the Ministry of Science, Technology, and Environment on list of obligatory application of Vietnamese environment standards.
- Decision No.22/2006/QD-BTNMT dated December 18th 2006 of the Ministry of Natural Resources and Environment on obligatory application of Vietnamese standards on environment.
- Decision No.23/2006/QD=BTNMT dated December 26th 2006 of the Ministry of Natural Resources and Environment on list of dangerous waste.
- Circular No.12/2006/TT-BTNMT dated December 26th 2006 of the Ministry of Natural Resources and Environment guiding the procedures for application, registration, licensing, code issuance for managing dangerous waste.
- Decision No.2561/QD-BGTVT dated August 25th 2004 of the Ministry of Transport on allowing the preparation of Feasibility Study for Lach Huyen Gateway Port Construction Project.
- Decision No.2570/QD-BGTVT dated July 27th 2005 of the Ministry of Transport on approval of outline, cost estimation for survey and FS preparation for Lach Huyen Gateway Port Construction Project.
- Decision No.202/QD-TTg dated October 12th 1999 of the Prime Minister on approval of Master Plan for Vietnam seaports system to 2010.
- Decision No.885/QD-TTg dated August 22nd 2004 of the Prime Minister on approval of the detailed planning for northern seaport group (Group 1) to 2010 and orientation for development to 2020.
- Decision No.04/2001/QD-TTg dated January 10th 2001 of the Prime Minister on approval pf revised planning of Hai Phong city to 2020.
- Resolution No.32/NQ-TW dated August 5th 2003 of the Politburo on constructing and developing Hai Phong city in the process of industrialization and modernization.
- Decision No.766/QD-CHHVN dated December 31st 2004 of the Vietnam Maritime Administration on assigning the representatives of the Project Owner for making Feasibility Study for the Lach Huyen Gateway Port Construction Project.
- Decision No.694/QD-CHHVN dated October 23rd 2007 of Vietnam Maritime Administration on transfer of projects from the Maritime PMU I to Maritime PMU III.
- Letter No.8327/TTr-BGTVT dated December 25th 2007 of the Ministry of Transport on proposal for approving in principle the investment of Lach Huyen Gateway Port Project.
- Decision No.06/2008/QD-TTg dated January 10, establishing and promulgating regulation on operation of Dinh Vu-Cat Hai Economic Zone
- Decision No 2231/QD-BTNMT dated Oct 31, 2008 of Ministry of Natural Resources and Environment, approving environmental impact assessment of Lach Huyen International Gateway Port Project, Hai Phong.

- Decision No. 3793/QD-BGTVT dated Dec 22, 2008 of Ministry of Transport, approving Construction Project of Hai Phong International Gateway Port (starting phase).
- Decision No.34/2009/QD-TTG dated March 02, 2009, approving the Master Plan on Development of the Tonkin Gulf Coastal Economic Belt up to 2020
- Decision No.1808/QD-CT dated Sep 11, 2009 of Hai Phong City People Committee, approving steering committee establishment of the city on Hai Phong International Gateway Port Project
- Decision No.1448/QD/TTg dated September 16, 2009, approving adjustment on general plan on developing Hai Phong city up to 2025 and vision to 2050.
- Decision No.1601/QD/TTg of Prime Minister dated October 15, 2009, approving marine transport development plan of Viet Nam up to the year 2020 and orientation to the year 2030.
- Decision No.2190/QD/TTg of Prime Minister dated December 24, 2009, approving system of marine port planning of Viet Nam up to the year 2020 and orientation to the year 2030.
- Letter No.330/BGTVT-KHDT of Ministry of Transport on Appointing management task for Hai Phong international gateway port infrastructure project

III-2 Technical Basis

- Vietnamese technical regulations on environment (QCVN 2008, 2009)
- Vietnamese standards on environment (TCVN 1995, 1998, 2001, 2005).
- Standards on environment and natural resources protection of the neighboring countries and international organization (not yet issued by Vietnam).
- Final report of Feasibility Study of the Lach Huyen Gateway Port Construction Project by TEDI, May 2007.
- Executive Summary of Final Report, Feasibility Study of the Lach Huyen Gateway Port Construction Project by TEDI, May 2007.
- Outline of basic design Feasibility Study of the Lach Huyen Gateway Port Construction Project by TEDI, May 2007.
- Geological survey report, Lach Huyen Gateway Port Construction Project by TEDI, 2006.
- Topography survey report, Lach Huyen Gateway Port Construction Project by TEDI, March 2006.
- Meteorology and hydrography survey report, Lach Huyen Gateway Port Construction Project by TEDI, July 2007.
- Wave survey report, Lach Huyen Gateway Port Construction Project by TEDI, August 2006.
- Hydrography survey report, Lach Huyen Gateway Port Construction Project by TEDI, September 2006.
- Technical paper of the World Bank on preparation of the Environment Impact Assessment report.
- Guiding regulations on preparation of the Environment Impact Assessment report.
- Report on natural conditions, ecology, socio-economic and environment conditions in the project area by the Center for National Hydrography and Meteorology, May 2006.
- Comments/opinions of the People's Committee of Cat Hai district, Hai Phong city Department of Natural Resources and Environment.
- Other relevant materials on topography, geography, socio-economic, and environment conditions in Cat Hai district, Hai Phong city.
- National Pollutant Invention 2002. " Emission Estimation Technique Mannual for Combustion Engines" Version 2.2, Commonwealth of Australia, available online at http://www.npi.gov.au
- FIRE v6.24 (Factor Information Retrieval for criteria and hazardous air pollutants) available online at http://www.epa.gov/ttn/chief/software/fire/
- World Health Organization, Geneva, 1993. Assessment of sources of air, water, and land pollution – a guide to rapid source inventory technique and their use in formulating control strategies Part one: rapid inventory techniques in environmental pollution by Alexander P.Economopoulos Dermocritor University of Thrace.

III-3 Legal and Technical Basis for EIA Implementation

Project Owner: Vietnam Maritime Administration (VINAMARINE)
Representative of the Project Owner: Maritime Project Management Unit III (MPMU3)
EIA Report Consultant: Center for Hydrography & Meteorology Network, and Environment (HYMENET)
Address: 62 Nguyen Chi Thanh street, Dong Da, Hanoi
Director: Mr. Nguyen Van Tue
Tel.: 04.8343581 Fax: 04.8358342
Associating agencies:

- Hai Phong Institute for Natural Resources and Sea Environment
- Hai Phong Port Authority
- Institute for Hydrography, Meteorology Science and Environment
- Center for Hydrography and Meteorology Technology Application
- Department of Natural Resources and Environment – the People's Committee of Cat Hai District

Members participating in the implementation of EIA report (Approved EIA)

No	Name	Qualification	Agency
1	Ho Mau Chuyen	Eng.. Waterway Construction	MPMU3
2	Duong Thi Quynh Nga	B.A. Economic	MPMU3
3	Vo Ho Nhat Quan	Eng. Waterway Construction	MPMU3
4	Nguyen Dinh Luong	Eng. Meteorology and Environment	HYMENET
5	Nguyen Kien Dung	Dr. Hydrography and Environment	Center for Hydrography and Meteorology Technology Application (HYMETEC)
6	Dang Lap	B.A. Sociology	HYMENET
7	Bui Hoai Thanh	MSc. Hydrography and Environmenr	HYMENET
8	Vu Quynh Hoa	MSc. Environment	HYMENET
9	Pham Chi Kien	B.A. Environment	HYMENET
10	Nguyen Nhat Anh	Msc. Environment	HYMENET
11	Tong Thanh Ha	B.A. Environment	HYMENET
12	Tran Danh Thieu	Eng. Hydrography	HYMENET
13	Dao Anh Van	Eng. Hydrography	HYMENET
14	Le Xuan Duc	Eng. Meteorology	HYMENET
15	Vu Van Dinh	Eng. Meteorology	HYMENET
16	Tong Van Anh	Eng. Chemistry	HYMENET
17	Trinh Quang Hoan	Eng. Chemistry	HYMENET
18	Bui Dinh Khuoc	B.A. Oceanography	HYMENET
19	Le Thi Thanh Hoa	MSc. Environment	HYMETEC
20	Duong Van Quyet	MSc. Biology	HYMETEC
21	Ly Duc Tai	B.A. Environment	HYMETEC
22	Nguyen Hong Tra	B.A. Environment	HYMETEC

The implementation process of EIA Report:

In accordance with the provisions of the Environment Protection Law 2005, Decree No.80/2006/ND-CP dated August 9th 2006, Decree No.21/2008/ND-CP dated February 28th 2008, and Circular No.08/2006/TT-BTNMT dated September 8th 2006 of the Ministry of Natural Resources and

Environment, the EIA report for the Lach Huyen Gateway Port Construction Project was carrying out in the following steps:

- Study the final report and the basic design of the Feasibility Study of the Lach Huyen Gateway Port Construction Project
- Study natural conditions, and socio-economic conditions in the project area
- Survey, measure, and assess environment conditions in the project area
- Define sources of impact, subject, scope of impact, analyze, assess and predict impacts of the project to the environment.
- Formulate mitigation measures to avoid adverse impact, prevent and cope with environment incidents of the project.
- Set up environment treatment facilities, management and supervision programs for the project.
- Prepare cost estimation for environment treatment facilities for the project.
- Carry out public consultation
- Finalize EIA report
- Submit EIA report for appraisal and approval

III-4 Implementation of Supplemental Report of the Approved EIA Report

Project Owner: Vietnam Maritime Administration
Implementation Agency of the Project: Maritime Project Management Unit II (MPMU2)
Supplemental Report Consultant: ORIENTAL CONSULTANTS Co. Ltd. (OC), the consultant for the Special Assistance for Project Formation (SAPROF) of JICA
Address: 12-1, Honmachi 3-chome, Shibuya-ku, Tokyo, Japan
Project Leader: Nobuaki Nagao
Tel.: +81 3-6311 7889 Fax: +81 3-6311 8043
Associating consultant: HYMENET

In accordance with the effective law and regulation of law on Environment Protection, MPMU2 is required to prepare "Additional EIA report" (the Additional EIA) for the appraisal of the proposed Hai Phong Gateway Port Construction Project due to the change in port design by SAPROF team and accepted by MOT. In order to accelerate preparation of the Additional EIA documentation, SAPROF team integrated the revision of the approved EIA (the Supplemental Report of the EIA) report and SAPROF port designing in the same time. The Supplemental Repost of the EIA will be submitted to JICA for the consideration of the project appraisal with the change in port design by SAPROF team. In addition, the Supplemental Report of the EIA will be referred to revise the approved EIA and complete the Additional EIA for the approval of the project.

Members participating in the implementation of Additional EIA report

No	Name	Qualification	Agency
1	Dang Van De	Eng. Hydroengineering	MPMU2
2	Tran Duc Duy	Eng. Hydroengineering	MPMU2
3	Nguyen Ngoc Quang	Eng. Hydroengineering	MPMU2
4	Nguyen Hai Au	Eng. Marine safety	MPMU2
5	Tran Van Thuyet	Eng. Marine safety	MPMU2
6	Dinh Van Thang	Eng. Hydroengineering	Science Technology and Environment Department (STED), VINAMARINE
7	Tran Thi Tu Anh	Eng. Envi.engineering	STED, VNINAMARINE
8	Nguyen Dinh Luong	Eng. Meteorology and Environment	Center for Hydrology & Meteorology Network, and Environment (HYMENET)
9	Nguyen Nhat Anh	Eng. Envi.engineering	HYMENET
10	Pham Van Chinh	Eng. oceanography	HYMENET

No	Name	Qualification	Agency
11	Bui Thai Hoanh	Eng. oceanography	HYMENET
12	Bui Hoai Thanh	MS. Water Environment	HYMENET
13	Nobuaki Nagao	Professional Engineer in Port and Airport	ORIENTAL CONSULTANTS, SAPROF (Team Leader)
14	Somasndaram Jayamohan	Dr. Environmental Engineering	ORIENTAL CONSULTANTS, SAPROF (Natural Environment Expt.)
15	Shinya Nagaoka	MSc. Ocean Civil Engineering	ORIENTAL CONSULTANTS, SAPROF (Social Environment Expt.)

III-5 Expected Process of Additional EIA Report Followed by This Supplemental EIA Report

In accordance with the effective law and regulation of law on Environment Protection, MPMU2 is required to prepare the Additional EIA report followed by the Supplemental Report of the EIA to acquire an approval of the revised port design.

The implementation process of Additional EIA Report:

In accordance with Article 13 of Decree No.80/2006/ND-CP and Article 6 of Decree No.21/2008/ND-CP Amending Article 13, b/ of Decree No.80/2006/ND-CP, it is required to prepare the Additional EIA report.

1) Required cases:
- a/ There is a change in the project's location, size, design capacity or technology;
- b/ The project is executed only after 24 months following the date of approval of its environmental impact assessment report. In case of no change in design capacity, technology and surrounding environment, it is not required to make an additional environmental impact assessment report but a written explanation must be submitted to the approving agency.

2) Coverage of the Additional EIA report:
- a/ Changes in the project's content;
- b/ Changes in the natural environmental conditions and economic and social factors up to the time the additional environmental impact assessment report is made;
- c/ Changes in environmental impacts and measures to minimize negative impacts;
- d/ Changes in the project's environmental management and monitoring program;
- e/ Other changes.

3) Within 30 (thirty) working days after the date of receipt of complete and valid dossiers, state agencies competent to approve environmental impact assessment reports shall have to examine and approve additional environmental impact assessment reports.

In accordance with Circular No.08/2006/TT-BTNMT*, approval procedures are as follows:

*Submission of the Additional EIA for the approval (Clause 10: Elaboration, appraisal and approval of additional environmental impact assessment reports, III Elaboration, Appraisal and Approval of EIA Reports; Implementation, Examination and Certification of the EIA Reports Additional EIA Reports and Satisfaction of Requirements Set in Approving Decisions, Circular No.08/2006/TT-BTNMT)

<Extraction of Relevant Description in Circular No.08/2006/TT-BTNMT>

A dossier of request for appraisal and approval of an additional EIA report comprises:
- a/ 01 (one) written request for appraisal and approval of the additional EIA report;
- b/ 07 (seven) copies of the additional EIA report
- c/ 01 (one) copy of the approved EIA report

d/ 01 (one) lawfully authenticated copy of the decision approving the EIA report
e/ 01(one) adjusted investment report, techno economic report, investment project or equivalent documents, bearing the signature, full name and title of the project owner and a stamp on its supplementary coversheet.

10.4. The additional environmental impact assessment report shall be appraised by seeking written comments from scientists and manager who possess relevant professional qualifications and the state management agency in charge of environmental protection in the locality where the project will be implemented. Comments and evaluations shall be made according to a set form. In case of necessity, the additional environmental impact assessment report may be appraised by an appraisal council or appraisal service organization.

10.5. If the dossier is unqualified for appraisal, within 05 (five) working days after receiving the dossier, the appraising agency shall notify in writing the reasons for its non-qualification to the project owner for completing the dossier.

10.6. If the dossier is qualified for appraisal, agency competent to appraise the report shall consider and approve the additional EAI report within 30 (thirty) working days; if the dossier fails to satisfy conditions for approval, it shall notify in writing the project owner of its comments and evaluation on the additional EIA report for finalizing the dossier.

10.10. The certified additional environmental impact assessment report and the approval decision shall be sent to recipients like those of the approved EIA report and its approval decision.

CHAPTER 1

Project description

1.1. Name of the Project

Hai Phong International Gateway Port construction Investment, the period 2010-2015 (star-up phase)

1.2. Project owner

Investor**:** **Vietnam Maritime Administration**

Representative of Investor: **Maritime Project Management Unit II**

Address: 10/389 Da Nang Str., Hai An District, Hai Phong City

Director: Mr. Nguyen Van Thiem

Tel: 031-3769176

Fax: 031-3769175

E-mail: banqldahanghai2@gmail.com

1.3. Project Location

Hai Phong International Gateway Port is to be constructed at Lach Huyen estuary, Chanh river in Cat Hai district, Hai Phong city.

Hai Phong International Gateway Port will be the center port of the northern area as well as the country, and will play an important role in maritime services and in strategic development of socio-economic of the northern economic zones and the region as a whole.

Hai Phong International Gateway Port stretches from the upstream of Trap Canal, runs along Chanh River via Lach Huyen estuary and goes to the South East direction to the sea.

1.1.1. Vietnam Seaport System Development Master Plan

VINAMARINE has prepared the Master Plan of Vietnam Seaport System Development until 2020 toward to 2030, which was approved by the Prime Minister on December 24, 2009. In this master plan, the Hai Phong Port is designated to develop as an International Gateway Port, national general hub port of the North.

Lach Huyen Terminal is the main terminal of Hai Phong Port, mainly used for import-export container vessel of 4,000 TEU to 6,000 TEU and 50,000 DWT to 80,000 DWT, operated in far navigation transportation routes. Port infrastructures and cargo handling technology will be developed as synchronous and modern system at international level.

This Vietnam Seaport Development Master Plan is one of the important rationales for the development of Lach Huyen Port. The conceptual map of the master plan is shown in Figure 1.1.

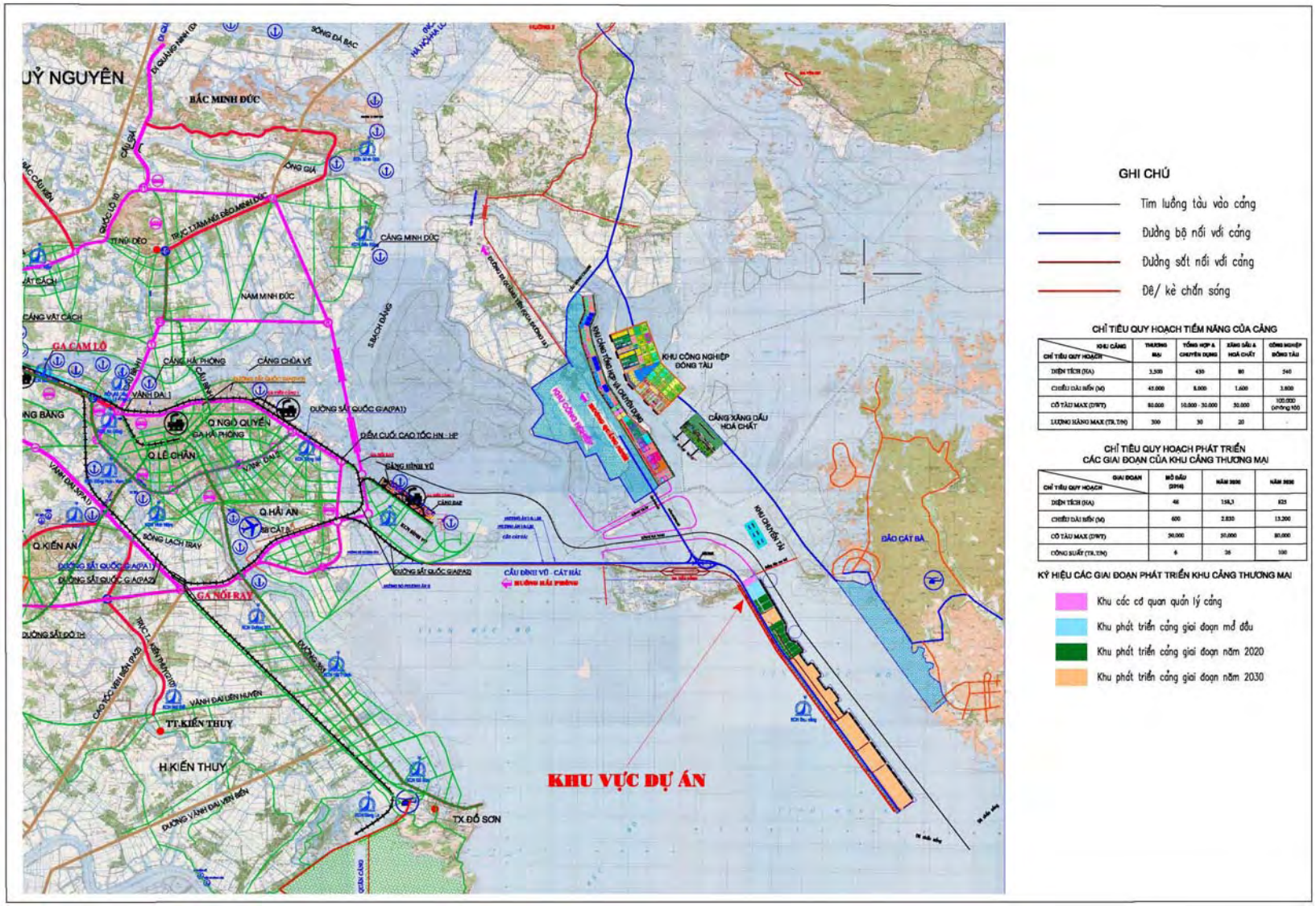


Figure 0.1 Survey Area

SAPROF Preparatory Survey On Lach Huyen Port Infrastructure Construction In Vet Nam Study Area

The Government of Socialist Republic of Viet Nam (hereinafter referred to as "GOV") directed Transport Engineering Design Incorporated (hereinafter referred to as "TEDI") to make a feasibility study on Lach Huyen Port Infrastructure Construction Project (hereinafter referred to as "the Project") located in the northern region of Viet Nam. Based on the result of the feasibility study, GOV has requested the Government of Japan (hereinafter referred to as "GOJ") to provide yen loan to the Project in order to enforce the development plan proposed in its feasibility study stage. In accordance with this request, JICA dispatched a mission on the Project (hereinafter referred to as "the JICA Mission") to Viet Nam from July 20 to 23, 2009 in order to develop scope and implementing arrangements of a further survey which will review the currently available data and conduct supplementary study to facilitate formation of the Project (hereinafter referred to as "the Preparatory Survey"). Based on this preliminary survey, the scope and implementing arrangements of the Preparatory Survey were settled and signed by JICA, Ministry of Transports and Vietnam National Shipping Lines (hereinafter referred to as "VINALINES").

The principal objectives of the Preparatory Survey are to examine the existing feasibility study on port development plans including the Hai Phong – Lach Huyen International Gateway Port development plan from a technical and a financial as well as a natural and social environmental standpoint, and refine the implementation plan of the future development plan of Lach Huyen Port Infrastructure Construction Project.

The Preparatory Survey shall cover the area of Hai Phong (Lach Huyen) International Gateway Port is shown in Figure 0.2.

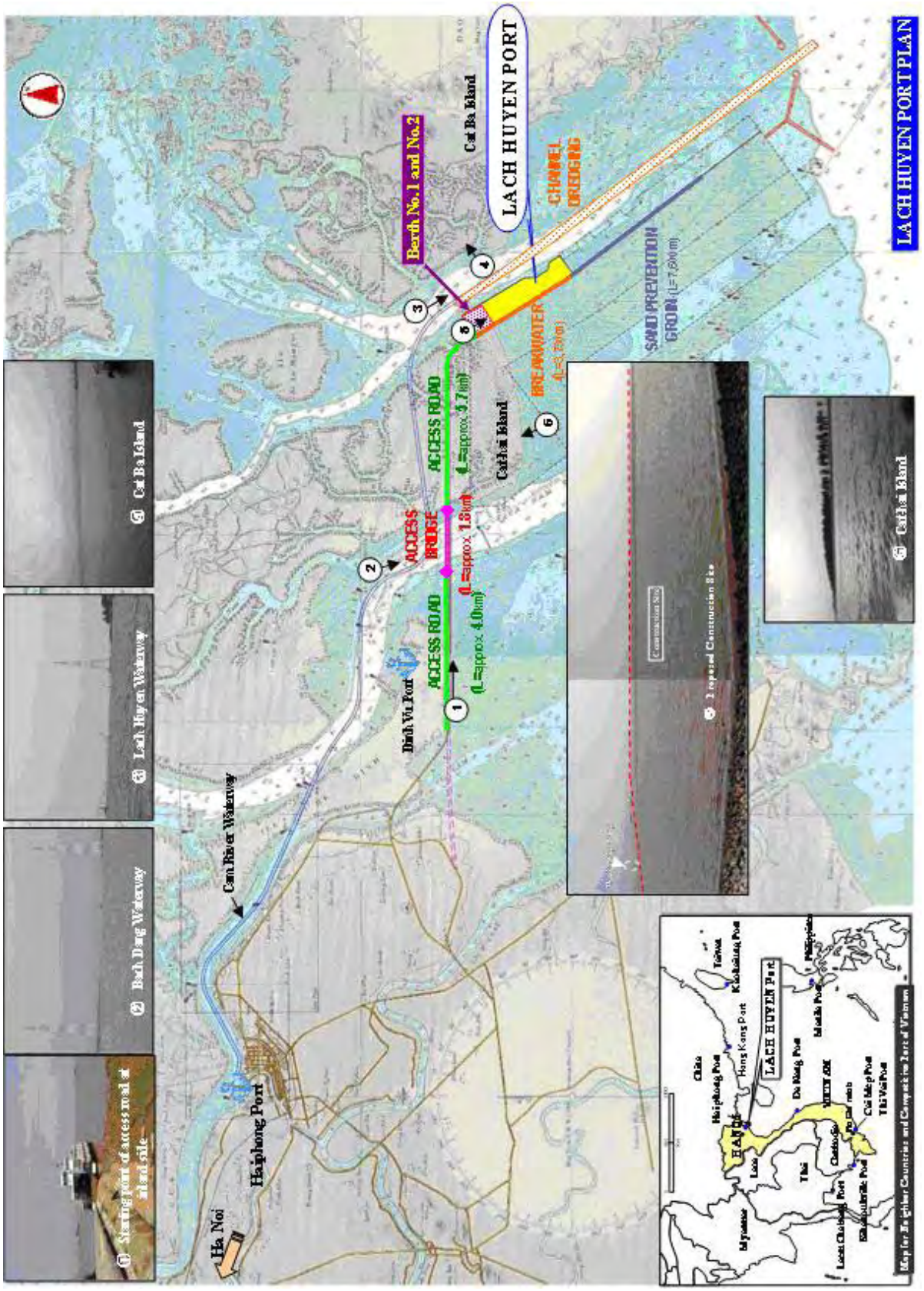


Figure 0.2 Survey Area

1.4. Project Scope (Extraction of The SAPROF Study)

The original project scope was determined by MOT with their Decision No. 3793/QD-BGTVT, dated 22 December 2008. However, SAPROF study recommended some modifications as follows:

Change of Scope

1) Land Reclamation and Soil Improvement

The responsibility of land reclamation and soil improvement of container terminal berth No. 1 & 2 should be shift from the private sector, VINALINES to the public sector, VINAMARINE.

Change of Scale

1) Design Vessel Size

Design vessel size for this Project was changed to 50,000DWT (full load) and 100,000DWT (partial load) container vessels instead of 30,000DWT (full load) and 50,000DWT (partial load) vessels.

Berth No.1 & 2

Based on the change of design vessels, the length of Berth No.1 & 2 shall be extended from 600m to 750m and terminal yard will also be widened accordingly.

1) Port protection Facilities

Outer Revetment

Based on the review results of demand forecast, required number and length of berths became 6 berths and 2,400m long (including space of barge berths) for container and 3 berths and 750m long for general cargo for Medium Term Development of target year 2020. As a result, total length of outer revetment (breakwater) has to be changed from 3,900m to 3,230m.

Sand Protection Dyke

Sand protection dyke should be constructed up to the seabed elevation of -5.0m CDL for 7,600m instead of seabed elevation of -3.0m CDL for 5,600m long.

2) Access Channel and Turning Basin

Access Channel

Based on the change of design vessel size, the width of access channel was modified as 160m with protection dyke and 210m without protection dyke instead of 130m, and the depth of access channel was deepened to -14m CDL instead of -10.3m CDL.

Turning Basin

The diameter of turning basin was determined for the length of design vessel of 100,000DWT as 660m (330m x 2) and the depth of turning basin should be the same with the depth of access channel of -14m CDL.

3) Port Service Road

Based on the change of terminal length from 600m to 750m and additional length of Public Related Facilities area of 250m, the length of port service road was modified from 630m to 1,000m and width

of road was modified at 44m instead of 41m of original plan.

Additional Scope

1) Barge Berth

To cope with the requirement of domestic container traffic demand, it is necessary to arrange a dedicated barge berth within the international container terminal for the most economical transportation of inland and coastal waterway. The length of barge berth should be 200m for accommodating 3 to 4 barges at same time.

2) Public Related Facilities

The public related facilities such as buildings for Maritime Administration, Customs, Immigration, Quarantine and amenity for port workers, and a mooring facility for service vessels are not included in the Scope of Project of Decision by MOT. However, SAPROF study team recommends these basic public related facilities to be included in the scope of project to realize smooth and quick cargo flow in the newly constructed port.

3) Navigation Aid

Channel Buoy (20 sets)

The new channel will have a width of 160m which is a very restricted width for 100,000DWT container vessels, therefore, it is recommended to replace existing floating buoys to spar buoys which will move only very limited range and can show exact location of boundary of channel.

Light Beacon (4 sets)

Sand protection dyke becomes under water during high tide and couldn't see from small boats like fishing boats. In order to eliminate collision between small boats and the sand protection dyke, light beacons should be installed on the dyke at 2km intervals for warning.

Pilot Assistance System

In the limited width of channel, it is very important to know the accurate position of own vessel at real time. For that purpose, a handy display showing vessel position by GPS is very useful for pilot and during the berthing maneuvering the pilot should works outside of bridge, when if a handy display is available, maneuvering become easy for pilot.

Recommended Project Scope

Table 0.1 Recommended Project Scope for Japan's ODA Loan

No.	Work Item	Description
1	**Container Terminal**	
1.1	Land Reclamation	750mL x 749mW, Top EL +5.5m, V=2,956,000m^3 including port service road area of 200mW.
1.2	Soil Improvement	ALICC: 50mW x 920mL including barge berth area PVD: 564,000m^2 including port service road area
1.3	Wharf Slope Dredging	Bottom EL -16.0m CDL, Slope 1:3, V=568,000m^3
1.4	Retaining Wall	Wharf side: Steel Sheet Pipe Pile Wall, Length 750m, Top EL +5.5m

No.	Work Item	Description
		South side: Rubble mound, Length 750m, Top EL +5.5m
1.5	Port Service Road	Asphalt pavement, Width 44m, Length 1,000m
2.	**Dredging**	
2.1	Access Channel & Turning Basin	Channel: Width 160m (with sand protection dyke) 210m (without sand protection dyke), Depth -14.0m CDL, Slope 1:10, Length 17.4 km, Turning Basin: Diameter 660m, Depth -14m CDL, Slope 1:10, V=31,000,000m^3 including sedimentation of 2,000,000 m^3 during capital dredging period of 3 years.
3.	**Protection Facilities**	
3.1	Outer Revetment	Top EL of Coping Concrete +6.5m, Covered by Wave Dissipation Concrete Blocks, Soil Improvement: 65,600m2Length 3,230m
3.2	Sand Protection Dyke	Top EL +2.0m, Covered by Wave Dissipation Concrete Blocks, Length 7,600m
4.	**Public Related Facility**	
4.1	Land Reclamation	Area 132,000m^2, V=344,000m^3 Including soil improvement: PVD 21,300m^2
4.2	Harbor Crafts Berth	374mL x 30mW x -4mD, Sheet Pile Wall structure Dredging: V=104,000m3
4.3	Buildings	4,600m^2 for Port Administration, Customs, Immigration, Quarantine, Coastal Guard, Security & Amenity Space
4.4	Utilities	Electricity supply, Water supply, Fire fighting, Sewage system within boundary.
5.	**Navigation Aids**	Channel buoy: Spar buoy 20 sets, Light Beacons on Sand protection dyke: 4sets, Pilot Assisting System: 7sets

1.5. Project Contents (Extraction of The SAPROF Study)

Demand Forecast and Port Development Scale

The estimated container cargo volume are 3.59 million TEU in 2015 and 5.08 million TEU in 2020 and the general cargo and bulk cargo volume are 11.2 million ton in 2015 and 12.9 million ton in 2020 for Northern Vietnam. These cargoes should be shared by Hai Phong port, Cai Lan port and Lach Huyen port. As a result, the container volume and general & bulk cargo volume for Lach Huyen Port are estimated as 2.23 million TEU and 2.38 million ton respectively in 2020.

In order to handle these cargoes in Lach Huyen port in 2020, the **five (5) container berths** (L=375m x 5, D= -14m CDL) and **three (3) multi-purpose berths** (L=250m x 3, D= -13m CDL) need to be constructed.

Container Berth No.1 & No.2 Development by 2015

In the frame work of Medium Term Development Plan of Lach Huyen Port for target year of 2020, the first two (2) container berths has been decided to be implemented by VINALINES as a Project Owner by the Prime Minister Decision dated April 11, 2007 and MOT Decision on December 22, 2008.

Therefore, this Initial Development Plan for the target year of 2015 is prepared for the first two (2) container berths development and other related port infrastructure development.

The scale and scope of container berths development was reviewed by SAPROF study and following modifications on original plan were proposed:

(1) The design container vessel sizes should be 50,000DWT (full load) and 100,000DWT (partial load) instead of 30,000DWT (full load) and 50,000DWT (partial load).

(2) According to the above modification for vessel sizes, total length of berths No.1 & 2 should be extended from 600m to 750m.

(3) The terminal yard area should be enlarged from 36ha to 45ha.

(4) Quay Gantry Cranes should be large-size one suitable for 100,000DWT container vessels.

(5) Barge berths for domestic waterway traffic should be constructed in the north-eastern part of terminal.

(6) The construction of terminal land reclamation and soil improvement should be carried out by the public sector instead of VINALINES.

1) Design Vessels

In TEDI's FS, the design vessels for the container terminals of Medium Term development were fully loaded 50,000DWT container vessels and partial loaded 80,000DWT container vessels. SAPROF study proposes following design vessels:

- Fully loaded 50,000DWT Container Vessel
  (LOA= 274m, Width= 32.3m, Draft= 12.7m)
- Partial loaded 100,000DWT Container Vessel
  (LOA= 330m, Width= 45.5m, Draft= 11.7m (80%)

2) Required Number and Dimensions of Berth

Dimensions of container berth for design vessels are 750m in length per 2 berths and 14m in depth below CDL. As explained in Chapter 5, the total container volume to be handled at Lach Huyen Port in 2020 is forecasted at 2.229,000 TEUs. To handle these containers, required number of container berth was calculated as five (5).

3) Container handling Equipment

Following cargo handling equipment will be required in each container berth.

Table 0.2 Required Main Cargo Handling Equipment

Cargo Handling Equipment		Unit 1 terminal 1 berth	Unit 1 terminal 2 berths	Basic Specification
1	Quay Gantry Crane	4	8	Capacit:60 tons, Outreach 56.6m, Rail gauge 30m, Lift Height 40.m, Twin 20' type,
2	RTG	12	24	Rail spun 23.47m, Stacking Height 15.24m (1 over 4), 16 wheeler
3	Top Lifter	3	5	Lifting Capacity 35 tons, with Telescopic Spreader
4	Yard Chassis	30	55	Convertible 40' & 20' with strong steel beam type
5	Yard Tractor-Head	25	50	More than 350 HP

Cargo Handling Equipment		Unit 1 terminal 1 berth	Unit 1 terminal 2 berths	Basic Specification
6	Multipurpose Forklift	2	4	Lifting Capacity 3tons
7	Hoist	1	2	Lifting capacity 5 tons with 24m outreach
8	Mobile Crane (for barge)	1	2	Lifting Capacity 40 tons with Outreach 4th row from Quay line available type

4) Summary of Land Requirement for Container Terminal

Table 0.3 Land Requirement/Berth for Container Port Facilities

Description	Area	Dimensions
1. Storage Area inc. Road, Drainage etc.	375,000m^2	375m × 500m
- Dry Container	160,000m^2	-
- Reefer Container	32,000m^2	-
2. Building Area inc. Road, Parking, etc.	75,000m^2	750m × 100m
Total	450,000m^2	750m × 600m

Source: Study Team

Multi-Purpose Terminal

1) Design Vessels

In TEDI FS, the general cargo vessels were divided into general cargo vessel and bulker but in SAPROF study both type of vessels are not divided and regarded as a general cargo vessel and terminal is designed as Multi-Purpose Berth since reviewed demand forecast showed that the bulk cargo volume is not big amount.

The design vessel of 50,000DWT general cargo vessel (LOA: 225m, B:31m, D: 12.0m) is adopted for the multi-purpose berth which is same as that of TEDI FS.

2) Required Number and Dimensions of Berth

Dimensions of multi-purpose berth for design vessels are 250m in length per berth and 13m in depth below CDL. As explained in Chapter 5, the total general and bulk cargo volume to be handled at Lach Huyen Port in 2020 is forecasted at 2,834,000 Tons. To handle these cargoes, required number of multi-purpose berth was calculated as three (3).

3) General Cargo Handling Equipment

Table 0.4 Required General Cargo handling Equipment

Equipment	Type	Nos. in demand	Remarks
Quay Crane	Jib type, Rail mounted	40 tons : 1 20 tons : 1	Outreach : 38m Outreach : 20m
Forklift	Finger Type	20 tons : 5 10 tons : 5	 With long mast type
Reach Stacker	Multipurpose, but mainly containers	4	For stuffed & empty Container handling.
Container Trailer	Yard type	10	
Hopper	For light weight cargo		For grain, fertilizer
Belt Conveyor	-“ -	(40m × 2) 2 sets	-“ -
Hopper	For heavy cargo		For ore loading

Equipment	Type	Nos. in demand	Remarks
Belt Conveyor	-"-	Total 150m, 2 sets	-"-
Dump truck		20	Haulage quay/open yard
Reclaimer		2	For ore loading
Shovel loader		4	For ore loading
Excavator		2	For ore loading

Source: Study Team

4) Summary of Land Requirement for Multi-purpose Terminal

Table 0.5 Land Requirement/Berth for Multipurpose Port Facilities

Description	Area	Dimensions
1. Storage Area inc. Road, Drainage etc.	85,000m^2	250m × 340m
- Transit Sheds	7,000m^2	-
- Open Yards	30,000m^2	-
2. Building Area inc. Road, Parking, etc.	15,000m^2	250m × 60m
Total	100,000m^2	250m × 400m

Source: Study Team

Access Channel

1) Number of Lane

In 2020, number and average length of ship calling for Haiphong Port and Lach Huyen Port will be 6,134 calls and 114m, and 1,268 and 239m respectively. One lane channel will be able to accommodate 11,700 ship-calls in a tear and enough for ship-calls at 2020.

2) Width of Channel

For this access channel, a sand protection dyke will be provided along the channel up to seabed elevation of -5.0m CDL and it will simultaneously function as a breakwater. Therefore, the portion of access channel protected by the sand protection dyke can be designed as so called in PIANC definition an "Inner Channel", however, the portion of access channel without sand protection dyke shall be designed as "Open Channel". Based on the PIANC formula, the width of channel is calculated as 160m for the portion of inner channel and 210m for the portion of open channel.

3) Depth of Channel

Lach Huyen port is designated as International Gateway Port of Vietnam by "Master Plan for Vietnam Seaport System Development till 2020 orientation to 2030". If container mother vessels shall wait tidal window before entering into Lach Huyen port, it can not be said that this port is international gateway port. In order to accept design vessels at any tidal conditions, the channel depth of 14.0m below CDL is required.

Road and railway behind Terminal

SAPROF study has estimated the road traffic volume as 24,320 trucks and 1,200 small cars for the container terminals and as 2,180 trucks and 600 small cars for multi-purpose terminals in 2020. These vehicles require 4 lanes for 2 ways of travelling lanes. In addition to the travelling lanes, 2 lanes of waiting lanes along terminal side are provided and 2.5m wide paved shoulders for motor-bike passage and emergency parking at accident are provided in both directions. Median is planned as 10m in consideration of U-turn of 45 feet container trailer. The total width of port road behind terminal is proposed to be **44m** for Medium Term Development.

The railway construction schedule is not determined yet and the land of 200m wide behind terminal area will be kept for future development.

Port Protection Facilities

1) Outer Revetment

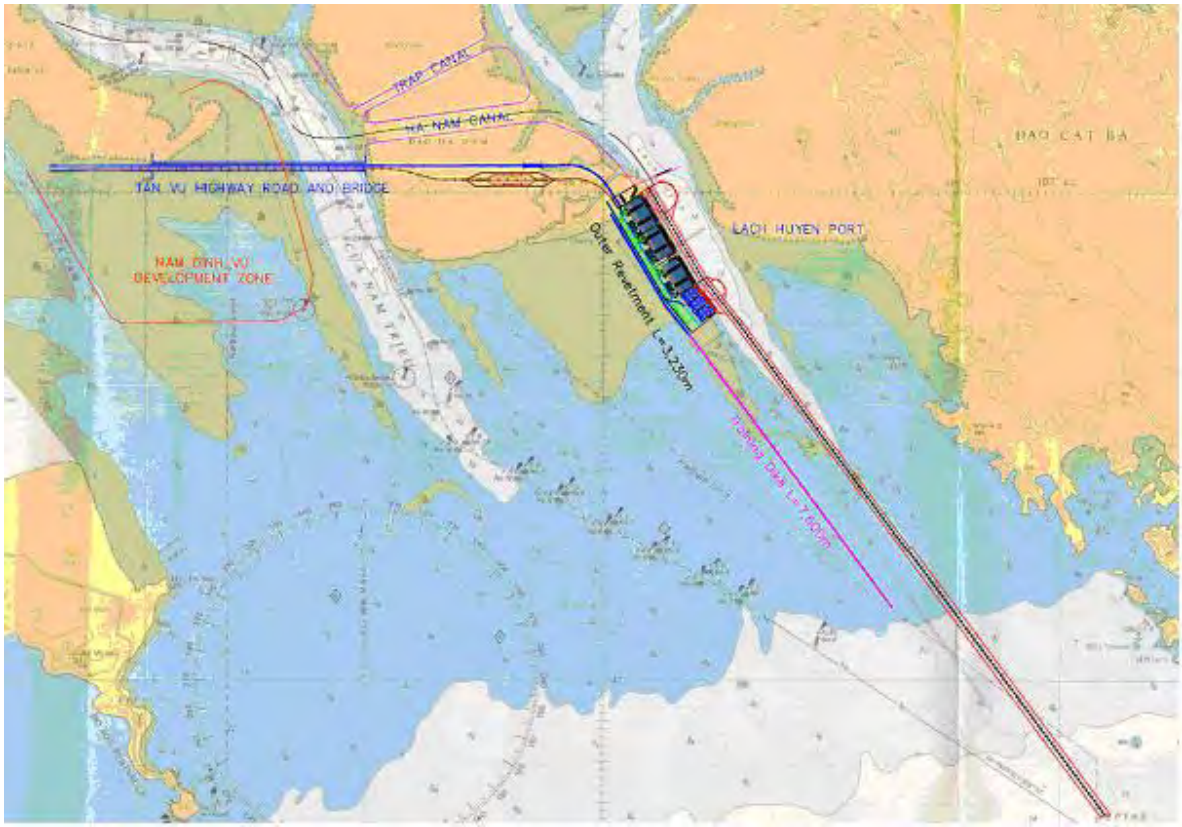
Almost once a year, Lach Huyen offshore area is subject to extreme wave attack which is generated by tropical typhoon. Therefore, it is essential that outer peripheral revetment of the reclamation area is protected as Seawall which is properly designed and constructed against to the extreme wave attack with provision of armored protection by wave-dissipating precast concrete units.

This seawall type of structure is required for 3,230m along the west side of reclamation area including future developing area by the year 2020. But, the south side area of the reclamation is provided with a sloped revetment armored by relatively smaller size of rocks for a length of around 750m once this water area shall be sheltered by offshore training dyke construction.

2) Sand Protection Dyke

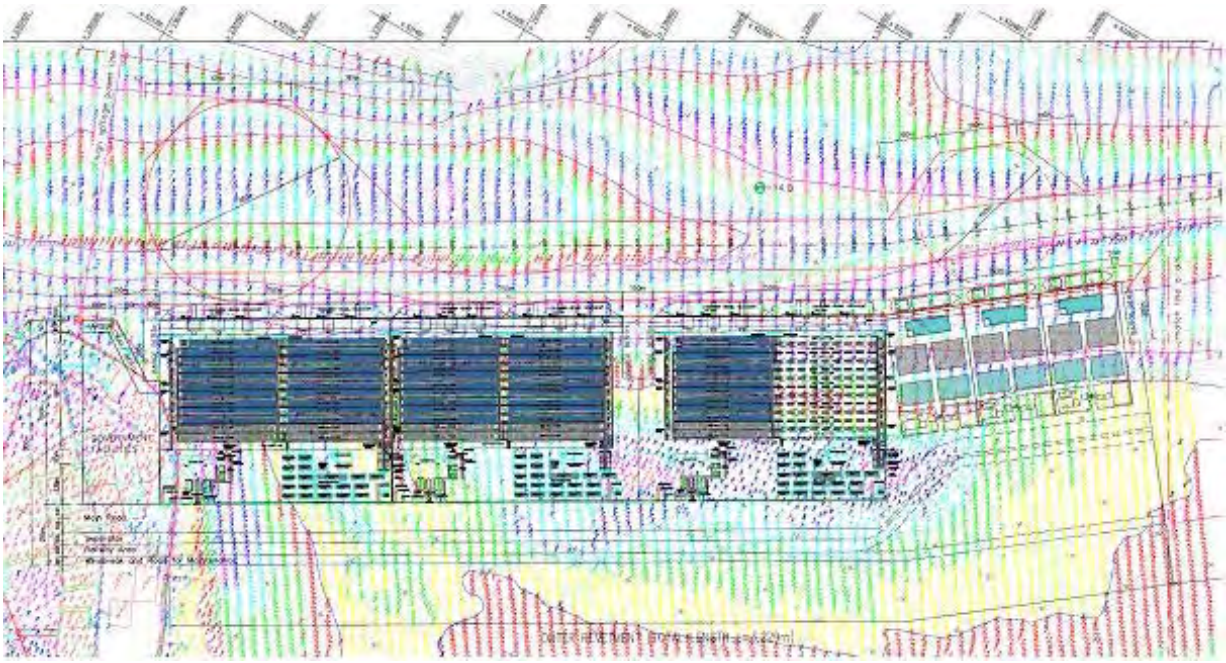
A dyke is provided along the access channel in order to trap sand transportation due to river estuary flow. It is recommended that the dyke is non-permeable type of structure with provision of enough stability against for extreme wave action. The top elevation is positioned to be +2.00m above CDL to trap sand transportation and properly function as breakwater to shelter access channel water area. The training dyke is provided along access channel for a length of around **11,760m**.

Proposed general port layout plan which shows alignment of access channel and port protection facilities is illustrated in Figure 0.3 and Container and Multipurpose terminal layout plan is presented in Figure 0.4.



Source: Study Team

Figure 0.3 Development Layout Plan



Source: Study Team

Figure 0.4 General Layout Plan of Terminal Facilities

Conceptual Design

Comparison Table of Major Port Facility Design

Facility	Item	TEDI F/S	JICA (SAPROF) Study
Access Channel Dredging	Side Slope	1:10	1:10
	Water Depth		-14.0m
	Width		160/210m
Reclamation	Elevation	CD+5.5m	CD+5.5 (to +6.0m)
	Consolidation Settlement	N.A.	S=143cm（U=100%）
	Soil Improvement	SVD 0.6m dia.@2.5m	PVD@1.2m
Outer Revetment (Seawall)	Structure	Sloped Rubble Mound with Wave Breaking Work	Outer A:Sloped Rubble Mound with Wave Breaking Work
	Armour Stone	6.7t/pc Wave Dissipating Concrete Block	4t/pc Wave Dissipating Concrete Block
	Crown Height	CD+5.5m with Wide Wave Breaking Work（13.7 m）or CD+9.0m with Standard Wave Breaking	CD+6.5m Retaining Wall
	Soil Improvement	SVD 0.6m dia.@1.6m	PVD@1.2m
Inner Revetment	Structure	L shaped Retaining Wall on Sloped Rubble Mound	Sloped Revetment
	Armour Stone	Not Required (Rubble Stone Only)	100-500kg Armour Stone
	Crown Height	CD+5.5m L shaped retaining wall	CD+5.5m（1:3 Gently sloped Revetment）
	Soil Improvement	SVD 0.6m dia.@2.5m	PVD@1.2m
Breakwater	Structure	Sloped Rubble Mound with Wave Breaking Work	Outer B：Sloped Rubble Mound with Wave Breaking Work
	Armour Stone	6.7t/pc Wave Dissipating Concrete Block	4t/pc Wave Dissipating Concrete Block
	Crown Height	CD+5.5m with Wide Wave Breaking Work（13.7 m）or CD+9.0m with Standard Wave Breaking	CD+6.5m（with Wave Breaking Works of 2-row of blocks at the top）
	Soil Improvement	SVD 0.6m dia.@1.6m	PVD@1.2m
Container Berth	Design Vessel	（50,000DWT）	100,000DWT
	Water Depth	CD-14m	CD-16m
	Structure	Coupled RakePiled Open Deck	Coupled Rake Piled Open Deck
	Foundation Pile	Vertical & Rake Pile PHC800mm dia@5x5.0m	Vertical & Rake Pile SPP1,000mm dia. @6x7.5m
	Earth Retaining Wall	L shaped Retaining Wall on Sloped Rubble Mound and supported by Foundation Piles	SSPPWall (500mm dia.) supported by Rake Pile (SPP 700mm dia.)
Multi-purpose Berth	Design Vessel	N.A.	50,000DWT
	Water Depth		CD-13.0m
	Structure		PHC Vertical Piled Open Deck
	Foundation Pile		Vertical Pile:PHC1,000mm dia. @5x6m
	Earth Retaining Wall		Self-standing SSPP Wall 800mm dia.
Training Dyke	Structure	Peamiable Wave Breaking Work	Rubble Mound Non-Permeable Dyke
	Armour Stone	8.9 to 25.1t/pc Wave Dissipating Concrete Block	4 to 8 t/pc Wave Dissipating Concrete Block
	Elevation	CD+2.0m	CD+2.0m
	Length	2015: 5.7km 2020: 10.7 km	2015: 6.4km 2020: 6.4km
	Soil Improvement	SVD 0.6m dia.@2.1m	No Improvement

Construction Method

1) Reclamation of the terminal yard

The terminal yard including access road width of 200m will be reclaimed to the elevation of +5.5mCD to +6.0mCD with river sand which will be transported to the site by barges, and pumped into the terminal yard by sand pump.

2) Soil Improvement work

The existing soft soil of the reclamation yard will be improved by PVD (Plastic board Vertical Drain) method.

The base machine will install casing with plastic drain material into the reclaimed ground @1.2m square. After the installation of the plastic board drain material, thin layer of the sand (Sand mat: thickness around 0.5m to 1.0m) will be laid in order to create drain layer. Then preloading will be commenced by embankment.

3) Construction of earth retaining wall and berth structure

Once soil improvement is completed, steel sheet pipe pile (SSPP) for the earth retaining wall will be driven by land piling machine. After the piling, the slope in front of the quay and berthing box will be dredged by grab dredger. Then the piles of the berth will be driven by piling barge, and the slope will be protected by placing the stones.

After the slope protection work, construction of the berth structure will start. The concrete structure shall be pre-fabricated on land as much as possible in order to shorten the construction schedule.

4) Multi-purpose wharf construction

The construction method of the multi-purpose terminal is more or less same as the container terminal. One of the differences is the pile design which is Pre-stressed Spun High Strength pile (PHC pile) instead of the steel pipe pile.

The existing access channel with design depth of -7.2m CD and the width of 100m will be dredged to the elevation of -14.0m CD with the width of 160m by 2015. After 2015, maintenance dredging of the channel may be necessary. The total dredging volume is estimated around 22,470,000 m^3. Cutter suction dredger (CSD) and Trailing Suction Hopper Dredger (TSHD) will be used for the dredging work. As well as the local dredgers, foreign dredgers with larger capacity such as CSD of 6,000ps class and TSHD with hopper capacity of 10,000 - 20,000m^3 shall be mobilized.

Project Implementation Plan

1) Project Implementation Schedule

Considering the standard process and steps necessary for the yen loan agreement, it is estimated that the construction work will commence from middle of the year 2012. As the construction work period required is estimated to be about 41months, the port operation can only be started earliest in July, 2015 as shown below.

Below schedule is the earliest case with the following conditions;

(1) Minimum 250,000m3/mth of the sand will be delivered to the site for reclamation.

(2) The CDM method (Cement Deep Mixing) will be applied for the soil improvement at berth area

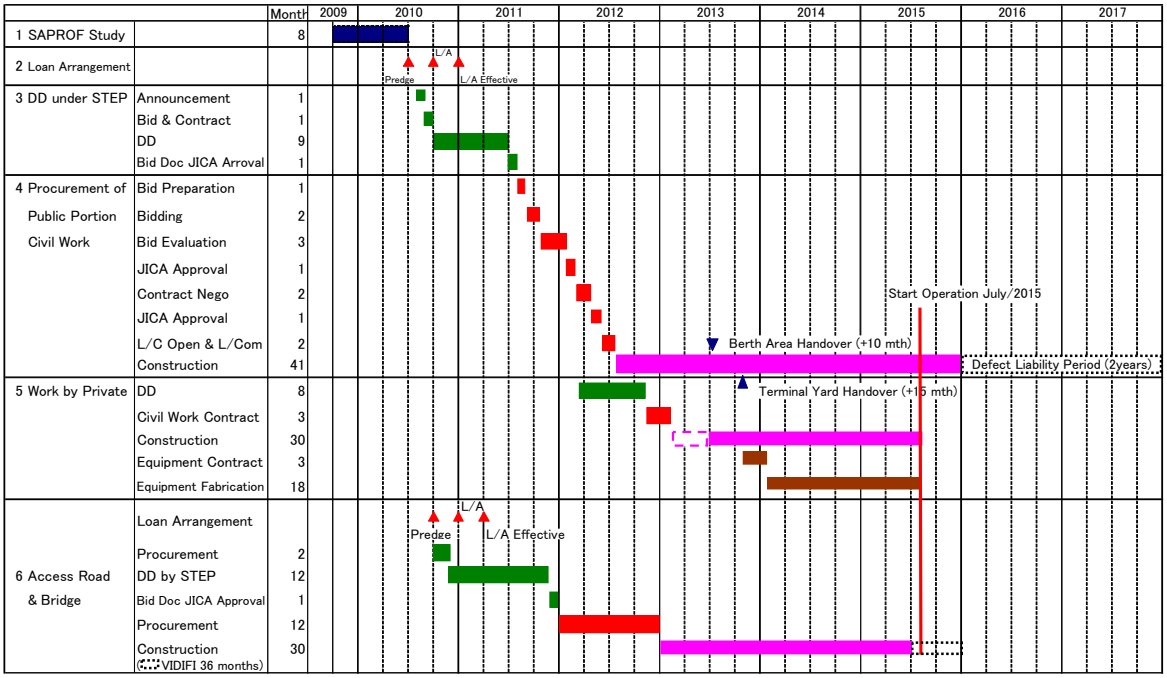
(3) The dumping location is secured during the whole construction period

In order to start the port operations as early as possible, following options were studied (Above implementation schedule is based on the Option-1).

- Option-1 (Original plan): Soil improvement by CDM and PVD method
- Option-2: Gradual opening of the terminal (i.e., start the operation of berth 1 first)

In case when oprion-2 is applied, the opening of the berth 1 will be April 2015, and berth 2 will be September 2015 respectively.

Table 0.6 Project Implementation Schedule



1.6. Organization Structure for Project Implementation (Extraction of The SAPROF Study)

General

The port portion of this Project was determined to be implemented by PPP (public Private Partnership) framework by GOV that is the first experience in Vietnam for port development applying Japan's ODA loan. Therefore, close coordination between the public portion and the private portion is essential and discussion on important issues including specification and allocation of responsibilities and risks of each side should be held among the stakeholders including MOT, VINAMARINE, VINALINES and other private parties in order to ensure such coordination.

Executing Agency

1) Public Sector

a) Borrower: Ministry of Finance (MOF)

(For the Port Portion)

b) Line Agency: Ministry of Transport (MOT)
c) Project Owner: VINAMARINE
d) Implementing Agency: Maritime Project Management Unit 2 (MPMU 2), VINAMARINE

(For the Road and Bridge Portion)

e) Line Agency: Ministry of Transport (MOT)
f) Project owner: Ministry of Transport (MOT)
g) Implementation Agency: Project Management Unit 2 (PMU 2), MOT

(For Land Clearance, Compensation and Resettlement)

h) Hai Phong People Committee

2) Private Sector

(For the Port Portion)

a) Project Owner: VINALINES

MPMU 2

MPMU 2 was established in accordance with the Decision 960/2002-QD-BGTVT dated April 4, 2002 of the Minister of MOT. The predecessor of MPMU 2 was Seaway Construction Unit I (SCU I) established in 1967 under Seaway Transportation Administration of MOT for the management and supervision of Hai Phong Expansion Project Then it became 213 Construction Unit under the Base Construction Administration of MOT in 1969 for managing the Ha Long Shipyard Construction Project.

Since then, MPMU 2 is ongoing to develop itself in the field of infrastructure construction and performed management and supervision of infrastructure construction in good results. All construction works and projects under management and supervision of MPMU 2 were highly appreciated by the State and the Employers as well and received diplomas of merit of the State and the Ministry concerned.

Among many infrastructure construction projects, MPMU 2 had managed and supervised the Cai Lan Port Development Project which was financed by Japan's ODA loan. MPMU 2 has now 41 professional personnel and of which 37 are university graduates.

Joint Coordination Committee (JCC)

In order to secure the smooth implementation and consistency between the two portion, the port portion and the road & bridge portion, MOT will establish a "Joint Coordination Committee (JCC)" which chairman will be the Vice Minister of MOT and assistant chairman will be deputy director of Department of Planning and Investment (DPI) of MOT and representatives of relevant stakeholders, such as VINAMARINE, MPMU 2, PMU 2, TEDI, VINALINES, MPI, MOF, Hai Phong PC, etc., will be the members of the JCC and they would hold the JCC periodically. JICA requested and MOT agreed that JICA representatives will take part in the JCC.

Organization Structure for Project Implementation

All works for implementation of the Project would be coordinated by the JCC. Figure 1.5 shows organization structure for Project implementation.

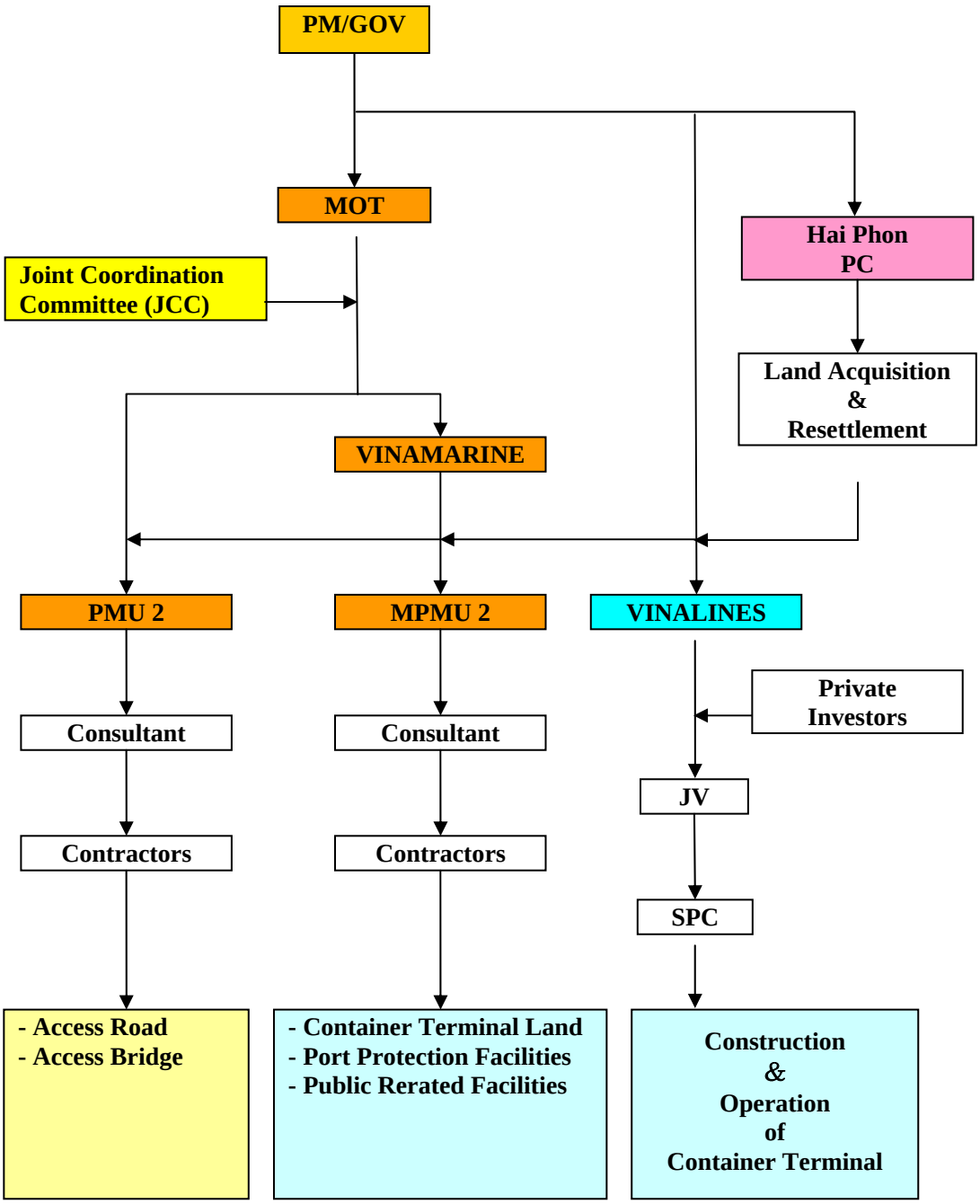


Figure 0.5 Organization Structure for Project Implementation

Organization Structure of SPC

1) Organization Structure

The Special Purpose Company (SPC) will be established as a 100% daughter of the JV company of VINALINES and operated as private company with profit-making obligations.

2) Human Resource need for SPC

Considering the roles of SPC, it suggests that new SPC before and after the commencement of the terminal operation will need approximately 200 and 500.

It should be made explicitly clear that the estimates for the number of necessary personnel for the SPC of the Berth No.1 & 2 remain tentative and that a final decision regarding employment falls entirely under the authority of the private investors.

Operation and Maintenance of Port Infrastructures

1) O & M responsible to Private Sector

The private sector, JV of VINALINES will invest for the construction of berthing structure, dredging in front of berth, road & yard pavement, buildings and utility supply system in the container terminal No.1 & 2. All of these facilities should be operated and maintained under the responsibility of SPC, private operation company under JV of VINALINES.

2) O & M responsible for Public Sector

After completion of reclamation and subsoil improvement of terminal land, 200m wide land behind the terminal and land for public related facilities, the ownership of these lands would be transferred to Hai Phong PC and the O & M of these lands should be responsible for Hai Phong PC.

The Port Owner of VINAMARINE should be responsible for operation and maintenance of other infrastructures such as Navigation Channel, Outer Revetment, Sand Protection Dyke and Public Related Facilities. The maintenance of these infrastructures will be performed by the MSC No.1 under the control of VINAMARINE.

1.7. Development Cost

The estimated total development cost for target year 2020 is shown in the below table.

Table 0.7 Estimated Development Cost for Target Year 2020

No.	Item	Unit	Quantity	in VND		in USD	in JPY
				Unit Price	Amount	Amount	Amount
I	Construction Expenses						
1	Container Terminal				*7,481,918,618,937*	*440,898,776*	*39,504,530,308*
a	Container Terminal	m	2,000.0	3,620,535,912	7,241,071,823,382	426,706,018	38,232,859,227
b	Barge Berth	m	150.0	1,605,645,304	240,846,795,555	14,192,758	1,271,671,081
2	Dredging				*5,918,886,127,689*	*348,791,504*	*31,251,718,754*
a	Access Channel	m3	32,300,860.0	160,927	5,198,064,989,137	306,314,544	27,445,783,143
b	Wharf Slope Dredging	m3	2,238,598.0	223,127	499,491,342,362	29,434,311	2,637,314,288
c	Berth Box	m3	337,886.0	223,127	75,391,442,191	4,442,710	398,066,815
d	Between Channel and Berth Box	m3	654,060.0	223,127	145,938,353,999	8,599,939	770,554,509
3	Reclamation				*2,454,564,015,423*	*144,643,951*	*12,960,098,001*
a	Terminal Area with Access Road	m3	12,088,923.0	203,042	2,454,564,015,423	144,643,951	12,960,098,001
4	Port Protection Facilities				*2,634,183,351,319*	*155,228,662*	*13,908,488,095*
a	Inner Revetment	m	750.0	40,162,324	30,121,742,708	1,775,031	159,042,801
b	Outer Revetment-A	m	720.0	193,692,006	139,458,244,549	8,218,075	736,339,531
c	Outer Revetment-B	m	2,510.0	193,692,006	486,166,935,860	28,649,123	2,566,961,421
d	Training Dike-1	m	3,110.0	135,785,924	422,294,223,886	24,885,195	2,229,713,502
e	Training Dike-2	m	3,290.0	332,374,699	1,093,512,759,260	64,439,145	5,773,747,369
f	Training Dike-3	m	1,200.0	385,524,538	462,629,445,055	27,262,092	2,442,683,470
5	Soil Improvement				*3,423,654,172,886*	*201,751,049*	*18,076,894,033*
a	Terminal Area	m2	1,730,975.0	1,356,451	2,347,983,425,697	138,363,309	12,397,352,488
b	Barge Berth Area	m2	5,000.0	3,373,909	16,869,543,472	994,098	89,071,190
c	Inner Revetment	m2	4,550.0	2,324,418	10,576,099,708	623,234	55,841,806
d	Outer Revetment A	m2	13,104.0	2,094,872	27,451,201,872	1,617,660	144,942,346
e	Outer Revetment B	m2	52,459.0	5,019,258	263,305,260,915	15,516,203	1,390,251,778
f	Access Road	m2	652,000.0	1,161,762	757,468,641,221	44,636,545	3,999,434,426
6	Access Road behind Port				*233,938,987,178*	*13,785,690*	*1,235,197,852*
a	Access Road	m	3,260.0	71,760,426	233,938,987,178	13,785,690	1,235,197,852
7	Public Related Facilities (CIQ)				*504,218,092,199*	*29,712,852*	*2,662,271,527*
a	Reclamation	m3	344,131.0	203,042	69,873,186,320	4,117,527	368,930,424
b	Dredging	m3	103,897.0	223,127	23,182,211,365	1,366,095	122,402,076
c	Quaywall	m	375.0	476,452,600	178,669,725,151	10,528,752	943,376,149
d	Pavement	m2	120,800.0	1,071,745	129,466,780,803	7,629,292	683,584,603
e	Building	L.S.	1.0	59,935,258,841	59,935,258,841	3,531,899	316,458,167
f	Utilities	L.S.	1.0	28,349,124,722	28,349,124,722	1,670,573	149,683,379
g	Soil Improvement	m2	23,600.0	624,653	14,741,804,996	868,714	77,836,730
8	Multi Per Purpose Terminal				*1,061,519,133,890*	*62,553,806*	*5,604,821,027*
a	Multi Purpose Terminal	m	750.0	1,415,358,845	1,061,519,133,890	62,553,806	5,604,821,027
9	Navigational Aids				*121,719,208,121*	*7,172,739*	*642,677,419*
a	New Channel Buoys	nos	20.0	5,438,764,550	108,775,290,991	6,409,973	574,333,536
b	Relpace Existing Buoy	nos	3.0	97,456,616	292,369,849	17,229	1,543,713
c	Light Beacon	nos	4.0	909,915,542	3,639,662,168	214,480	19,217,416
d	Pilot Assistance System	L.S.	1.0	9,011,885,114	9,011,885,114	531,058	47,582,753
	Total Construction Expense				23,834,601,707,642	1,404,539,029	125,846,697,016
I	Equipment Expenses				*6,909,301,597,091*	*407,155,273*	*36,481,112,433*
1	Equipment for Container Terminal	Berth	5.0	1,038,827,888,000	5,194,139,440,000	306,083,217	27,425,056,243
2	Equipment for Multi Purpose Terminal	Berth	3.0	571,720,719,030	1,715,162,157,091	101,072,056	9,056,056,189
	Total Equipment Expense				6,909,301,597,091	407,155,273	36,481,112,433
	Total Cost				30,743,903,304,732	1,811,694,302	162,327,809,449

CHAPTER 2

2. Natural, environmental, and socio-economic conditions

2.1. Natural conditions

2.1.1. Topographic features

Hai Phong international Gateway port will be located in Cat Hai district, Haiphong city. The construction area is on the right side of estuary Lach Huyen. Overall length of the port according to the master plan is over 10km along the river.

The right bank of the river, beginning from the south dyke of Cat Hai island, is a big sand bar with the length of about 6000m and the width of 1000m, its altitude from 0 to - +1,0m. The opposite bank is Cat Ba island.

This estuary is a part of the access channel from Hai Phong port to the sea with a quite large width, the most narrow section reaches about 1000m (1000m far from the high voltage electrical transmission line**)**. At present, the channel is dredged to the depth of -7,8m.

The water basin at 4000m far from Ben Got has , the deepest point of -12,5m and the width of 400 -500m.

2.1.2. Geological features

The Transport Engineering Design Incorporation (TEDI) has conducted geological survey at the project site in October 2006. The Summary of the survey results are Bellows

1) Geological features of the access channel

Because the bores are placed rather faraway from each other (1km- 2km) and the number of samples is limited and the results were quite distributed, therefore we don't include the experimental data into the summary table. However, both drill and experiment digital data showed only soft soil (mud- clay, clay/mixed clay, plastic deliquescence, mixed sand), which are favorable for dredging works in the later stage.

2) Geological features of the port area

To show the geological structure in the port area, on the basis of site survey and laboratory test, we formulated 02 geological sections following locations of bores.

Stratums at the survey site are divided into different levels from top to down as follows:

The 1st layer – Grey sand mixed with shell : the 1st stratum covers topographical surface and could only found in inside bores position (KB2 , 4 , 6 , 8 ,10, 11 and 12), the stratum's thickness varies from 0,8m (KB4) to 5,0m (KB12).

The 2nd layer – Plastic grey clay: located in various places, in all outside bores and can be seen in the topographical surface, the stratum's thickness varies quite a lot from 2,5m (KB11) to 13,5m(KB7), 8,6m on average.

The 3rd layer – Plastic mixed sand: seen in bores at the dyke area

The 4th layer – Soft clay: seen in bores at the dyke area

The 5th layer - Speckled clay (grey- greyish, yellow- greyish, red- brown) , hard- plastic to semi-hard: same as 2nd layer, the 5th layer also seen in all bores. The layer's thick is likely to increase especially the area near the sea side, the smallest is 1,8m (KB7), the biggest is 16,3m (KB10), the average is 7,0m.

The 6th layer - Green- grey-greyish, grey clay in plastic state: this 6th layer is also wide- distributed, however not found in Bore KB10, the layer's thickest at KB11 (19,8).

The 7th layer - Golden- grey sand, medium tight: only found at KB10 3,9m thick.

The 8th layer - Clay / Weathered- illuviation from hard to medium: due to different status of the weathered soil, a few of collected samples are hard clay while some collected samples are medium. However, this 8th layer is found to be greatly loadable. The layer's height varies from -17,8m (HKB1) to -31,8m (KB7).

The 9th layer - Clay/ Weathered- illuviation from medium to light: the beneath layer, all bores bottom reach this layer 's bottom which is considered highly loadable.

Some remarks on geological features in the port area and access channel

- Stratum structure in the port area and access channel is rather simple.
- Within the limit of the dredging depth, only soft and sporadic soil are found and therefore the dredging works need to be carried out by hopper suction dredger
- In the port area, beside the 5th layer, the 7th layer could only be seen in KB10. Other layers including 1st, 2nd, 6th are soft soil. In our opinion, the pile foundation and pile cap should be placed in the 8th layer.

3) Geological features in the sand-control dyke area.

Based on bores results and laboratory test, the stratum consists of the following layers, from top to down:

The 1st layer: grayish sand, medium level, the thickness varies from 0.5m (B8) to 6.0m (B2), formed up during the flow of water transportation

The 2nd layer: ash-grey clay-mud, the thickness varies from 6.5m (B6) to 14.6m (B4), highly loadable with thick layer.

The 3rd layer: plastic yellow-grey sand, the thickness varies from 1.3m (B5) to 2.4m (B3).

The 4th layer: plastic grayish clay, the thickness varies from 1.0m (B5) to 3.7m (B1). This layer covers wide area.

The 5th layer: plastic hard grayish clay, deep level reaches from 3.0m (B8) to 5.6m (B1), the top level varies from -11.8m (B3) to -16.9m (B7).

4) Geological features in the tunnel or flyover

Due to the distance of the bores (1,3km to 2,1km faraway from each other) and the variations of geological features, the geological cross-section at site is difficult. Based on the tested bores and laboratory test, the stratum consists of the following layers, from top to down:

The 1st layer: embankment soil consists of mainly plastic grey-brown mixed clay, found in the borehole CD2 1.5m in thickness.

The 2nd layer: liquid ashy clay, found in the area where the thickness varies from 6.8m (CD5) to 16.3 (CD2), this layer is thick but not loadable. Throughout value meets standard N30 = 1-3 hummers.

The 3rd layer: plastic-liquid grayish clay, found in borehole CD6 8,5m in thickness. Throughout value meets standard N30 = 3-6 hummers.

The 4th layer: liquid ashy mixed sand, found in the borehole CD1 5.1m in thickness. Throughout value meets standard N30 = 5-6 hummers.

The 5th layer: plastic yellow-grey clay, only found in the borehole CD3, CD4, the thickness varies from 2.2m (CD3) to 8.4m (CD4). Throughout value meets standard N30 = 5-10 hummers.

The 6th layer: plastic hard red-brown and grayish clay, the thickness varies from 4.2m (CD3) to 13.8 (CD6), the top level varies from -7.8m (CD3) to -21.4m (CD5). Throughout value meets standard N30 = 7-22 hummers.

The 7th layer: plastic brown clay, only found in the borehole CD2 2.3m in thickness. Throughout value meets standard N30 = 6 hummers.

The 8th layer: plastic ashy mixed sand, only found in the borehole CD3 2.5m in thickness. Throughout value meets standard N30 = 8 hummers.

The 9th layer: medium hard white-grey sand, the thickness varies from 3.5m (CD1) to 9.8m (CD6), highly loadable. Throughout value meets standard N30 = 15-50 hummers.

The 10th layer: hard red-brown clay, the thickness varies from 0.6m (CD4) to 1.5m (CD1), formed up during the stone weather process.

The 11th layer: chapped and weathered purple-brown, red-brown clay stone, the thickness varies from 1.4m (CD2) to 4.5m (CD5).

The 12th layer: little chapped and weathered purple-brown, red-brown clay stone, the top level of stone surface varies from -21.2m (CD3) to -41.84m (CD6), loadable.

2.1.3. Meteorological features in the project area

Cai Hai island locates in the tropical monsoon region and is directly affected by ocean climate. its climate condition is moderate, less severe than neighboring inland areas. The collected data on meteorology, hydrology and oceanography at Phu Lien, Hon Dau, Bai Chay, Cat Hai, and Cua Ong stations were taken into study.

1) Air temperatures

The average temperature per annual varies between 23°C to 24°C. There are two seasons per year and the temperature differs 11-12°C each season:

- Winter season: from November to March, average temperature below 20°C. January has the lowest temperature, normally between 16°C-17°C, and 10°C at the lowest.
- Summer season: from May to October, average temperature is 25°C. July has the highest temperature at 28°C-29°C on average, and 32°C-33°C at the highest.

Table 2.1 Average air temperature at stations in the project area

Unit: ^{O}C

Month / Station	1	2	3	4	5	6	7	8	9	10	11	12	Year
Phủ Liễn	16,4	16,8	19,1	23,7	26,4	28,0	28,3	27,7	26,8	24,5	23,4	18,2	23,0
Hòn Dấu	17,1	17,1	19,3	23,9	27,0	28,6	29,1	28,5	27,7	25,5	23,3	19,0	23,7
Bãi Cháy	16,1	16,7	19,4	23,1	26,8	28,3	28,6	27,8	27,0	24,7	23,3	17,8	23,1
Cát Hải	16,9	17,5	20,3	24,1	27,5	28,5	29,4	28,8	27,9	26,0	23,7	19,1	24,1
Cửa Ông	15,4	16,0	18,8	23,7	26,6	28,1	28,5	27,8	26,8	24,3	20,8	17,2	23,7

Table 2.2 The lowest temperature at stations in the project area

Unit: ^{0}C

Month / Station	1	2	3	4	5	6	7	8	9	10	11	12	Year
Phủ Liễn	5,9	4,5	6,1	10,4	20,0	18,4	20,3	20,4	15,6	13,7	9,0	4,9	4,5
Hòn Dấu	13,1	6,6	7,3	13,0	16,5	19,2	19,9	23,5	16,7	14,9	13,6	6,9	6,6
Cát Hải	8,9	8,4	10,5	13,3	18,4	20,3	23,2	23,3	23,3	17,0	13,9	8,4	8,4
Bãi Cháy	14,6	5,3	7,1	13,4	15,9	18,4	23,4	23,1	16,6	14,0	9,0	3,7	3,7
Cửa Ông	17,7	4,7	6,0	13,1	16,8	17,8	20,9	20,5	16,6	13,3	8,2	5,0	4,7

Source: The North-East Hydro-Meteorological Center, 1975-2000

Table 2.3 The highest temperature at stations in the project area

Unit: ^{0}C

Month / Station	1	2	3	4	5	6	7	8	9	10	11	12	Year
Phủ Liễn	30,4	33,3	35,0	37,4	38,7	37,8	38,5	36,9	35,7	33,7	33,1	29,3	38,7
Hòn Dấu	27,9	28,3	30,0	33,5	37,3	37,8	38,0	38,6	35,0	34,0	33,5	29,8	38,6
Bãi Cháy	28,8	29,5	33,0	34,6	36,1	37,0	37,9	36,5	36,3	33,5	33,8	29,7	37,9
Cát Hải	27,8	27,6	28,8	33,6	36,2	36,1	35,9	35,7	35,3	38,0	33,6	28,2	38,0
Cửa Ông	28,7	29,8	33,5	33,6	35,6	37,4	38,8	36,8	35,8	34,1	33,3	29,6	38,8

Source: The North-East Hydro-Meteorological Center, 1975-2000

Cat Hai area is affected by sea so that its critical temperature is lower than at inland stations such as Lang Son, Bac Giang, Bac Ninh. Hoarfrost and frost are not observed at neighbouring to the project stations such as Cua Ong, Bai Chay, Hon Dau. At thsese stations the temperature under $4^{0}C$ was never observed

2) Rain regime

Rain regime is divided into 2 main seasons:

- Rainy season from May to October
- Little rainy season from November to April

Rainfall:

The average rainfall in the area ranges from 1,700mm to 1,800mm in which 85-90% are in the rainy season.

Table 2.4 Rainfall by seasons recorded at stations in the area

No	Station	Total rainfall per year (mm)	Rainy season		Dry season	
			Rainfall (mm)	Percentage %	Rainfall (mm)	Percentage %
1	Phủ Liễn	1755,2	1489,9	84,9	265,3	15,1
2	Hòn Dấu	1549,1	1340,0	86,5	209,1	13,5
3	Cát Hải	1831	1626,0	88,8	205,0	11,2
4	Cát Bà (Cảng)	1353	1200,0	88,7	153,8	11,3
5	Cát Bà (VQG)	1495,9	1326,0	88,6	169,9	11,4
6	Bãi Cháy	1960,9	1733,7	88,4	227,2	11,6
7	Cửa Ông	2218,5	1937,2	87,3	283,3	12,7

Source The North-East Hydro-Meteorological Center, 1975-2005

Numbers of rainy days: commonly, rainy day is defined as a day with a rainfall ≥ 0.1mm. The number of rainy days is a special feature in analyzing rainfall regime. Cat Hai area has about 113 rainy days per year accounting for 31% of days in a year.

Table 2.5 Average number of rainy days per year

Unit: day

No	Station	Number of rainy days per year	Season	
			Rainy season	Dry season
1	Phủ Liễn	153,4	85,3	66,1
2	Hòn Dấu	114,6	68,7	45,9
3	Cát Hải	113,1	74,9	38,2
4	Cát Bà	91,6	58,3	33,3
5	Bãi Cháy	125,8	79,8	46,0
6	Cô Tô	119,9	73,2	46,7

Source: The North-East Hydro-Meteorological Center, 1975-2005

Drizzly rain:

Drizzly rain only occurred in the northern provinces. In drizzly days, the humidity is very high, approximately 100%. Table 2-6 shows the number of drizzly days per year at the stations of the island and adjacent area.

Table 2.6 Average number of drizzly days per month, per year

Unit: day

No	Month / Station	1	2	3	4	5	6	7	8	9	10	11	12	Year
1	Phủ Liễn	5,9	8,1	10,6	5,1	0,6	0	0	0	0,1	0,5	3,1	3,2	34,2
2	Hòn Dấu	3,3	4,1	5,2	3,1	0,1	0	0	0	0	0,1	0,2	0,3	13,4
3	Bãi Cháy	3,0	6,7	10,2	3,6	0,1	0	0	0	0	0	0,2	0,6	24,4
4	Cát Hải	0	3,4	4,4	2,0	0	0	0	0	0	0	0	0	10,8
5	Cửa Ông	3,5	5,9	5,8	3,0	0,5	0,2	0	0	0	0	0,1	0,4	18,4
6	Cô Tô	2,0	3,6	4,2	3,6	0,1	0	0	0	0	0,1	0,3	1,0	13,9

Source: The North-East Hydro-Meteorological Center, 1975-2005

The number of drizzly days in the island is less than in the land and concentrate mainly in February, March, April. The amount of drizzly rain is not much but it contributes significantly to the floral eco-system after dry season. However, drizzly rain causes certain negative impact to shorten the visibility, causing difficulties for road and waterway transport.

3) Air Humidity - Evaporation bility

In the Ha Long – Cat Ba area, the difference of the annual average air humidity between areas is not much, (about 2-4%) but month average is rather high.

The most humid time in a year is from February to April after activity of North east monsoon. Except October, November, December when monthly average humidity is under 80%, from February to August, the air humidity ranges at about 85- 90% or even higher. This is the highest humid area of the country.

Table 2.7 Annual average air humidity

Unit: %

No	Month / Station	1	2	3	4	5	6	7	8	9	10	11	12	Year
1	Phủ Liễn	83,2	87,6	90,8	90,1	86,9	85,9	86,1	87,8	85,3	80,5	78,3	78,8	85,1
2	Hòn Dấu	83,2	86,5	89,9	89,9	86,1	85,8	84,7	85,8	83,3	79,1	77,0	77,0	83,9
3	Cát Hải	76,7	84,9	86,7	89,0	84,0	85,6	84,0	84,7	84,0	80,2	77,2	78,7	83,1
5	Bãi Cháy	80,2	84,4	87,6	86,6	83,9	83,6	83,4	85,6	83,4	78,3	76,0	76,4	83,3
6	Cửa Ông	83,3	85,7	88,1	86,9	83,2	84,0	83,6	85,3	83,2	78,2	76,9	77,2	83,7
7	Cô Tô	83,5	87,6	90,0	89,7	87,9	86,8	85,4	85,7	83,8	77,8	76,5	77,7	84,1

Source: The North-East Hydro-Meteorological Center, 1975-2005

The average evaporation per annual is about 700mm. During the dry season, the evaporation condition is unbalanced, the evaporated water is bigger than rainfall resulting in dryness, water shortage, causing negative impact to plant.

4) Sun radiation, cloud, and sunshine

Sun radiation in the Cat Hai area is rather high and unified, but the annual distribution is unbalanced.

Table 2.8 Features of sun radiation at Phu Lien – Hai Phong

Unit: w/m^2

Features	1	2	3	4	5	6	7	8	9	10	11	12	Year
Total radiation	6,1	4,5	5,1	7,1	11,9	11,5	12,9	11,1	11,0	10,1	8,6	7,4	107,5
Diffusion	4,25	3,7	4,43	5,75	7,3	7,03	6,87	6,48	5,81	5,37	4,79	4,59	66,4
Radiation absorption	3,8	3,4	3,8	4,0	6,9	6,9	7,9	6,7	6,5	5,8	4,3	3,3	60,2

Source: The North-East Hydro-Meteorological Center, 1975-2005

According to the recorded statistic, the total volume of sun radiation in a year is at 107-108 $kcal/cm^2$. Sun radiation at the end of winter and beginning of spring is about only 40-50% of summer months. The cloud thickness and continuing drizzy rain have direct impact to the sun radiation condition. The cloud coverage above the Cat Hai island is quite large, especially in winter days which totally hinder the sun radiation.

Table 2-9 shows the annual average cloud coverage of station near the project area

Table 2.9 Average cloud coverage per month, per year (1/10 of sky)

Month / Station	1	2	3	4	5	6	7	8	9	10	11	12	Year
Bãi Cháy	7,9	8,9	9,1	8,7	7,8	8,4	8,2	8,2	6,9	6,1	6,1	6,5	7,7
Cô Tô	7,8	8,7	8,6	7,9	7,0	7,6	7,3	7,4	6,2	5,6	5,9	6,3	7,2
Phủ Liễn	8,0	9,1	9,3	8,9	7,8	8,4	8,2	8,2	7,0	6,2	6,2	6,6	7,8
Hòn Dấu	7,5	8,7	9,0	8,4	7,0	7,5	7,3	7,4	6,2	5,5	5,6	6,0	7,2
Cát Hải	6,5	8,5	8,8	7,8	5,8	7,6	6,7	7,0	5,9	5,5	5,5	6,4	6,9
Cát Bà	7,1	7,1	9,2	7,6	8,3	6,6	7,3	7,7	5,1	5,6	6,1	4,9	6,9

Source: The North-East Hydro-Meteorological Center, 1975-2005

Sunshine is also another climate feature that describes characteristics of sun radiation. It is observed at broader network of stations. Table 2.10 shows the record of sunny hours at 2 meteorological stations nearest to Cat Hai island and at the Cat Hai climate station (1961-1966)

Table 2.10 Total average number of sunny hours per month per year

Unit: hour

No	Month / Station	1	2	3	4	5	6	7	8	9	10	11	12	Year
	Bãi Cháy	88	52	47	88	107	173	179	173	188	189	161	142	1683
	Cát Hải	117	50	58	105	209	162	221	185	181	188	156	128	1764
	Phủ Liễn	83	46	41	85	183	179	189	170	182	191	155	133	1636

Source: The North-East Hydro-Meteorological Center, 1975-2005

Cat Hai area has total number of about 1,650 – 1,750 sunny hours per year, it is higher than at 2 meteorological stations in Bai Chay and Phu Lien. In the summer, total number of sunny hours are about 160-220 hours per month. In the beginning months of spring, the number is only 50-60 hours per month.

5) Wind

Wind direction

In Vietnam, there are 2 predominant wind direction, namely Northeast in the winter and Southwest in the summer. However, due to the region's location and topographical feature, the predominant wind direction may change. In the northern delta area, the southwest wind direction has been changed to southeast wind. In order to compare the frequency of the wind, we summarized into the following table with the statistic recorded over the past 40 years at Bai Chay station.

Table 2.11 Frequency and average wind speed in 8 directions at Bai Chay station

Direction	Feature	1	2	3	4	5	6	7	8	9	10	11	12
Calm	P%	8,1	15,7	19,4	15,8	7,3	7,5	6,4	9,3	7,0	4,0	5,5	5,4
N	P%	32,3	25,4	17,2	10,8	13,4	15,1	12,0	18,0	27,5	35,5	35,7	36,0
	V m/s	3,6	3,6	3,2	3,3	3,3	3,0	2,9	2,9	3,6	4,0	3,9	3,8
NE	P%	20,5	18,8	15,1	11,7	8,5	8,4	6,2	10,5	16,6	20,9	22,5	19,2
	V m/s	2,9	2,9	2,6	3,0	2,7	2,9	3,3	3,4	4,0	3,6	3,2	2,9
E	P%	10,0	11,2	11,2	11,8	9,1	6,3	5,9	6,0	6,0	7,8	7,9	8,8
	V m/s	2,1	2,3	2,3	2,4	2,6	2,5	2,6	2,7	3,1	2,6	2,6	2,5
SE	P%	12,9	15,4	19,6	28,6	35,4	31,8	29,8	16,7	15,1	12,4	11,6	12,1

Direction	Feature	1	2	3	4	5	6	7	8	9	10	11	12
	V m/s	2,7	2,4	2,4	2,7	5,3	5,2	3,4	2,9	3,0	3,1	3,3	2,9
S	P%	7,5	7,7	10,3	13,1	17,0	15,7	19,7	12,1	8,8	6,8	6,1	8,0
	V m/s	2,7	2,6	2,4	2,7	3,4	3,5	3,7	3,3	3,0	2,9	3,0	3,0
SW	P%	1,5	2,1	1,8	2,5	2,8	6,3	9,6	8,8	3,7	1,5	1,6	1,5
	V m/s	2,6	2,1	2,1	2,3	3,3	3,9	4,0	5,6	3,5	2,9	3,1	3,0
W	P%	0,3	0,4	0,3	0,3	0,7	5,0	1,6	2,6	0,8	0,3	0,3	0,3
	V m/s	1,4	1,5	1,7	2,1	3,3	2,6	2,5	2,6	2,6	2,6	2,7	2,0
NW	P%	6,9	5,8	6,1	5,4	5,8	8,6	9,8	16,0	15,5	10,8	10,8	8,7
	V m/s	2,9	2,6	2,3	2,5	2,5	2,7	2,9	2,8	2,9	3,3	3,0	2,9

Source The North-East Hydro-Meteorological Center, 1975-2005

As it can be seen in the table above, for Bai Chay station, the most prevailing wind direction in dry season is the north, and south & southeast in the summer.

Due to the location of Cat Hai island which is blocked by Cat Ba island, so winter monsoon has been completely changed. The north wind has changed to northeast or east while summer wind has changed to southeast or south.

Besides the above feature, sea wind also plays an important role to regulate the weather condition in the island. This explains why this area is normally warmer in the winter and cooler in the summer.

Wind speed

The average wind speed of stations in the area differs due to the topographical differences and height of stations.

Table 2.12 Average wind speed per month per, year of stations in the area

Unit: m/s

Month / Station	1	2	3	4	5	6	7	8	9	10	11	12	Year
Phủ Liễn	3,2	3,3	3,4	3,8	4,1	4,1	4,1	3,4	3,4	3,6	3,5	3,4	3,6
Hòn Dấu	4,7	4,5	4,3	4,5	5,3	5,6	5,9	4,4	4,2	4,7	4,5	4,4	4,8
Bãi Cháy	3,7	3,3	2,0	3,2	3,8	3,8	3,9	3,7	3,0	3,3	3,1	3,0	3,7
Cô Tô	4,6	4,5	3,9	3,3	3,5	4,2	4,7	3,8	4,1	5,0	5,0	4,7	4,3
Cát Hải	3,9	3,9	3,9	3,1	3,2	3,1	3,0	3,7	3,3	3,3	3,2	3,0	3,4

Source: The North-East Hydro-Meteorological Center, 1975-2005

The maximum wind speed causes certain negative impacts to some works and other socio-economic activities. The maximum wind speed in the winter is normally caused by northeast wind in the end of the season. In the summer, the maximum wind speed is normally caused by thunder storm and tropical cyclone. In the spring and autumn, the maximum wind speed is brought by thunder storm.

Table 2.13 Maximum wind speed recorded at station in the area

Unit: m/s

Month / Station	1	2	3	4	5	6	7	8	9	10	11	12	Year
Phủ Liễn	19	24	27	31	28	33	51	44	50	25	24	20	51
Hòn Dấu	24	20	34	28	40	40	40	45	45	34	24	28	45
Bãi Cháy	19	20	22	28	40	34	45	40	40	28	19	20	45
Cô Tô	24	26	26	26	30	40	40	47	40	40	28	30	47
Cát Hải	10	12	20	20	>20	>20	>20	>20	>20	20	14	12	>20

Source: The North-East Hydro-Meteorological Center, 1975-2005

6) Some special weather conditions

a) Fog

Fog is created from 2 processes namely sun radiation and advection, which represents a good and stable climate. However, fog limits the visibility and causes difficulties for traffic activities.

Number of foggy days recorded in stations in the area varies from 13 to 30 days per year depending on the topographical condition, the height of the station. At Cat Hai station, only 2 times were recorded over the past 5 years, which was relatively fewer than neighbor stations.

b) Rainstorm

Rainstorm is an electrical discharged between 2 clouds or between cloud and the ground, bring in eradiation and thunderbolt. In the Cat Hai area, annually rainstorm appeared 40-45 days on average, same as other neighbor stations.

Table 2.14 Average number of rainstorm days per month per year

Unit: day

Month / Station	1	2	3	4	5	6	7	8	9	10	11	12	Year
Phủ Liễn	0,1	0,5	3,5	3,8	5,9	7,3	7,1	8,7	5,6	2,0	0,2	0,1	44,8
Hòn Dấu	0,2	0,3	3,4	3,8	5,1	6,3	5,7	9,4	6,2	3,3	0,3	0,1	44,1
Cát Hải	0,0	0,29	3,29	3,43	4,57	9,29	7,43	8,14	5,43	2,0	0,43	0,0	44,3
Bãi Cháy	0,2	0,4	3,5	3,8	5,8	8,5	7,6	13,2	6,3	3,9	0,1	0,1	53,4
Cửa Ông	0,1	0,5	3,3	3,6	4,9	8,1	8,3	10,0	5,6	2,0	0,2	0,0	46,6

Source: The North-East Hydro-Meteorological Center, 1975-2005

Rainstorm relates to the development of a large volume of cloud, rain, and whirlwind. This should be carefully taken into study during the design stage.

c) Tropical cyclone

Tropical cyclone including storm and tropical low pressure is a great atmosphere turbulence which causes 3 most typical natural calamity namely strong whirlwind, heavy rain and water level increasing.

According to the statistic data for second half of twenty century, there were 13 tropical cyclones on average per year in the East Sea, of which 7 affected our country. The most affected area is the northern coastal area with the frequency of about 0.62 typhoons 100km/per year. Cat Hai receives 6-11 tropical cyclone every decade, 0.92 typhoons per year on average, 61% is normal storm and 56% is strong storm.

The maximum wind speed in the storms recorded in the adjacent area is about 40-50m/s.

Table 2.15 The maximum wind speed recorded in storms in Quang Ninh - Hai Phong area

Storm			Strongest wind			
Name	**Date**	**Location**	**Direction**	**Speed (m/s)**	**Equipment**	**Station**
VERA	8/7/1956	Hải Phòng-Thái Bình	Northeast	42	Vild	Gia Lâm
CARMEN	17/8/1963	Quảng Ninh	Northeast	45	Juncalor	Móng Cái
WENDY	9/9/1968	Hải Phòng	Southeast	> 50	Munro	Phủ Liễn
SARAH	21/7/1977	Hải Phòng	Southeast	52	Munro	Phủ Liễn
JOE	23/7/1980	Bãi Cháy	Southeast	> 40	Vild	Hải Dương
VERA	18/7/1983	Hải Phòng	Southeast	40	Vild	Hòn Gai

Source: The North-East Hydro-Meteorological Center, 1975-2005

Water-level raising as a result of the storm is one of the point need to be considered especially for the residential area and construction works in Cat Hai. There has been no data on water-level raising recorded at stations in the area but observation from survey shows that the water level may increase 1-2m. During Typhoon Joe to Hai Phong in August, 1980 water level raising of 1,76m is recorded. During Washi's storm to Thai Binh – Nam Dinh in 2005 recorded 4.27m of water level raising at Hon Dau Station. The situation may get worse if the storm comes at the same time with high -tide.

In general, impacts caused by hydrological and meteorological factors are very important to tidal regime and water level in the area. Such impact is likely to hinder the maritime activities as well as constructions, houses, farming in the coastal zones.

Damages caused by storms and water-level raising in the Hai Phong area since 1940 have been very huge:

- Kate's storm (26/9/2995) to Hai Phong which came at the same time with high-tide broke 158 pieces of dykes, 669 people were killed and lost, drown hundreds of ships/boats, cleared hundred houses and destroyed 12,960ha of rice paddy field.
- Wendy's storm (9/9/1968) wind speed at 200km/hr with heavy rain. Hai Phong was heavily damaged.
- Sarak's storm (21/7/1997) wind speed at 200km/hr with heavy rain
- Lora's storm (22/7/1986) occurred mainly in Quangxi, China, however, Hai Phong's sea dykes No. I, II were heavily collapsed.
- Chuck's storm (29/6/1992) to Quang Ninh and Hai Phong collapsed 61.500m3 sea dykes, cleared thousands of houses.
- 1996's Storm No.4: collapsed 2000m3 sea dykes, destroyed 500ha paddy field and 800 shrimp cultivating ponds.

2.1.4. Hydrological and oceanographycal features

1) Tidal regime conditions

The tidal regime in Cat Hai island is a daily homogenous condition.

The tidal volume: 2 periods in a month with amplitude of 2.6-3.6m. The tidal condition in Cat Hai is almost same as in Hon Dau island. The average monthly tidal is normally over 3.5m and water level change can reach 0.5m/h. The water level observed at Hon Dau is as follows:

- Average water level: 1.9m
- Highest water level: 4.21m (22/10/1985)
- Lowest water level: -0.07m (21/12/1964)
- Highest tidal amplitude: 3.94m (23/12/1968)

2) Flow regime

The flow at river estuary of Hai Phong coastal area is being affected by river flow of Cam River, Bach Dang River, Chanh River and tidal level, and the flow's speed therefore is very strong and complicated.

There's a strong interaction among factors including water level, river-bed's topography, wave, wind, and tide.

According to the survey, the impact of the wind condition and wave in the summer to the Cat Hai area is very minor. The river flow depends on topographical condition and variation of water level. Results of the survey at the estuary and coastal area show that in the winter when the wind and wave are stable, the flow is mainly created by tidal flow and water level's differences.

When the tide goes down in the Nam Trieu and Lach Huyen estuary, the flow may reach the speed of 1m/s. The survey in January 1987 showed that the flow's average speed was at 40-60cm/s and even more than 1m/s at the highest. In reality, such highest flow speed eroded the river's bed. It is also noted that the river flow, even when the tide went down, runs toward the Lach Huyen direction. This explains why the depth of the canal is getting deeper near the Lach Huyen area.

When the tide goes up, the water level before the island is higher than the level at Lach Huyen estuary, formed up a flow and run further. This flow system is also seen in Nam Trieu estuary although the speed and timing is a bit different.

Observations from the above situation at Nam Trieu and Lach Huyen estuaries show that this is a daily scheme flow (25 hours cycle) and accumulated flow (from the tidal flow and wave flow driven). This feature is suitable with natural conditions of this area, the flow is normally formed up by the tidal level increasing and decreasing.

Besides the above-mentioned flow, there is also another flow formed up by the wind. As it was mentioned earlier, the winter wind only causes impact to the east side of Cat Hai (Lach Huyen) where the river opens to Ha Long Bay on the northeast side. The speed of this flow is not high, only at 20cm/s compared to wind speed on the water surface 10cm/s. In Cat Hai area, the flow reaches the highest speed at the estuary when the tide goes up and down. In other areas such as Van Chan, Gia Loc, the flow at the coastal area is much smaller compared to the summer. In the high flood-tidal day, the daily tide may reach 0.9-1.0m/s while the semi-daily tide could only reach 0.1-0.2m/s. The accumulated flow may reach 0.2-0.35m/s in a strong wind and heavy rain.

Besides the wave flow, the surface flow together with the decreasing tidal may set up a general flow with speed of 1.2-1.3m/s that easy to clear all materials from the estuary to the sea.

In the area from the Van Chan dyke to the Border Guard Station No.30, the wave flow – formed up by the coming-wave could only reach the high speed when there is a southeast wind. The most popular flow in the coastal area is the tidal flow. When the tidal flow comes to the dyke's side, it separates into 2 and runs to Van Chan and Hoa Quang and the speed may reach at 0.8m-0.9m/s.

In the normal climate condition, in the end of winter and beginning of summer, the complex tidal flow of >25cm/s at the Nam Trieu estuary accounts for 74%. In addition to that, the dredging works also facilitate the smooth flow at the estuary and its expansion.

Inside the estuary, the general flow at the time the tidal flow goes down with its high speed eroded the alluvial sediment at the river's bed, leaving only the soft plastic clay.

According to the study of the Ocean Research Center - the Oceanography Institute, the flow system in the Cat Hai coastal area is summarized as below:

Tidal flow: at the Nam Trieu estuary and Lach Huyen estuary, the tidal flow with 25hours cycle is most prevalent, the speed is at 1.0m/s. When the tide goes up, the flow reaches its maximum speed before the top level 6-9 hours.

Semi-daily tidal flow is normally smaller than 0.1m/s

- The water flow:
- River flow: in Nam Trieu estuary, the river flow reaches 0.3m/s, the speed is higher in the summer
- Wind-caused flow: at the high frequency of wind speed at 5-10m/s, the speed of the flow is at 0.1-0.15m/s. the direction of the flow decided by the wind direction
- Wave flow: due to the topographical condition, the flow at Cat Hai coastal area reaches 0.1-0.2m/s, stable and stronger in the summer; the flow separates into 2 to Hoang Chau and Ben Got

The general flow:

The topographical condition in Cat Hai coastal area with Do Son island on the west side and Cat Ba island on the east side has forced the tidal flow to an uneven surface and formed up a complicated Gradient flow in Nam Trieu estuary. The general flow comprises of: daily tidal flow, semi-daily tidal flow, wind-caused flow, wave flow, Gradien flow. The overall speed reaches 1.0-1.2m/s.

In Cat Hai coastal area, the features of the general flow are same as the ones at Lach Huyen and Nam Trieu. The tidal goes up and reach its maximum speed at 1m/s. The tidal flow goes up in 12-16 hours while it goes down in only 6-8 hours. The speed of the general flow when the tidal goes up (0.9m/s in Hoang Chau and 0.82m/s in Hang Day) is higher than when it goes down (0.5m/s in Hang Day). When the tidal flow goes up, the general flow separate into 2 to Hoang Chau and Ben Got due to the 2 tidal system in Hon Gai and Hon Dau. The period when the tide falls or rises in Ben Got is 3-4 hours different from Hoang Chau.

According to the storms statistic in the past, the storms came when the tide went down. However, this rule is not absolutely followed. In 2005, a storm came when the tide went up.

From the above-mentioned conditions of tidal flow, we can see that the transportation of mud and sand is quite complicated where both erosion and alluvium happened at the same time.

3) Wave

High wave generally comes in May, November while July and September has its highest level (h=5.6m)

In the northeast wind season, the strongest wave recorded in the Lach Huyen and Nam Trieu estuary was from the south and the southeast. The wave from the east, southeast, and south direction is most

dangerous to the Nam Trieu and Lach Huyen estuary.

Results of survey at Hon Dau as of July 3rd 1964

- Wave's length: 210m towards south direction
- Cycle: 11s

Table 2.16 Statistic results of wave features in at Hon Dau

Month / Feature	1	2	3	4	5	6	7	8	9	10	11	12	Year
Height (m)	2,8	2,2	2,3	2,8	3,5	4,0	5,6	5,0	5,6	2,4	2,1	2,1	5,6
Direction	S	ESE	E	SSE	SSE	SE	S	E	E	E	S	NE	SE
Day	28	20	19	19	4	19	3	13	20	20	1	1	20,9
Year	1957	1969	1976	1976	1959	1975	1964	1968	1975	1960	1959	1963	1975
Length (m)	63	63	67	80	62	66	210	91	96	90	65	47	210
Direction	SE	E	SE	SSE	ESE	SW	S	S	S	ESE	E	NE	S
Day	22	2	2	11	21	13	12	12	2	24	8	23	12,7
Year	1964	1983	1974	1959	1957	1961	1962	1962	1962	1971	1983	1971	1962
Cycle (s)	9,1	7,6	7,5	9,3	9,3	8,2	11,0	7,7	7,72	6,8	6,7	7,1	11
Day	28	26	2	22	25	17	3	12	2	13	23	3	3,7
Year	1957	1973	1973	1958	1957	1959	1964	1962	1962	1957	1976	1976	1964

Source: The North-East Hydro-Meteorological Center, 1975-2000

4) Alluvial in Cat Hai area and its flow mechanism

The flow of alluvial depends on direction of general flow, particularly on tidal flow. When the tide goes up, the flow of alluvial moves horizontally to the seaside, then separate into 2, one goes to Ben Got in the north and the other goes to Hoang Chau in the west.

- When the tide goes down, the flow of alluvial moves down to the direction of Lach Huyen and Nam Trieu along the east side of Hang Day sand bar and west side of Hoang Chau
- The above 2 flows tend to move to Hoang Chau direction, bring in alluvium in the river-bed at Hoang Chau and eroded further than in Hang Day. Given such circulation of alluvial, the Cat Hai seaside area is suffered from alluvium shortage.

The flow of overall alluvial: Calculation applying the dynamical method shows that the volume of alluvial moved out of the Cat Hai area is about 586.000m^3 per year, the volume of alluvial moved in is about 227.000m^3, the shortage volume of alluvial is about 341.000m^3.

The popular wave in the area has height H≤2.0m, the maximum speed at Gia Loc dyke is V=1.4m/s and at Van Chan dyke is1.2m/s.

At Van Chan – Hoang Chau section, the main flow of the alluvial from the east to the west was strengthened by the tidal flow. In the summer, the wave flow plays an important role in the transportation of alluvial in the middle of the island. In contrast, in Hoang Chau and Hoa Quang, the tidal flow plays a vital role but it is very changeable in terms of direction and circulation. The flow of alluvial in this area keeps changing in a day-time.

Conclusion: from the above-mentioned condition on geography, topography, geology, climate and hydrology of the Cat Hai area, we can see that this area has a special features of the northern coastal zone. Cat Hai island is being situated in between 2 estuaries, the topographycal and geological

conditions are quite complicated.

Causes for the erosion relate to the development history of the Cat Hai island. During the process of development, the river-bed is eroded as a result of impact caused to the environment.

The erosion at Cat Hai island brought in negative impacts to people's daily life, hinder the economic development and infrastructure construction, failed to achieve the strategic development policy of the Hai Phong city. If this issue could be addressed, Cat Hai would become a promising center of seafood, services and tourisms.

After having analyzed all aspects including topography, geology, wave flow, wind flow, tidal flow, muddy sand, etc, we found the causes for the erosion in Cat Hai area:

- The flow at Cat Hai is a general flow which interacts between up-tidal and down-tidal flow via 2 canals at Hoang Chau and Hang Day
- Being situated in between of 2 big estuary, and being impacts by various exogenous factors: the wind comes most often from southeast and south in the summer, and heavy wave comes when tide goes up
- The wave broke right at the bottom of the dyke, form-up a high speed flow which erodes all alluvium, causing serious erosion at the dyke's roof. This happens at the same time with storm and tide.
- The speed of the flow at the estuary is very fast, especially when the tide goes down
- The soil condition at the dyke is soft

Therefore, the protective works at the Cat Hai area needs to be carried out to satisfy the following requirements: decrease wave's flow, prevent alluvial's flow, and be able to stand in heavy storm. The protective works shall be designed to meet the 3 criteria: wave fencing, sand control, and dyke reinforcement.

5) Alluvium at Access channel

a) Alluvium at Cam River channel

The Cam river channel from the Quay No.0 to the Dinh Vu Canal is the beginning section of the channel connecting Hai Phong to the sea area with its total length of 8.5km, its right side is Hai Phong city area and its left side is Thuy Nguyen district. The length of the section from Ruot Lon estuary to Dinh Vu Canal is 6.0km in the NW – SE direction. According to the classification of the shape of channel, the studied section from Binh ferry to Dinh Vu Canal is classified as a curved/bent section.

The width of the cross-section of +2.0m (CDL level) from the Quay No.0 to Ruot Lon estuary varies from 300m to 500m. The bottom level on the vertical cross-section is

-5.0m. The river bed is in the process of alluvial with the speed <0.1/ per year. The average depth of river bed is at -6.0m.

The width of the cross-section of +2.0m (CDL level) from Ruot Lon estuary to Dinh Vu Canal varies from 300m to 350m. The bottom level on the vertical cross-section is -4.1m at the intersection of Ruot Lon estuary and -4.4m to -4.6m at Ha Doan. Alluvial in the river bed is observed but the process is lower than before. The depth varies from -9.5m to -4.5m at the beginning point of Dinh Vu Canal.

The situation in Cam River, based on the data of several typical years, has been taken places as below:

The curved line tends to move toward downstream, deep into the seaside, the radius of the curved

section is decreasing resulting in a longer section.

The vertical cross-section keeps increasing while the width of the section seems decreasing.

The cause of the above situation was by the volume of alluvial, and volume of dredging works for this section is becoming bigger.

In reality, although the dredging works were done periodically, the depth of the channel could only be maintained in such a short period of time, about 3-6 months. After stormy season, the situation was almost same as before. This limits the smooth flow of cargo throughput and port operation.

The changes observed in this section are explained as below:

Dinh Vu Canal: L= 1.0km, straight, in NW-SE direction. W=250m in the beginning section and W=300m in the ending section. The lowest level at the bottom is -4.5m. Special features of Dinh Vu Canal are:

Expanding the horizontal cross-section together with the sediment of the muddy sand decreased the depth of the canal.

The average level of erosion is about 1.000m3/year, the depth keeps decreasing 2cm/per year on average. There are two main causes for this situation:

The volume of alluvial transported from upstream is too large, and therefore unable to accommodate. The level of sediment, according to the survey by Russian experts, is P=0.67.

The changes of water flow resulting in the decreasing of channel's depth and changes of designed specification. From the historical data and the research applying MIKE21, TEDI experts has set up the relationship between the changes of water flow on the curved section. The findings has been utilized for drafting the proposal for renovating the Cam River during 1990-1996 period in order to minimize the volume of dredging works per year.

Some improvements achieved during the captioned period were:

Adjustment of the water flow: after renovation, the speed became much faster. At present, the highest speed at the curved section reaches 1.05m/s when the tide goes down (increase 160% as compared to before construction). The water flow has been also in stable condition and suitable with the channel condition.

Adjustment of the river-bed: the depth -5.5m and the width is from 90m to 130m. Currently, the access channel is maintained at -5.5m without the regular dredging works.

b) Alluvium at Bach Dang channel

The section from the Dinh Vu channel to Den Cut: L=3.2km, W=875m ÷1,125m at the level of +2.0m, the lowest level at the bottom -3.50m. Since the construction of Dinh Vu dyke up to present, the sediment in the river-bed has been observed with the speed from 0.08m/per year to 0.10m/per year. The deepest area near Dinh Vu canal is at -9.5m and it tends to move toward the right bank with the speed of 3m/per year. The depth of center point of river-bed varies from -9.5m to -0.4m.

The section from Lighthouse Cot to Nam Trieu estuary: L=2.8km, W=2,500m at the level of +2.0m, the lowest level at the bottom -4.4m ÷ -5.0m. The sediment has been very serious over the past few years. Same as the upstream, since the construction of Dinh Vu dyke up to date, the sediment in the

river-bed has been has taken placed very speedy 0.15m to 0.25m/per year. The average lowest level at the bottom is -4.0m to -4.5m except one section near Nam Trieu estuary only -4.3m to -3.5m.

The section from lighthouse Phung Van Bang to Nam Trieu estuary (Buoy No.22): L=4.8km, the lowest level at the bottom ranges from -6.5m ÷ -11.0m.

The situation taken placed in Bach Dang section is summarized as follow:

The access channel at Bach Dang used to be quite deep in the past but the depth has been decreased relatively.

The radius of the curved section in Den Got, Phung Van Bang back to the 1962's shape.

The width of the horizontal cross-section at the upstream tends to decrease while the section at the downstream tends to increase. In the Dinh Vu and Cat Hai area, the cross-section decreases as a result of decrease in the average depth.

There are 2 main causes for the sediment at the Bach Dang river, according to TEDI experts:

The volume of alluvial transported from upstream is too large, and therefore unable to accommodate.

The changes of water flow resulting in the decreasing of channel's depth and changes of designed specification. From the historical data and the research applying MIKE21, TEDI experts has set up the relationship between the changes of water flow on the curved section.

c) Alluvium at Nam Trieu gate

The section from the Nam Trieu estuary to Hoang Chau peak: sediment at the left bank is at the speed 20m/per year, and tends to move to left bank with the speed 20-25m/per year. The vertical depth is up from 1.0m to -1.2m. The deepest level of -10.6m in 1990 is now only -9.2m – 9.3m.

From the Hoang Chau peak to AVAL light (Buoy No.16):

The direction and the shape keep unchanged, but the depth changed drastically at the speed of 0.15m to 0.20m, especially the area near the AVAL light and Buoy No.16.

The average alluvial level in rainy season is at 0.25m/per month and 0.15m/per month in dry season.

From the Buoy No.16 to Buoy No.0:

From the Buoy No.16 to Buoy No.12/12: the alluvial level has been taken place most severe in this section. The average speed in the rainy season is 0.25m/per month, and 0.20m per month in the dry season.

From the Buoy 11/12 to Buoy 5/6:

From the Buoy 11/12 to Buoy 7/8: the average speed is 0.14/per month in dry season and 0.10m/per month in rainy season

From Buoy 7/8 to Buoy 5/6: the average speed is 0.05m/per month in dry season and 0.08m/per month in rainy season

From Buoy 5/6 to Buoy 0:

No dredging works carried out for this section. The average speed is 0.1m/per year.

In conclusion in the Nam Trieu estuary, the alluvial level happened most severe in the section from Buoy No.16 to Buoy 11/12 with the speed of 0.25m/per month in rainy season and 0.17m/per month

in dry season. The thickness of the alluvial level after 5 months compared to the thickness of the dredging works is 90% in rainy season and nearly 60% in dry season.

The volume of alluvial come to Nam Trieu estuary is about 3.04 million tons per year.

From the periodical statistic during the period 1992-1996, TEDI experts have defined the coefficient of the average sediment of this section is P=0.95.

d) Alluvium at Lach Huyen channel

With is favorable natural conditions, Lach Huyen passage is sheltered by Cat Ba and Cat Hai islands. As a result, the impact caused by waves coming from northeast and western directions is minimized. Though waves from the southern, southwestern directions cause more impact on the passage but it is reduced when going through Nam Trieu estuary. When considering the origin of sediment on the sand bar in the western direction of the Lach Huyen passage, we can see its similarities with the sediment of the sand bar west of Nam Trieu passage. Therefore, it can be speculated this mud comes from estuaries of Cam, Lach Tray, Van Uc and Thai Binh rivers to settle in Nam Trieu estuary. Then under the impact of waves and ocean currents it is brought to settle in the western part of Lach Huyen estuary. According to previous studies, the siltation on Lach Huyen estuary is as follows :

The section between Trap Canal - Got Wharf: Survey data collected in 1990 and 1995 shows that:

From the Trap canal to 3.5 km downstream the passage is built up with siltation at a speed of 0.10 to 0.15 m per year. In the past (*in 1990)* the path -4,0 m deep linked Trap canal to Got wharf, but by 1995 it only reached downstream of Trap canal >1km. The deep passage across Trap canal was pusched back to the upstreams direction. The alluvia ground in front of the Mango Island developed and extended southward. The siltation mostly orginates from the mud and sand from rivers (Chanh River and Bach Dang River via Trap Canal).

From downstreams of Trap Canal estuary 3.5 km to Got wharf, the topography changed little. The depositing speed only reaches 0.02-0.03 m per year. According to survey data upto July 1997, the passage section from Trap Canal to Got wharf, the depositing level considerabley reduced and tended to move forward to stability.

From Got wharf to across Xuan Dan area: The leading axis and the bottom topography underwent little change. The underwater sand bars at the end of Got wharf developed both in lenth and in width. When the beginning of the sand bar reached across Xuan Dan area, it seemed to change from south southeast direction to the eastern direction and advance into the passage.

From Xuan Dan area to Bouy Zero: This seciton can be divided into two sub-secitons:

From Xuan Dat across the dry sand banks to -4,0m: Due to the influence of the sand bank across the passage, the dry sand bank tends to develop and is built up with silt at a speed of 0.15 to 0.2 m per year. From the result of experiemental digging hole here from Novmber 1995 to July 1997 (20 monhs) we can come to the following assessment: The sea bottom elavation before digging the dredging hole was -2.4m to -2.5m. After having dug, the hole was at the elavation of -5.0m to -5.3m. The current bottom height is from -3,43m to -3,77m. Deposit thinness averages 1.55m for twenty months (0.08 m per month). The depositing speed is shown as follows:

- Dry season 1995-1996 (11/95-4/96) V= 0.11m/month
- Rainy season 1996 (5- 10/96) V= 0.08m/month

- Dry season 1996- 1997 (11/96- 4/97) V= 0.04 m/month
- The siltation thickness for one year, (from November 1995 to October 1996) is 1.22m, accounting for 45% of the dug depth.
- The depositing level of the passage evaluatd through the annual average depositing co-efficietn is P=0,52.

From elavation -4,0m to Bouoy Zero*:* The topographical features in this section of the passage vary a little. According to the survey results in July 1995 and July 1997, after two years, the topography was eroded by 0.08 m, which suggests that the natural passage here is relatively stable.

The calculatd results within the framework of this project for the passage section from the proposed area for the gateway port to the deep sea is comparatively conforms to those of previous studies.

- The depositing level for the whole passage is Ptb=0.174. With :
- The section from the port to Xuan Dat Ptb=0.14;
- The section from Xuan Dan to the road -3.0 m Ptb=0.18. In this section there forms a blocking sand bar with Ptb=0,55.
- This result conforms to the result of silt research on the experiemtnal dreging holes in 1995~1997 conducted by HAECON and TEDI.
- The section from the depth of -3.0 m up to the deep waters is Ptb=0.14

e) Alluvium at Trap Canal

The existing Trap canal was opened in 1982 when the lowest level at the bottom -2.2m. After 15 years operation, the bottom is now -1.8m, the average alluvial level is only 0.02m/per year to 0.03m/per year, and 0.15m/per year to 0.2m/per year at the beginning section of the channel.

The access channel for the vessels is not yet existed, and therefore not be able to study the level of sediment. It is forecasted that the level in this section is much fewer than in Bach Dang river to Nam Trieu estuary.

f) Conclusion of access channel passing through Nam Trieu and Lach Huyen

From the available studies of scientific research institute at home and abroad on alluvial level at the access channel, we can come to the following conclusion:

(1) There are 2 main reasons causing the alluvial in the access channel in the Cam river and Bach Dang river:

- The volume of alluvial transported from upstream is too large, and therefore unable to accommodate.
- The changes on the relationship between the river-bed to the access channel, resulting in the inappropriate up and down of the channel.

The above two causes need to be addressed by constructing a renovating work to stabilize the flow and thus help to increase the speed of the flow when the tide goes down and up, and by conducting the periodical dredging works.

(2) Main reasons causing the alluvial in the Nam Trieu estuary and Lach Huyen estuary:

- Wind-driven wave stirs alluvial at the sea-bed, and the flow transports them, leaving a part on the access channel

- Alluvial from the river discharged to the sea remained directly in the access channel, add up to the volume of alluvial at the river bed.

(3) The alluvial level is quantified in each section as follows:

- The alluvial level at Cam river: the alluvial transported in the river flow P=0.67 (according to the research of Russian experts)
- The alluvial level at Bach Dang river: preliminary quantified =5-21% of volume of muddy sand transported to the sea
- The alluvial level at Nam Trieu estuary: P=0.95 (according to TEDI study before 2000)
- The alluvial level at Nam Trieu estuary: P=0.52 (according to TEDI study before 2000)

(4) Forecasts on volume of dredging works for access channel maintenance:

- According to HAECON, for the access channel with its bottom level of -8.5m, the volume of dredging works is forecasted at about 4 million tons per year (including the access channel offshore as well as Trap Canal, Bach Dang and Cam river). The volume of dredging works is also forecasted to decrease with the following reasons:
  + The volume of sand is limited
  + Slope will be stabilized in the mud and sand
  + The volume of maintenance dredging works (million tons dry mud/per year)

Access channel	Start-up phase	After 10 years
Sea channel	3.83	2.70
River channel	0.80	0.80

2.2. Environment Conditions in the project area

2.2.1. Air environment conditions

a. Survey site and sample taking site

The area reserved for the construction of the Hai Phong international Gateway port is in Cat Hai island. To assess the air environment condition at the project area, The Center for Hydrography Meteorology Network and Environment has conducted the survey and took the sample, analyzed the quality of the air in May 2006.

Survey site, sample taking site to assess the air environment as below (Figure 2.1)

Table 2.17 Survey site for the air temperature

No	Location	Code	Longitude	Latitude
1	Cát Hải Town Primary School	KK01	106°53'24.1" E	20°47'43.3" N
2	Hoà Hy Temple	KK02	106°53'36" E	20°47'35.9" N
3	Cross-road	KK03	106°53'51.8" E	20°47'42.9" N
4	Next to Mr. Nguyễn Quang Đức's house	KK04	106°54'11.2" E	20°47'49.9" N
5	Gót Ferry	KK05	106°54'27.1" E	20°48'17.3" N
6	Center for Culture-Science	KK06	106°53'29.9" E	20°47'41.7" N

b. Analyzing factors

- The air temperature factors were measures at the site and the samples were taken for analyzing in the laboratory.
- The meteorological factors : temperature, air humidity, wind direction, and wind velocity
- The air environmental factors: CO, NO_2, S O_2, dust, lead

c. Sample taking method and sample preservation method

The method for measure, sample collection and preservation was carried out following Vietnamese technical regulations and standards. Result of the analysis is summarized in the below table:

Table 2.18 Result of the measure of microclimate factors

No	Indicator	Unit	Result					
			KK01	KK02	KK03	KK04	KK05	KK06
1	Temperature	°C	28,5	28,4	28,4	28,4	28,6	28,7
2	Humidity	%	63	67	63	63	60	60
3	Wind direction		ESE	SE	SE	SE	SE	-
4	Wind speed	m/s	2,2	2,6	2,2	2,2	2,4	0,2

Source: Center for Hydro- Meteorological and Environmental Station Network

Note: Average result of the whole survey period

Table 2.19 Result of the analysis of air quality at the project area

Unit: mg/m^3

No	Factors	Result						QCVN
		KK01	KK02	KK03	KK04	KK05	KK06	
1	NO_2	0,0012	0,0014	0,0010	0,0010	0,0013	0,0012	0,1
2	SO_2	0,024	0,029	0,026	0,025	0,027	0,024	0,3
3	CO	0,380	0,500	0,321	0,346	0,446	0,375	5
4	TSP	0,14	0,15	0,15	0,14	0,13	0,16	0,2
5	Pb	0,00014	0,00015	0,00013	0,00012	0,00015	0,00011	0,005

Source: Center for Hydro- Meteorological and Environmental Station Network

Note: QCVN 05: 2009/BTNMT (24hours on average)

The above results show that:

- NO_2 concentration: varies from 0.001mg/m3 to 0.0014mg/m3, lower than Vietnamese Technical Regulation QCVN 05: 2009/BTNMT (24hrs average) 80 – 100 times

- SO_2 concentration: varies from 0.024mg/m3 to 0.029mg/m3, lower than Regulation TCCP 10-12 times
- CO concentration: varies from 0.321mg/m3 to 0.05mg/m3, lower than Regulation TCCP 10-15 times
- Dust concentration: varies from 0.13mg/m3 to 0.16mg/m3, 65-80% lower than Regulation TCCP
- Lead concentration: varies from 0.00011mg/m3 to 0.00015mg/m3, lower than Regulation TCCP 30-45 times.

It could be concluded that the air environment quality at the project area is very clean. At present, there is no activity causing impact to the environment. Only a few number of vehicles for tourism purposes and commodity supply for Cat Ba island.

2.2.2. Noise, vibration condition in the project area

a. Survey site

To assess the noise and vibration condition in the project area, the Center for Hydrography Meteorology Network and Environment has conducted the measures, and survey the noise and vibration in May 2006.

The survey site for the noise and vibration are the same as the survey site for air quality. Figure 2.1.

b. Survey factors

- Noise criteria: Leq, L10, L90 (MAX)
- Vibration criteria : low and high frequency

c. Methodology of measurement

The measurement for noise and vibration was carried out following Vietnamese standard. Result of noise and vibration is shown in the table below:

Table 2.20 Results of Noise measurement

No	Indicators	Unit	Result					
			KK01	KK02	KK03	KK04	KK05	KK06
1	Leq	dBA	52,0	49,9	47,8	51,5	51,5	54,4
2	L10	dBA	47,6	49,7	46,2	46,8	51,0	53,1
3	L90(MAX)	dBA	34,5	41,7	35,9	35,1	42,2	39,6

Source: Center for Hydro- Meteorological and Environmental Station Network

Table 2.21 Vietnamese noise standard TCVN 5949-1998 *(Unit: dBA)*

No	Area	From 6h-18h	From 18h-22h	From 22h-6h
1	Very quit area: hospital, health care center kindergarten	50	45	40
2	Redidential area, hotel, houses, offices	60	55	45
3	Residential houses inside the areas of commerce, services, production	75	70	50

Table 2.22 Results of vibration measurement *(Unit: dB)*

Time / Location	0h-1h	7h-8h	12h-13h	15h-16h	18h-19h
KK01	33	34	35	35	34
KK02	33	34	35	35	34
KK03	34	35	35	37	35
KK04	34	34	35	36	35
KK05	34	35	35	36	35
KK06	33	34	35	36	35
TCVN 6962:2001	Ground	75	75	75	75

Source: Center for Hydro- Meteorological and Environmental Station Network

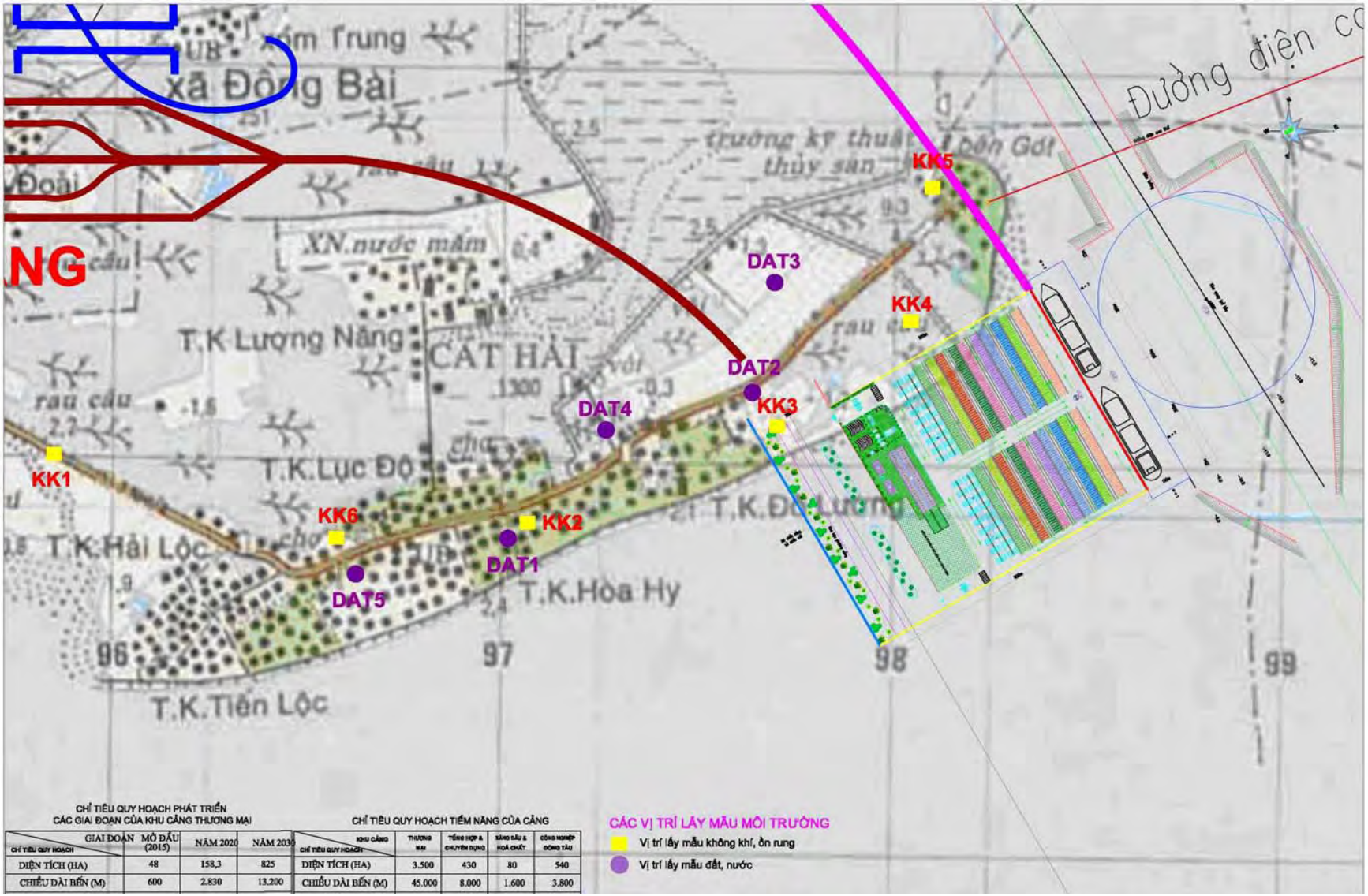
Results of the survey showed that the noise and vibration at the project area are low, much lower than the acceptable level of Vietnamese standard TCVN 5949-1998, TCVN 6962-2001.

Currently, the volume of transport is very few in Cat Hai island in particular and Cat Hai district in general. At Got ferry, the ship carrying tourists from Dinh Vu comes every hour, and therefore the noise is minimal.

2.2.3. Soil conditions in the project area

a. Survey site

To assess soil condition in the project area, the Center for Hydrography Meteorology Network and Environment has taken the samples at 5 different sites from MD1 to MD5 in May 2006. The survey sites are shown in the Figure 2.1.



GIAI ĐOẠN / CHỈ TIÊU QUY HOẠCH	MỞ ĐẦU (2015)	NĂM 2020	NĂM 2030
DIỆN TÍCH (HA)	48	158,3	825
CHIỀU DÀI BẾN (M)	600	2.830	13.200

KHU CẢNG / CHỈ TIÊU QUY HOẠCH	THƯƠNG MẠI	TỔNG HỢP & CHUYÊN DỤNG	XĂNG DẦU & HÓA CHẤT	CÔNG NGHIỆP ĐÓNG TÀU
DIỆN TÍCH (HA)	3.500	430	80	540
CHIỀU DÀI BẾN (M)	45.000	8.000	1.600	3.800

Figure 2.1 Environmental Survey Sites

b. Analyzing factors

To assess the soil condition, the following factors are analyzed: composition, weight, oil and metal (Cu, Pb, Zn, Cd, As, Hg).

c. Methodology for sample taking, preservation, and analyze

The sample taking, preservation and analyze was conducted following Vietnamese standard. The results show in the table below:

Table 2.23 Soil composition

Name of sample	Soil particle (%) in radius mm			
	< 0,002 mm	0,002 – 0,02 mm	0,02 – 0,2 mm	0,2 – 2 mm
MĐ1	4,6	7,0	86,5	1,9
MĐ2	1,4	4,5	39,5	54,5
MĐ3	4,2	6,5	58,7	30,6
MĐ4	12,7	17,1	51,5	18,7
MĐ5	1,4	3,1	61,2	34,3

Source: Center for Hydro- Meteorological and Environmental Station Network

The result shows that the size ≥0.02mm is the most popular one, the type ≤0.02 accounts for only 1,4-12,7%, the type from 0.02 to 0.2mm ranges from 39,5% to 86,5%.

Table 2.24 Result of weight and soil composition analyze

Indicator	Unit	Result					TCVN 7209-2002
		MĐ1	MĐ2	MĐ3	MĐ4	MĐ5	
Cu	mg/kg	9,82	17,35	10,97	36,42	5,96	50
Pb	mg/kg	15,06	25,74	17,13	58,28	9,24	70
Zn	mg/kg	41,67	95,65	66,85	142,19	39,14	200
Cd	mg/kg	0,56	1,57	0,88	1,99	0,50	2
As	mg/kg	2,36	4,12	3,64	4,27	2,44	12
Hg	mg/kg	0,32	0,29	0,31	0,35	0,36	-
Oil	mg/kg	14,0	8,0	12,0	322,0	10,0	-
Weight	g/cm^3	2,57	2,44	2,54	2,49	2,6	-

Source: Center for Hydro- Meteorological and Environmental Station Network

The above result shows that:

- The soil preposition is quite even, range from 2.44mg/cm3 to 2.67mg/m3.
- The composition of bronze in the soil varies from 5.96mg/kg to 36.42mg/kg, lower than the acceptable level of 1.4 – 8.4 times.
- The composition of lead in the soil varies from 9.24mg/kg to 58.28mg/kg, lower than the acceptable level of 1.2 – 7.6 times.
- The composition of zinc in the soil varies from 39.14mg/kg to 142.19mg/kg, lower than the acceptable level of 1.4 – 5.1 times.
- The composition of cadimi in the soil varies from 0.5mg/kg to 1.99mg/kg, lower than the acceptable level of 1.005 – 4 times.
- The composition of asen in the soil varies from 2.36mg/kg to 4.27mg/kg, lower than the acceptable level of 2.8 – 5.08 times.

The above results of soil condition in the project area showed that all the analyzed criteria are lower than the acceptable of Vietnamese standard TCVN 7209-2002. It could be concluded that there is no signal of heavy metal appeared in the project area.

2.2.4. Underground water quality conditions in the project area

The clean water supply system is not yet available in the project area, and therefore the water for daily life is sourced from the dig-well 3-7m deep.

a. Survey site, sample taking site

During the survey period in May 2006, the Center for Hydrography Meteorology Network and Environment has taken the samples at 5 different sites. The survey sites are shown in the Figure 2.1.

b. Sample taking methodology

The water sample was taken by a specialized equipment and kept in a standard bottle. The underground water for microorganism analysis was kept in a standard glass bottle. All the water samples were preserved and taken to the laboratory.

c. Survey and analyzing factors

The underground water factors include: pH, NO_3, Fe, Hg, Pb, Zn, Coliform, Fecal coliform.

Results of the quality analysis of underground water shown in the Table 2.25 below

Table 2.25 Results of the quality analysis of underground water

No	Indicators	Unit	Result					QCVN 09 2008/BTNMT	MOH standard
			NN1	NN2	NN3	NN4	NN5		
1	pH	-	7,55	7,47	7,15	7,47	7,74	6,5-8,5	6,5-8,5
2	NO_3^-	mg/l	15,58	0,91	3,90	7,48	2,81	45	50
3	Total Fe	mg/l	0,11	1,93	2,99	0,20	0,10	1-5	1,5
4	Hg	µg/l	0,40	0,59	0,57	0,12	0,30	1,0	1,0
5	Pb	µg/l	1,51	21,83	71,61	22,67	17,46	50	1
6	Zn	µg/l	5,66	84,92	38,52	87,99	28,25	5000	3000
7	Total Coliform	MNP/ 100ml	94	55	110	0	18	3	
8	Fecal coliform	MNP/ 100ml	37	0	55	0	0	0	

Source: Center for Hydro- Meteorological and Environmental Station Network

Compared to QCVN 09: 2008/BTNMT, we have several comments:

- All the measured and analyzed factors are lower than the acceptable standard
- Except for the Coliform which is higher than the allowable standard

2.2.5. Seawater quality conditions in the project area

The survey was conducted in May 2006 in 5 different sites. (The map of survey site locations is shown in the section 2.2.7.2).

a. Survey site, sample taking site

The samples were taken at 5 different sites, the samples were taken at 3 different levels incl. the surface, middle, and bottom. The survey sites are shown in Figure 2.2.

b. Method for sample taking and preservation

The sample was taken by a specialized equipment and kept in a standard plastic bottle for chemical analysis, kept in a high temperature sterilized grass bottle for microorganism analysis. All the samples were storage in a standard cool box before moving to the laboratory.

c. Survey and analyzing factors

To assess the quality of the seawater in the project area, the following factors were taken into analysis: pH, temperature, saltiness, turbidity, DO, TSS, BOD,

Result of analysis is shown in the Table 2.26.

Table 2.26 Results of seawater quality analysis in the project area

No	Indicator	Unit	Result															QCVN 10:2008/BTNMT		
			NB1			NB2			NB3			NB4			NB5			A	B	C
			Surface	Middle	Bottom	Surface	Middle	Bottom	Surface	Middle	Bottom	Surface	Middle	Bottom	Surface	Middle	Bottom			
1	Temperature	^oC	26,5	25,8	25,2	26,7	26,2	25,9	27,4	27,1	26,7	27,8	27,6	27,2	28,2	27,9	27,3	30	-	-
2	DO	mg/l	6,36	6,29	6,21	6,55	6,50	6,43	6,85	6,78	6,72	6,42	6,39	6,31	6,58	6,51	6,47	≥ 4	≥54	≥ 4
3	TSS	mg/l	16	17	17	17	18	16	22	21	23	37	32	32	42	38	38	25	50	200
4	Saltiness	‰	28,8	27,6	27,8	27,5	27,2	27,2	27,3	27,2	28,7	26,9	26,6	27,3	26,7	25,0	25,8	-	-	-
5	pH		8,21	8,23	8,24	8,23	8,23	8,27	8,27	8,27	8,28	8,26	8,26	8,27	8,31	8,26	8,29	6,5 - 8,5	6,5 - 8,5	6,5 - 8,5
6	BOD_5	mg/l	4,36	5,68	6,68	5,40	5,50	6,02	6,12	5,24	6,72	7,52	5,62	7,14	6,66	6,42	6,24	<20	<10	< 20
7	Turbidity	NTU	17	20	18	23	26	19	29	26	27	45	37	36	49	46	45	-	-	-
8	NH_3 (N)	mg/l	0,055	0,123	0,019	0,332	0,434	0,443	0,319	0,277	0,243	0,298	0,267	0,363	0,398	0,729	0,342	0,1	0,05	0,05
9	Cl^-	µg/l	17,47	16,74	16,86	16,68	16,50	16,50	16,56	16,50	17,41	16,31	16,13	16,56	16,19	15,16	15,65	-	10	-
10	F^-	mg/l	0,707	1,143	0,891	0,843	0,865	0,842	0,891	0,842	0,914	0,762	0,891	1,542	1,012	0,865	1,002	1,5	1,5	1,5
11	Fenolx10^{-3}	mg/l	0,280	0,310	0,296	0,295	0,281	0,331	0,310	0,242	0,281	0,312	0,363	0,368	0,361	0,282	0,281	1	1	2
12	Mn	µg/l	8,718	10,812	8,593	6,235	2,545	4,386	7,237	4,945	4,354	4,793	7,462	5,815	4,246	5,897	5,965	100	100	100
13	Fe	mg/l	0,283	0,331	0,498	0,404	0,488	0,544	0,396	0,485	0,307	0,947	1,452	0,740	1,442	0,910	0,875	0,1	0,1	0,3
14	SO_4^{2-}	mg/l	1973,56	2235,19	2029,18	2148,67	2292,88	2142,49	2243,43	2340,26	2379,40	2274,33	2309,36	2167,21	2103,35	1819,06	2000,34	-	-	-
15	CN^- x10^{-3}	mg/l	4,81	3,21	4,82	4,80	3,04	7,14	3,05	3,21	3,03	6,38	8,72	6,37	7,14	3,04	3,21	10	10	20

No	Indicator	Unit	Result														QCVN 10:2008/BTNMT		
			NB1			NB2			NB3			NB4			NB5			A	B	C
			Surface	Middle	Bottom	Surface	Middle	Bottom	Surface	Middle	Bottom	Surface	Middle	Bottom	Surface	Middle	Bottom			
16	As	µg/l	2,212	1,681	1,432	2,840	1,673	1,558	2,872	1,978	1,768	2,720	1,372	1,085	2,570	1,836	1,723	50	10	50
17	Cd	µg/l	0,868	1,253	1,026	0,658	0,661	0,544	0,484	0,327	0,593	0,108	0,246	0,134	0,217	0,289	0,376	5	5	10
18	Pb	mg/l	0,277	0,479	0,254	0,216	0,232	0,178	0,118	0,145	0,124	0,132	0,121	0,128	0,178	0,214	0,286	0,1	0,05	0,1
19	Cr^{6+}	mg/l	0,036	0,054	0,037	0,054	0,053	0,051	0,037	0,035	0,040	0,112	0,132	0,080	0,075	0,055	0,049	0,05	0,05	0,05
20	Cr^{3+}	mg/l	0,040	0,022	0,026	0,109	0,091	0,054	0,100	0,137	0,030	0,105	0,080	0,026	0,013	0,017	0,012	0,1	0,1	0,2
21	Cu	µg/l	2,137	1,291	1,368	0,255	0,445	0,372	0,162	0,159	0,274	0,332	0,418	0,864	0,917	0,752	0,554	20	10	20
22	Zn	µg/l	1,426	1,283	0,753	0,658	1,103	0,583	0,946	0,957	0,804	1,024	0,850	0,751	0,358	0,433	0,501	100	10	10
23	Hg	µg/l	0,418	0,721	0,635	0,492	0,602	0,578	0,313	0,544	0,478	0,521	0,673	0,577	0,496	0,637	0,554	5	5	10
24	Oil	µg/l	0,58	0,44	0,24	0,53	0,41	0,25	0,42	0,28	0,22	0,60	0,43	0,30	0,62	0,47	0,31	0	0	300
25	Coliform	MPN/100ml	170	150	130	220	260	290	320	120	110	230	250	200	190	210	240	1000	1000	1000

Source: Center for Hydro- Meteorological and Environmental Station Network

Note: QCVN 10:2008/BTNMT: Column A: applied for the beach area

QCVN 10:2008/BTNMT: Column B: applied for aqua-culture ponds

QCVN 10:2008/BTNMT: Column C: applied for other places

The result indicates that the quality of the seawater in the project area satisfy the Vietnamese Technical Regulation QCVN 10:2008/BTNMT. However, there are certain criteria which exceed the acceptable level (NH3, Cl, Fe, Pb, oil contents). It could be said that the seawater environment in the coastal area is slightly polluted.

d. Saltiness in seawater

The saltiness in Cat Hai island changes from season to season and normally lower than Cat Ba island due to the impact of the water flow from Kinh Thay river, Bach Dang river and Chanh river.

The average saltiness in Cat Hai is 26-28% in dry season and 15-20% in rainy season. The highest level is 31,4%. The biggest fluctuation ranges in a day is 7,9%.

e. pH concentration in seawater

pH concentration in seawater in Cat Ba island is relatively high and stable, 7.88-8.0 on average, 8.34 at the highest and 7.69 at the lowest. pH in seawater on the surface level as of 2000 in Cat Hai is shown in the Table 2.27 below.

Table 2.27 pH in seawater at Cat Hai island as of 2000.

Month	Average	Highest	Lowest	ΔpH max
1/2000	7,92	8,02	7,70	0,28
3/2000	8,00	8,25	7,84	0,20
7/2000	7,88	8,34	7,69	0,34
11/2000	7,96	8,25	7,77	0,26

Source: North-East Hydro-Meteorological Center

2.2.6. Sediment conditions in the river-bed

The sample was conducted in May 2006.

a. Survey site, sample taking site

The sample of sediment at the river bed was taken at 5 different sites which are same as the seawater sample at the site reserved for the construction of transshipment terminal and access channel. The survey sites are shown in the Figure 2.2.

b. Methodology for sample taking and preservation

The sample was taken by a specialized equipment, and kept in a nylon bag and stored in a standard cool box.

c. Survey and analyzing factors

The factors for survey and analysis include: Cu, Pb, Zn, Cd, As, Hg and Oil

Table 2.28 Results of analyzing muddy sand conditions in the project area

No	Indicator	Unit	Results				
			BC 1	BC 2	BC 3	BC 4	BC 5
1	Density	g/cm^3	2,55	2,53	2,50	2,60	2,61
2	Cu	mg/100g	2,38	2,13	3,02	2,18	1,71
3	Pb	mg/100g	1,25	1,62	1,87	1,29	1,30
4	Zn	mg/100g	7,61	7,03	5,91	7,49	7,73
5	Cd	mg/100g	0,058	0,071	0,072	0,059	0,068
6	As	mg/100g	0,19	0,21	0,15	0,18	0,24
7	Hg	mg/100g	0,012	0,013	0,009	0,011	0,016
8	Oil	mg/100g	0,89	0,72	0,52	0,91	0,92

From the above result, we can see that the oil content varies from 0.52 to 0.92mg/100g. Due to different air conditions, Hydrocacbon in alluvial is kept longer and alluvial at the bottom would absorb Hydrocacbon.

2.2.7. Ecological system conditions and natural resources

In May 2006, the Center for Hydrography Meteorology Network and Environment in collaboration with Hai Phong Institute for Natural Resources and Environment conducted the survey on natural resources and maritime ecological system of the project area.

The survey sites shown in the Figure 2.2.

The methodology for sample taking and analysis was made following Vietnamese standard:

- Ephemeras flora: the quantitative sample was tested by bathormeter, the qualitative sample was collected by a net size 20x20
- Ephemeras fauna: the qualitative sample was collected by a net size 38, the quantitative was filtered though the net.
- Species at the bottom: the sample was collected by a specialized equipment size 25x25, filtered by a net size 1x1. 3 samples at each site
- Sea-weed – sea grass was also collected
- Wet-land flora: surveyed at the mangrove forest.

All the samples were preserved by a specialized chemical before moving to laboratory.

The data was treated using the mathematical methodology.

Results of the analysis and studies on maritime ecological and natural resources are summarized as

follows:

1) Wet-land flora in the project area

a. Variety

The survey was conducted only in Phu Long side. The survey found 23 varieties. Some are highly valuable such as Kandelia candel, mangrove Rhizophora stylosa which could be used as materials for cooking; the husk provides tannin and the flower is for bee raising.

b. Distribution features in Phu Long area, Cat Hai

The sea-bed comprises of mud, muddy sand and sandy mud, which are very favored for wet-land flora development. They are divided into different zones:

- Zone I: Avicennia lanata
- Zone II: aegiceras, mangrove,
- Zone III: aegiceras, sea portulaca, Bermuda grass

2) Seaweed and sea grass in Lach Huyen estuary

a. Composition

There are 43 varieties in which

- Cyanophyta: 11
- Chlorophyta: 13
- Phaeophyta: 4
- Rhodophyta: 9
- Others: 6

b. Distribution features

In the tidal zone: In general, all seaweed and sea grass are distributed in the tidal zone, and in the aegriceras forest.

In the seafood cultivating pond: the variety are more diversified and the quantity are larger in old pond like Luong Nang and Dinh Vu as it depends on the nutritious saltiness and the bottom layer structure.

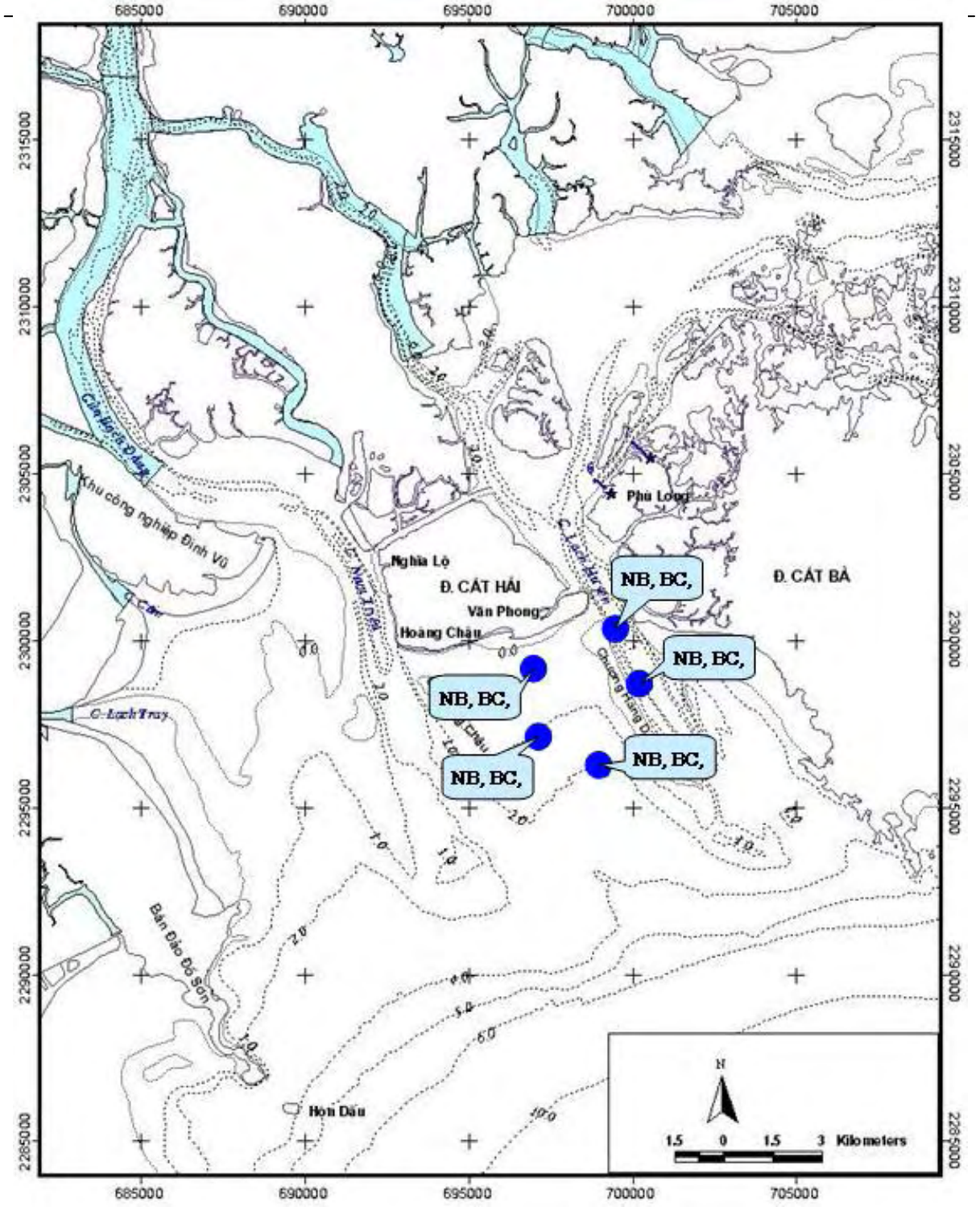


Figure 2.2 Survey sites for underwater species, sedimentation, and seawater

Note: ● *Survey sites for underwater species, efemeras, sedimentation and seawater.*

★ *Survey sites for alga and sea grass*

\+ *Wetland flora survey sites*

Table 2.29 Survey sites for underwater species, sedimentation, and seawater

Site	Longitude E	Latitude N	Site	Longitude E	Latitude N
1	106^{0}46'23"	20^{0}50'44"	22	106^{0}48'10"	20^{0}43'28"
2	106^{0}48'10"	20^{0}50'44"	23	106^{0}49'57"	20^{0}43'28"
3	106^{0}49'57"	20^{0}50'44"	24	106^{0}51'44"	20^{0}43'28"
4	106^{0}51'44"	20^{0}50'44"	25	106^{0}53'31"	20^{0}43'28"
5	106^{0}53'31"	20^{0}50'44"	26	106^{0}46'23"	20^{0}41'39"
6	106^{0}46'23"	20^{0}48'55"	27	106^{0}48'10"	20^{0}41'39"
7	106^{0}48'10"	20^{0}48'55"	28	106^{0}49'57"	20^{0}41'39"
8	106^{0}49'57"	20^{0}48'55"	29	106^{0}51'44"	20^{0}41'39"
9	106^{0}51'44"	20^{0}48'55"	30	106^{0}53'31"	20^{0}41'39"
10	106^{0}53'31"	20^{0}48'55"	31	106^{0}46'23"	20^{0}39'50"
11	106^{0}46'23"	20^{0}47'06"	32	106^{0}48'10"	20^{0}39'50"
12	106^{0}48'10"	20^{0}47'06"	33	106^{0}49'57"	20^{0}39'50"
13	106^{0}49'57"	20^{0}47'06"	34	106^{0}51'44"	20^{0}39'50"
14	106^{0}51'44"	20^{0}47'06"	35	106^{0}53'31"	20^{0}39'50"
15	106^{0}53'31"	20^{0}47'06"	SV1	106^{0}51'32"	20^{0}45'25"
16	106^{0}46'23"	20^{0}45'17"	SV2	106^{0}50'38"	20^{0}45'01"
17	106^{0}48'10"	20^{0}45'17"	SV3	106^{0}50'43"	20^{0}44'15"
18	106^{0}49'57"	20^{0}45'17"	SV4	106^{0}51'50"	20^{0}44'49"
19	106^{0}51'44"	20^{0}45'17"	SV5	106^{0}51'23"	20^{0}43'57"
20	106^{0}53'31"	20^{0}45'17"	Alga 1	106^{0}51'41"	20^{0}47'28"
21	106^{0}46'23"	20^{0}43'28"	Alga 2	106^{0}51'18"	20^{0}47'05"

***Note**: 1-35: Wetland flora survey sites.*

SV1 - SV5 : Survey sites for underwater species, efemeras, sedimentation and seawater.

Alga 1, Alga 2: Survey sites for alga and sea grass

3) Ephemeras flora

In general, ephemeras flora are quite important to ecological system. They are involving in the process of producing organic substance – a major source of food for larva and other young individual of creature.

Ephemeras flora is a single-celled one, they can associate with each other and floated on the surface as a red tide. They are also indicating the quality of the environment in the area.

a. Composition

There are 135 varieties belonging to the groups of seaweed Silic Barcillariophyta, Pyrrophyta, Chlorophyta, and Cyanophyta.

In the dry season February –March, the number of ephemeras found was 145 while in the rainy season August – September the number was only 108.

From the above-mentioned analysis, we could see that most of them are suitable with saltiness. The variety may also depend on season of the year, in the rainy season the number may increase

significantly when the saltiness is higher.

Table 2.30 Total number of ephemeras at Bach Dang area as of 1996

Season	Ephemeras flora - Algae								Total
	Silíc		Tảo giáp		Tảo lục		Tảo Lam		
	No. of species	%	No. of species	%	No. of species	%	No. of species	%	
Dry	137	94,4	2	1,4	4	2,8	2	1,4	145
5/2006									135
Rainy	75	69,4	2	1,9	18	16,7	13	12,0	108

b. Fluctuation/density

The density in the Bach Dang estuary varies from 105-106 Tb/per litter and from 104-105 Tb/per litter in the rainy season.

Table 2.31 The density at 5 survey sites as of May 2006

Location	Survey taking layer	Quantity (Average)	Density (Average/littre)
1	Surface layer	667	53.360
2	Surface layer	5.436	54.360
3	Surface layer	484	38.720
4	Surface layer	319	25.520
5	Surface layer	6.285	62.850
	Average	2.642	46.962

4) Ephemeras fauna

This group has an important role in understanding the features of each area. Under the scope of environment impact assessment for the Hai Phong International Gateway Port project, we had conducted survey, investigation and gather all relevant data to assess the ephemeras fauna in the project area.

a. Composition

Samples were taken at 5 survey sites. The result shows that there were 22 varieties. Given the time constraints, it is impossible to collect all varieties in 4 seasons in a year.

Based on the ecological features, this ephemera could be classified into the following groups:

- Offshore group: the group living offshore such as Eucalanus subcrassus
- Coastal group: a large group with high density such as Arcrocalanus gilber, Acartia pacifica, Centropages furcatus,
- Brackish water: wide distributed with a large number in Bach Dang such as Acartiella sinensis, Schmackerria spp, etc

- Fresh water: only appeared in the rainy season when the fresh water comes from the upstream such as Thermocyclops hyalinus, Microcyclops varicans

b. Fluctuation

Fluctuation in the composition of ephemeras by season.

The feature of ephemeras at the survey site indicated the environment condition at that time especially the saltiness. In this survey, there was no fresh water group which is same as in reality. Although the survey was conducted in May but the rainy season has yet to come, thus fresh water has not yet available.

Based on the study in the past, the numbers of ephemeras found in the dry season were 46 in March, higher than 34 in the rainy season.

The changes of composition following the tidal condition

The tidal condition causes certain impact to the composition of ephemeras. Under this survey, we only collected samples in a narrow areas and therefore the number of varieties were limited 9-14. However, the changes may experience depending on the impact of the water environment. The number of ephemeras is normally higher when the tide goes up when the saltiness is more concentrated.

Table 2.32 Distribution of ephemeras varieties and individual at the survey station

No	Survey sites	No. of species	Density (pc/m^3)
1	SV 1	11	5.500
2	SV 2	13	5.000
3	SV 3	9	3.500
4	SV 4	14	15.000
5	SV 5	13	10.500
6	Average	12	7.900

Note: SV1-SV5: survey sites for sea-bed species, flora, ephemeras species (Figure 2.2)

c. Quantitative distribution features

Quantitative classification by survey station.

Samples were taken at 5 different sites: 2 sites near Lach Huyen, 2 sites near Nam Trieu estuary, and 1 site near the outer area. The density was not distributed evenly, the gap among each station was 2-3 times.

Changes of individual density by seasons.

The density of individual ephemeras in dry season is higher than in rainy season, about 15-20% when the tide goes up, and about 2 times when the tide goes down. This might be the result of the different level of saltiness. In the rainy season, the fresh water cause impacts to ephemeras.

5) Fauna in the river-bed

Under the limitation of the scope of the survey, the data collected only represents the current condition in the project area. We have summarized results of previous studies which was carried out in Bach Dang estuary including Lach Huyen and Phu Long estuary.

a. Composition

We have found 41 varieties of fauna in the river-bed, accounting for 28,7% varieties found in the area. Due to the limitation of scope of survey, the numbers of varieties found were quite limited and thus did not represent the characteristics of all species. Except the Polychaeta, numbers of species in the pond are less than that in the estuary.

b. Quantity

Under the scope of the survey, we have found the quantified samples at 5 sites (Figure 2.2) in the Cat Hai estuary as shown in the Table 2.32.

Table 2.33 Quantity of the fauna in the Cat Hai estuary

Survey sites	Density (con/m^2)	Quantity (mg/m^2)
SV 1	0	0
SV 2	96	5.850,8
SV 3	96	6.435,6
SV 4	299	20.044,9
SV 5	165	11.061,1
Average	131	8.678,5

Although the species in the pond are less than in the estuary but they grew much more faster.

The result shows that the fauna in this area are same as in other areas such as Cai Trap, Tien Phong, Dinh Vu. Among the 5 survey sites, samples were taken at only 4 sites, and did not exist in one site.

Table 2.34 Numbers, density, and quantity of fauna in the pond and in the estuary

Location	Aqua-culture ponds			Sea-bank		
	No.of species	Con/m^2	mg/m^2	Số loài	Con/m^2	mg/m^2
Cái Tráp	41	287	63.361	81	167	10.178
Tiền Phong	30	284	35.648	20	17	6.485
Đình Vũ	20	182	9.148	28	148	5.832
Toàn vùng	71	251	36.052	111	105	7.975

Cai Trap and Phu Long pond has a larger numbers of species as it is near the sea, and the condition is more favorable than the usual pond condition.

We can see the environment where the density of wet-land flora are large, the water is not smoothly

circulated and these are not a good condition for growing. In the outer area where the water circulation is faster, the organic disintegrated and mixed with the water flow, provided a very good source of food to the species, and contribute to the richness of the layer.

Table 2.35 The relationship between the distribution of species at the river-bed and the wet-land flora in the pond

Variety	Far from wet-land flora		Close wet-land flora		In the middle of wet-land flora	
	pcd/m^2	mg/ m^2	pcs/m^2	mg/ m^2	pcs/m^2	mg/ m^2
Gastropoda	133	2500	362	41125	8	2800
Bivalvia	103	4856	138	3975	16	1800
Polychaeta	12	750	13	250	24	400

6) Sea fish

The shape of Bach Dang estuary looks like a funnel, the topography remains unchanged but the structure is quite changeable as a result of economic activities in the area. This situation has caused certain impacts to the fauna and floral including the fish. Under the scope of this survey, we did not conduct any studies but just rely on previous studies in Cat Hai and Phu Long area and through interview with local people.

a. Composition

The previous study revealed a total number of 101 varieties of fishes, some has a large numbers for instance Goliidae which comprises 30 species, Sardine – 18 species, Turbot – 14 species. In general, they are rich in terms of varieties. However, due to their movement, only about 20 species could be caught in each time of survey.

In terms of ecological environment, fishes in Bach Dang estuary could be classified into 2 groups:

- Fishes in the estuary: quite popular, highly adaptable to the changes of saltiness and seasonal temperature. Most typical area Turbot Clupanodon, Thrissa, Coilia, Salanx Acuticeps, Tylosurus Strongilurus, Siganus, Mugil, Glossogobius, Hemiramphus Itermedius, etc
- Offshore fishes coming to the seaside in the breeding season: some species are highly economical which are often caught by the fisherman. Their sizez are quite big, living in the floating layer and near the Gulf of Tonkin.

b. Value of natural fish resources

The fish resources in the Nam Trieu estuary was studies in 1970-1972. It could be said that the resources in the Dinh Vu, Trang Cat, and Cat Hai estuary are valuable.

Source of fish variety

Some popular varieties found in the brackish water are: Ambassidae, Gobioidei, Gobioidei with the frequency of 100% all year round, Ambassidae 83%, Mugilidae 50%; other varieties such as Clupeidae, Syngnathidae, and Tetrodontidae are less popular.

Mugilidae family ‘s density is just very few, from 2 – 4pcs/100m3 . According to Dekhnix (1973), the size is becoming bigger and bigger when it reaches the estuary area about 1,5 - 2,5 cm. Due to its special charateristic, it is difficult to catch this group of fish by a small net.

Table 2.36 The average number of fishes caught by net 15 and net 38 (pcs/100m3)

No	Season / Composition	Rainy season			Dry season		
		1	2	4	1	2	4
1	*Ambassidae*	460	3175	30	-	15	1
2	*Gobioidei*	10	165	220	52	21	46
3	*Clupeidae*	2	-	5	-	-	-
4	*Tetrodontidae*	-	-	-	1	-	-
5	*Mugilidae*	-	-	2,5	4	-	2
6	*Syngnathidae*	-	-	-	-	-	50
	Total	**472**	**3340**	**257,5**	**57**	**36**	**99**

Economical fish group: highly valuable, fisherman’s targeting group, comprising of about 20 species, accounting for 1/5 of the species in the study area. Representing this group are Dasyatis zugei, Sardinella jussieu, Chypancdon punetatus, Sanrida undosquamis; Priacanthus tayenus; Canax malabaricus; Decapterus maruadsi; Upeneus maluccensis, Cephalopholis pacchicentron; Epinephelus movera), Saurida undosquamis, Priacanthus tayenus, Caranx malabaricus, Lutianus vitta; Nemipteus sp; Upenneus moluccensis, Dasyatis zugei, Psettodes erumei, etc.

High exportability group: Cephalopholis pacchicentro and Epinephelus movera

Due to its location, characteristics, the fishes ‘distribution are different. They are rich in density, big in size. This group normally moves to the seaside for breeding in the spring-summer when the weather is warm, and when the weather becomes cooler autumn – winter they back to southern side of the Gulf or even further. Some typical species are Sardiaella, Decapterus marnadsi, Saurida undosquamis, Priacanthus tayenus, Caranx malabaricus, Lutianus vitta, Nemipteus sp, Upenneus moluccensis, Dasyatis zugei, Psettodes erumei, etc.

2.3. Socio-economic conditions in the project area

2.3.1. Economic development condition

Cat Hai is a tourism island, the economic structure remains relatively small, only 1,24% of the city’s

GDP. 2004 GDP of the district was 219,4 billion VND, 4,98 million VND /per person. The average GDP growth rate is about 11,9% during 1996-2004. The district achieved its first ever recorded high of 14,4% in 2004. Although the economic growth rate is high but further development needs to be realized in order to catch up with the city and the country.

- Services: incl. trade, hotel, tourism, maritime services, transport services, post and telecommunication, and environment services: these sectors 'contribution have been on increase, accounting for 63,4% while other sectors (agriculture, forestry, fishery) reach only 21% and 15,6% (industry, construction).
- Key economic sectors have been developing more sustainable and expanded.
    - + Fishery increase by 10%
    - + Tourism – hotel increase by 10.5%
    - + Transport increase by 21,9%
    - + Construction increase by 18,5%
    - + Industry increase by 13%

One of the key industry is the fishery which we saw development both in value-added and exportation. 2004 export value was 5.53 million US$. However, there have been certain limitations on technical issues, low productivity, and poor infrastructure.

Fishery production which fish source production achieved 4.1 million litter per year but it provides mainly to domestic market, leaving a small volume for export. 2004 export credit was only 80,000 litter.

Salt production concentrated in Cat Hai island with the scope of 142,2 ha in total, the production increase 13-14% per year. Due to some natural impacts, the production remains low.

Aquatic production and cultivation

Cat Hai leads the Hai Phong city in terms of aquatic cultivation and production for import – export. The aquatic product is considered to be a key of the province, contributing to the production value of the district. Every year the production reach between 80-90 billion dong, bring in job opportunities for local people.

The district aquatic cultivation experienced a good movement over the past 5 years. The average production increase 10,5% during the period 1996 – 2004. In 2004, the area for aquatic cultivation was decreasing to 2,739 has, resulting in the decreasing volume of production to 2,334 tons.

Table 2.37 Some indicators for aquatic products development of Cat Hai district

Indicator	1995	2000	2003	2004	Increase percentage per year (%)		
					1996 - 2000	2001 - 2004	1996 - 2004
Area for aqua-culture (ha)	**2.048**	**2.216,6**	**2.850,1**	**2.739,3**	**1,6**	**5,4**	**3,3**
In which: fish	-	77,4	60,1	67,0	-	-3,5	-
shrimp	-	2.109,2	2.594,1	2.087,3	-	-0,3	-
Production (ton)	**3.027**	**4.848,2**	**7.155,3**	**7.418**	**9,9**	**11,2**	**10,5**
In which: Exploitation	2.689	3.708,7	4.574,1	5.083,9	6,6	8,2	7,3
Cultivation	455	1.139,5	2.581,2	2.334,1	27,5	19,6	23,9

Source: Hai Phong Ststistics Office, 2005

The aquatic production and cultivation in Cat Ba island is well-developed especially for those who are also expanding the services to attract tourism. The shrimp cultivation on-going in Phu Long has its total investment cost of 44,369 million dong.

The average offshore aquatic production increase from 10 to 20% per year, accounting for 50-55% total production volume of the district. In 2004, the value was almost 5,100 tons.

The challenges and outstanding issues at the moment are:

- the production remains low which is yet to maximize the potential availability
- labor forces are not skillful and technically proficient enough
- aquatic production near the sea side became exhausted and affected the sea environment in the area
- investment into offshore cultivation is quite risky
- the infrastructure for fishery development is still poor that makes the production and cultivation inefficient
- the production depends largely on weather and natural condition. The most popular retail export market is China that we may foresee some disadvantages for the fisherman.

2.3.2. Population and labor

Cat Hai island district has a total of 12 administrative units, from these 2 towns and 10 communes:

- 1 town and 6 communes in Cat Ba island
- 1 town and 4 communes in Cat Hai island
- Population as of beginning of 2005 was 28.400, accounting for 1.6% of the city population. Based on the Hai Phong Statistic Office, the population in Cat Hai increases 0.94% on average, much lower than the average of Hai Phong city and the country.

Population structure

- Man/women ratio : 49.5%/50.5%
- Distribution: uneven, mainly in 2 towns and 3 communes namely Hoang Chau, Van Phong, Nghia Lo of Cat Hai.
- Population density in 2 towns: much larger than other communes

Labor structure

Non-agricultural population are the majority, accounting for 87,7%, higher than the average of Hai Phong city (49,2%)

The labor is distributed into the following economic sectors, as of beginning 2005:

- Agriculture, forestry: 1,217
- Fishery: 2,517
- Industry – construction: 3,043
- Services: 5,093

Qualification of human resources

The qualification of human resources in the district is quite low. In 1999, only 100 people who are working in administrative units and hospitals are university graduates. Trained workers account for only 16,5% of the population.

2.3.3. Infrastructure condition

- Culture: 12 cultural houses, 2 radio stations
- Trade: mainly in 2 towns Cat Ba and Cat Hai, 2 markets
- Education: the education system from kindergarten to high school: 2 high schools, 14 secondary schools, 14 primary schools, 46 kindergartens. Total area for schools: 8.63ha
- Health: 1 hospital in Cat Hai and 12 clinics at commune level, 3.02 ha
- Economic units: mainly aquatic production: 1.22ha
- Religious units: 0.4ha
- Salt production units: 154.68 ha
- Tourism places: system of hotels, restaurants, guesthouses on the increase. In 2004, there were total 63 hotels, 27 guesthouses with 1.500 rooms and 3.000 beds.

The infrastructure structure of the district had been improved recently. Several projects had been competed and put into operation such as national transmission line, access road connecting Hai Phong – Cat Hai – Cat Ba, Cat Ba water supply project, etc

1) Transport system

Transport infrastructure condition:

- Road transport: there were total 191.125km road as of 2004 in which 28.045km provincial road, 48.38km district road, 29.5km commune and inter-commune road. All provincial and district roads constructed with asphalt pavement, 100% of commune and inter-commune roads were also concreted. The access road connecting Hai Phong and Cat Hai – Cat Ba, upon its completion, contributed to the smooth transportation from the land to the island.
- Waterway transport: there were total 120km waterway with 3 major lines namely i) Cat Ba – Cat Hai – Hai Phong 55 km long, ii) Cat Hai – Minh Duc, Quang Ninh 30km long, and iii) Cat Ba – Hon Gai, Quang ninh 35km long. Waterway transport is one of the advantage of the district which yet to maximize.
- Port, terminals: 1 fishing port in Tung Vung, Cat Ba, 1 Quay for passenger, 5 ferry for passenger transportation from the island to Hai Phong, Quang Ninh

2) Electrical cable system

- Power supply: 35KV from the national transmission line from the Bieu Nghi Transformer 110/35KV in Yen Hung, Quang Ninh
- Grid: 110/35KV to the mid station Trung Lam 35/10KV and distribute to 13 sub stations 10/0.4KV

The 35KV transmission line from the mid station to Cat Ha island distributes to 15 sub stations 35/0.4KV for the town, national park, and adjacent communes. National power supplies to all districts/communes except for the Viet Hai communes which is still using the generator.

3) Clean water supply system

The electric and water supply station was constructed in 1979. a private com[any is now providing the water supply to people in the Cat Ba island and Gia Luan commune.

The water in Cat Hai island and other 9 communes were sources from digging well, surface water or rainy water. Tapped water consumption increases and reaches 350.000m3 as of 2004. The quality of these water are not guaranteed as it pumped directly from the well without filtration.

To ensure the clean water for daily life and water for production is an important task for Cat Hai during the project implementation.

4) Information and communication system

There is one post and telecommunication center in Cat Hai which could serve the needs of the localities

The subscribed telephone line system covered 100% communes, towns, and residential areas. Numbers of subscribe are on the increase and recorded at 13,2 telephone/per 100 people.

5) Land use condition

The total natural land of the district was 323km2, accounting for 21,3 total area of the city. The land availability is ready and this is found as a very good condition for the city socio-economic development.

Agricultural land: 240 ha agricultural land in total, accounting for 1,3% total natural area, in which 55.24% for perennial trees and 34.76% for yearly trees.

Forestry land: 16.482 ha in total, accounting for 51.01% of total natural area.

- area for fishery production and cultivation: increase 2.81% on average per year and as of 2004, it was 2.739ha, accounting for 8.43% of total natural land of the district
- land for transport, salt production, etc, are also on the increase recently and as of 2004, 529 ha were specialized land, 44% for transport and 24% for salt production.

Residential land: on the increase, accounting for 0.98% total natural area. The availability of natural land is confirmed, accounting for 36.59% of total district natural land. A large part of land in this area could be maximized for socio-economic development.

CHAPTER 3

3. Environmental Impact Assessment

3.1. Sources of impact

As described in chapter 1, SAPROF study team recommended some change in design of the TEDI's port design. There are some major changes in structure and scale of the associated structures such as approach channel depth and length and sand protection dyke. Following are the major changes between TEDI-F/S and SAPROF study.

Item	TEDI F/S	SAPROF study team	Remarks
1. Design vessel for container berth	Fully loaded 30,000DWT vessel Partial loaded 50,000DWT vessel	Fully loaded 50,000DWT vessel Partial loaded 100,000DWT	Total berth length changes from 600m to 750m accordingly
2. Channel Width and Depth	130m wide, -10.3m deep below CDL	160m to 210m wide, -14m deep below CDL	Due to change of design vessels.
3. Length of sand protection dyke	Applying till -3m	Applying till -5m	Total length changes from 5,700m to 7,600m
4. Public Related Facilities/ Service Berth	Not included	1) Land reclamation 2) Service boats berth, 3) Port Admin. Bld., 4) Amenity Bld. 5) Pavement	1) Land Reclamation: 344,000 m^3/Berthfront dredging: 104,000 m^3 2) 375mL x 30m W, -4m, 3) & 4) 4,600 m^2 5) 121,000 m^2

Expected impacts led by the SAPROF's port design are summarized as follows.

3.1.1. Source of Impact relating to Waste

1) Sources of dust and waste

a. Construction phase:

The civil works including berths/terminals, reclaimation, breakwater, sand-control dyke, access road, building, equipment & machinery transportation, etc all are the sources of impact relating to dust and air during the construction stage.

From SAPROF studies, the natural environmental issues concerned to construction stage of the Hai

Phong international gateway port project fall into 3 broader categories.

- Effects due to sourcing of required material for construction works, in particular sand, soil, gravel, stones and rocks that would involve sourcing of these materials from natural environmental areas of lands and also underwater (in particular sand and gravel are widely sourced in Vietnam from rivers and estuaries).
- Dredging and dredged material management issues which is very significant in particular considering the generation of substantial amount of dredged material consequent to the deepening of access channel (the dredged material quantity is estimated around 10 million m3).
- EHS (environment, health and safety) management and monitoring aspects of construction works (by the construction contractor).

Due to the location of the project site, the construction materials and equipment shall have to be transported to the project site by waterway transport.

Dust

The sources are from activities such as digging, land clearance, ground leveling for the construction of breakwater, sand-control dyke as well as for construction materials transportation.

The volume of dust generated during the ground improvement works and transportation will affect people living in the project site and adjacent areas. The ground leveling estimated to consume 2,200,000 m3 soil and sand.

Each activity in construction stage will create the sources of dust. The air polluttion coefficient for some activities is summarized in the table below:

Table 3.1 The air pollutted coefficient during construction

No	Causes of the pollution	Estimated coefficient
1	Dust from ground embankment, leveling	1-100g/m^3
2	Dust from removal of construction materials and equipment	0,1-1g/m^3
3	Dust from transportation vehicles	0,1-1 g/m^3

Source: WHO evaluation document

During the construction period, total volume of dust from transportation activities is estimated and summarized into table below.

Table 3.2 Volume of dust during construction

No	Causes of dust	Volume
1	Dust from ground embankment, leveling	2,2-220 ton
2	Dust from removal of construction equipment and materials	0,2 – 2,2 ton
3	Dust from transportation vehicle	0,2 – 2,2 ton
4	**Total**	**2,6 - 224,4 ton**

Although the volume of dust is relatively large, the impact of the dust would be minimal due to its wide area distribution among on and offshore construction sites.

Discharged air

During the construction, the following equipment shall be used: steam hammer, pneumatic tire wheelchair, pile driving machine, bulldozer, barge, truck, electric wielding, generator, etc. While these quipment run, they will discharge to the air a considerable amount of wastes. Depending on the features of each equipment and methods of transportation, the concentration of discharged wastes are different.

The air pollution caused by transport depends on quality of road, density, vehicle, technical standards and volume of fuel. The WHO have formulated an estimation of hamfull gases dischage from vehicles as follows:

Table 3.3 Waste discharged coefficient of each type of vehicle

Types of vehicle	Unit(U)	SO_2 (kg/U)	NO_x (kg/U)	CO (kg/U)
Diezel-run small truck < 3,5 ton	1000 km/ ton of oil	1,16S 20S	0,7 12	1 18
Diesel-run truck from 3,5-16 ton	1000 km/ ton of oil	4,29S 20S	11,8 55	6 28
Diesel-run big truck >16 ton	1000 km/ ton of oil	7,26S 20S	18,2 50	7,3 20

Source: WHO 1986

Note: 01 vehicle which consumes 1000 litre gasoline on average will discharge to the air:

292 kg CO *11,3 kg NO_x* *0,4 kg Aldehyde* *33,2 kg Hydrocarbon (HC)*

0,9 kg SO_2 *0,25 kg Pb* *S: surphul concentration in gassoline (%)*

Number of transport vehicles and construction equipment are very huge. The volume of wastes discharged to the environment was estimated as in the table below:

Table 3.4 Volume of wastes discharged during the transportation of sand and materials (mg/m3/day)

Wastes / Source	SO_2	CO	NO_x	PM_{10}
Transportation process	14,76S	20,64	40,59	0,115-11,5

Besides the running of all equipment, machinert will also generated a large amount of wastes to the air environment.

Table 3.5 Wastes discharged coefficient of construction modes using Diesel

Equipment	**Discharge coefficient (kg/l)**				
	SO_2	**CO**	**NOx**	**PM_{10}**	**VOC**
Waste carrier	0,00374	0,00993	0,0408	0,00288	0,00485
Ground leveling equipment	0,00373	0,00655	0,0517	0,00266	0,00153
Digger	0,00374	0,0102	0,031	0,00327	0,00228
Bulldozer 110 CV	0,00374	0,0147	0,0343	0,00177	0,00158
Ground roller	0,00373	0,0226	0,0485	0,0029	0,0036
Others	0,00373	0,0184	0,0441	0,00361	0,00404

Total volume of major wastes forecasted to generate as below

Table 3.6 Volume of wastes from construction equipment (mg/m3/day)

Equipment/machinery	**PM_{10}**	**CO**	**NO_x**	**SO_2**	**VOCs**
Pile driving machine	0,285	1,450	3,476	0,294	0,318
Gantry crane	0,059	0,491	1,147	0,125	0,053
Bulldozer	0,251	2,087	4,870	0,531	0,224
Concrete mixer	0,051	0,260	0,623	0,053	0,057
Rammer	0,097	0,497	1,190	0,101	0,109
Ground leveling equipment	0,543	4,230	9,077	0,698	0,674
Water sprayer car	0,009	0,064	0,149	0,016	0,007
Tugboat	0,129	0,657	1,576	0,133	0,144
Cano	0,200	1,023	2,451	0,207	0,225
Generator 50kwA	0,021	0,106	1,094	0,022	0.023
Total	***1,646***	***10,866***	***25,654***	***2,179***	***1,835***

Although the level of pollution is not serious but we need to formulate mitigation measures for risky places

b. Operation phase:

When the Hai Phong international gateway port comes into operation, the major source of pollution is from the modes of transportation including both road and waterway transport, cargo handling equipment such as crane, cargo lifting, etc. Also, gasoline stations are included due to the pumping of oil/gas.etc.

Operational safety in port terminal including navigational safety in ship berthing and effective measures to handle emergency situation like ship accidents, fire is the most significant aspect of port operation. Moreover, effective surveillance system to ensure all ship originated wastes are duly disposed in the port terminal and not illegally dumped into the port waters is also very important.

The other significant aspect is management of maintenance dredging works including disposal management of dredged materials. These measures have added significance also considering the location of the port in the vicinity of Cat Ba Island (a protected national park and world natural conservation area). In effect port operational including navigational safety and both port operation and ship related pollution control issues (including maintenance dredged material management) are the most significant aspects of port operational impacts. All these aspects are basically categorized as EHS (environment, health and safety) of port operational management.

The major equipment for transportation is estimated as below:

Table 3.7 Volumes of equipment

TT	Name of equipment/machinery	Quantity	Power
I	Container berth equipment		
1	Grantry Craine	4	Electric
2	RTG	12	Electric
3	Dragger	20	Diesel
4	Romooc	60	Diesel
5	Fork litf	6	Diesel
II	General cargo, packed cargo berth		
1	Multi-purpose crane 40T	1	Electric
2	RTG 10 – 15T	2	Diesel
3	Cargo lifter 3 – 5T	2	Gasoline
4	Truck10 – 15T	4	Diesel

Fuel for running the above-mentioned equipment are diesel, gasoline, etc. the wastes discharged from these equipment are SO2, NOx, CO. the volume of wastes discharged from the equipment are as follows:

Table 3.8 Volume of wastes diacharged during tendering stage

Equipment/machinery	Quantity	PM_{10}	CO	NO_x	SO_2	VOCs
Dragger	20	5,3	30,66	49,9	3,55	7,37
Romooc	60	15,91	91,99	149,7	10,66	22,11
Fork litf	6	3,30	16,82	40,3	3,41	3,69
RTG 10 – 15T	2	0,343	1,75	4,198	0,355	0,385
Cargo lifter 3 – 5T	2	0,084	43,5	1,45	0,064	1,49
Truck10 – 15T	4	0,198	77,8	3,5	0,125	2,92
Total		**25,8**	**263,3**	**249,5**	**18,6**	**38,4**

Besdies there are some dust and organic sunstances generated during the process of container cleaning.

2) Sources of waste water

a. Construction phase: including

- Daily waste
- Rainy waste
- Construction materials equipment, transport modes, maintenance items

Daily wastes: the average water consumption is 100 littre/per person/per day

Construction wastes: incl. construction materials cleaning, equipment shinning, concrete maintenance, etc. the concentration of organic sunstances are very high

Table 3.9 Concentration of polluted substanced in the discharged wastes

No	Criteria	Unit	Construction waste	QCVN 24:2009/BTNMT (column B)
1	pH	-	6,99	5,5 – 9
2	TSS	mg/l	663,0	100
3	COD	mg/l	640,9	80
4	BOD_5	mg/l	429,26	50
5	NH_4^+	mg/l	9,6	10
6	Total N	mg/l	49,27	30
7	Total P	mg/l	4,25	6
8	Fe	mg/l	0,72	5
9	Zn	mg/l	0,004	3

No	Criteria	Unit	Construction waste	QCVN 24:2009/BTNMT (column B)
10	Pb	mg/l	0,055	0,5
11	As	mg/l	0,305	0,1
12	Oil	mg/l	0,02	5
13	Coliform	MPN/100ml	53 x 10^4	5000

Source: CEETIA

The table shows that the concentration of wastewater is within the limit of the Vietnamese Technical Regulation QCVN 24:2009/BTNMT. Except for the suspension substance which is 6.6 times higher, COD 8 times, BOD 8.6 times and Coliform 106 times.

Rain water: total are for the construction of container terminals for the period 2010-2015 is 48 ha. The average rainfall in the area is 1750mm/year. In the rainy days, the rain sweep away soil, sand, sludge, oil, etc. According to the WHO statistic, the concentration of pollution in the rainy water is normally fron 0.5 – 1.5mgN/l; 0.004-0.03mgP/l; 10-20mgCOD/l and 10-20mgTSS/l.

Table 3.10 Volume of pollution in the rainy water

No	Area and volume	Unit	Container berth for the period 2010 - 2015
1	Total area	ha	48
2	TSS	kg/year	8.400 – 16.800
3	COD	kg/year	8.400 – 16.800
4	Total N	kg/year	420 – 1.260
5	Total P	kg/year	3,36 – 25,2

b. Operation phase

During the operation phase, sources of waste water incl. bilge water, daily waste water, rainy water, etc

The waste water discharged by incoming vessels: normally the waste water from the ship including:

- bilge water
- oily wastes
- oil sludge

The volume of waste water depens on capacity/size of vessels, numbers of vessels calling to the port in a day

Container cleaning water

The clean-up of the cargo storage is often done after the cargo loading. The cleaness of goods depends on type of goods. Normally, water sprout is used to clean the container. After the process, the waste water is pumped into a storage tank and treated when the vessels arrive. However, this way may cause a large volume of accumulated waste water that may spread over to the sea and pollute the environment. Total volume of waste water is estimated about 70 m3/per day.

Daily waste water: comes from the administrative units, houses and WC area of the company. This kind of waste comprises of high concentration of organic substances, solid substances, coliform. The demand of water supply is about 30m3/per day.

3) Sources of solid wastes

a. Construction phase

Solid wastes mainly come from civil works of infrastructure such as construction of berths, breakwater, sand-control dyke, channel dredging and activities by construction workers.

Solis wastes during construction are soil, brick, stone, cement, steel, wood, etc remained from the ground improvement work. In addition to that, the construction materials which spilled over during the transportation would also bring in adverse impact to the residential area/

The volume of dreging is quite huge, which is summarized into the table below:

Table 3.11 Volume of access navigation channel grading and water basis, the period 2010-2015

Crown level of dredged bottom (m)	Crown level of construction works (m)	Crown level of water surface (m)	Volume of dredging works (m^3)		
			Access channel	Turning basin	Total
-10,2	-9,8	+3,5	6.700.367	595.363	7.295.730
-10,7	-10,3	+3,0	8.221.225	720.209	8.941.434
-11,2	-10,8	+2,5	9.865.644	871.562	10.737.206
-11,7	-11,3	+2,0	11.647.366	1.054.614	12.701.980
-12,2	-11,8	+1,5	13.547.609	1.282.357	14.829.966

During the period 2010-2015, the CDL level at the bottom is -10,7m, volume of dredging was 8,941,434m3 in total in which navigation channel dredging was 8,221,225m3 and 729,209 for the water basin. (Final F/S report, TEDI May 2007.

The solid wastes, come from activities of construction workers, contain many organic substances and nylon bag. It is forecasted that the average volume was 0.6kg per person per day while the numbers of construction worders was 700. The daily wastes in this period is approximately 420kg per day. A portion of daily wastes could be collected and utilized for another purposes. Wastes that are not able to recycle will be transported to the regulated area.

b. Operation phase

Solid wastes during the operational stage of the Lach Huyen port are sources from (i) daily solid wastes and (ii) mud from periodical dredging of the water basin.

The volume of daily solid wastes discharged by 150 construction workers is approximately 90kg per day (the average daily solid wastes per person is 0.6kg/per day). Basic elements are fissile organic substance.

The volume of mud collected from the periodical dredging is forecasted to be as large as the volume of alluvial originately from the sandy mud and bottom sand approximatelt 2,915,000m3 (Source: Final report, the Feasibility Study of Hai Phong International Gateway Port Construction Project, TEDI May 2007 and Calculation Result in Appendix 7). The volume is very large, the alternative for dumping site are presented in Chapter 4.

4) Sources of hazardous wastes

a. Construction phase

Hazardous wastes that possibly generated during the constructional period are oily wastes. Although it is difficult to quantify its volume but it is possible to forecast the types of oily wastes (oil sludge, other oily wastes) possibly generated during the repair and cleaning construction equipment. The volume of oily wastes in this period is forecasted to be minimum.

b. Operation phase

Sources of hazardous wastes: a small portion of daily solid wastes such as used bulb, battery, etc. Daily operation is likely to discharge oily wastes and scummy oil from the treatment system, estimated at approximately 5 tons per year. This kind of waste has to be treated in accordance with the standard and regulation.

3.1.2. Sources of impact not relating to waste

1) Loss of land and coastal fishing area

Due to the change in design and scope of the project, it is required to secure the land on Cat Hai island and the coastal waters in Lach Huyen estuary adjacent to Cat Hai island (ref. Section 1.4). The expected sources of impacts are as follows:

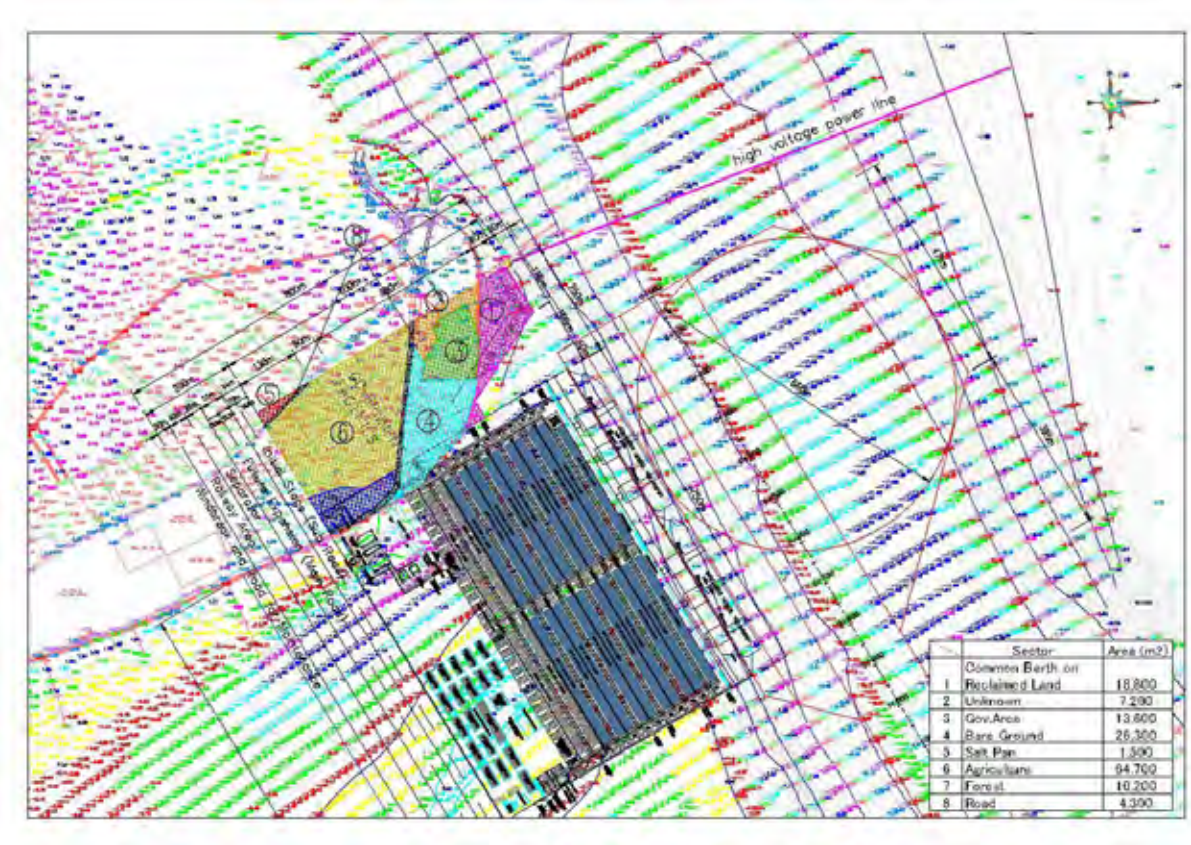


Figure 3.1 Source of impacts relevant to loss of land and coastal fishing area

a. Loss of land on Cat Hai island by public related facilities

As shown bellow, the effective source of impact area would be 11.4 ha on Cat Hai island due to the assumption of the continuous operation of the existing public related facilities..

Present Use	Area (m^2)
1. Unknown use	7,200
2. Gov. facilities*	13,600
3. Bare ground	26,300
4. Salt pan	1,500
5. Acureculture pond	64,700

Present Use	Area (m^2)
6. Forest	10,200
7. Road	4,300
Total	127,800
Considerable source of impact*	**114,200**

* Because the existing governments' facilities (border control and VTS station) are likely to serve their function without any change in the public related facility area, the existing Gov. facilities should not considered as a source of impacts.

b. Loss of coastal fishing area

As shown bellow, the maximum source of impact area would be 208 ha in and around Lach Huyen estualy adjacent to Cat Hai island. Since the 2) access channel and 3) turning basin are currently serving as channe and there are least fishing activities in such area, they could be considered as souces of partial impacts. In addition, the assumed impacted area of the sand protection dyke would be less than the assumed area due to the simplified calculation for the impacted area, So, the considerable impact source of the sand protection dyke should be considered as reference purpose and expected to be less than the assumed area.

Present Use	Area (m^2)	
1. Container terminal with service road	561,750	= 750m (L) x 749m (W)
2. Access Channel	278,400	= 160m (W) x 1,740m (L)
3. Turning Basin	342,200	= 660m (D) x 660m (D) / 4 x PI
4. Sand Protection Dyke*	334,400*	= 24-44m (W)** x 7,600m (L)
Total	2,078,500	= 750m (L) x 749m (W)
Considerable source of impact*		**2,078,500**

* maximum impacted area assumed by 44m (W) x 7,600m (L)

** width of the sand protection dyke vary depending on the water depth.

2) Labor safety and community health

With regards to the labor safety issue, all kinds of works at site such as transportation, cargo handling and installation of equipment and machinery, utilization of electricity during construction, etc is likely to create some risks if safety measures and preventive action are missing.

With regards to community health, this should be highly prioritized because the project gathers a large numbers of labors and therefore labor's life need to be ensured at least living spaces, clean water, etc. Those who are working at the site during the bad weather condition are likely to be infectious and

likely to spread to local community.

3) Noise and vibration

During the construction period, the operation and installation of quipment such as concrete mixer, compressor, truck, excavator, etc are very noisy. In order to assess the level of noise of equipment at the site, we could refer to the U.S noise regulation standard mentioned in Table 3.12.

During the operational period, the noise is mainly sources from the transportation vehicle, cargo handling vehicles, etc. the area which is most noisy are wharl, access road, cargo handling storage, cargo loading yard.

Table 3.12 The noise of the construction equipment

Equipment/Machinery	Noise 15 m away from equipment (dB)	Criteria
Pile driving equipmwnt	90-104	
Hammer and driller	76-99	
Truck	70-96	
Gantry	72-96	
Ground roller	72-88	6h ÷18h: 80
Dragger	73-96	18h ÷22h: 75
Ground leveling equipment	77-95	22h ÷6h: 65
Asphalt pavement	82-82	
Cement mixer	71-90	
Generator	70-82	
Rammer	70-80	

4) Alluvial in the access channel

a. Alluvial of the access channel based on previous studies

According to previous study, the Lach Huyen channel used to start from Trap estuary to "Buoy #0: 20-4.3'N, 106-59.6'W", which could be divided into 2 main section with different level of alluvials

The section from Trap Canal to Xuan Dan: based on 1990 and 1995's data, the level of alluvial was from 0.02m ÷0.15m/per year and decreasing from the indie to outside (the section from Ben Got to Xuan Dan was stable). This explains that the volume of alluvial in Lach Huyen is minimal.

The section from Xuan Dan to Buoy #0: including the section from Xuan Dan to the deep level of -4.0m and from the deep level of -4.0m to Buoy #0.

The section from Xuan Dan to the deep area -4.0m: the total length is 3.0km, the level of alluvial is 0.15m÷0.2m/ per year. According to the observation of the sample hole from November 2005 to July 1997 with the level of -2.5m deep, and 160m long.

The average thickness of alluvial level is 1.55m/every 20 months. The speed is faster in the dry season.

Dry season from Nov.1995 ÷April.1996: the thickness ≈0,11m/month

Rainy season from May 1996 ÷Oct.1996: the thickness ≈0.08m/month

The average thickness of alluvial per annual ≈ 1.22m, accounting for 45% total length of dredging

The section from -4.0m to Buoy #0: the topography is quite stable. Based on the survey conducted in July 1995 and1997, after 2 years the area reaches additional 0.08m deep. This means the navigation channel in the area is quite stable.

b. Current alluvial conditions based on survey data

At present, the dreging works in the Lach Huyen channel have been executing following the standard: width B =100m, CDL of design speed -7.2m. The survey conducted in September 2004, November 2005, May 2006, August 2006, November 2006, June 2007 and September 2007 showed that:

The actual length of the dredging works ≈1,400m, the average width of the dredged area ≈163m, the average thickness of dredged layer ≈3.30m.

The average level of alluvial on the whole section Ptb=0.202, the average thickness ≈0.70m per year. The volume of alluvial in the first year was ≈1,301,000m3.

The survey also revealed that the average thickness of the alluvial from November 2006 to September 2007 was only 16cm. It means the level of alluvial in the 2nd year of its operation tends to decrease due to the slope landslide.

In order to utilize the result of quantifying alluvial in Lach Huyen as mentioned in the table 3.13 into the forecast of the alluvial in different desin specification, the average alluvial coefficient per annual was defined.

Ht =Ho (1-P)
P: the annual average alluvial coefficient
Ht: channel's depth at an average level after t time
Ho: channel's depth at an average level after the dredging
T: calculation time

From the 7 surveys with 58 typical cross-sections, the average alluvial coefficient of the Lach Huyen was defined as in the table 3.13 below.

Table 3.13 The average alluvial coefficient

Average alluvial coefficient per year	Alluvial coefficient in different survey times				
	05/2006	**08/2006**	**11/2006**	**06/2007**	**09/2007**
P	0,275	0,223	0,212	0,146	0,152
P_{tb}	0,202				

In addition to the previous studies, The SAPROF study conducted comprehensive analysis of the sedimentation with bathymetric survey in November 2009. Based on the section 8.1 (Sedimentation in Lach Huyen Channel) of The SAPROF study, the updated alluvial condition is as follows:

c. Depth changes in existing channel

The changes in water depth within the channel are shown in Figure 3.2. with the form of longitudinal cross section between proposed project area and buoy #0. The upper figure shows the longitudinal profile of the channel center and the lower figure shows the net depth change plotted based on the profile in November 2006.

The survey in November 2006 shows the channel bottom one year after completion of the initial dredging work. The figure indicates that significant sedimentation has occurred in the area of Km36-42 and slight erosion has occurred in the area of Km29-32. From these characteristics, it is confirmed that sedimentation in Lach Huyen channel is significant in the offshore part of the channel.

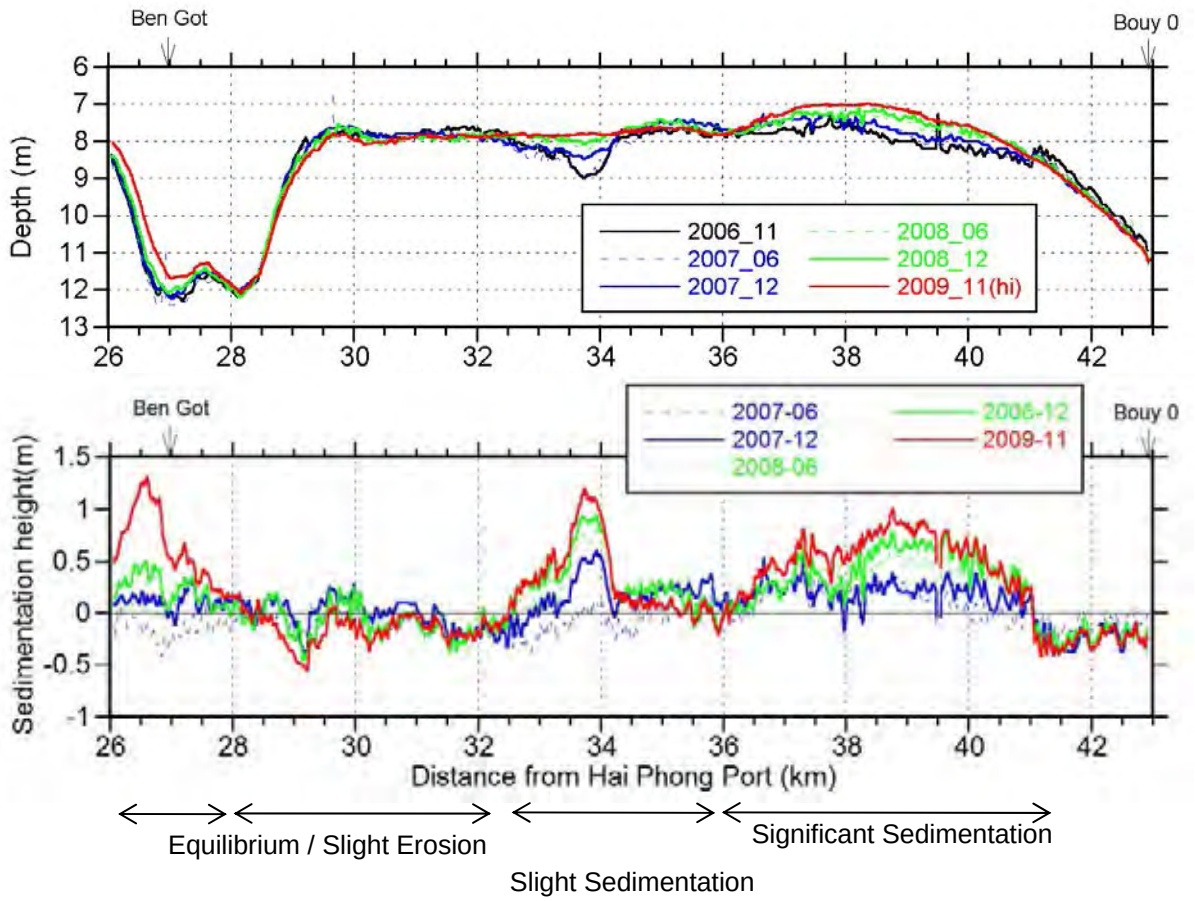


Figure 3.2 Topography on the center line of the channel and sedimentation height based on 2006.11

d. Sedimentation Speed

Figure 3.3 shows the sedimentation speed at each location. The sedimentation speed is relatively fast in Km37 to Km42, the offshore part of the channel. The sedimentation speed is negative in Km29 to Km32, which shows erosion. In Km33 to Km35, the sedimentation speed is fast because the area is partly deeper and refilled.

The averaged sedimentation height was calculated by integration of the net accretion area along the channel. The result is shown in Figure 3.4. The averaged sedimentation height is plotted with respect to elapsed months after the completion of initial dredging in the end of October 2005. The plotted data include the data written in the report by JOPCA (2009) with the data collected by The SAPROF survey. The curve in the figure is the regression curve of the all data. As shown in the figure, the averaged sedimentation height gradually increases with the elapsed months, but decreasing the sedimentation speed.

The annual sedimentation speed estimated by the regression curve is shown in Figure 3.5. The sedimentation in first year is much higher than that of second year or later. The survey data of October 2005 shown in Figure 3.6. However, it is confirmed that the high sedimentation in the first year is induced by that the excessive dredged area around Km34 to Km41 had been refilled. On the topography of November 2006, the excessive dredged area is almost refilled, and therefore it is considered that the sedimentation speed decreased significantly after November 2006.

From the analysis described above, characteristics in sedimentation in Lach Huyen channel are summarized as follows.

- Most of sediments around the channel are mud (silt and clay), and the sedimentation is induced by siltation.
- Sedimentation speed is different from place to place along the channel, and the location of significant sedimentation is from Km37 to Km41, the offshore part of the channel.
- In the area of Km29 to Km32, no sedimentation has been occurred in the present situation. Because the area is located near the entrance of Lach Huyen estuary, the strong tidal currents usually act on the bottom and do not allow sediment to deposit.

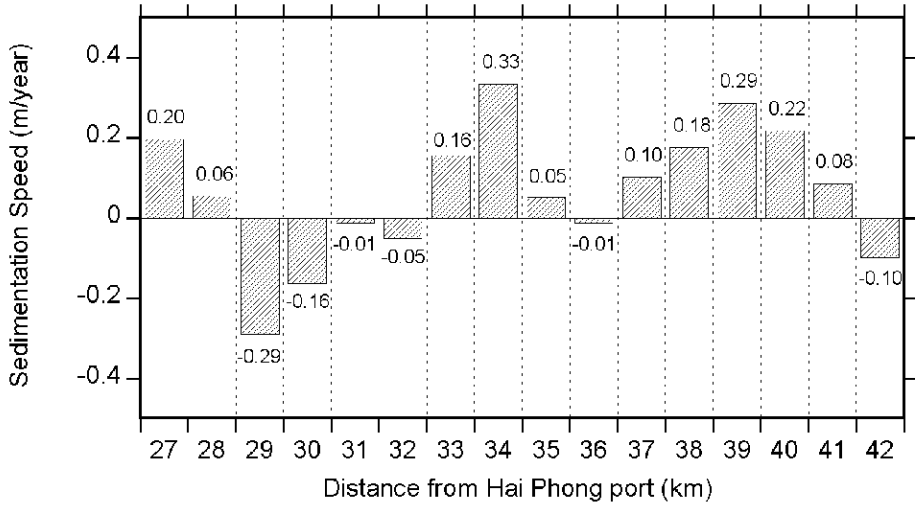


Figure 3.3 Recent sedimentation speed of Lach Huyen Channel

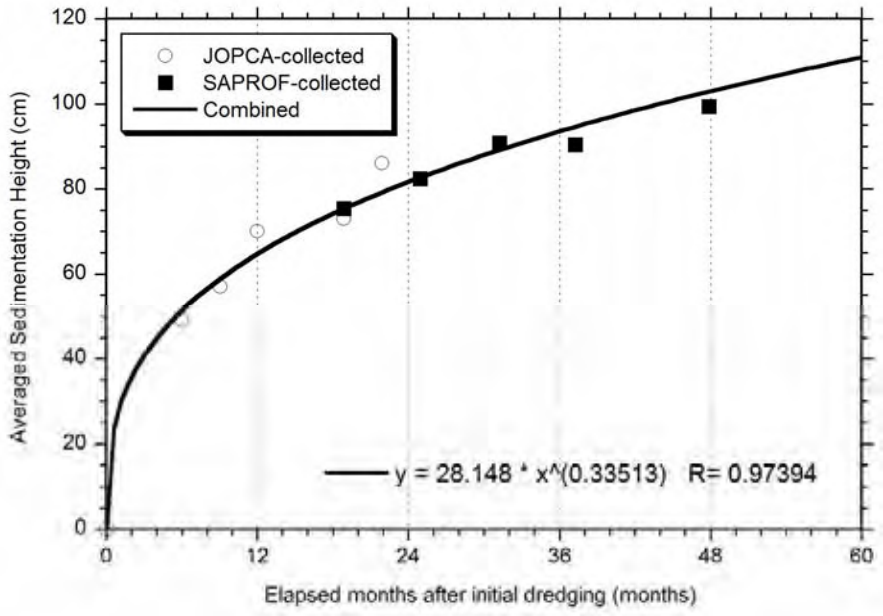


Figure 3.4 Averaged sedimentation height and the regression curve

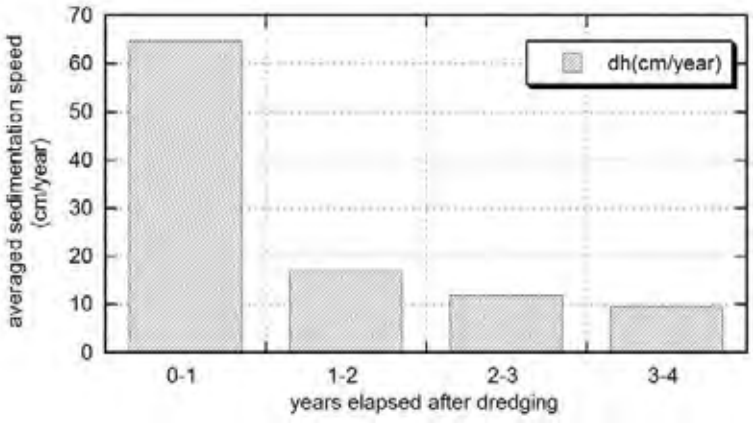


Figure 3.5 Averaged sedimentation speed every year after dredging

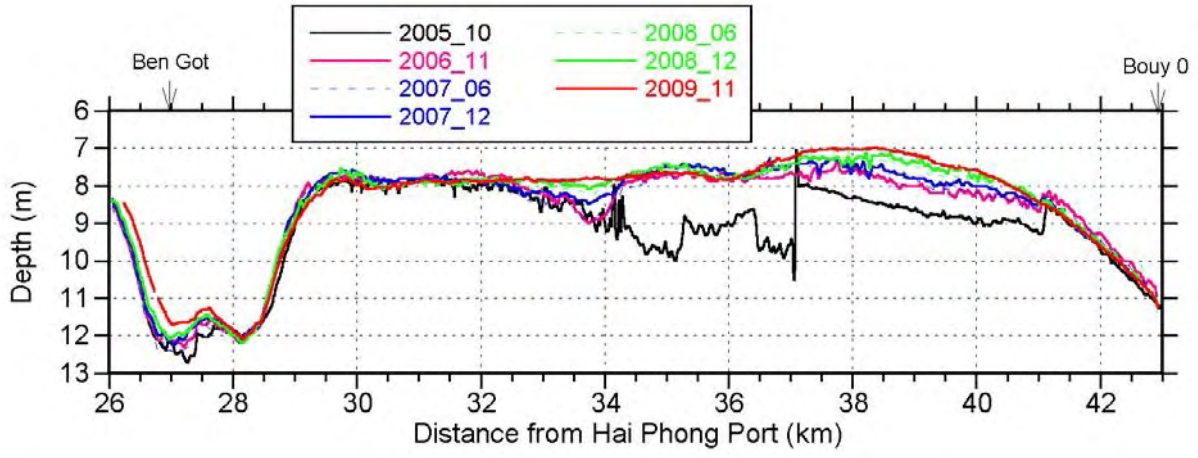


Figure 3.6 Longitudinal cross-section along the channel including the data of October 2005

e. Forecast of the alluvial deposit along the channel

In order to predict sedimentation in Lach Huyen channel, numerical simulations have been carried out by the SAPROF Study. As shown in existing allubia studies and the SAPROF surevey result, conteniuous and significant sedimentation in Lach Huyen channel is clearly induced. The siltation is the phenomena that the cohesive sediment such as silt and clay is moved up from the seabed by waves and currents and flows into channel bottom. As the cohesive sediment is typically transported as suspended load, the advection-diffusion sediment transport model is applied to simulate the sedimentation.

In order to minimize the maintenance dredging and maximize the efficiency of public expenditure for long-turm, “Sand protection dyke/training dyke” was originally proposed by TEDI. The SAPROF Study also extended the analyses of the most economical options for such objectives. The TEDI’s original design of the dyke was the length of 5,700m from retaining wall of the port up to water depth of CDL-3.0m. As shown in Figure 3.7, several opton was considered by the SAPROF Study including without dyke conditions, and recommended option was given in Table 3.14.

Based on the series of cost analysis, The SAPROF Study recommends the construction of sand protection dyke to be:

Length: 7,600m up to the water depth of CDL-5.0m
Crown highgt: CDL +2.0m.

Detailed description of the simulation model and results shall be referred to chapter 8.2 Numerical Simulation of The SAPROF Study. Following is the summary of the SAPROF’s simulation result.

f. The Sumary of the Siltation Study By The SAPROF Study

- Once channel is dredged to -14m water depth without any terminal and dykes (Case 3 in Figure 3.7.), the volume of sedimentation is estimated at 1,491,000 m^3 per year (6,873,000 m^3 for 1st year). This annual rate of sedimentation by siltation along Lach Huyen access channel is smaller as compared with those predicted in the previous studies.

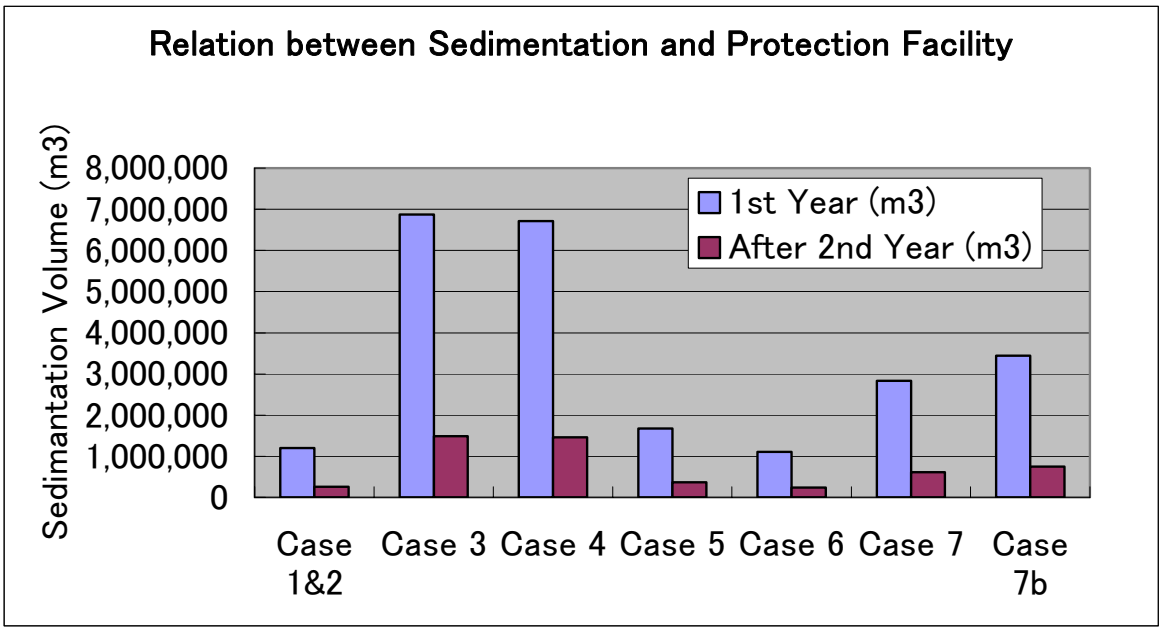
- Sedimentation by siltation could be decreased by the construction of sand protection dyke along access channel (Cases 4 to 7)

- .Possible volume of sedimentation is estimated around 1,456,000 m^3 per year (6,712 th m^3 for 1st year) in case of no sand protection dyke (Case 4 in Figure 3.7.), but this could be decreased to 364,000 m^3 per year (1,678 th m^3 for 1st year) or 614,000 m^3 per year (2,829 th. m^3 for 1st year) in case sand protection dyke is constructed up to the water depth -10m or -5m respectively (Case 5 and 7 in Figure 3.7.).

- The rate of sedimentation differs by the location along the access channel waterway. Once the sand protection dyke is constructed to -10m or -5m water depth (Case 5 and 7 in Figure 3.8.), it is predicted that the accretion zone along the channel occurs at the offshore area from a distance of 37 km from Hai Phong Port.

g. Comparison of the most feasible options for the sand protection dyke construction

Three (3) cases of construction scenarios are compared in Table 3.14. Although the maintenance dredging cost is higher than other two seenarios, “Scenario 3” is the most economical option even for a 50years long-term investment project. SAPROF recommended the scenario 3 as the most suitable option to balance the initial investment and maintenance dredging. Therefore, we considered the Scenario 3 as the souce of impacts relevant to the proposed port development project in the latter sections and chapters.



Case	Protection Facilities	1st Year (m3)	After 2nd Year (m3)
Case 1&2	Present state (approx. −8m)	1,200,000	260,000
Case 3	−14m without Structure	6,873,000	1,491,000
Case 4	−14m with Terminal Facilities	6,712,000	1,456,000
Case 5	−14m with Terminal Facilities and Training Dyke up to −10m deep and 1.5km apart from Channel	1,678,000	364,000
Case 6	−14m with Terminal Facilities and Training Dyke up to −10m deep and closed to Channel	1,107,000	240,000
Case 7	−14m with Terminal Facilities and Training Dyke up to −5m deep with 1.5km apart from Channel	2,829,000	614,000
Case 7b	−14m with Terminal Facilities and Training Dyke up to −5m deep with 1.5km apart from Channel (hc=2.0m)	3,442,000	747,000

Figure 3.7 Relation between Sedimentation and Protection Facility

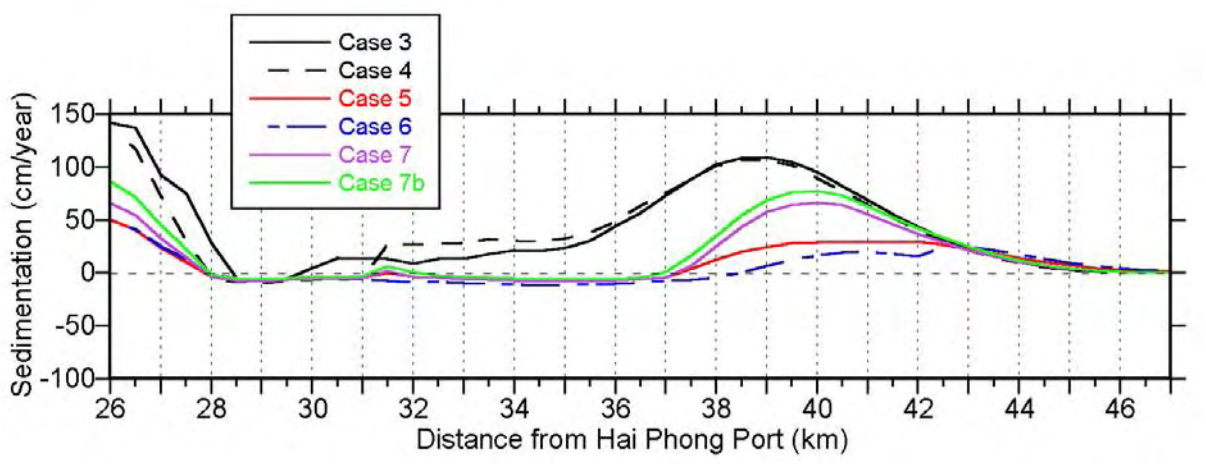


Figure 3.8 Predicted sedimentation speed with channel of 14 m in depth

Table 3.14 Construction Scenario of Sand Protection Dyke

	Scenario 1	Scenario 2	Scenario 3
Water Depth	● Up to -10m initially	● Up to -5m initially and ● extend to -10m after 5 years	● Up to -5m initially and ● no extension in future
Length and Top elevation of Dyke	● 11,500m ● +4.0m	● 7,600m initially and ● 11,600m after 5 years ● +4.0m	● 7,600 m initially (with provision of wider access channel for the portion of no protection dyke) ● +2.0m
Investment Cost	● 529 mil. US$	● 575 mil US$ ● (295 mil US$ +280mil.US$)	● 294 mil US$ ● (205 mil US$ +89 US$)
Maintenance Dredging Volume	● 1st Yr: 1,678 th.m^3/y ● Succeeding Yrs: 364 th. m^3/y	● 1st Yr: 2,829 th.m^3/y ● Succeeding Yrs: 614 th. m^3/y ● After 9 Yrs: 364 th. m^3	● 1st Yr: 3,442 th.m^3/y ● Succeeding Yrs: 747 th. m^3/y
Maintenance Dredging Cost	● 1st Yr: 8,3900 th. US$ ● Succeeding Yrs: 1,820 th.US$/y	● 1st Yr: 14,145 th. US$ ● Succeeding Yrs: 3,070 th.US$/y ● After 9 Yrs: 1,820 th US$/y	● 1st Yr: 17,210 th. US$ ● Succeeding Yrs: 3,735 th.US$/y
NPV for 50 Yrs	● **494 mil US$**	● **475 mil US$**	● **322 mil US$**
Evaluation	-	-	**Recommendable**

3.1.3. Forecasts the risks of environment impact caused by the project

1) Fires accident

Fire accident due to fuel storage explosion may happen and may cause serious impact to the environment in the project area and surrounding area. The followings are the causes for fire explosion:

- Seriuos vessels' crashes
- Leakage of oil, liquid gas, and other inflammable things from container on the way of transportation to vessels or on the way of cargo handling
- Leakage of oil, liquid gas, and other inflammable things from storage and repair shop.

2) Shipping accident

Shipping accident normally cause losses both in terms of human and property. Besides, it also brings in serious disaster due to oil leakage. In a special circumstance, it may also cause fire explosion.

In addition to the losses of ships, shipping accident is regared as a serious problem. Whenever accident taken place, the oil leaked out and form a layer preventing the atmosphere Oxy's endosmous to the water, causing shortage of Oxy's dissolve into the water, increase the fastidious activities and kill the fish and cause negative impacts to the water eco-system; oil comes to the seaside pollute the sandy mud and the salt-marsh forest or the tourism activities. Especially, special attention should be paid to the fire by oil spreading in the sea. All activities need to be carefully done to avoid leakaging to the water surface. Furthermore, if the oil spread to other ships, the risk of mass explosion may happen at the same time.

In case the ship crashes to each other, the impact to environment may varies from one to another from with different levels. Impacts to the environment such as: losses of ships and equipment, oil leakage from the storage tank and losses to construction workers and crew members also.

3.2. Environment impact assessment

3.2.1. Impact assessment during preparation stage

In this stage, the primary impacts are led by land acquisition, loss of fishing area and unexploded ordnances' (UXOs) clrearance.

1) Natural ecological system

The land acquisition and bomb and mine clearance in the pre-construction stage causes impact to the eco system in the project area, to the livelihood of species along the seaside. However, such activities to be carried out in a small scope and therefore the impact to the eco system are minimal.

2) Land area

As described in the section 3.1.2.1, the expected impact of land use change would be 11.4Ha (considerable inpact) excluding the existing government facilities, which is likely to function as a part of the new port's public facilities without major change (Table 3.15.). Based on the field observation by SAPROF experts and MPMU2 representatives at the site, there are no acuaculturea l activities in the expected land clearance pond.

At this moment, MPMU2 is preparing the detailed land survey and land acquisition plan with the collaboration with relevant authorities. Detailed land use information and land acquisition plan will be given and implemented in six (6) month after MPM2 starts the initial process. Thus, we assumed the potential impacts on the land as follows:

Table 3.15 Expected Impacts by Land Aquisition

Present Use	Area (m^2)	Pottential Impacts
1. Unknown use	7,200	There are no sign of land use at this moment. However, the property is just next to residential area so that the land use rights may belong to private. In case it does not belong to public, it is necessary to aquire the land with market price as defined by the effective regulations.
2. Gov. facilities	13,600	No potential impacts are expected due to its present fanctions.
3. Bare ground	26,300	There are no sign of land use at this moment except 5 graves. 5 graves will be relocated by the full support of responsible authorities.
4. Salt pan	1,500	This salt pan is still active in use. Though the acquired portion of the land would be minority of the targeted area, but it would be majority of the targeted area in case we count affected area by TanVu-LachHuyen Highway land clearance. In the case of the minor impacts, it would be only compensated by monetary under present regulation. In the case of the major impacts with the consideration of highway construction, not only menertry or land to land compensation but also support for livelihood recovery are also needed.
5. Acureculture pond	64,700	Based on the MPMU2's explanation, the acureculre ponds belong to the border control office adjacent to the ponds.Since there are no activities in the pond at this

Present Use	Area (m^2)	Pottential Impacts
		moment, we assumed no impacts on the either local communities and the border control office.
6. Forest	10,200	The forest befolngs to the local community and thre are no sign of the environmentally essential species. Due to the land clearance for the highway, majority of the community forest will be cleared.
7. Road	4,300	These two (2) roads are primary connection between Cat Hai TT (town) and Got harbor at this moment. Reroutes along the public facilities of the port will be constructed and present necessary connection between Cat Hai TT and Got harbor.

3) Coastal fishing

As shown bellow, the maximum source of impact area would be 208 ha in and around Lach Huyen estualy adjecent to Cat Hai island. Based on the SAPROF experts' basic survy to understand the coastal fishing activities, there are significant number of coastal fishermen belonging to the Cat Hai district or adjecent area and immigrant fishermen belonging to far region and living on their boats. Due to the characteristics of the fishing, fishermen follow the fish to get yield so that it is not easy to estimate the precise loss or impacts. However, it is highly recommendable to conduct detailed base line survey to consider the potential safeguard policy for such affected people.

Table 3.16 Expected Impacts on Coastal Fishing

Present Use	Area (m^2)	Pottential Impacts
1. Container terminal with service road	561,750	There are active coastal fishing in the area due to the favorable environment for small fish, shell fishhis, and shrimp, and octopus are actively taken by local and imigrant fishermen living on the fishing boats. The . fishing area will be permanently removed so that it is highly recommnendable to provide reasonable safeguard measures to maintain or improve the standard of living for those who depend on coastal fishing in the project area. Though there are no safeguard policies at this moment under Vietnamese law and regulation, Hai Phong people's committee (the responsible authority) and MPMU2 (the responsible implementation agency of the project) shall pay attenthion to such fishermen and implement a safeguard policy for such people on time.
2. Access Channel	278,400	Few potential impacts are expected due to its present fanctions. Though there are some fixed fishing nets along the existing channel, they have already been compensated for the relocation of the net for the port development project. However, deepening and widening of the channel might lead further loss of the fishing area.
3. Turning Basin	342,200	Some fixed fishing nets are observed at the proposed

Present Use	Area (m^2)	Pottential Impacts
		turning basin. Such fishing net owner may have already been given a 500,000VND for the relocation of the fishing net in the past. There are also some coastal fishing activities in the area at this moment.
4. Sand Protection Dyke	334,400	The cross section of the dyke increases water depth respectively. The dyke is also constructed on the shallower area along the channel where preferable fishing area at this moment. It is highly recommended to conduct detailed fishing survey to estimate the potential loss of fishing and discuss any possibility of occupation change as a sustainable solution.

4) UXO clearance

As suggested by the approval decision of the proposed project's EIA dated 31 October, 2008, UXO clearance is requied before the construction works. The failuar of the UXO clearance may possibly cause the faital accidents in the construction and operation stage. Though the possibility of the UXO existence in the region is low, it is reuired to provide secure environment for the contractors and operators.

3.2.2. Impact assessment during construction phase

During the construction period, the number of vehicles transporting construction materials, equipment, machinery, construction workers, equipment installement workers will increase rapidly and thus likely to cause negative impact to the environment such as dust, noise, air temperature and labor accident. Major impacts to the project during the construction period are:

- Change eco system when executing ground leveling
- Adverse impact caused by dust to construction workers and residential people during the construction materials transportation
- Adverse impact caused by fuel's burn by transportation vehicle, construction equipment
- Adverse impact caused by noise and vibration from construction equipment
- Adverse impact caused by daily waste water discharged by construction workers
- Adverse impact caused by rainy water filled-over in the project area
- Adverse impact caused by solid waste from construction activities

In general, during the construction stage, the project will cause a series of adverse impacts to the environment and to the people's health in which most seriously are dust and noise.

1) Impact to air condition

Major scope of works during this period are: ground leveling, infrastructure, storage, breakwater (3,900m) and sand-control dyke (5,700m) will bring in adverse impact to the environment. These impacts are categorized into 2 groups:

- Impact to the construction workers at the site
- Impact to surrounding area such as dust during transportation, ground leveling

Dust is harmful to people's health such as respiratory organ, eye, skin and digestion system, etc. The level of dust concentration into our respiratory organ's could be summarized as below:

- a speck of dust with diameter < 0.1µm is not kept in the lung and is expelled through breath
- a speck of dust with diameter in the range 0.1 ÷0.5µm, 80% ÷90% is kept in the lung
- a speck of dust with diameter in the range >0.5µm is kept in the nose

In case where the dust concentration is up to 200µm/m3 (0.2mg/m3) in 8 hours, the impact to human and animal is serious. A small speck of dust will cause asthma, pneumonia, and bronchitis. Dust left in the trees' leaves is likely to reduce the photosynthesis process and delay the trees' growth process. When the dust falls into the water, it makes the water turbid. If the dust composes of hazardous substance, when dissolves into the water, it limits the development of species. However, dust's impact is regarded as minimal which could be controllable by watering or covering. Add to that, as the project location is nearby the sea, the numbers of residents are only a few, dust will mainly affect construction workers at the site. The majority of dust are speck of sand and thus its impact to human and environment is not serious because speck of sand is normally accumulated in the air and is not stick to trees' leaves or equipment/machinery.

Air pollution brought by NOx, SO2, CO, VOC is generally minimal and temporary, only at the construction site or along the access road only.

2) Impact caused by rainfall during construction

In rainy days, rainy water spilled over in the project area will swept along soil, sand, sludge, oil to the ditches. If such waste water is not properly treated, they will cause negative impact to the surface water, underground water and species in the area.

3) Impact caused by waste water during construction

Wastewater from construction contains of sludge, construction materials, and oily waste, ect. The criteria for suspension substance is 6.6 times higher than the allowable limit, 8 times as for COD, 8.6 times as for BOD_5 and 106 times as for Colifoen. Daily wastes from construction workers contains of

suspension solid waste, organic substance, and microorganism. Without proper treatment facilities, these two kinds of wastes would flow down to Cat Hai area through sewer and cause negative impact to the eco system in the area. However, as the treatment of daily waste has been done and proper water treatment facilities is expected to be installed by the responsible public authorities, the concentration of polluted substances shall not be the significant impacts on the environment. Furthermore, organic polluted substances will be swept away by the sea water and be used as a nutrition source for some species. A part of suspension solid waste will also be swept away by the water flow while the another part may be accumulated to sediment. Therefore, the impact of waste water during the construction period is not serious.

Table 3.17 below estimates total volume of waste water discharged by a number of 700 construction workers in 3 year times (310 working days per year).

Table 3.17 Total volume of polluted substances form daily wastes during the construction period

No	Polluted substances	Discharged volume (g/person/day)	Total volume of discharged wastes of the whole construction period (tons)
1	BOD5	50	32,6
2	COD	90	58,6
3	Total suspension solid substances	100	65,1
4	Oil	20	13,0
5	Total Nitto	9	5,9
6	Total surphur	2	1,3
7	Amoni	4	2,6
8	T-Coliform	108	65×1012

4) Impact caused by noise

The level of impact is anticipated based on the following fomula:

The noise from the distance of 200m or above is higher than the allowable limit for the residential area (from 6:00 am to 18:00) in accordance with TCVN 5949:1998 (75dBA). During the construction period, the noise will cause impact to the residential area at the construction site.

Table 3.18 Noise impact to the human being by level and timing of impact

Noise level (dBA)	Impact timing	Impact
85	Nonstop	Safe
85-90	Nonstop	Uncomfortable impact
90-100	Immediate	Light impact, return to normal after such period
> 100	Nonstop	Seriously damage to hearing

Noise level (dBA)	Impact timing	Impact
	Immediate	Certain impact but avoidable
100-110	Several years	Cause Deaf
110-120	Several months	Cause Deaf
120	Immediate	Seriously damage, uncomfortable
140	Immediate	Painful in hearing
>150	Short time	Physical harmful to hearing

Source: World Bank, EIA Report of Nongtrai Limestone Mine in India, 2002

Noise impact to human being depends on intensity and timing. Level of noise impact to human being was studied and shown in table 3.18. During the construction period, many civil work items will be constructed at the same time and thus the construction equipment/machinery will be utilized at the same time, and the noise impact is quite serious, especially to the health of costruction workers.

5) Impact caused by dredging works & dumping of the dredging materials and solid waste

During the construction period, the project owner shall implement the dredging works at the access channel and turning basin. The volume of dredged mud is much larger than that of TEDI's development plan (8,941,434 m^3) The volume of the SAPROF's proposal is 35,635,301m^3 including channel dredging (32,300,860m^3) and port and relevant facilities' construction (3,334,441m^3).

Based on the attachment of The Approved EIA report, the people's committee of Hai Phong city gave permission to the implementation agency of the new port development to dump the dredged material in the six (6) locations that are capable to handle 50,000,000m3 (No.2702/UBND-GT of the people's committee of Hai Phong city dated 19th May, 2008). Such dump site will be fully covered by retaining wall or other necessary measures to maintain the dumped material within the area so that the impacts of the dredged material would be limited within the permitted dump area where the area has already been secured for the soild waste management.

The proposed dump site at the Nam Dinh Vu (South Dinh Vu) is also permitted as a coastal industrial development zone and has acquired the EIA approval from MONRE (Decision 2457/QD-BTNMT dated December 23, 2009, MONRE, approving environmental impact assessment of South Dinh Vu Development Joint Stock Company (SDVDC) and Decision 570/QD-BTNMT dated March 24, 2010, MONRE, approving environmental impact assessment of Hai Phong Industrial Zone (HAPCO).

Thus, the environmental impacts of SAPROF's port design should be considerd as the same level as the approved EIA as long as the dredged material is properry managed within the permitted dump sites (Figure 3.9).

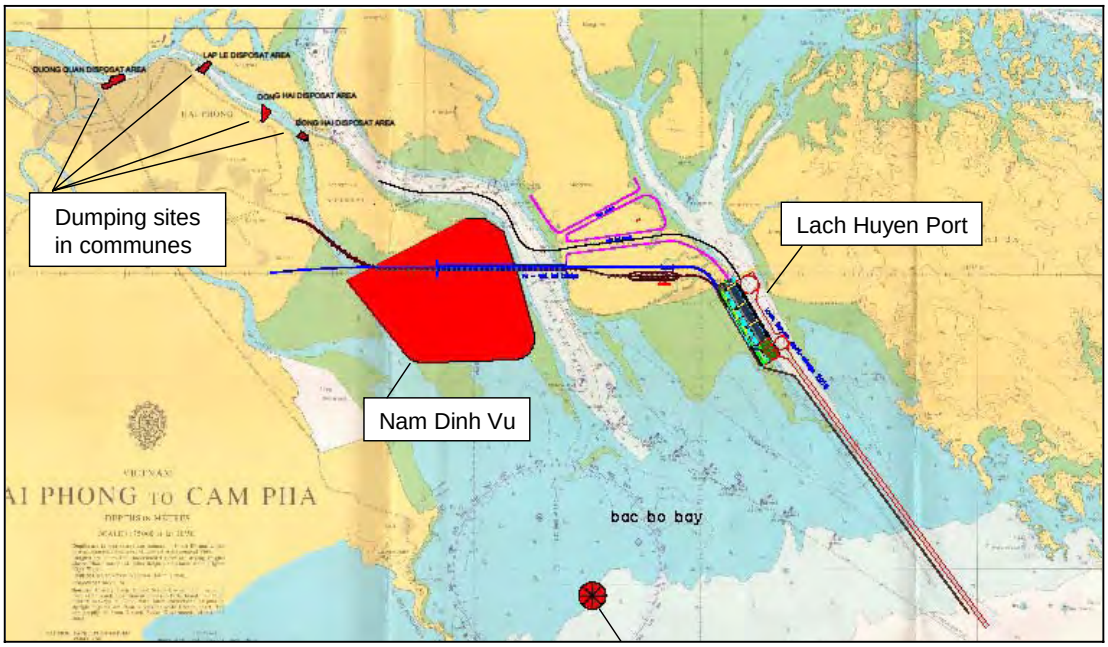


Figure 3.9 Approved Dump Site for Dredged Material

The dredging works also brings in impact to water quality in the area, increase the water turbidity, suspension solid concentration, numbers of species and density. Add to that, other kinds of solid wastes also be found in the construction period and if no proper collection and treatment be done, its impact to the environment is quite certain, worsening the scenery and wasting the investment. However, some kinds of solid wastes could be recycled to use for ground leveling; packing, plastic bottle could be recycled or sold for wasted materials shop.

Daily solid wastes contain many organic substances and are therefore easy to disintegrate, enable the growth of insects, microorganism and diseases.

6) Impact to the socio-economic condition in the project area

A large numbers of contruction workers come to the area to take up the construction may cause certain impact to daily life of local people (estimated at about 500-700 people). This fact may increase the living costs and bring in some conflict due to the differences in the living style and culture of construction workers who are coming from different regions. In order to prevent conflicts between construction workers and local people, the camp for construction workers have to be constructed seperatedly in the project site. However, the appearance of the construction workers is likely to increase the consumption of goods and other demands and therefore the economic situation in the area will be developed and the circulation of goods will be taken place more rapidly.

In general, the negative impact to the community people is minimal while the positive impact is to

increase consumption demand, helped to boost services and circulation of goods at locality, and thus improve living standard and socio-economic development of the region.

Considering the potential negative impacts of the SAPROF's change in port design, it is unlikely to affect the socio-economic condition by the change. Thus, the additional impacts of the SPROF's design shall be negligible.

7) Impact to transport in the region

One of the issues during the construction period observed is the increase of volume of transport in the area. There are 2 main flow of transportation: (1) construction materials by road transport (about 160,000 times/per year) and (2) water transport including the transport of ship/boat for undertaking construction of water area (breakwater, sand-control dyke, access channel dredging, etc) and installation of signaling and light bouy. A large number of ships as well as construction equipment/machinery will be mobilized for the project, especially on the access channel via Lach Huyen. The increase of both road and water transport may lead to the traffic safety issue in the region.

Considering the potential negative impacts of the SAPROF's change in port design, it is likely to inclease the traffics, especially water transport due to the larger development and deeper channel requirrment. Additional caution for the water transport is required to avoid the potential impacts on the natural environment by the accidents and to avoid disturbing other transportation measures.

3.2.3. Impact assessment during operation phase

1) Impact caused by discharged air

During the port operational phase, oil and gas consumable equipment and machinery discharge exhaust. The most affected are construction workers due to the air pollution and exhaust. The most heavy area is fuel supply station (VOCs), car parking area, etc. Since the port area is large (48ha), the strong wind blows dust and exhaust into the air.

2) Impact caused by waste water

a. Wastewater discharged from incoming/outgoing ships

The volume of waste water depends on capacity of ships, machinery, engines, and numbers of calling ships, ect. However, according to Vietnamese regulation (Decree 71/2006/ND-CP dated July 25, 2006 on maritime management – Maritime Law) as well as international regulations, calling ships are forbidden from discharging waste water in the port area. The discharge of waste water shall be in accordance with the instruction of Hai Phong Port Authority.

b. Oily waste

Oily waste is dangerous for the environment, therefore oily waste should be pumped to oil separating system before transefering to the treatment. Oil separator will be installed at the wate water treatment station.

Oily waste will be collected and separated. Oil sludge will be collected and treated following the Decision No.23/2006/QD-BTNMT on promulgating the list of hazardous waste of the Misnister of Natural Resources and Environment and the Circular No.12/2006/TT-BTNMT dated December 26,2006 guiding the application, registration, licensing, code management for hazardous waste of the Ministry of Natural Resources and Environment. Bilge water and oily waste during the calling period will be collected and pumped into the piping system for treatment on-land. After treatment, the water which satisfies required standard could be discharge to the sea.

c. Daily waste

This kind of waste comes from WC, bathroom, laundry and restaurants in the project area may pollute the environment, harmful to people's health and other species.

Ecoligical effect of the organic causing pollution is occurred in the process of reducing dissolved oxygen, harmful to environment and species. The process is described below:

$$2NH_4^+ + 3O_2 \rightarrow 2NO_2^- + 2H_2O + 4H^+$$

$$2NO_2^- + O_2 - 2NO_3^-$$

Oxygen contents reduce rapidly during 1-3 days. The reduction of oxygen in the water is not favourable for bottom species. On the other hand, this may lead to the break-out of disease for scpecies who are very sensitive to the organic contamination.

Besides, together with the organic contamination mentioned-above, the Eutrophication in the water area is considered as an immediate task to deal with for the purpose of preserving and developing a sustainable environment. Eutrophication is the over-growth of coral and phytobenthos which may kill some species under the water.

3) Impact caused by solid waste

Solid waste during the port operational period is also dangerous to the environment, mainly sourced from the regular dredging works of the access channel, turning basin.

Volume of dredging per year is huge. Thanks to the permission of Hai Phong PC, the dumping sites

have been reserved (Official letter No.2702/UBND-GT dated May 19, 2008). Mitigating measures when excecuting the regular maintenance is presented in Section 4.3.3,

Daily solid waste normally consists of organic and therefore easy to dissolve. Such organic daily wastes need to be categorized and treated appropriately.

4) Impact caused by harzadous waste

Hazardous waste appreared in this period are mainly lubricating oil from ship repair works or ship cleaning works; a portion of daily solid waste comes from old bulb, old battery, etc. These wastes, if discharge into the sea directly, will bring in heavy impact to water environment in the seashore area, alluvial and ecological system.

5) Impact to natural resources and diversified biology

Very few on-land flora exists in Cat Hai island, a small quantity of coconut trees and casuarinas. Residential houses locate along sides of seashore. Animals in the area are mainly animals raised by local people, no endanger species. In the Cat Ba island, there is a national park where many animals and plants lives in the primeval forest. However, the port's operation causes no impacts to the Cat Ba national park as the port is far away.

As to the underwater natural resources, the most heavy affected are species which live in the sandy mud. The environmenr impacts are defined to cause from (i) change of water quality due to the discharge of bilge water from the calling ships, bring in the booming of hazardous species, and (ii) noise and wastes during In the port's operation stage, during the breeding season, the ratio of species's breeding reduced dramatically to ÷50 – 70% compared to normal condition without port construction. Impacts caused by the port operation could be summarized as follows:

Drive away all kinds of species who used to live at the bottom layer; increase the contents of metal and biological agents, increase BOD & turbidity, abd reduce dissolved oxygen, pollute the environment, disorder the bottom species, affect species on-land.

Where new animals transported to the port area, they will bring in adverse impacts to aqua cultivation. The possible impact caused by bilge water is likely to reduce the density of animals in the project area.

6) Impact to aqua culture and fishery in Cat Hai, Cat Ba island area

The impacts to the aqua culture and fishery in the area mainly caused from maritime activities from Lach Huyen port via Trap Canal to Hai Phong Port/ Currently there has been no aqua culture activities in the port construction area in Cat Hai town, however in the opposite area in Cat Ba island, Phu

Phong commune there are numbers of aqua culture cultivation ponds along 2 sides of Trap Canal, Dong Bai and Nghia Lo commune, therefore the port operation may affect quality if seashore water and aqua culture activities in the area.

The impacts also cause to fishing activities but the level is minimal.

7) Impact to transport

a. Impact to road transport

The current traffic volume in the port construction area is very small. When the port puts into peration, the volume will be dramatically increased in terms of both volume and types of vehicles including container truck, passenger cars. Given such circumstances, it is necessary to have a good traffic management to avoid traffic congestion. Upon completion of the port access road, the traffic condition will be improved.

b. Impact to waterway transport

When the port completes and puts into peration, the volume of ships coming in and out the port will increase considerably. The port opens the opportunities to connect with international maritime services, help to improve the waterway transport system in the region and solve the limitation of cargo handling capacity of the northern ports. Besides the said advantages, the high volume of ships will also cause impacts to waterway transport in the region. According to the master plan for ports development, various numners of services port, transshipment ports fuel ports, shipping manufacturing zones will be constructed by the year 2030. Therefore, the volume of ships coming in and out the Hai Phong International Gateway port will be very huge, which will bring in certain negative impacts to waterway transport such as high risk of accidents, oil spreading and fire.

8) Impact to socio-economic conditions

a. Impact to tourism

In the master plan, Cat Hai island and Cat Ba island are set to be an attractive destinations for overseas and domestic tourists thanks to its beautiful sea and Cat Ba national park. Currently, travel to Cat Ba either by car or by boat is quite time consuming i.e. 2 times ferry takes 2 hours or 1 hour by high speed boat from Hai Phong. Due to the inconvenient transport condition, there has been not enough services and facilities for tourism development.

It is planned, together with the construction of the port, to have the bridge constructed connecting Hai Phong to Cat Ba island. This will surely help Cat Ba island to become a good destination for tourists

and tourism industry will be a major key economic sector of the city.

b. Impact to other economic activities

The port will attract a large numbers of construction workers and staffs when the port puts into operation. This will bring in the flourishing of other services, create more jobs, raise income and improve people's living standard. However, together with the positive impacts, negative activities such as drug users, prostitution, security disorder may also be spread without proper control measures. Therefore, the local authority and the port authority shall need to coordinate with each other to control these negative things.

9) Impact caused by regular dredging to protect the access channel

Based on the SAPROF Study, the requirement of the maintenance dredging is 3,442,000m^3 at the first year and 747,000m^3/y for the succeeding years while the approved EIA estimated annual dredging volume as 2,195,000 m^3/y with TEDI's port design. Though such dredging volume is substantial order as a source of environmental impact, such impact shall be minimal as long as the dredged material is propery settled and managed at the permitted dump site shown in Figure 3.9. Based on the SAPROF's sedimentation study, the maximum capacity of the permitted dump site will be full in only 14years with channel dredging. With the maintenance dredging for the port and turning basing, other dump site or sustainable solution for the continuous dredging will be urgently needed within 10years.

10) Impact caused by the construction of breakwater and sand-control dyke

a. Alluvial condition

Same as the Nam Trieu and Cua Cam estuary, Lach Huyen estuary has a large volume of alluvial transported to the sea every year, therefore in these areas, there exists many sand-bank, sand-bar, and sand-dune. Sand flowed to the sea are. The slope degree is relatively minimal.

Same as the salinity distribution nature, the turbidity along with fresh waterinringes sea water in the estuary, and in some places strengthened by erosion and turbidity in the sea side area. Result of measurement of turbidity in the estuary in September – October 1996 showed that the sea water's turbidity was reduced in comparision with beginning of summer. The highest turbidity in this season only reaches 147mg/l in Hai Phong port.

- At Lach Huyen estuary (Chang river): the sea water's turbidity has a lowest level in the northern delta sea side area. The section from Ben Got to Xuan Dan estuary has a level of 30mg/l while the other water areas in Lach Huyen has its turbidity < 30mg/l.

- At Nam Trieu estuary: the turbidity of water reduce gradually from the port to the sea with the measurement at the port at 147mg/l, 80mg/l at Dinh Vu Cannal, 50mg/l at Cai Trap Cannal, and 30mg/l at the beginning of the estuary (Aval light location).

When the tide ups, the flow of alluvial moves horizontally from the bottom to the sea side, along with the flow and wave direction. When it comes near to the sea side, the flow of alluvial separates into 2, the first one, via Hang Day Canal, meet with the flow from Lach Huyen and goes to northern side of Ben Got, the second one, via Hoang Chau, meet with the flow from Nam Trieu and goes to western side of Hoang Chau.

When the tide falls, the flow of alluvial moves down along with the Lach Huyen and Nam Trieu, close to the east of Hang Day and west of Hoang Chau. Only a small volume of alluvial goes up when the tide turns back via the mentioned cannals to return to the sea side of Cat Hai.

The above-mentioned flow of alluvial tends to prefer the direction toward Hoach Chau which may cause further alluvial at the bottom of Hoang Chau. Given such circulation system, the Cat Hai seaside area is suffering from alluvial shortage.

Result of topographical survey at the bottom of Hai Phong sea area by Naval Military Unit in 2004, TEDI in 2006, and Geography Institute in 2008 showed that the alluvial situation has been taking place quite seriously in the project area at the average speed of approximately 1.0m/per year.

Impact from the construction of breakwater and sand-control dyke

In order to evaluate the impact of the construction of breakwater and sand-control dyke to the flow of alluvial transportation and the alteration at sea bottom, we have used mathematical model. At first, the wave area and sea side water flow needs to be studied and followed by determination of sandy mud transportation flow and finally calculation of alteration of sea bottom and sea side. Figure 3.10 describes calculation chart of the sea side model, sand transportation and topographical alteration of sea bottom and sea side.

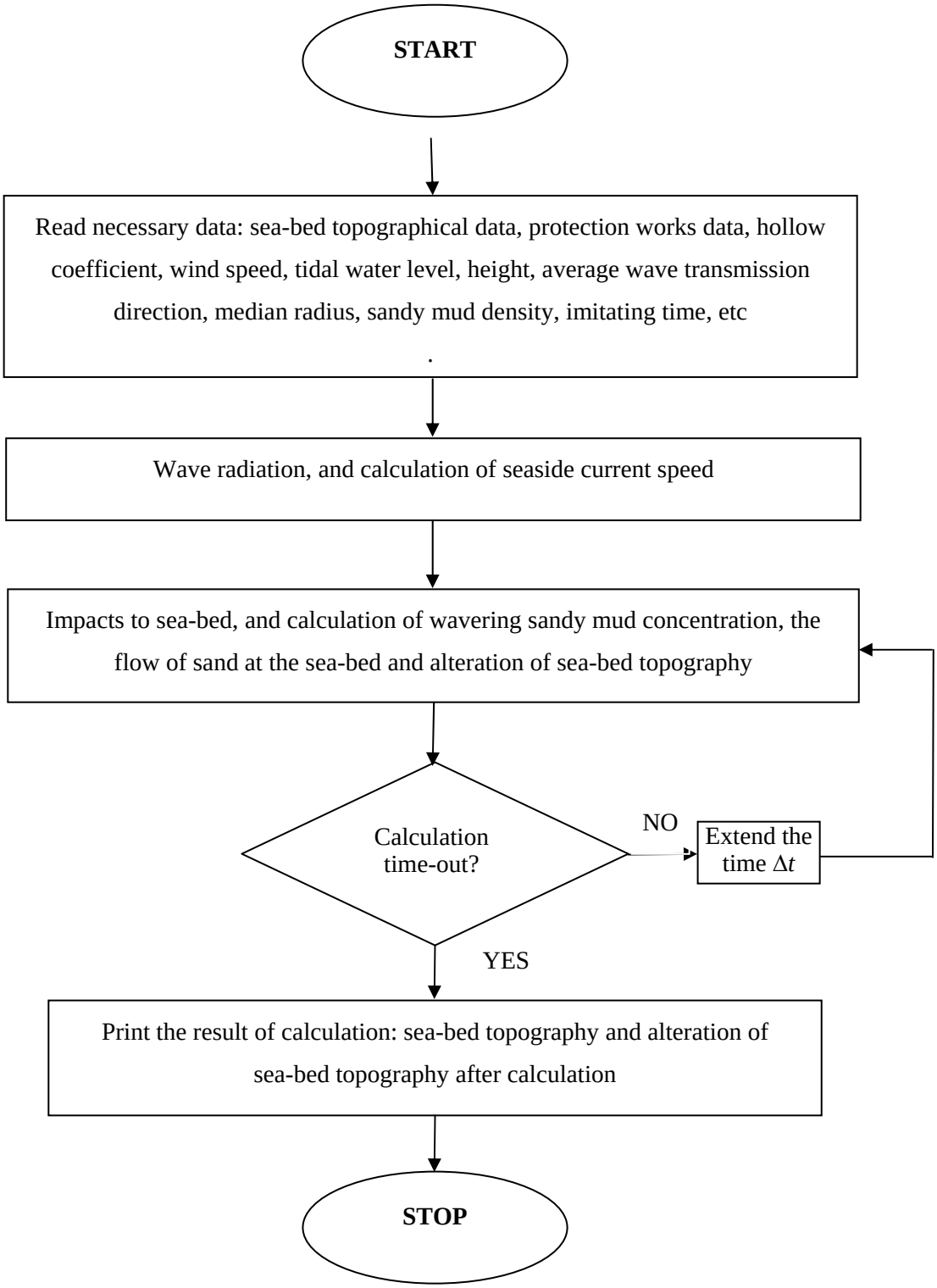


Figure 3.10 Calculation model of the flow of seaside, sand transportation and alteration of bottom topography

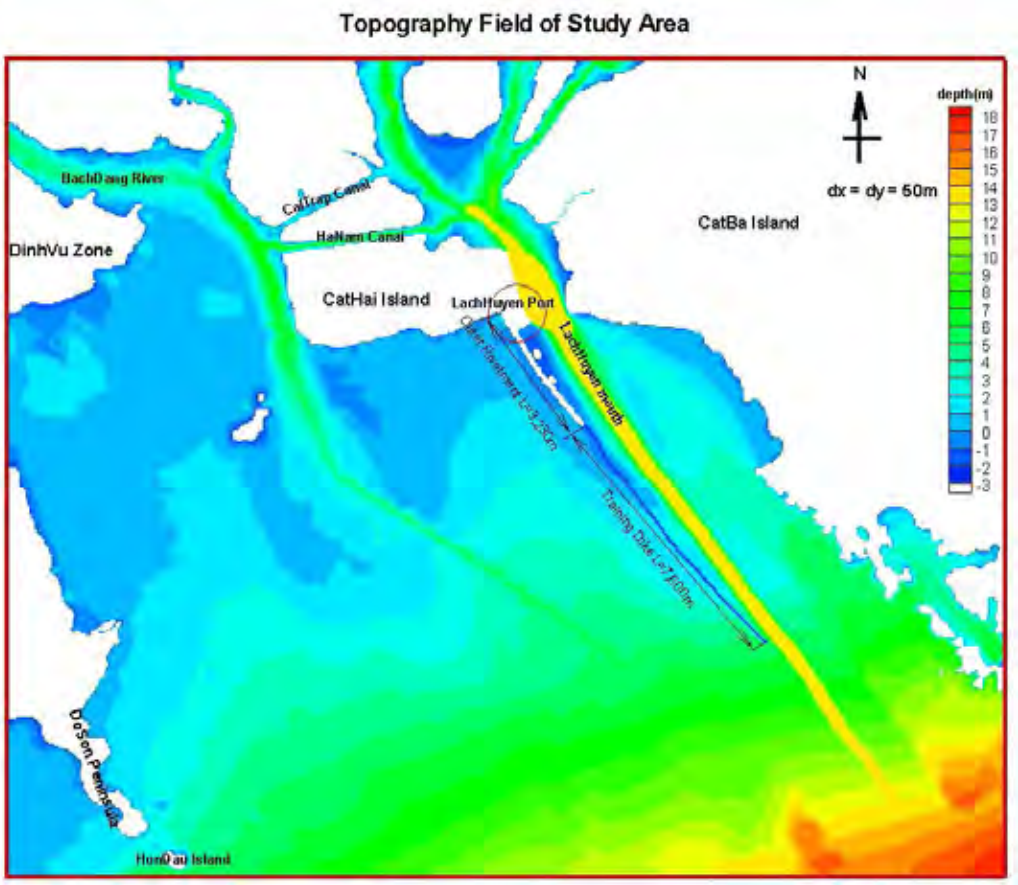
The calculation model of contingent wave transmission near seashore formulated by Mase in 1998 based on the equation of multi-direction contingent wave energy, in connection with the process of wave reflexion and diffraction with changeable topography.

The model imitating seashore flow was formulated based on the equation of 2 ways movement taking integral depth of the water flow (Sain-Vernant equation) in connection with influence of wind, wave, and tide to the seashore flow.

The calculation model of the changeable bottom topography and seashore based on the equation of differential derivation on the sandy mud equilibrium which is defined by the calculation model of the bottom sand transportation and wavering materials (see Appedix 7). The input data for the sandy mud transport calculation and bottom changes includes topography, wind features, wave, water flow and sandy mud from the relevant rivers.

Topography: The topographical map Scale 1:10.000 made by the Port Engineering Design Consultant in 2006 and the Sea chart Scale 1:25.000 made by Naval Forces were used to calculate and assess the impact of the breakwater and sand-control dyke to the water flow and sandy mud in the area.

Figure 3.11 shows the lay out of breakwater and sand-control dyke proposed by SAPROF



topographical map 530 (East-West) x 440 (North-South) and 50mx50.

Figure 3.11 Topography at the survey area for construction of breakwater and sand-control dyke

Wind feature: the calculation was done at the average speed of 5m/s for all 3 main directions: North East, East, and South East

Wave feature: wave feature was selected based on the data of offshore Bach Long Vy Station

Table 3.19 Height and wave cycle energy in all directions

Direction	NE	E	SE	S
Height of wave with equivalent energy (m)	2,1	1,3	1,6	2,0
Cycle of equivalent wave (s)	5,6	4,5	4,9	5,4
Timing of wave impact (day)	96,42	17,46	13,42	54,07

River flow feature: average speed of the rive flow of 1,2m/s and 0,75m/s equivalent at Bach Dang and Chanh river were selected as an input data for the model calculation. As to the other estuary, the river flow involves in the process for changing bottom topography is minimal with average speed of

0,15m/s.

Alluvial feature from the river: Lach Huyen estuary has a suspension alluvial concentration of about 30mg/l, smallest one in the northern delta area. Nam Trieu estuary (Bach Dang river) has a wavering concentration decreasing from the port to the sea at about 147mg/l where it was about 80mg/l at Dinh Vu Canal.

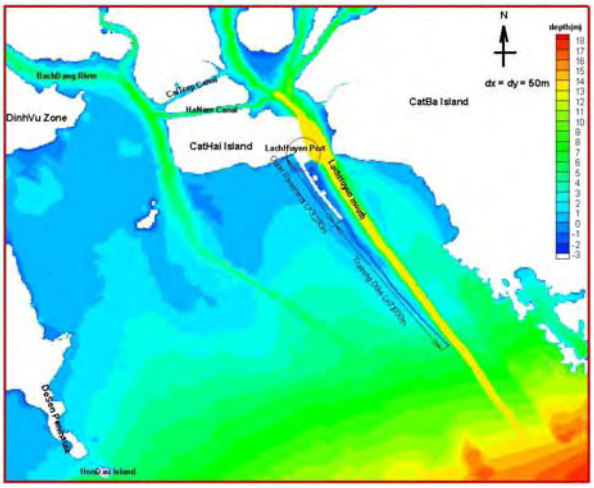
b. Result of the sedimentation simulation up to 20years

Comparative result of SAPROF and TEDI port design for year 1, 5, and 10 is shown in Figure 3.12. For the purpose of understanding the long term and regional trend, expected sedimentation after 20years is also shown in Figure 3.13. Due to the different colar band (expression of depth difference in color) use for the TEDI's design, the impact of the sedimentation in the project area looks larger, but there are not significant difference in absolute number of the sedimentation and trend of the sedimentation each other except the south end of the sand control dyke and enclosed shallow water of Cat Hai island (south of Hoan Chau Commune and Van Phong Commune). At the south end of the dyke and the mentioned enclosed area, erosion would be occurred for long term. Based on the present fishing activities and hearing from fishermen, the expected long term impacts of the erosion would be ecologically and socio-economically minimal.

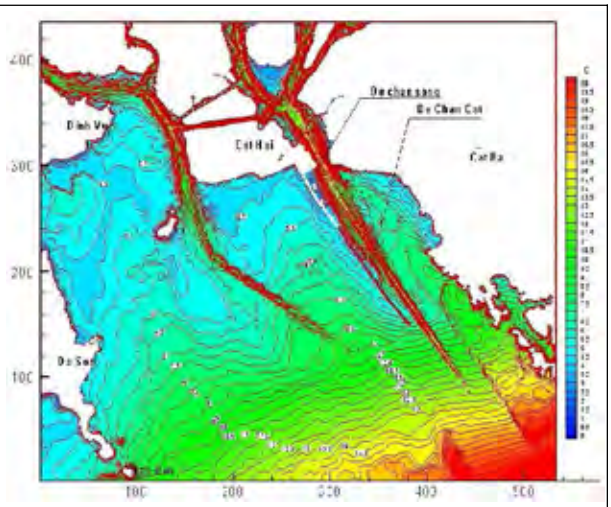
Generally, the calculation results show that waves can cause significantly sediment transport along the shore. The sand control dyke would effectively prevent the sedimentation of the access channel. Based on the simulation result, the expected impacts of the port and sand control dyke would be moderate and may not cause drastic bathymetrical change in the region. Due to the moderate cahge, it is likely to be acceptable for the local ecosystem as well as coastal fishing activities.

Considering the realiability of the calculated results, they should be considered as reference purpose and appropriate monitoring shall be conducted to verify the calculated results and consider countermesures if they are necessary. Although the calculation model of the sandy mud transportation and bottom topographical changes formulated by Dr. Vu Thanh Ca and MSc. Nguyen Quoc Trinh were used to calculate and define the dumping site of various projects such as Cai Mep – Thi Vai International Port and Van Phong Transhipment Port, the applicability and accuracy of the applied model is limited for the proposed new port area. Since the proposed area is one of the most complicated hydrodynamics systems, alluvial deposit systems in Vietnam, few numerical models are able to simulate the detail fanominon in the region. However, the above-mentioned model is capble to simulate the general movement of the sediment in the region. Thus, it is highly recommendable to monitor the methoological events and actual sedimentation at the project site and understand the actual

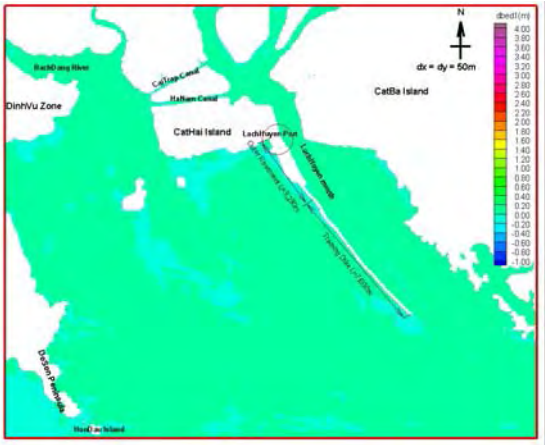
fenomina on the ground. In case of need for some counter measures for the environmental protection with the carefull analyses of the monitoring results, responsible agency shall take necessary actions in the future.



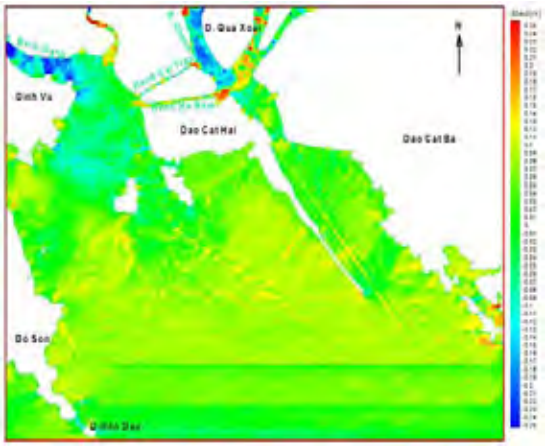
SAPROF's Port Design, 2010



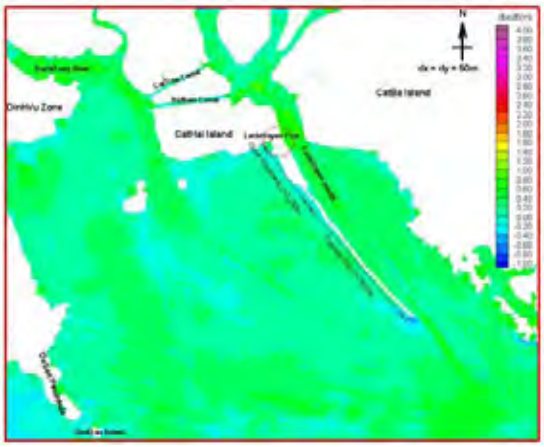
TEDI's Port Design, 2008



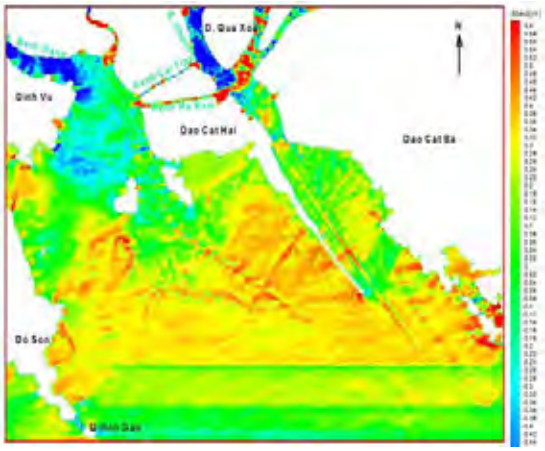
Sedimentation after 1 year (SAPROF)



Sedimentation after 1 year (TEDI)



Sedimentation after 5 year (SAPROF)



Sedimentation after 5 year (TEDI)

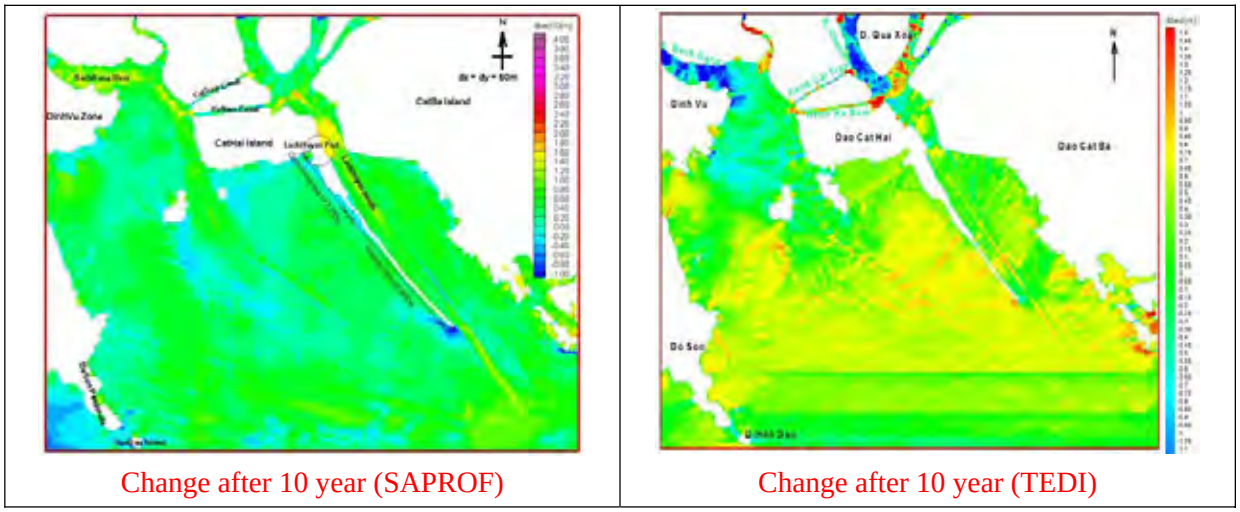


Figure 3.12 Comparative Topography Change after 2-10 year (SAPROF and TEDI) at the survey area for construction of breakwater and sand-control dyke

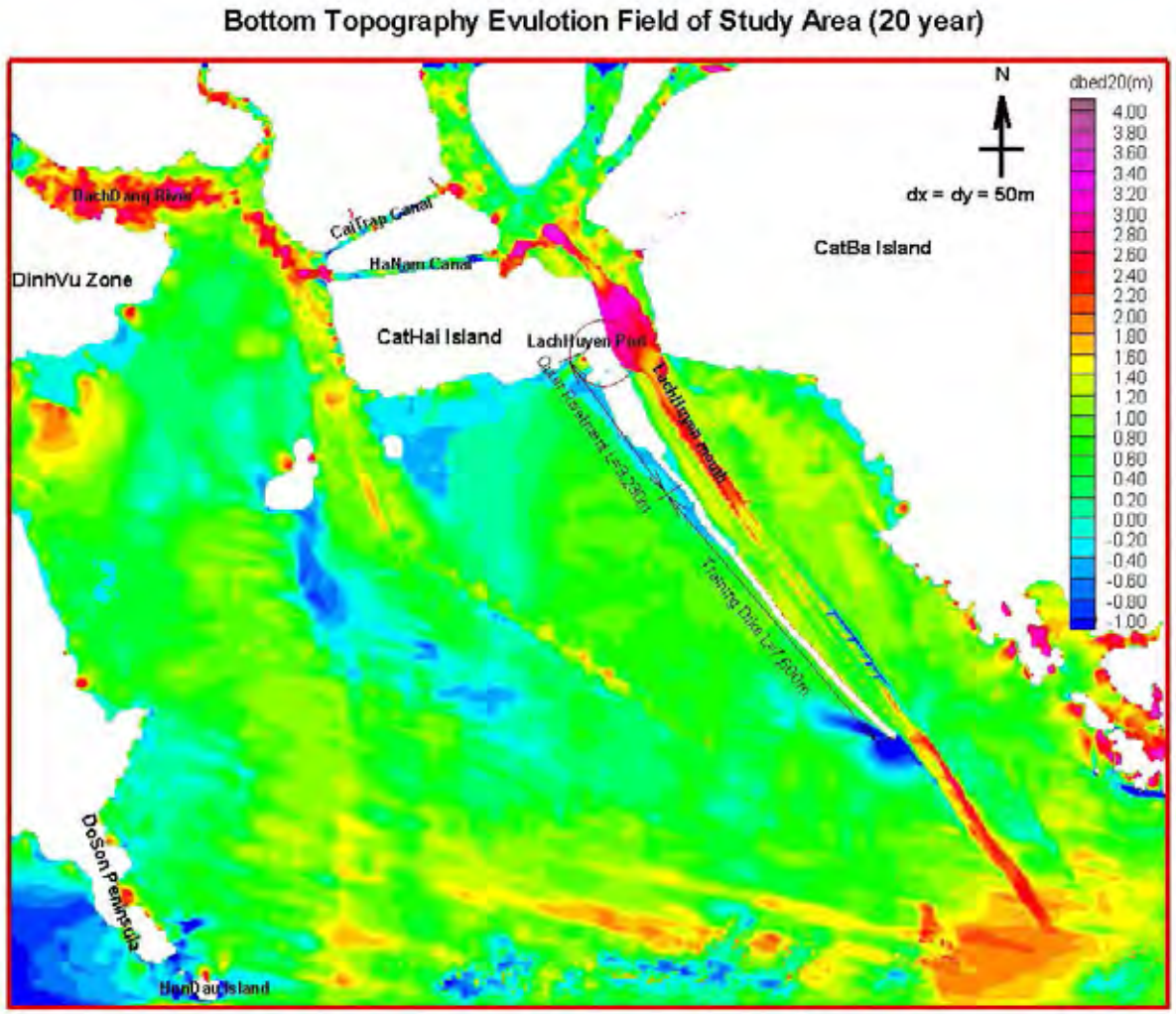


Figure 3.13 Topography Change after 20 year (SAPROF) at the survey area for construction of breakwater and sand-control dyke

11) Impact caused by transportation and cargo handling works

The volume of cargo throughput at 2 berths is forecasted at about 6 million tons per year in which container cargo accounts for 5.5 million tons per year, the remaining are bulk cargo and general cargo. The cargo handling for bulk cargo such as fertilizer, chemical fertilizer will certainly cause impacts to the environment especially air environment and seashore environment. However, these 2 berths will turn into the specialized container berth by 2020 and therefore the impacts caused by bulk cargo handling and transportation will not long.

12) Impact caused by foggy situation, rising of sea level, storm

The environment is not only being impacted by the project but also cause certain impacts to the project in return, especially to the stability of the construction works, resulting in negative impacts to the environment.

Fog limits the eyesight, when the eyesight is less than 1 km or even 50m, there is a high risk for waterway accidents. According to the study, numbers of foggy days in meteorological station fluctuates from 13 – 30 days per year depending in topography and height of the survey station. In Cat Hai island, only 2 foggy days recorded at the meteorological station during the past 5 years. This number is relatively smaller than other station's and therefore it could be said that the impact caused by foggy days is minimal to the waterway transport condition in the port area.

Rising of sea level may affect the residential area, erode construction works in Cat Hai island. There are no figures measured the increase of sea level in the storm in Cat Hai, however according to the calculation and survey, the sea level risen as a result of storm may reach 1-2m in this area.

Big storm may destroy dyke during construction period or cause ships crashes/drowning. Such accidents may cause oil spreading besides the losses of human being and property.

13) Impact caused by oil spill by accidents

a. Oil characteristics and major causes of the oil spill

Vietnam with its key location in the southeast Asia with a total length of 3.200km seashore, 2.700 islands, and densed rivers network is favorable for waterway transport development. Thanks to the industrialization amd modernization policy of the Party and the Government, more attention and investment has been given to the waterway transport especially to the coastal area of Da Nang, Hai Phong, Vung Tau. Besides the development of the waterway transport, the numbers of incidents are also increased. According to the statistics of the Environment Authority, from 1987 to 2001 there were

more than 90 cases of oil overflow, the volume of polluted oil was 7,380 tons, 10,020 tons and 17,650 tons in 1992, 1995, and 2000, respectively.

The pollution sourced from the maritime activities is about 337 tons per year in the country. We use waterway to export crude oil and import gasoline. Since 1992, the total volume of both import and export fuel by the waterway increase 19,4% per year, up to 12,621 tons in the end of 1995. There was about 200 million tons per year transported from Middle East to Japan and Korea via Vietnam. It is forecasted by the year 2010, the total volume of oil transshipped via Vietnam 's ports will reach 40 million tons. The oil investigation and survey carried out in the continental area also increase the oil discharged to the sea and the risk of oil polluted is getting more serious.

The causes of oil overflow are categorized, according to the International Tanker Owners Pollution Federation Ltd, as follows:

Table 3.20 Categorization of causes of oil overflow

Major causes for oil overflow	Area of oil overflow (%)		
	Less than 7 ton	7 - 700 tons	Over 700 tons
1. Cargo handling activities	35	28	6
2. Technologies	15	5	-
3. Damage of ship's cover	7	7	13
4. Ship's drown	3	19	35
5. Breakdown of fuel storage	7	2	-
6. Ship crashes	2	22	29
7. Fire or explosion	2	2	6
8. Other causes	29	15	11

Source : ITOPF 1974 - 1998

In the above-mentioned causes, the largest one is from the ships activities (more than 85% of total oil overflow per year) and is further explained in the below table.

Table 3.21 Categorization of causes for oil overflow in US by the location

Causes of oil overflow	Times of accidents	Volume of overflowed oil (million galong)	Percentage (%)
I. Vessel			
1. Oil vessel	8034	66	30
2. Oil barge	12765	38	17
3. Other vessels	38778	12	5
II. On-land causes			
1. Industrial activities	48295	40	18
2. Oil piping system	7813	39	18
3. Other causes	7900	7	3
III. Other causes			
1. Unclear	46	19	9
Total	170340	221	100

Source: American Maritime Authority 1976-1993

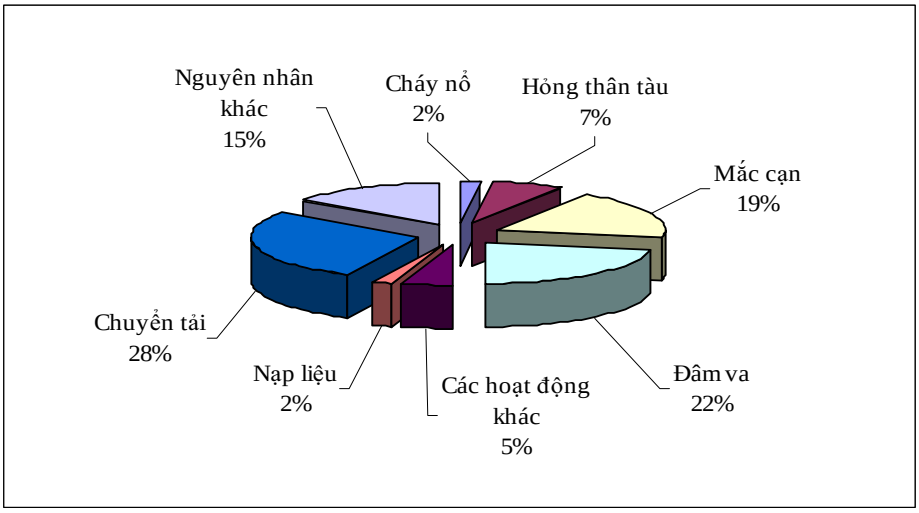


Figure 3.14 Causes for oil spreading average 7-700 tons from 1974-2001, ITOPF

Table 3.22 Categorization of causes in US based on each location (1973-1993)

Location of overflowed oil	Volume of overflowed oil (million galong)	Percentage (%)
1. Terminal	109	49
2. Nearshore (0- 3 nautical mile)	80	36
3. Water line (3 - 12 nautical mile)	3	1
4. On sea (12 - 200 nautical mile)	21	10
5. On Ocean	2	1
6. Other areas	6	3
Total	**211**	**100**

The East Sea has been one of the most popular site for oil investigation and survey in which oil exploitation are mainly observed in the sea of Vietnam, Gulf of Tonkin, Thailand Gulf, and Sparaty island. The oil exploitation and transportation normally cause oil pollution. When accidents happened, the volume of oil spilled-over is up to 0,7% of its total. Wave and wind tend to move the oil to the seashore. Specifically, on December 12th 2002, Prestige Ship cracked in Galicia offshore, north west of Spain and the volume of oil spilled-over was 77,000 tons; or on October 30th 1994 Neptune Arises of Singapore crashed Saigon Petro Pier and spilled-over 1,867,766 tons.

On August 23rd 2004, the Asia-Pacific high level meeting on oil spreading was held in Australia. On the same day, another workshop on this issue was organized in HCM city by Environment Protection Authority in collaboration with Riveria (Singapore) and Enware (Australia). From 1993 up to present, there has been 8 cases of oil spreading in HCM city with the total volume of oil estimated at about 2,520 tons.

Big cases of oil spreading happended in Vietnam over the past few years:

Table 3.23 Big cases of oil overflow in Vietnam

No	Name of ship	Timing	Location	Causes	Type of oil	Volume of overflowed oil	Losses	
							Economic	Environment
1	Pan Harves (Taiwan)	20/09/93	Offshore of Vung Tau	Ship crash		300 ton		
2	Humanity (Taiwan)	08/05/94	Can Gio, HCM	Ship crash	FO	130 ton	200000 USD	400000 USD
3	Neptune Aries - Singapore	03/10/94	Cai Lat, HCM	Hit to Quay	DO	1.700 ton	4. 200 000 USD	
4	Promex Cita Cabvan (Malaysia)	04/12/97	Bien Ly Son	Drown	FO DO	300 ton FO 30 ton DO		
5	Gemini (Singapore)	27/01/96	Cai Lat, HCM	Hit to Quay	Crude oil	32 ton	600 000 USD	
6	Name unclear	09/07/98	Da Nang	Sink				
7	Sokimex (Vietnam)	16/08/98	Can Gio, HCM	Hit the barge	DO	41 ton	500million dongs	
8	Nhat Thuan 1 and Hoa Hiep 2	1999	Saigon river	Ship crash		113 ton		
9	Sunny (Hongkong)	2000	Phu Yen sea	Accident	DO	300 ton		
10	Barge	02/06/01	Da Nang	Hit the rock	TC-1 oil	30-40 m^3		
11	Formosa One (Liberia)	07/09/01	Gang Rai, Vung Tau	Ship crash	DO	900 m^3	17. 200 000 USD	
12	Bach Dang Giang (Vietnam)	06/02/02	Hai Phong	Hit the rock	DO	2.500 m^3		
13	My Dinh (Vietnam)	15/02/05	Hai Phong	Hit the rock	DO	300 ton		
14	KASCO	21/01/05	District 12, HCMC	Hit the Quay	DO	100 ton	14. 300 000 000 USD	
15	Ham Luong 5	06/04/05	Saigon port	Hit the ship	DO	40 m		

b. Impact assessment due to oil spreading

To assess and forecast the impact, apply the numerical model (theory of numerical model is presented in the appendix) with natural conditions of the project area, topographical features, depth, tidal features, temperature, wind and wave condition, and input data.

Table 3.24 Input value of the calculation model

Wave				Wind		Water level	Volume of overflowed oil (ton)
Height (m)	Cycle (s)	Direction	Water level (m)	Speed (m/s)	Direction		
2.1	5.6	NE	1.86	5.6	NE	Data from Hon Dau Station	300
1.3	4.5	E		5.6	E		
1.8	4.9	NE		5.6	NE		
2.0	5.4	S		5.6	S		
1.5	4.7	SW		5.6	SW		

Based on the possibility of the maritime accidents, we have selected 3 locations for the purpose of the worst case scenario analyses. For the comparative purposes between SAPROF study and the Approved EIA, we have set the same accidental condition as the approved EIA. The volume of the oil spill is 300tons for 10hours. For the each location, we have examined the 5 dominant wind directions in the region as same experiment as the Approved EIA (Table 3.27). Sumary of the oil spill points are as follows:

1. Grounding accidents at the south of offshore Cat Ba island due to sunken rock/reefs
2. Grounding accidents at the south end of the sand control dyke due to the new structure and lower crouwn hight
3. Vessel crashes around the terminal due to the complexity of the traffic and high density of vessels

c. Results of calculation

The comparative results of the expected oil spill calculation for the SAPROF and TEDI's port design, are shown in Figure 3-15 and 3-16 below.

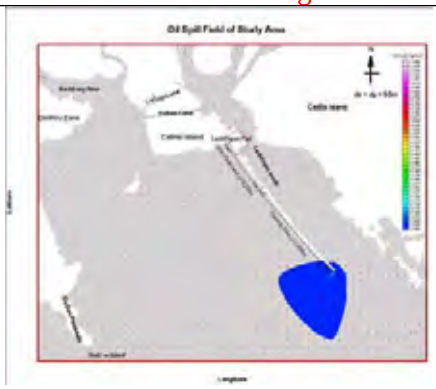
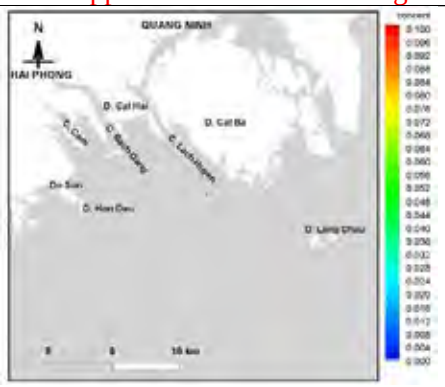
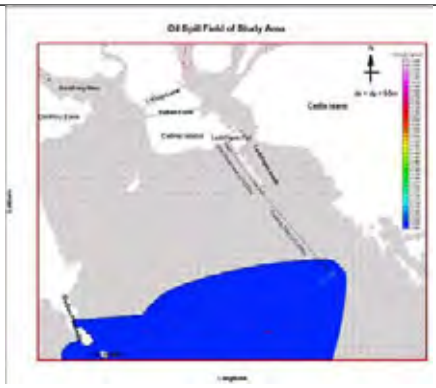
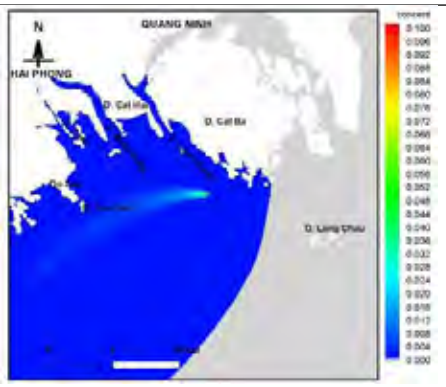
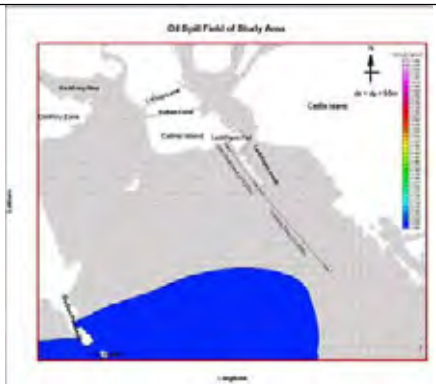
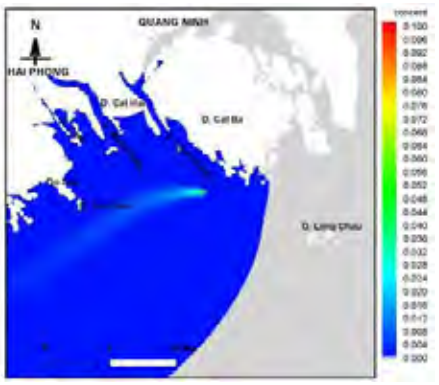
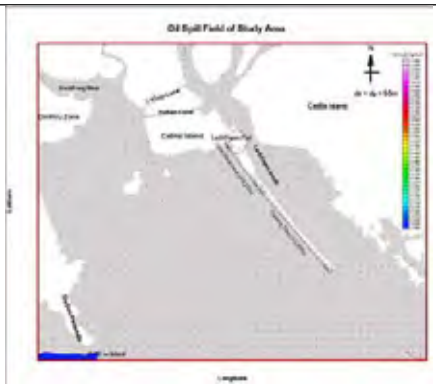
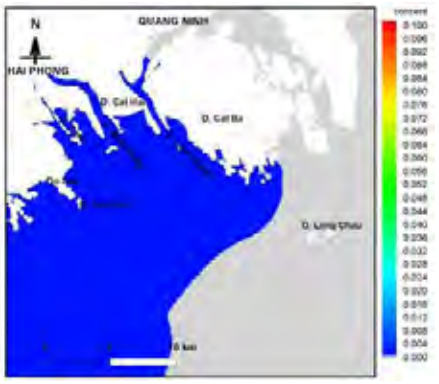
	SAPROF's design	The Approved EIA/TEDI's design
After 1h @South End of Sand Control Dyke NorthEast Wind		
After 6h @ South End of Sand Control Dyke NorthEast Wind		
After 12h @ South End of Sand Control Dyke NorthEast Wind		
After 24h @ South End of Sand Control Dyke NorthEast Wind		

Figure 3.15 Comparative Result (SAPROF/TEDI) Expected Oil Spill Area with Northeast Wind

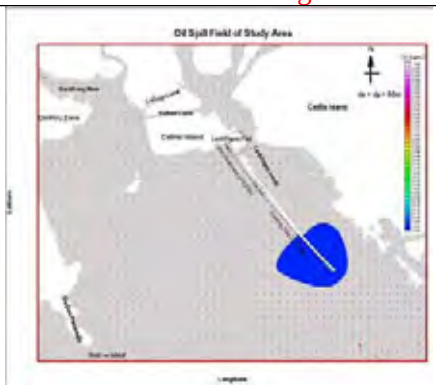
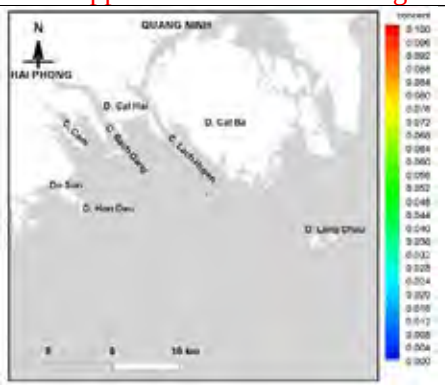
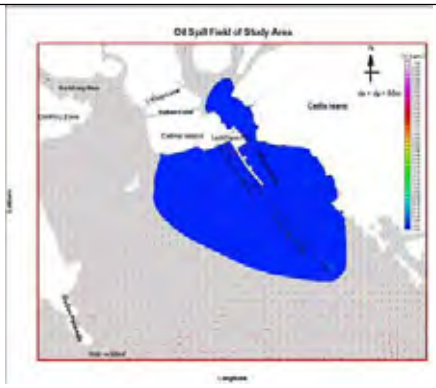
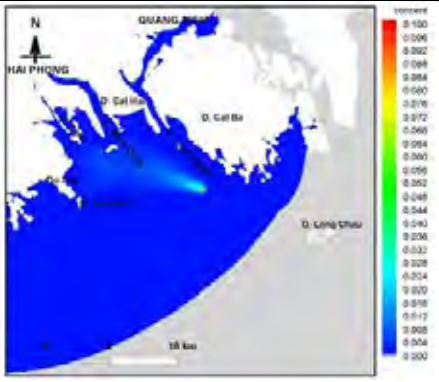
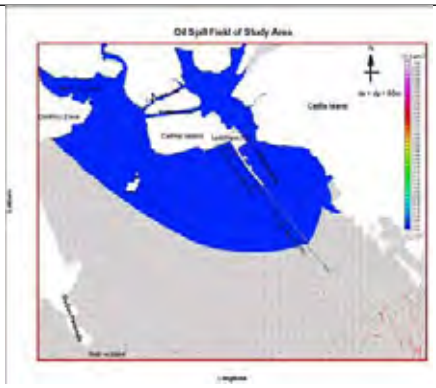
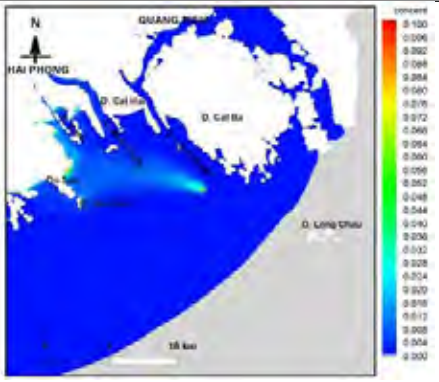
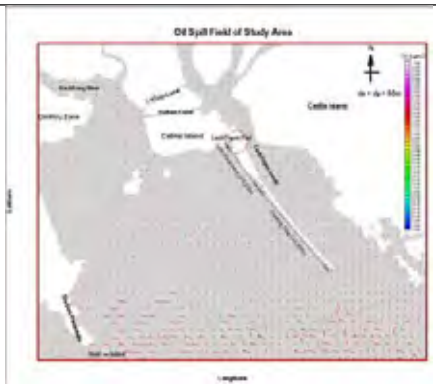
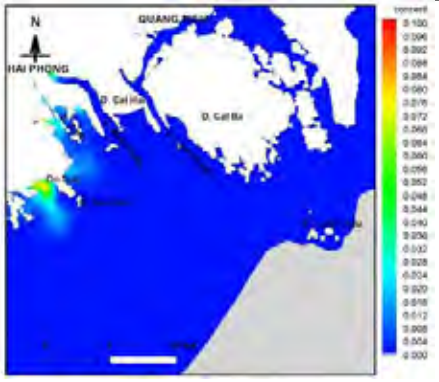
	SAPROF's design	The Approved EIA/TEDI's design
After 1h @South End of Sand Control Dyke SouthEast Wind		
After 6h @ South End of Sand Control Dyke SouthEast Wind		
After 12h @ South End of Sand Control Dyke SouthEast Wind		
After 24h @ South End of Sand Control Dyke SouthEast Wind		

Figure 3.16 Comparative Result (SAPROF/TEDI) Expected Oil Spill Area with Southeast Wind

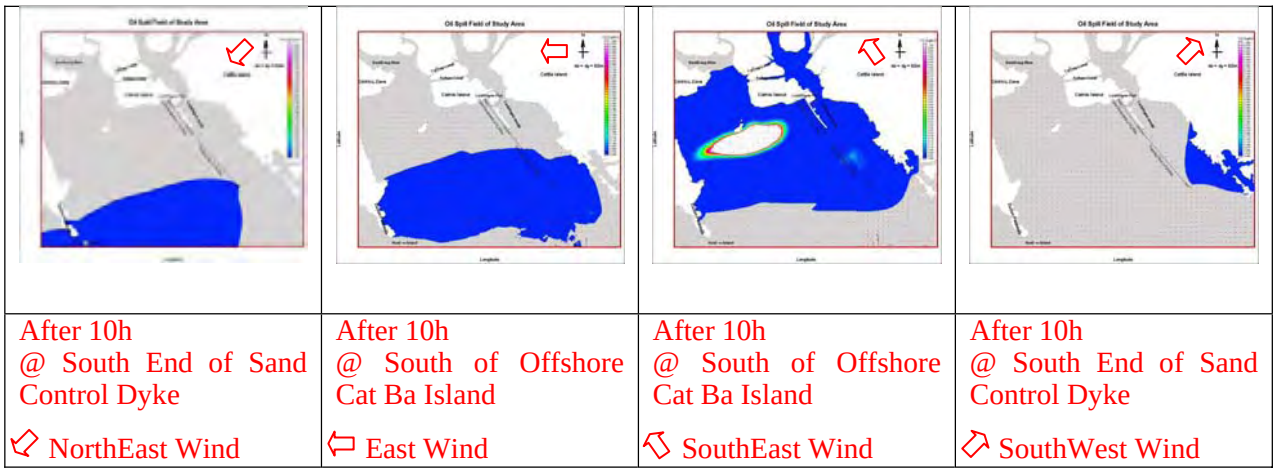


Figure 3.17 Comparative Result of Worst Oil Spill Senario for Each Wind Direction (SAPROF only)

d. Effects of the design change

Based on the comparative result summaries above, the SAPROF Study seems much smaller impacts than that of TEDI's design though the conditions of the oil spill are similar or same except the change in port strucures. However, such difference may not be led by the design. It is likely to be led by the numerical model. Considering the historical oil spill accidents and the comparative results, the result of the Apporoved EIA/TEDI's design seems over estimated. On the contraly, the SAPROF calculation might be underestimated especially the residual oil contamination along the coast. As same as the sedimentation model, the hydrology of the caltulated area is one of the most complex areas so that calculated results may contain some errors. Thus, the result of the oil spill model should be considered as the reference purpose at this moment with the respect of the best available options.

Complete results of the selected 3 oil spill locations with 5 dominant wind directions are shown in Appdendix 8. Based on the SAPROF's simulation results, wind direction of northeast would be the only scenario without significant coastal damage while the rest of east, southeast, south and south west direction would cause serious damage on coastal ecosystem and economic activities including fishery and tourism (Figure 3.17).

e. General description of the impacts to the seashore ecosystem

Wet-land flora rooted from the mud layer where there's lack of oxygen and rich in organic substance. Salt-marsh forest is favorable for aquatic products such as fish, shrimp, crab, arca, snail, etc. when absorbed polluted oil, the plant's root is closed, the metabolism process especially the respiration process is restricted, the evaporation in the air will affect the phytosynthesis of leaf and salt-balancing of plant, and drive it to death. The root layer soak deep in the oil for a long period will limit the growth

of young plants. The polluted oil may heavily affect the salt-march forest and ecosystem in many years. When oil absorbs the soil layers in the forest, the impact may lasts for many years. Even when the oil leakage is at medium level, its seriousness may last at least one year.

f. Impact to ephemera and bottom species

The oil leakage is likely to kill a number of ephemera species during the very first days of the incident, and change the numbers and compositions of species in the region, reducing the diversified biology. This leads to the shortage of natural foods for underwater species as well as the shortage of food for aqua cultivation.

Oil pollution may directly change the composition of ephemera species and bottom species depending on oil sensitiveness of each species, or indirectly affect the ephemera species and to the ecosystem. Some species may be able to move out of the polluted area.

Oil pollution also causes serious impacts to bottom species or even drive them to death. This means oil pollution makes great losses to water ecosystem and unbalancing the ecosystem in the region.

g. Impact to fishes and larvae

When oil leakeage occurred, fishes may be suffered directly from the oil level in the water. In clean water, oil is totally removed after couple of weeks. However, fishes could not live in the oil polluted water due to the physical and biological impacts, they will move to other water areas and the numbers reduces significantly.

In contrast to big fishes, egge and larvae are very sensible as they could not endure the oil level > 50µ oil/litter, the breeding is heavily affected by oil. Where the oil leakage happened during the season of bredding, it may kill eggs and larvae. As to some special species, its larvae may died when the hydrocarbon concent is too much.

h. Other impacts

Oil leakage will affectsnot only natural environment but also to aqua cultivation, fishery, agriculture and tourism, Furthermore, oil leakage threaten the economy and fisherman’s life.

Once polluted, it stops all fishery activities and destroys larvae and small fishes, and this loss will last for many years.

CHAPTER 4

4. Reccomended Mitigation Measures Preventing Adverse Impacts to Environment

Hai Phong International Gateway Port, upon its completion and put into operation, will be contributing to the socio-economic development of the country in general and the economic triangle in the north in particular. During the construction and operation phase, there will be certain adverse impacts to the environment at the project site and the adjacent areas. Particularly, next to Lach Huyen Port are Ha Long Bay, the world heritage, the Lan Ha Bay – a diversified biological area, and Cat Ba island – an international biosphere reserves. In order to minimize the adverse impact caused to the environment during construction and operation stage, this chapter mentioned mitigation measures preventing such adverse impacts.

4.1. Mitigation measures during planning stage

4.1.1. Land acquisition

In the pre-construction stage, one of the most critical issue, bringing in great impact to the project would be the land acquisition. Due to the additional requirement for the public related facilities and the common berth, roughly 11.4ha of land clearance is required by the SAPROF's original development plan.

The compensation, land acquisition shall be conducted following to the Decision No 1665/TTg-CN of Prime Minister dated October 17th, 2006. Based on Laws and Regulations, Hai Phong People Committee has issued Decision No 130/2010/QD-UBND dated January 22, 2010 on promulgation of rules for compensation, support and resettlement when government acquires land on the territory of Hai Phong city and Decision No 2640/2009/QD-UBND dated December 31, 2009 on issuing land price on the territory of Hai Phong city. According to this decision, the owner of acquired land will get compensation or support depending on legal status of acquired land.

Based on the discussion with MPMU2 and basic concept of the land acquisition policy for the government's needs, the land acquisition shall be enough but minimal. Thus the

Table 4.1 Recommended Land Acquisition

Present Use	Area (m^2)	Recommnended Mitigation Measures
1. Unknown use land between residential building and VTS Station	7,200	There are no sign of land use at this moment so that it is recommendable to aquired the land either it belongs to public or private. The compensation shall be setteled by the conpensation policy of Hai Phong City (Decision No 130/2010/QD-UBND)
2. Gov. facilities	13,600	It is reccomendable to continuously utilize the existing facilities (border control and the VTS station) without

Present Use	Area (m^2)	Recommnended Mitigation Measures
		major change in facilities and properties. In case of need for land acquisition, it shall be followed by the Decision No 130/2010/QD-UBND.
3. Bare ground along the coast with 5 graves	26,300	This portion is necessary to acure the land for the public facilities. At this moment, there are no sign of land use except 5 graves. 5 graves shall be relocated by the full support of responsible authorities following Decision No 130/2010/QD-UBND.
4. Salt pan	1,500 Reduced to 0	It is reccomendable to avoid the land clearance since this portion could be avoidable by the rearrangement of the public facilities. VINAMARINE/MPMU2 are also agreeable to avoid the land clearance of the salt pan.
5. Acureculture pond	64,700	This portion is necessary to acure the land for the public facilities. At this moment, there are no sign of aquacultural usage. The acureculre ponds belong to the border control office. The compensation shall be setteled by Decision No 130/2010/QD-UBND.
6. Forest	10,200	This portion is necessary to acure the land for the public facilities. The forest befolngs to the local community. and thre are no sign of the environmentally essential species. The compensation shall be setteled by Decision No 130/2010/QD-UBND.
7. Road	4,300 Reduced to 3,500	Due to the VINAMARINE/MPMU2's prefereance and possibility of the design arrangment, one of two roads could be avoidable to acqurire. As a result the necessary land acquisition could be reduced to 3,500m^2. Although both roads will be cut off by the Tan-Vu – Lach Huyen Highway, it is required to maintain the function of the existing two roads connecting between Cat Hai TT and Got harbor. Such counter measures shall be prepared by the responsible implementation agency of the highway.

1) General guideline of land aquisition

By the effective legal flamework in Vietnam, land clearance is the responsibility of the People's committee of the Hai Phong City. However, as the responsible implementation agency of the Hai Phong International Gateway Port, MPMU2 is actively involved in the land clearance to ensure the timely delivery of the necessary land clearance. Followins are the drafted guideline for the land aquision.

The owner of acquired land will get compensation or support for acquired land. Compensation and support will be calculated according to the Decision No 130/2010/QD-UBND dated January 22, 2010 on promulgation of rules for compensation, support and resettlement when government acquires land on the territory of Hai Phong city and Decision No 2640/2009/QD-UBND dated December 31, 2009 on issuing land price on the territory of Hai Phong city issued by Hai Phong People Committee. According to these decisions, the major principles and conditions of compensation and support are as following:

- The owner of acquired land will get compensation if meets conditions listed in items: 1, 2, 3, 4, 5, 7, 9, 10, 11 of article 8 of Government Decree No 197/2004/ND-CP dated December

3rd, 2004 and articles 44, 45, 46 of Government Decree No 84/2004/ND-CP dated May 25th, 2007. December 3rd, 2004. The owner of acquired land will get only support if do not meet above mentioned conditions.

- The compensated land will have the same land use purpose as of acquired land. In other case, the land owner will get compensation in money.
- In case when value of compensated land, resettlement land or apartment is higher than value of acquired land or apartment the owner has to pay for this difference.
- In case when value of compensated land, resettlement land or apartment is lower than value of acquired land or apartment the owner can get this difference.
- Land price for compensation is calculated on basis of the land use purpose. This price is promulgated every year on January 1st. by city people committee.

2) DRAFT implementation work of land acquisition, clearance and compensation, support plan for Hai Phong international Gateway port construction by MPMU2

a. Expected work for the land acuision

(i) To hand over the ground, determine the coordinates, boundary markers set up detailed plan of 1 / 500 and issue planning certificates. Conduct measuring, drawing and completing maps of 1 / 500 and 1 / 1,000 scale after completion of the planning certificate issuing and detailed planning. Issue documents for hand landmarks to establish overall plans for land clearance.compensation

(ii) To strengthen the professional division assisting the Council on compensation preparation facilities and professional training for staff working on the inventory, compensation plans, policies issued, the unit price.

(iii) To inform land acquisition policy.

(iv) Land inventory and Compensation plans

(v) Estimate the total full funding plan, including administrative and compensation costs.

(vi) To issue Decision on general land acquisition as the basis for Cat Hai District People's Committee to issue Decision on more detailed land acquisition.

(vii) Announcing the decision to withdraw the land.

(viii) Resolving complaints against the land acqyisition decision (if any).

(ix) Declaring inventory to identify the source of land, scheduled statistical sheets of compensation volume .

(x) Appraise and and approve compensation plans.

(xi) Disclosure of compensation plans and make compensation payment.

(xii) Formulation, appraisal, approval list of candidates and determination of land allocation criteria.

(xiii) Handover of cleared land to the project.

(xiv) Settling back against administrative decisions, administrative actions of People Committee Chairman at competent level (if any).

With all considerations listed above, the maximum compensation for removing one grave is estimated by about of 19 mill. VND, and compensation for aquaculture pond is about of 136 mill. VND/ha. The real compensation can be calculated only after detail inventory.

3) Implementation schedule.

SCHEDULE FOR IMPLEMENTATION WORK OF LAND ACQUISITION, CLEARANCE AND COMPENSATION, SUPPORT PLAN FOR HAI PHONG INTERNATIONAL GATEWAY PORT CONSTRUCTION (COMPONENT A)

TT	CONTENTS OF WORK	Implementing Agency	AGENCY COORDINATION	Implementation period (6 months)					
				The first month	month 2	month 3	month 4	month 5	month 6
1	Conduct Cadastral mapping of hai Phong international gateway port location	Technical centre for resources and the environment	Department of Natural &MT; Cat Hai district, II Marine PMU	—					
2	Cadastral maps and cadastral milestone by maps	Technical centre for resources and the environment	Department of Natural &MT; Cat Hai district, II Marine PMU	—					
3	Determining the origin of land	Cat Hai district	Department of Natural &MT; Cat Hai district, II Marine PMU		—				
4	Plans	Cat Hai district	Department of Natural &MT; Cat Hai district, II Marine PMU		—				
5	Approval	Chairman. Hai Phong	Department of Natural Resources Marine II &MT; PMU			—			

TT	CONTENTS OF WORK	Implementing Agency	AGENCY COORDINATION	Implementation period (6 months)					
				The first month	month 2	month 3	month 4	month 5	month 6
6	Inventory, site clearance compensation	Cat Hai district	Maritime Management Unit II						
7	Temporarily hand over the ground for the project	Cat Hai district	Maritime Management Unit II						
8	Land Compensation to support aquaculture	Cat Hai district	Department of Natural &MT; Cat Hai district, II Marine PMU						
9	Land compensation for cultivation land	Cat Hai district	Department of Natural &MT; Cat Hai district, II Marine PMU						
10	Payment of compensation	Cat Hai district	Maritime Management Unit II						
11	Total hand over the ground to project owners and contractors	Cat Hai district	Maritime Management Unit II						

4) Safeguard policy for people affected by the project

Compensation policies: To comply with Decision No. 130/2101/QD - UBND dated 22/01/2010 of the People's Committee of Hai Phong city, basically as follows:

a. Land compensation:

- For agricultural areas allocated for households in the long term, apply 100% of compensation rates, compensation rates based on land class are taxed at the local, concrete compensation rates based on the decision 130/2101/QD-UBND dated 22/01/2010 of Haiphong People's Committee: "Regarding the implementation of land prices in the territory of Hai Phong city in 2010";
- For agricultural 5% land and land out of long-term allocation cultivated land, 30% of compensation rates will paid directly to landusers, remaining 70% will paid to the district budget for the construction of local infrastructures accordance with the Law on State Budget.
- Land for perennial crops plantation land and land under aquaculture: If the quota allocation of cultivated land in accordance with the demographics of households lacking land than the average limit of communal compensation shall be usually 100% placement rate calculated land area equivalent to the deficit. The remaining area is just compensation for the cost of investing in land as prescribed.
- Compensation for land acquisition to support the aquaculture and forestry land.

b. Aquaculture land

Compensation, support of land.

(i) Land category:

- It is defined as agricultural land for taxation.
- Where the new reclaimed land is used for cultivation: the land location is defined as category 3.
- If there is investment with productive yield, based on the equivalent land in area to propose rates of compensation.

(ii) The level of support.

- For the hard delivered land, pond and river beach land (not under long-term agricultural fund) support for households and local governments the support is equivalent to 30% of the land price. The support is allocated as following:
- Pond fully invested by local authority before assigning to household for farming: Household gets 15%, 15% for the commune People's Committee.
- Pond assigned by contract with local authority: household: 20%, 10% for the commune People's Committee.
- Pond reclaimed by household: household 20%; commune People's Committee: 10%.
- Pond used for farming by collective and household is supported by 20% of investment: collective: 10%, household: 10%.

(iii) Compensation, support assets for properties on the land and pond treatment

Legal basis for calculating compensation and assistance:

- Branch standard 28 TCN 110: 1998 Aquaculture technology Process for semi-intensive shrimp farming.
- Branch standard 28 TCN 171: 2001 Technology Process for intensive shrimp farming.
- Branch standard 28 TCN 108: 1998 Technical requirements for seaweed cultivation.
- Results of annual aquaculture production of Statistical Office in Hai Phong city.

(iv) Compensation, support of land and properties on the land

- Compensation, support for pond treatment.
- Compensation, support for pond dredging.
- Compensation, support for farming production.
- Compensation, support for man labour.
- Compensation, support for forest land.

- Compensation, support for grave.

5) Assumed Cost of Land Acquisition

For the purpose of estimating total project cost, SAPROF experts and HYMENET experts assumed the cost of land acquisition based on the bast available information at this moment. Reliable cost estimation will be calculated by the Cat Hai district as shown above.

a. Legal basis for calculation:

- Decision No 130/2010/QD-UBND dated January 22, 2010 of Hai Phong PC on promulgation of rules for compensation, support and resettlement when government acquires land on the territory of Hai Phong city.
- Decision No 2640/2009/QD-UBND dated December 31, 2009 of Hai Phong PC on issuing land price on the territory of Hai Phong city.
- Other related regulations and decisions

b. Unit Cost of Compensation

Due to the uncernity of the land acquisition plan, the experts assumed the maximum unit costs defined by the mentioned safeguard policy above. In practical, it is likely to exceed the defined costs to meet the agreement from affected people.

Table 4.2 Unit Cost of Land Acquisition Defined by the Safegard Policy

Present Use	Basic Costs of the Compensation
1. Unknown use land between residential building and VTS Station	This land is defined as agricultural land. Unit price is 33,000VND/Sq.m
2. Gov. facilities	this land is defined as land for residence and unit price is 2,700,000VND/Sq.m
3. Bare ground along the coast with 5 graves	- The land is defined as agricultural land and unit price is 3,000VND/Sq.m. - For graves the highest compensation rate (6.9 million/grave) is applied.
4. Salt pan	Salt pan is considered as agricultural land and unit price is 32,000VND/Sq.m (This unit price is applied for salt pan and do mot depend on land type.)
5. Acureculture pond	- Land: Compensation rate is 30% of agricultural land price. Unit price is 33,000VND/Sq.m - Bank creation: it is supposed that the dredged volume for bank creation is 500 cub.m with unit price is 40,000VND/cub.m and for drainage channel is 250cub.m with unit price is 20,000VND/cub.m - Facilities: include pump, electricity supply line etc. - Labor tool: unit price is 12mill.VND/ha - Fence: it is estimated the length of fence is about 1,000m and unit price is 20,000VND/m - Pond treatment: Unit price is 15 mill. VND/ha - Living facilities: 7,000 Thousand? /household with assume that only one household cultivate on this pond - Aquaproduct: It is supposed that pond is in middle phase of cultivation and compensation is 70% of price. Unit price is 150 mill. VND/ha. - Labour: For aquacultural pond with area of under 10ha, the labour norm is 0.5 worker/ha and unit price is 2.2mill. VND/worker.
6. Forest	This forest land is defined as agricultural land and compensation is 20% of price. Unit price is 33,000VND/Sq.m
7. Road	It is supposed that this part of road is cleared and new concrete road should be built. Estimated unit price is 1 millVND/Sq.m of road.

c. Assumed Costs of Land Acquisition

Table 4.3 summarized the auumed cost of the land acuquisition. The assumed cost for the land acquisition is million VND 7,481 (thousand USD 440.89)

Table 4.3 Assumed Cost of Land Acquisition (SAPROF ESTIMATION)

Present Use	Area (m^2)	Compensation/support Cost (million VND)	
1. Unknown use land between residential building and VTS Station	7,200		237.6
2. Gov. facilities	N/A		
3. Bare ground along the coast with 5 graves	26,300	- Land: - 5 Graves:	867.9 34.5
4. Salt pan	N/A		
5. Aquaculture pond	64,700	- Land: - Bank creation: - Facilities: - Labor tool: - Fence: - Pond treatment: - Living facilities: - Aquaproduct: - Labor:	640.53 25.0 1,220.8 77.64 20.0 97.05 7.0 679.35 7.12
6. Forest	10,200	- Land:	67.32
7. Road	3,500		3,500.0
Total			**7,481.81**

4.1.2. Support for coastal fishing

Though there are few legal frameworks to maintain or support the potentially affected fishermen, the people's committee of Hai Phong is actively working on the new safeguard policy development to take care of such project affected fishermen at this moment. Since there are no legal flameworks for such matter at this moment, the Hai Phong PC has requested relevant authorities of Hai Phong city, such as DONRE, department of land management, department of agriculture, fishery and rural development, and department of finance to consider the possible option for such project affected fishermen. Since there is not good enough information to develop a realistic policy, it is highly recommendable to conduct "Detailed base line survey" to understand the reality of the fishing activities and to consider the potential safeguard policy for such affected people.

Although the development of the safeguard policy is not the responsibility of VINAMARINE/MPMU2, both authorities are keen to contribute to such safeguard policies as the project owner and inprementation agency of the port development. MPMU2 has actively consulted with the people's committee of Hai Phong to meet the requirement of the necessary land delivery with timely manner as well as the comittemnt of the Vietnamese authorities under the Japanese ODA loan processes. However, due to the new policy development, it is likely to take more than a six (6) months. However, in the case of the higher priority matter suggested by appropriate higher authorities, the process might be shorthened. In order to aquire the majorities of the project affected fishermen and meet the tite schedule of the port development, it is highly recommendable to develop such safeguard policy as soon as possible and lead smooth transaction of the construction stage. In order to convince the appropriate higher authorities to accerelete the such process, JICA or relevant Japanese agency may be able to support such matter by official request form or other means.

4.1.3. UXO clearance

Bomb and mine may be remained in the project area from the war time. As cettinity of the clearance

work and special knowledge are required, MPMU2 is suggested to contract with functional organizations to conduct bomb and mine disarming in project site area for safety; to coordinate with government of various levels at for land acquisition and compensation in accordance with current regulation" (article 8 of No. 2231/QD-BTNMT, Hanoi, 2008 by MONRE). In order to avoid losses caused by the bomb and mine explosion, the bomb and mine clearance activities shall be done following the applicable laws and regulation.

- The bomb and mine clearance activities are listed in the scope of land acquisition plan, to be done before the execution of the ground improvement works.
- This package shall be contracted-out to an authorized and specialized agency of the Ministry of Defense.

4.2. Mitigation measures during construction stage

During the construction stage, the following works will be carried out: ground leveling, construction of terminals, storage, management office building, installation of equipment, channel dredging, etc. These activities would bring in the increase of vehicles and labor forces, resulting in huge impact to the environment such as dust, noise, and hygiene, etc. the following mitigation measures should be applied to avoid the adverse impact.

4.2.1. Mitigation measures for air environment

During the constructional period, the Contractor shall have to undertake all the regulations on labor safety and environment hygiene. Followings are some of such measures:

- To locate the access road for transportation and protecting fence, lighting system at night and safeguard, fence around the dusty area, use the watering car to water the road during the dry season.
- To plan the construction schedule, personnel arrangement to avoid duplication, to apply the modernized construction methodology to … the construction progress
- To provide all the guiding materials of the construction equipment for references, check periodically the technical specification, install fire alarm system, signaling system and other sign boards
- To provide necessary protective clothes to minimize the dusty environment to construction workers

Besides, in order to minimize the dust and noise from the transportation vehicle and construction equipment, the following measures will be applied:

- The use of old transportation vehicles and construction equipment should be avoided
- To reduce the speed of construction works and volume of transportation from 22:00 to 6:00 to minimize the impact to the households in the area
- To check the noise and vibration during the constructional period and set up the construction schedule in compliance with the Vietnamese standard TCVN 5949- 1998 and TCVN 6962:2001.
- Avoid using a large number of noisy equipments at the same time

4.2.2. Mitigation measures for water environment

- During the construction period, do not discharge the wastewater directly to the sea, avoid polluting the sea water due to the waste water from daily activities and construction activities
- During the construction period, the numbers of construction workers are estimated at 700, therefore temporary WC will be set up (10 mobile WC (s) with the capacity of 200 litre/each), a temporary waste transshipment places should be arranged, to educate construction workers not to discharge daily wastes.
- the fuel storage area need to be equipped with a hard foundation, roof, and protective wall to avoid dropping of the fuel or …. To the surrounding area which may pollute the soil,

underground water and surface water

- during the construction period in the water area, protective measures should be applied to limit the risk happened during the construction of dyke and terminal to avoid the spreading of the oil to the surrounding area

4.2.3. Mitigation measures to impacts caused by dredging works

The total volume of dredging works at the initial construction would be the largest volume in the history, which is estimated at 35,635,301m^3. The People's Committee of Hai Phong City has agreed to allocate 2 areas with the capacity of 50,000,000m^3 in

- 5 locations in the following communes: Dong Hai 1, Duong Quang, Thuy Duong, Lap Le with the total area of 35.6ha (Figure 3.9)
- 1 location in Nam (South) Dinh Vu industry zone with the total area of 1.000ha

Based on the SAPROF's sedimentation study, the maximum capacity of the permitted dump site will be full in only 14years with annual channel dredging only. With the maintenance dredging for the port and terning basing, the permitted dump site of the dredged material would be full in 10years.

Since the proposed port is expected to expand its facilities in the future, it is highly recommendable to consider "Sustainable solution" for the dredged material management. For the limited time flame for the proposed two (2) container terminal and a common berth, it is recommendable to utilize the permitted dump site, but other sustainable measures such as:

1) offshore dumping with appropriate environmental measures to avoid the negative impacts on enclosed waters and surrounding ecosystem,

2) beneficial use for the estuary/tidal flat creation adjacent to the sand control dyke, which is subject to provide favorable environment for tidal and coastal organism, especially for juvenile fish and shell fish

shall be considered in the detail design stage as well.

4.2.4. Mitigation measures to impacts caused by daily solid waste

During the construction period, the volume of solid wastes discharged by the construction workers are forecasted at 420kg per day. To minimize the impact caused by the solid waste, the project owner shall also undertake the following measures:

- To build the workplace policies, ban from discharge solid waste to the sea
- To allocate 5 solid waste storage tank, 200 litre type, to collect all the daily solid wastes discharged by the construction workers and employee in the construction site. The project owner shall also contracted-out to Hai Phong Urban Environment Company to transport to the dumping site.

4.2.5. Mitigation measures to impacts caused by hazardous waste

To minimize the adverse impact caused by hazardous wastes (oily wastes, oil and gasoline products) generated during the construction period, the project owner shall undertake the following measures:

- minimize the repair of equipment and machinery at the construction site. The repair shop will be equipped with the oil collecting system discharged from the equipment repair works
- oily wastes discharged at the project site ban from dumped at the site but will be collected to the storage tank placed at the construction site
- the volume of lubricated oil used is 18 l/per time/per vehicle, each vehicle will replace 4 times per year. The total volume of oily wastes at the site is about 150l per month. To minimize the impact of the oily waste discharged from construction equipment, the project owner shall arrange 5 storage tanks, 150 l type, for oily waste collection.

- During the construction period, the contractor shall be responsible for collecting, storage, treating and destroying oily wastes in accordance with the Decision 23/2006/QD-BTNMT dated December 26, 2006 of the Ministry of Natural Resources and Environment on issuing list of hazardous wastes and the Circular 12/2006/TT-BTNMT dated December 26, 2006 of the Ministry of Natural Resources and Environment on guiding the application procedures, registration, licensing, and management code for the hazardous waste.
- During the construction and operation period, the project owner committed to strictly supervise contractor, waste water collection company, especially for the hazardous waste to avoid the adverse impact to the environment.

4.2.6. Mitigation measures to other impacts

The project shall set up regulations on environment protection inside and outside the construction area. Construction materials need to be kept in the right place, minimize the impact to environment, transportation and daily life of the residents.

- Labor's health: ensure the living condition with proper facilities including camp, clean water, living spaces, etc; construction workers who are working in harsh condition will be equipped with protective clothes to protect them from harsh weather condition and disease.
- Labor safety: ensure the labor safety for construction workers by equipping enough protective facilities including clothes, gloves, hat, glasses, etc. For workers who are involving in the execution of elevated work items or equipment installation which are in dangerous condition, special facilities such as helmet, mask, signaling light, etc should be provided.
- Draft monitoring and maintenance schedule to check construction equipments' specification.
- Provide training on operation and maintenance for workers who are directly involved in daily operation.

4.3. Mitigation measures during operation stage

4.3.1. Wastewater collection measures

1) Wastewater categorization

Wastewater discharged during the construction period is categorized into 2 kinds in view of the characteristics and level of pollution:

- "Clean" wastewater: rainy water falls into the port area and water discharged from air conditioner. This kind of waste water could be treated by infiltration
- "Polluted" wastewater: waste water discharged from port operation including the daily waste water by construction workers and oily waste from repair shop and container cleaning. This kind of waste has a high level of pollution and therefore needs to be treated properly before discharge to the sea.

2) Drainage system

The drainage system in the port is positioned in the following 2 system:

a. System 1

This system is only designed for rainy water and "clean" waste water. This system comprises of drainage ditches to take the flow of rainy water from the top to the underground drainage system along the port access road. Rainy water in the port area and inner access road will go to rainy water collection ditches along the container terminal and lead to the common sewer. Air conditioning tank and filter tank should be placed at the end of the common sewer before flow into the main drainage system to the sea.

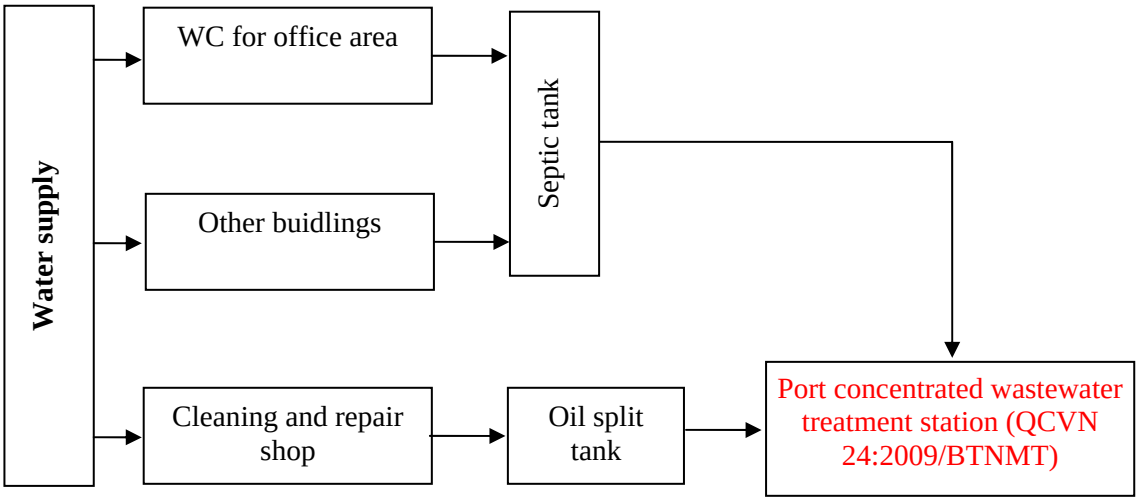


Figure 4.1 Scheme of waste water discharge

b. System 2

This system 2 is only designed for "polluted" waste water discharged from construction works. All of the polluted wastewater will be channeled through the drainage system (separate from rainy water) to the concentrated wastewater treatment system inside the port before discharge to the sea.

3) Waste water treatment

a. Daily waste

During the port operational period, it is estimated that the volume of daily wastewater is about 23m3/per day. This kind of waste will be treated by biological method at the treatment tank following Vietnamese Technical Regulation QCVN 14:2008/BTNMT before go to the concentrated wastewater treatment station and then discharge to the sea (Figure 4.2). The daily wastewater treatment station is functioned both as a filter and disintegration of sludge. A part of the sludge in the tank, under the impact of microorganism and disintegrated organ substances, turns into gas and the other part become dissolved inorganic substance. Wastewater after being treated at the filter tank No.1 goes to biological filter tank and then filter tank No.2 and No.3 before discharge into drainage system to the concentrated wastewater treatment station. The output of wastewater treatment shall ensure the compliance with Vietnamese Technical Regulation QCVN 14:2008/BTNMT

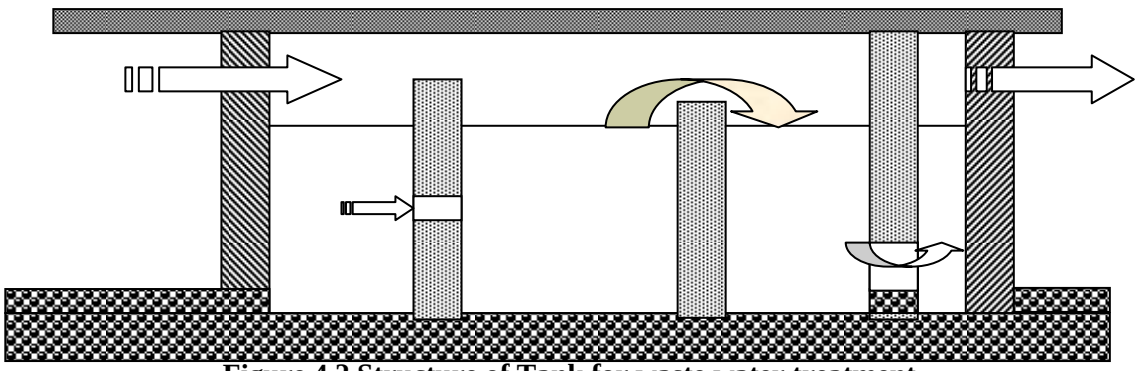
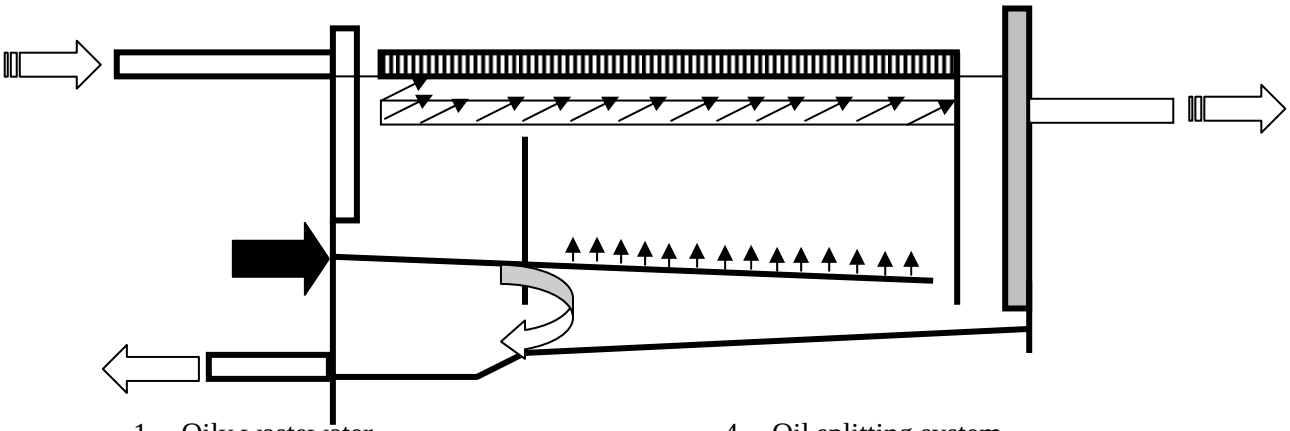


Figure 4.2 Structure of Tank for waste water treatment

b. Industry waste

The volume of industry wastewater from the repair shop and vehicle cleaning shop is estimated at about 70m3/per day, which could comprises of hazardous solid waste. Oil and chemical substances will be collected to the oil splitting treatment tank and then discharge to the common drainage system and go to the concentrated wastewater treatment station. Oil collection and oil sludge splitting method is described in the following Figure 4.3.



1- Oily wastewater
2- None oil wastewater
3- Air pump system
4- Oil splitting system
5- Oil collecting piping
6- Oil sludge collector

Figure 4.3 Treatment scheme for oil polluted water

c. Bilge water, wastewaster discharged from ship

Following the current Vietnamese regulation (Decree No.71/2006/ND-CP dated July 25, 2007 on seaport and maritime management) Article 48 stipulates "Ships coming to the port area shall follow regulations of Port Authority on waste discharge, waste water and bilge water pumping; Port Operators and the company or agency undertaking the cleaning services for coming ships shall provide facility to collect trash and waste water from ships, and has the right to collect fees as per regulation.

Bilge water needs to be discharged following regulations of Hai Phong Port Authority. As to the oil sludge, oily waste discharged from calling ships (upon request), the project management board will coordinate with Tan Thuan Phong Limited Company (an authorized company to be responsible for collecting, transporting, and treating hazardous wastes) to collect and transport wastes to outside area and treat accordingly.

d. Concentrated waste water treatment

Based on the estimation of volume of wastewater as mentioned in 3.1.1.2.(b), the concentrated wastewater treatment station will be constructed with the design capacity of 100m3/per day. The water after treatment is qualified as indicated in Vietnamese Technical Regulation QCVN 24:2009/BTNMT (B column, K_q coefficient = 1,2, K_f = 1,1) and then transfer to the common drainage system and goes to the sea. The common drainage system is shown in the Figure 4.4.

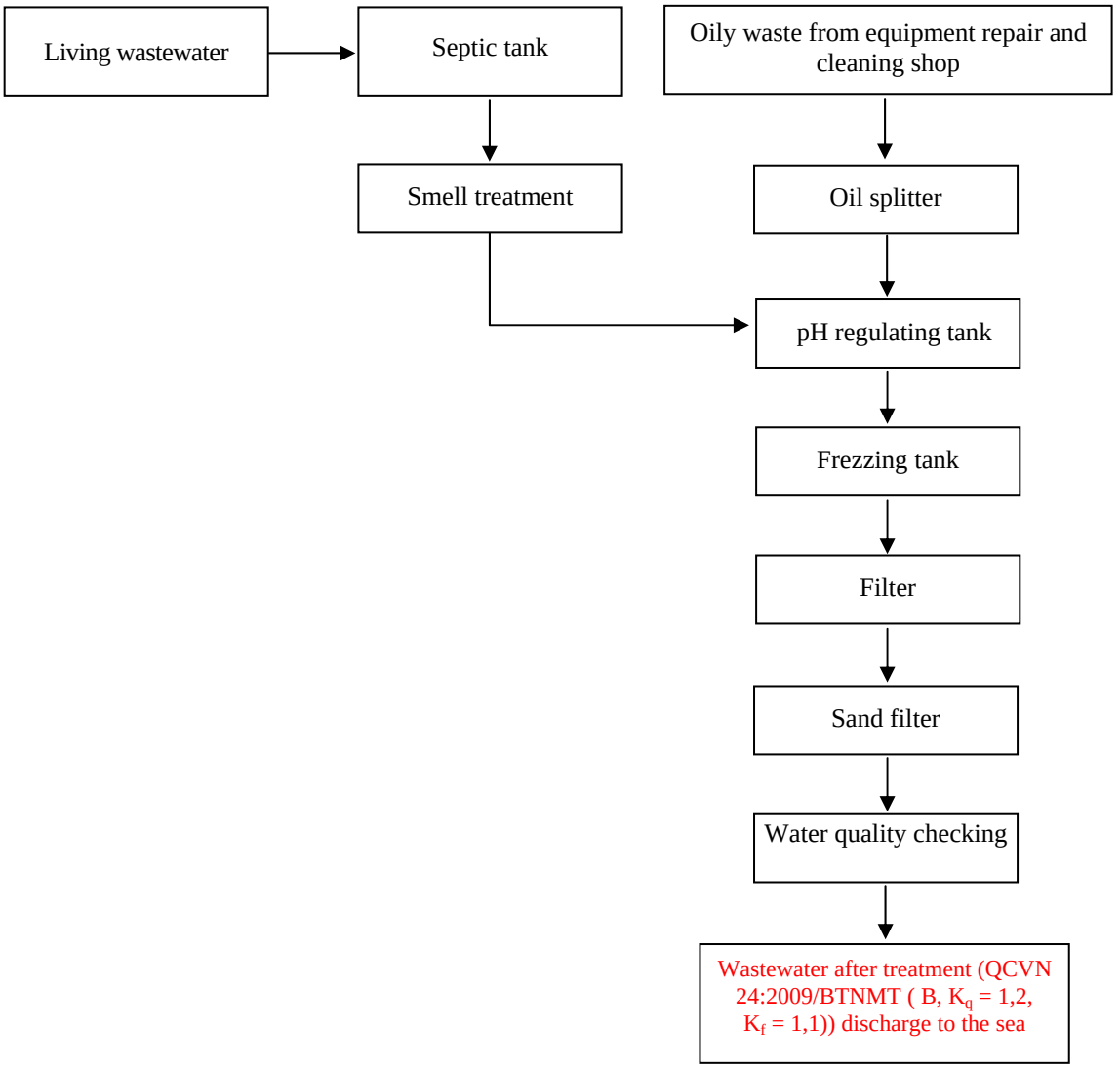


Figure 4.4 Treatment scheme for waste water at Hai Phong international gateway port

4.3.2. Solid waste collection and treatment measures

Storage tank and oily waste storage tank and trash from ships will be placed in the port area The port management board will send a notice and provide information regarding waterway environment protection regulations and penalty imposed to ship owners when discharge wastes to waterway system. Wastes from port and calling ships will be collected and kept temporary in the port. The solid wastes after collection will be categorized into 2 kinds: hazardous waste and un-hazardous wastes.

- Un-hazardous waste: the project owner shall contracted-out to the Hai Phong Urban Environment Company (URENCO) to transport to the dumping site in Cat Hai district
- Hazardous waste: the project owner shall contracted-out to Tan Thuan Phong, company (an authorized company) to collect, transport and treat in accordance with the regulation of the Decision No.23/QD-BTNMT of the Ministry of Natural Resources and Environment on issuing the list of hazardous waste and the Circular No.12/2006/TT-BTNMT dated December 26, 2006 of the Ministry of Natural Resources and Environment guiding the application, registration, and licensing, code management for hazardous waste. The project owner shall also report to the Department of Natural Resources and Environment of Hai Phong City.

Other kinds of wastes such as paper, nylon bag, carton boxes, metal, etc. will be collected and sold to the recycling factory.

4.3.3. Mitigation measures to impacts caused by periodical dredging works

In addition to the initial dredging, the new port requires substantial amount of maintenance dredging, which is expected to be 3,442,000m^3 at the first year and 747,000m^3/y for the succeeding years. Based on the SAPROF's sedimentation study, the maximum capacity of the permitted dump site will be full in only 14years with channel dredging only. With the maintenance dredging for the port and turning basing, the permitted dump site of the dredged material would be full in 10years.

Since the proposed port is expected to expand its facilities in the future, it is highly recommendable to consider "Sustainable solution" for the dredged material management. For the limited time flame for the proposed two (2) container terminal and a common berth, it is recommendable to utilize the permitted dump site, but other sustainable measures such as:

1) offshore dumping with appropriate environmental measures to avoid the negative impacts on enclosed waters and surrounding ecosystem,
2) beneficial use for the estuary/tidal flat creation adjacent to the sand control dyke, which is subject to provide favorable environment for tidal and coastal organism, especially for juvenile fish and shell fish

shall be considered in the detail design stage.

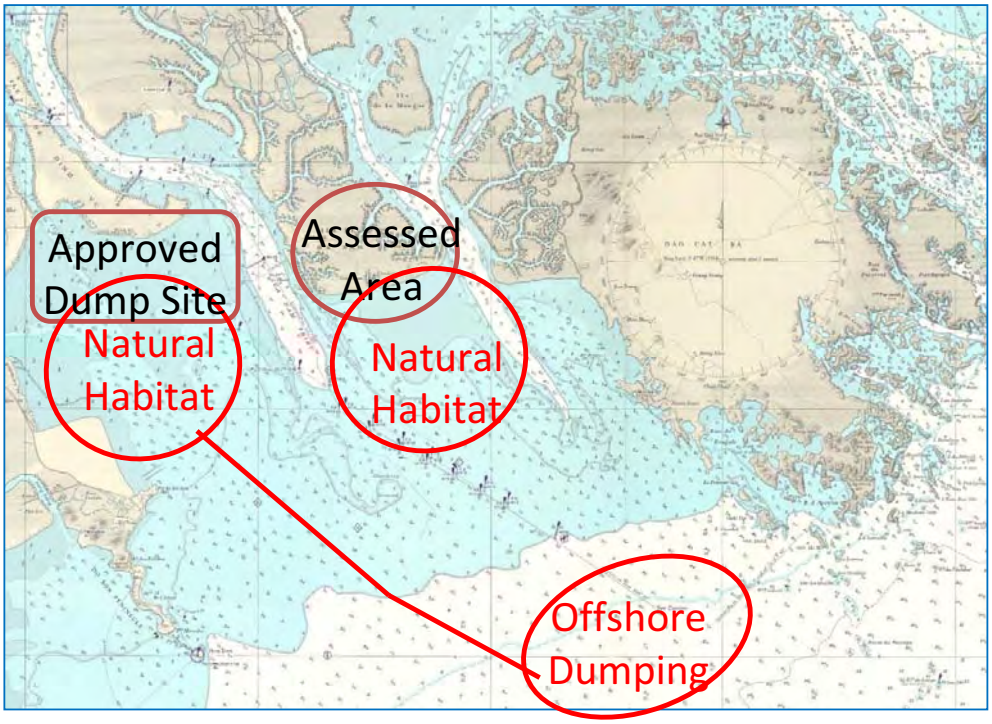


Figure 4.5 General Location of the Potential Mitigation Measures

Considering the sustainability and practicability of the offshore dumping, it is economically and practically favorable for the port development. However, careful consideration of the environmental

impacts should be studied with substantial number and period of baseline study. With the sufficient studies and appropriate counter measures to reduce the environmental impacts, it would be possible to acquire the approval of the EIA and permission of the dumping.

Considering the beneficial use of dredged material, it would be good opportunity to utilize dredged material as natural habitat restoration rather than costly reclaimed landfill material or no value dumping. Due to the elimination of the coastal mangrove forests for decades in the region, substantial decline of the fish catch has been observed and reported by fishermen in the region. It would be a good opportunity for the Hai Phong City to restore the tidal flat with tidal vegetation such as mangroves, which would be able to add further benefits in the region from recovery of fish catch with sustainable solution for dredged material management.

Since both offshore dumping and tidal flat creation is likely take time to develop reliable design/plan, it is recommendable to consider the utilization of the permitted dumpsite for the initial construction and explore the sustainable management measures for the maintenance dredging. In addition to the detailed dredging plan at the detailed design stage, it is recommendable to analyze the potential options for the sustainable management measures for the maintenance dredging.

4.3.4. Measures preventing accidents

To avoid ship accidents, the following measures will be taken:

- Light buoy or signaling will be installed in the container terminal. The light, sign board, signaling system will be designed and installed following Vietnamese and international standard.
- Restrict the working area by the light buoy system. This is also a part of the maritime rescue works
- The lighting system needs to be on services 24 hours.
- Navigators have to be trained with special skills to be able to handle incoming/outgoing ships, and need to be provided with special navigation equipment
- (02) tug boats need to be provided for incoming large vessels, however depending on the weather condition, the number of tugboats may increase whenever necessary.
- A communication system among port authority, vessels, and tug boats need to be smoothly maintained
- Other measures to avoid accidents
- the buffer should be placed in each berth appropriately to enable the safety calling of small ships.
- The schedule for incoming and outgoing ships should be noticed 48 hours well beforehand
- Fire precaution and prevention should be stipulated to ensure safety operation of the port. Any kind of activities of ships or fuel supply are subjected to the compliance of fire precaution and prevention as well as labor safety. The ships should be called separately to avoid strike fire.
- During the fuel supply process, the likely fire accident activities should be put under control. The gas supply station should be fenced and equipped with fire preventing light and safety equipment, inflammable materials are not allowed to keep in the area, fuel supply piping system should be check carefully to ensure no leakage or spill-over to the water flow.

4.3.5. Other measures preventing environment pollution

Pollution prevention equipment may comprise of the following:

- Waste water treatment system to treat the waste water before discharge to the sea
- Wastes collection basket along the access channel
- Fire extinguish equipment should be regularly maintained. In case where fire happens, all cargo handling activities will be suspended, and calling ships should be ready for removing.
- Fire rescue system, sand and fire extinguish chemical should be ready at all berths

- In case where a ship drown, it is necessary to have some measures to avoid the oil spreading, oil in the ship should be pumped into a storage tank to avoid the spill-over to the sea
- Provide the following equipment to avoid oil spill-over: high-speed boat, light motorized boat, oil preventing buoy, oil storage bag and basket to keep the oil temporary. Rescue plan and method should be made and practiced for all construction workers; and mobilize port equipment/facilities for rescue purposes in case of necessity.

4.3.6. Measures preventing and coping with oil spill

The cargo handling at Hai Phong international gateway port shall be in compliance with the Vietnamese and international maritime regulation and other relevant regulations. However, there might be an unexpected accident which causes great losses of human being and environment. There might be several reasons for the oil spill-over resulting from the ships' crash, therefore prevention and rescue works is a matter of great importance to avoid losses to the human being, property and environment.

1) Principle preventing oil spill

- Comply with all rules and regulations such as: Environment Protection Law, Maritime Law, guiding regulations for implementing the laws, the Decision 103/2005 dated May 12, 2005 of the Prime Minister on regulations to cope with the oil spill-over
- The project owner shall prepare a rescue plan and submit to the People's Committee as per applicable laws
- Carry out the operation process following rules and regulations to ensure the safety for people and environment in the Hai Phong international gateway port area
- Ensure the safety in all kinds of activities in compliance with ICS và OCIMF (Ship to ship transfer Guide/Petroleum, Third Editionn 1997).
- Mobilize all kinds of available resources to rescue in case of necessity
- Strengthen the monitoring and management of state agencies and enhancing a further close coordination among concerned agencies and individual in the to cope with oil spill-over

2) Prevention and coping with oil spreading

Rescue Equipment

To be ready for coping with the oil spreading in Lach Huyen area, it is necessary to equip with rescue equipment. Where necessary, Lach Huyen port will contract-out to a specialized company which could be able to provide and support rescue equipment whenever needed.

Equipment required for rescue works:

- Communication equipment: VHF/Walkie/Talkie, cell phone MP and other in-land communication equipment
- Fire alarm and fire extinguish equipment, certified by the Vietnam Registration and the Police, should be monitored and maintained regularly to make sure they are in good condition. Fire alarm and fire extinguish equipment comprises of the following:
  + automatic fog spray system
  + automatic CO2 spray system
  + water pressure system, fire-pump system
  + fire extinguisher
  + the inert gas system
- 01 tug boat with a capacity of 1,000 – 2,000 HP with oil control buoy, oil skimmer, pump, and intake pipe
- 01 tug boat with a capacity of 400 HP

- 01 canoe on full-time services basis
- 06 buffer buoy with a diameter of 3,3m and L=6,5m
- 16 oil conveyance pipes, in which 06 pipes has D =20m and L=10, and 10 pipes has D=25m and L=10m
- For cargo handling ships or fuel supply ships which travel to international area, fire alarm and fire extinguish equipment should be installed in accordance with international treaties and Vietnamese standard. These equipment are subjected to certification by the maritime inspection agency before involving in the cargo handling activities

Besides the above-mentioned equipment, equipments from Hai Phong Port or Quang Ninh port area could also be mobilized where necessary.

Personnel arrangement for rescue works

During the port operation, Lach Huyen port will set up an unit to be responsible for taking rescue works. This unit will manage the accidents by themselves given it is manageable or coordinate with other agencies where complicated.

Coordination with other agencies such as Hai Phong Port Authority, Hai Phong's Fire Precaution and Fire Prevention Police in case of emergency.

International agencies

International agency who is able to provide rescue within 80 hours is the Singapore's SEM. They could provide the equipment including:

- Protective buoy >2000m
- Oil skimmer (5 complete sets)
- Oil storage with a capacity of 150 m3, dracone type
- Underground pump with generator (4 pieces)
- Rescue boats

b. Coping alternatives in different scenario

According to the Prime Minister Decision, there are 3 levels of oil overflow:

- Level I: the volume of overflowed oil to the sea < 100 tons, this case the pollution level is minimal and could control within the radius of 0,5 miles from the accident site
- Level II: the volume of overflowed oil to the sea fr. 100 – 2000 tons
- Level III: the volume of overflowed oil to the sea >2000 tons. This could not be controlled in a timely manner and therefore the risk of polluting the sea environment is very huge.
- Accidents happened in the sea is likely to cause oil pollution and impact the surrounding water area. The volume of overflowed oil to the sea > 2000 tons is very dangerous. Besides the above-mentioned cases, there might be the case where the bilge water, oily water, oil sludge discharged from the ships to the Lach Huyen area. This case is not considered as oil overflow but it brings negative impacts to the sea water in the region and the ecological system and economic activities such as aqua-culture and tourism. Therefore, it is necessary to issue regulations on wastes management in the port area in order to maintain a sustainable economic development.

Option for preventing and coping with the oil overflow Level I:

Main causes are:

- Leakage of connecting piping system during the fuel supply process
- Leakage of oil piping system in the ships

Prevention measures:

When calling to the Hai Phong international gateway port area, the large vessel shall have to use tug boat in order to come nearby the port area to handle the cargo or receive the fuel. Or the fuel supply boat shall have to come to the large vessel to supply fuel. During the operation/fuel supply process, the following rules and regulations need to be strictly comply with in order to avoid the accidents:

- regular checking and maintenance of equipment, machinery, fuel supply piping system
- buffer joint for the soft pipes for fuel supply need to be properly maintained.
- when executing the fuel supply or cargo handling, the speed should be maintained from low speed at the beginning and increase gradually; the crew members need to closely monitor the process to make sure no oil leakage
- due to the differences of air pressure among vessels, the air pressure in the oil and fuel piping need to be adjusted accordingly.

Rescue measures:

In spite of taking the above-mentioned preventing measure, when the oil leakage is observed, all the operations will be stopped until everything are safe to get back to normal condition

When there's such occurrence, the person in charge will immediately report to the port authority and all the concerned parties. Upon receipt of such notice, all parties shall have to take the following actions:

** Captain of calling vessels:*

- Notify the accidents to the agency in charge of coping with oil overflow immediately
- Carry out the rescues works in coordination with concerned parties
- Notify all crew members to launch rescue equipment/facilities
- Carry out the following works:
  - + Notify the tug boats to launch protective buoy, pump and oil-pump equipment
  - + Notify all crew members of the receiving ships and fuel supply boat to be ready for receiving protective buoy
  - + Use oil-skimmer to collect oil from the protective buoy and pumped to temporary storage tank on barge
  - + If necessary, use fire extinguisher to the oil spreading place to prevent the explosion and strike fire
  - + If the oil spread outside the protective buoy, use oil skimmer to collect all the oil and avoid further spreading

** The authorized company in charge of coping with oil spreading in Hai Phong international Gateway Port:*

Upon receipt of the notice on the accident, the agency shall have to report to the following authorities:

- The People's Committee of Hai Phong PC
- Hai Phong Port Authority
- Department of Natural Resources and Environment of Hai Phong

The report should update the current status of rescue works being taken place at the site, level of

pollution, etc.

Normally, as to Level I, the oil overflow is limited inside the ship calling area. Therefore, right after reporting to higher authorities, the company shall have to coordinate with Hai Phong Port and Dinh Vu Port to undertake the following works:

- Be ready to provide protective buoy to the fuel supply and receive ships or the water basin
- Launch the pump and oil skimmer, and collect the oil and pumped to the temporary storage tank on barge immediately

Communication system

When such accident happens, the captain of the fuel supply ship and the container ship will be responsible for taking the lead and communicating among concerned parties:

- Be responsible for communicating and reporting to the company all the happenings at the site
- Maintain a smooth communication among ships to be timely and effectively rescue
- When accomplishing the rescue works, the company shall have to report to all concerned authorities details of the accidents.

The cargo transshipment and fuel supply activities will be resumed upon receipt of the permission from the Hai Phong PC and Hai Phong Port Authority.

The Report on the oil overflow accident will be jointly prepared by the company, the captain of the container ship, captain of the fuel supply ship and submit to the Hai Phong PC and Hai Phong Port Authority.

Prevention options to coping with oil spreading Level II

Major causes are:

- Break out of transmission piping system
- Break out of oil piping system
- Oil spill-over at the storage tank of the oil receiving ship

Prevention measures

During the fuel supply process, the air pressure of 2 ships (supply and receive) are almost zero and therefore the only reason could be the closure of valve in one ship and the pumping system is working in the other ship. Therefore, all the crew members should be trained to make sure that in any cases at least one valve has to be kept opened to facilitate the oil supply

- the oil spill-over to the storage tank is rarely happened, however, all the ships be reminded that one storage needs to be kept not to be full when receiving fuel and the pumping speed has to be reduced at the lowest
- regular maintenance of oil piping system

Rescue measures in case of accidents

In spite of taking the above-mentioned preventing measure, when the oil leakage is observed, all the operations will be stopped until everything are safe to get back to normal condition

When there's such occurrence, the person in charge will immediately report to the port authority and all the concerned parties. Upon receipt of such notice, all parties shall have to take the following

actions:

Captain of calling vessels:

- Notify the accidents to the agency in charge of coping with oil spreading immediately
- Carry out the rescues works in coordination with concerned parties
- Notify all crew members to launch rescue equipment/facilities
- Carry out the following works:
  + Notify the tug boats to launch protective buoy, pump and oil-pump equipment
  + Notify all crew members of the receiving ships and fuel supply boat to be ready for receiving protective buoy
  + Use oil-skimmer to collect oil from the protective buoy and pumped to temporary storage tank on barge
  + If necessary, use fire extinguisher to the oil spreading place to prevent the explosion and strike fire
  + If the oil spread outside the protective buoy, use oil skimmer to collect all the oil and avoid further spreading

** The authorized company in charge of coping with oil overflow in Hai Phong international Gateway Port:*

Upon receipt of the notice on the accident, the agency shall have to report to the following authorities:

- The People's Committee of Hai Phong PC
- Hai Phong Port Authority
- Department of Natural Resources and Environment of Hai Phong

The report needs to be precise and specific about the happenings of Level II and the rescue activities being undertaken at the site. The source of pollution and the risk of oil spreading could be controllable but the company has to undertake the following works:

- Be ready to provide protective buoy upon receipt of the request by the captain
- Launch the pump and oil skimmer, and collect the oil and pumped to the temporary storage tank on barge immediately
- Support the ship's separation following the guidance of the captain of the calling ships
- In case of necessity, mobilize more equipment from nearby areas
- Mobilize tugboats from Hai Phong Port in order to launch protective buoy

Rescue works at the site:

- Surround the area by protective buoy
- Use oil skimmer to collect oil
- Prevent the oil spreading to the seaside

On-land rescue works:

- Upon receipt of site report from the company and the Hai Phong Port Authority, the People's Committee of Hai Phong PC will instruct the Department of Natural Resources and Environment and Hai Phong Port Authority to set up a steering group whose members would be able to provide rescues works on-land to prevent the oil spreading to the seaside. They may also mobilize further supporting equipment from Hai Phong Port and Dinh Vu Port.
- Once the safety condition is confirmed, the company shall have to report to concerned parties the result of rescue works and the pollution prevention measures.

As this is more serious than Level I, the captain of the ship which causes the oil spreading need to contact to its insuarance company for settlement.

The fuel supply will be resumed after the safety condition is confirmed and upon receipt of permission of Hai Phong PC and Hai Phong Port Authority.

The Report on the oil spreading accident will be jointly prepared by the company, the captain of the container ship, captain of the fuel supply ship and submit to the Hai Phong PC and Hai Phong Port Authority.

Communication system

When such accident happens, the captain of the fuel supply ship and the container ship will be responsible for taking the lead and communicating among concerned parties:

- Be responsible for communicating and reporting to the company all the happenings at the site
- Maintain a smooth communication among ships to be timely and effectively rescue
- Due to the seriousness of this Level, the concerned parties shall have to take the following measures:

** Rescue works at the site*
- Captain of the oil supply ship shall provide guidance at the site how to carry out the rescue works
- The company shall be responsible for informing the higher authorities about the process of rescue works and be responsible for communicating with the Center on-land, if any.
- Where necessary, the captain of the oil supply ship shall request cargo transshipment ships to prepare temporary tank to receive oil in case the rescue ships are full of oil collected.

Oil polluting prevention works
- The first priority task is to prevent the oil spreading to the seaside by using the protective buoy and oil skimmer and pump to oil storage tank on barge; or use other kinds of equipment or materials to collect oil
- The use of dispersion substances are not allowed
- If the situation is getting more serious, the alarm to Level III could be made

The prevention options and rescue works for Level III

Main causes are:
- Ships crashes
- Ships accidents causing damage to ship's cover
- Fire explosion due to many reasons
- Other causes

Prevention measures
- The above-mentioned causes rarely happened at Lach Huyen as the ships calling in parallel with each other and tugboats are allocated to lead the calling ships to the designated locations
- Buffer equipment are positioned between the calling ships and the tugboats to avoid crashes, and follow regulations on fuel supply and cargo transshipment during the operation process
- Comply with all regulations/ guidance on maritime during the operation process
- This kind of accident could be occurred when the major machine are out of order

Rescue works in case of accidents:

In spite of taking the above-mentioned preventing measure, when the oil leakage is observed, all the operations will be stopped until everything are safe to get back to normal condition

When there's such occurrence, the person in charge will immediately report to the port authority and all the concerned parties. Upon receipt of such notice, all parties shall have to take the following actions:

** Captain of calling vessels:*

- Notify the accidents to the agency in charge of coping with oil spreading immediately
- Carry out the rescues works in coordination with concerned parties
- Notify all crew members to launch rescue equipment/facilities
- Carry out the following works:
  - + Notify the tug boats to launch protective buoy, pump and oil-pump equipment
  - + Notify all crew members of the receiving ships and fuel supply boat to be ready for receiving protective buoy
  - + Use oil-skimmer to collect oil from the protective buoy and pumped to temporary storage tank on barge
  - + If necessary, use fire extinguisher to the oil spreading place to prevent the explosion and strike fire
  - + If the oil spread outside the protective buoy, use oil skimmer to collect all the oil and avoid further spreading

** The authorized company in charge of coping with oil spreading in Hai Phong International Gateway Port:*

Upon receipt of the notice on the accident, the agency shall have to report to the following authorities:

- The People's Committee of Hai Phong PC
- Hai Phong Port Authority
- Department of Natural Resources and Environment of Hai Phong
- The report needs to be precise and specific about the happenings of Level III and the rescue activities being undertaken at the site. The source of pollution and the risk of oil spreading could be controllable but the company has to undertake the following works:
- Contact authorized agencies in Hai Phong and Singapore to immediately dispatch the protective buoy and other rescue equipment to the site
- Launch the pump and oil skimmer, and collect the oil
- Contact the rescue team in Hai Phong, and Petro Company in the region to immediately provide rescue equipment including oil skimmer, tugboats, and oil collection barge
- Support the ship's separation following the guidance of the captain of the calling ships
- Arrange additional rescue equipment from Singapore where necessary

The rescues team at Lach Huyen will be the focal point to contact with the Center on-land and other parties involving in doing rescue works

Oil polluting prevention works

- The first priority task is to prevent the oil spreading to the seaside by using the protective buoy and oil skimmer and pump to oil storage tank on barge; or use other kinds of equipment or materials to collect oil
- Use the mechanical measures to prevent the oil spreading. If necessary, use air plane to mobilize protective equipment from Quang Ninh and try to limit the oil spreading to the seaside

On-land rescue works:

- Upon receipt of site report from the company and the Hai Phong Port Authority, the People's Committee of Hai Phong PC will instruct the Department of Natural Resources and Environment and Hai Phong Port Authority to set up a steering group whose members would be able to provide rescues works on-land to prevent the oil spreading to the seaside. They may also mobilize further supporting equipment from Hai Phong Port and Dinh Vu Port.
- Once the safety condition is confirmed, the company shall have to report to concerned parties the result of rescue works and the pollution prevention measures.

As this is more serious than Level II, the captain of the ship which causes the oil spreading need to contact to its insuarance company for settlement.

The fuel supply will be resumed after the safety condition is confirmed and upon receipt of permission of Hai Phong PC and Hai Phong Port Authority.

The Report on the oil spreading accident will be jointly prepared by the company, the captain of the container ship, captain of the fuel supply ship and submit to the Hai Phong PC and Hai Phong Port Authority.

3) Mitigation measures for accidents during operation stage

During the period 2010-2015, the first 2 berths will be constructed. To ensure the safety operation for construction workers, gantry crane system will be used for container cargo handling and transportation in the container yard. This system is able to handle a large numbers of container cargos at the same time. The trailer will be used to transfer cargo from the pier to the berth. Containers are aligned in parallel with the pier. There is a separate way specifically for gantry crane and container carrier along with container yard.

The advantages of this system is space saving as the container could piled up many stacks vertically (up to 750 TEU/ha) and occupies a limited space horizontally. This system could also cut investment cost significantly as the ground improvement works require different level from one place to the other. The equipment and machinery utilized in the system is also reliable. Also, the system allows the participation of both skillful workers for operating gantry cranes and unskillful workers for operating trailer, therefore reduce the maintenance cost and minimize the accidents during the port operation.

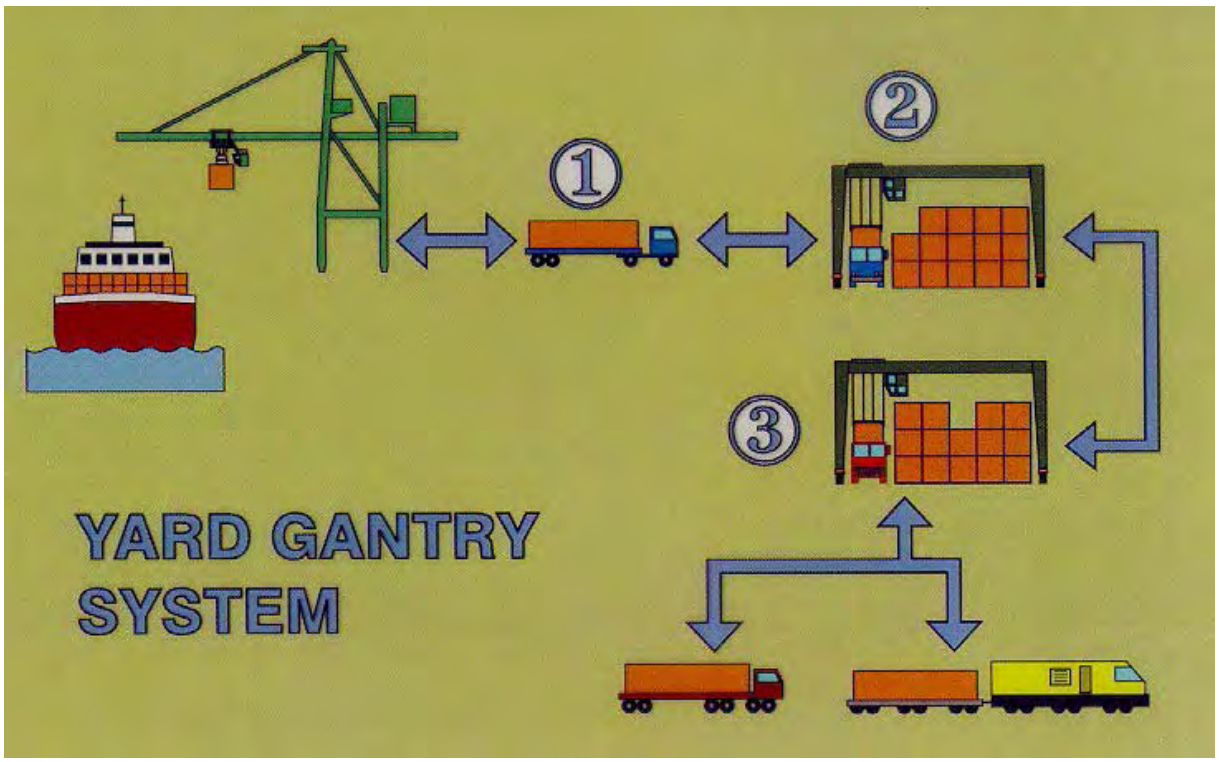


Figure 4.6 Gantry crane operation system

Besides, the port will also issue a workplace policy on labor safety and provide staff's training as well as the supply of protective facilities to ensure the labor's health and safety conditions.

CHAPTER 5

5. Recommended Commitment for Implementation of Environmental Protection Measures

Vietnam Maritime Administration and Maritime PMU II committed tocarry out the following environment protection measures during project implementation and operation phase.

5.1. Committment to carry out mitigation measures to adverse impact

Environment pollution prevention measures to minimize negative impact which has been proposed in the report are feasible and in compliance with the Vietnamese standards:

- Maritime PMU II (Representative of the Project owner) committed to undertake measures for preventing and minimizing negative impacts during the construction period and operation period as mentioned in chapter 4 of this report
- The project owner committed to comply with all the Vietnamese standard on environment protection during the project implementation including the Environment Protection Law 2005, other guiding laws and regulations, Decree 59/2007/ND-CP dated April 9th 2007 of the Government on solid waste management, Decree 71/2006/ND-CP dated July 25th 2006 of the Government on maritime and access channel management.
- The project owner committed to undertake measures for preventing incidents and minimizing pollution as mentioned in the report. at the same time strengthening the staffs capacity building on environment management during the project operation period to ensure good management.
- The project owner promised to accomplish the environment treatment station/facilities right after completion of the construction works.

5.2. Committment to carry out mitigation measures, regulations on environment protection relating to the project

The project owner committed to undertake all measures for preventing adverse impacts, and coping with environment incidents as mentioned in chapter 4; and also committed to carry out measures and regulations on environment protection during the construction and operation period in compliance with the Vietnamese standard, including the followings:

- waste air: carry out all prevention measures as mentioned in chapter 4 to satisfy with the Vietnamese Technical Regulation QCVN 19:2009/BTNMT on industrial emission of inorganic substances and dusts , and Vietnamese Technical Regulation QCVN 20:2009/BTNMT on industrial emission of organic substances .
- Surrounding air environment: the polluted wastes when discharge to the air needs to satisfy the Vietnamese Technical Regulation QCVN 05:2009/BTNMT on ambient air quality, Vietnamese Technical Regulation QCVN 06:2009/BTNMT on hazardous substances in ambient air.
- Noise: the noise generating during the construction and operation needs to satisfy the Vietnamese standard TCVN 5949:1995 – allowable level of noise in the residential area
- Vibration: the vibration and seismic occurred during the construction and operation has to satisfy the standard TCVN 6962-2001 – vibration and seismic during industry activities, the maximum allowable level for residential area and industrial zone
- Daily waste water and industrial waste water: make sure to satisfy the Vietnamese Technical Regulation QCVN 24:2009/BTNMT on industry waste water; discharge standard column B K_f = 1,1, K_q = 1,2
- Hazardous solid waste: the project owner shall be responsible for collecting, keeping treating, and destroying all hazardous solid waste during construction and operation stage in compliance with

the Decision 23/2006/QD-BTNMT dated December 26th 2006 of the Ministry of Natural Resources and Environment on issuing list of hazardous waste and the Circular 12/2006/TT-BTNMT dated December 26th 2006 of the Ministry of Natural Resources and Environment on guiding the procedures for application, registration, licensing, and code management. The project owner shall contracted-out to an authorized agency for hazardous waste treatment and report to the Hai Phong Department of Natural Resources and Environment

- Daily solid waste: shall be collected, transported, and treated in accordance with the standard following the Decree 59/2007/NĐ-CP dated April 9th 2007 of the Government on solid waste management.
- Waste water from calling ships: coordinate with the concerned agency, port authority to forbid the discharge of bilge water, oily water to the port area. Strictly follow rules and regulations, Decree No.71/2006/NĐ-CP dated July 25th 2006 on maritime and access channel management, Article 48: calling ships are requested to follow the regulation on discharge the waste and bilge water in compliance with the instruction of the port authority or the authorized agency. The company involving in providing the services in the port area shall have to equip with equipment to receive waste water and collect the fees as regulated.

In case the waste water discharged form the ship is bilge water and oily water, the port authority and the company will coordinate with each other to collect and transport the waste to the designated place following the current regulation.

- other commitments: the project owner committed to undertake other measures for preventing environment incidents (fire, oil spreading, ect) and pollution prevention as mentioned in the report. and at the same time strengthening the staffs capacity building to ensure the effective and safe operation of the port. This is also the focal point to be responsible for communicating with the state agencies on environment prevention.

5.3. Safety issue

The project owner committed to coordinate with concerned ministries and agencies in ensuring safety for the port operation including the measures and actions in case of emergency. Detailed safety instructions are:

- set up a joint working scheme with the maritime control authority to coordinate the incoming and outgoing ships
- be prepared and be ready to take actions for safety control including supply of signaling equipment, wind direction locating equipment, and accident solving measures
- the port are is restricted to authorized person only
- provision of special equipment for hazardous cargo handling
- undertake measures for coping with oil and chemical spreading, fire, or other serious accidents; supply equipment, and provide training for operation staffs, and organize rehearsal;

5.4. Training programs

Provide training to workers who are participating in the port construction and operation to be able to cope with emergency incidents, and to keep them noticed of regulations concerning safety, and measures to cope with such incidents in line with safety regulations and environment requirements

Provide training on measures to coping with oil and chemical spreading to workers, and supply fire extinguish equipment

The project owner committed to provide training programs to workers as well as to set up a monitoring plans, and measures for mitigating impacts to socio-culture.

5.5. Committment on management and monitoring environment pollution

- The task of environment management, environment pollution control and labor safety is highly prioritized during the port construction and operation.
- The project owner committed to undertake environment monitoring measures and ensure labor safety and traffic safety; and the project is also subjected to the monitoring of the competent agencies as per stipulation of Environment Protection Law
- The project owner shall coordinate with concerned agencies to prevent environment pollution during the engineering design stage and construction stage
- The project owner committed to undertake environment management program as mentioned in Chapter 6 during the port operation stage and report periodically to National Environment Protection Authority, the Department of Natural Resources and Environment of Hai Phong PC and the port authority.

CHAPTER 6

6. Recommended Environment Treatment Facilities, Environmental Supervision and Management program

In order to define the risks to the environment, evaluate the effectiveness of mitigation measures to adverse impacts, it is necessary to formulate and carry out supervision and management programs.

6.1. List of environment treatment facilities

As mentioned in Chapter 4 on mitigation measurement to adverse impacts, the list of environmental treatment facilities is showed in Table 6.1.

Table 6.1 Environmental treatment facilities

No	Items of treatment facilities	Progress
I	Construction phase	
1	Provision and installation of 05 bins for daily waste, 200 litres/bin	During construction and completion period
2	Provision and installation of 05 bins for oil sludge, 150 litres/bin	
3	Provision and installation of 05 mobile WC, 200 litres/WC	
II	Operation phase	
1	Provision of 30 waste collection bins along the access channel and berth areas	During construction and completion period
2	Wastewater treatment system	
3	***Water supply system***	
4	Drainage system	
5	Fire rescue system, PCCC	
6	Decoration trees	
7	Oil spreading preventing system - 01 barge 1000-2000HP - 01 dredger 400 HP - Small size boat - Oil prevention buoy - Oil tank	

6.2. Environmental management and monitoring programs

6.2.1. Objectives of the environment management and monitoring programs

Objectives of the environment management and monitoring programs are to collect information continuously concerning the change of environment quality in the project site and propose measures for preventing and minimizing pollution. Moreover, monitoring the environment in the project site also aimed at ensuring the effectiveness of waste water treatment system and other systems in the production area in compliance with the Vietnamese standard on environment.

In addition, objectives of the environment management and monitoring programs are to ensure the compliance with prevention measures as mentioned in this environment impact assessment report, and propose quick action plan to cope with unforeseeable environment incidents and urgently manage unpredictable environment incidents.

6.2.2. Environment management program

a. Environment management program during construction phase

In order to carry out the environment management tasks during the pre-contruction stage, the project owner shall undertake measures for environment protection and management for each period of implementation.

Before commence the construction works, the project management board of the Vietnam Martitime Administration, Maritime Project Management Unit II (Representative of the project owner) will set up a technical, safety, and environment team to supervise Contractor's works in terms of environment and safety during the construction period. The supervision will cover mainly the Contractor's compliance with measures on environment impact prevention and labor safety as mentioned in the Environment Impact Assessment report. The team will include 01 team leader, 03 technical staffs specializing in environment and labor safety.

Figure 6.1 describes structure and relationship among concerned parties in the environment monitoring and management during the port construction period.

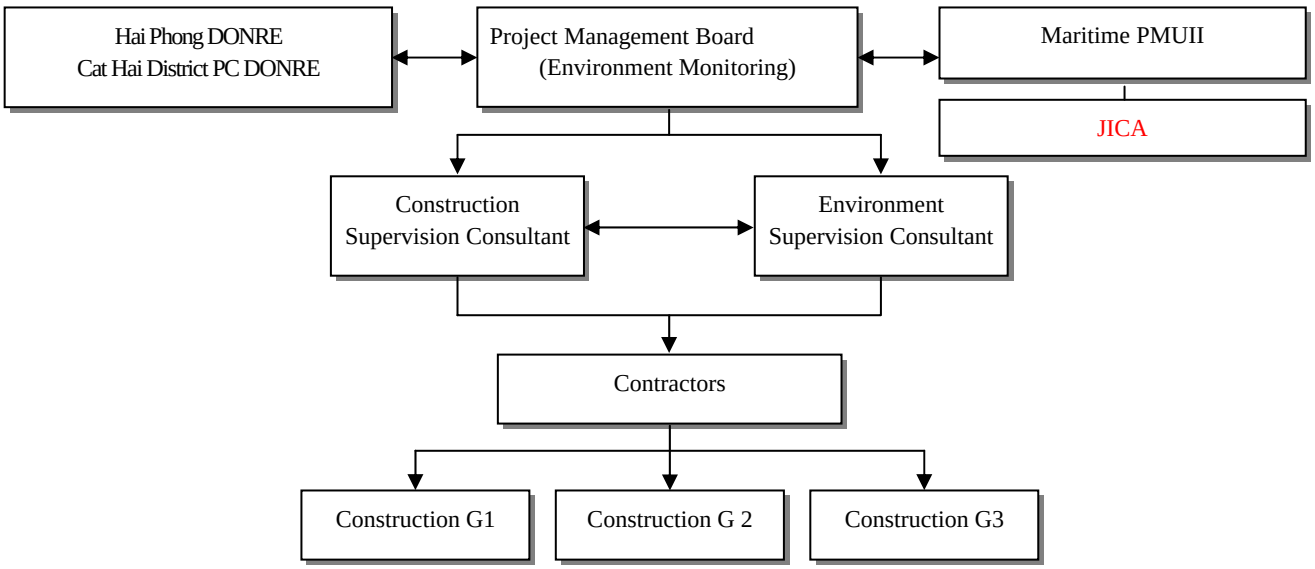


Figure 6.1 Organization chart for environment management, supervision and safety – Construction Phase

The environment supervision consultant team shall be responsible for supervising the Contractor's compliance with regulations on labor safety, environment prevention, and the submission of progress report on environment supervision in the project area to the competent agencies. Regulations on labor safety and environment protection have to be prepared and disseminated to construction workers.

b. Environment management program during operation phase

When the port puts in to operation, Hai Phong international gateway port will establish a group take charge of environment supervision and labor safety issue. One independent environment consultant will be selected to supervise environment activities. This group will represent the project owner to submit reports on implementing environment supervision and management including physical data to the Department of Natural Resources and Environment of Hai Phong both during the construction and operation period.

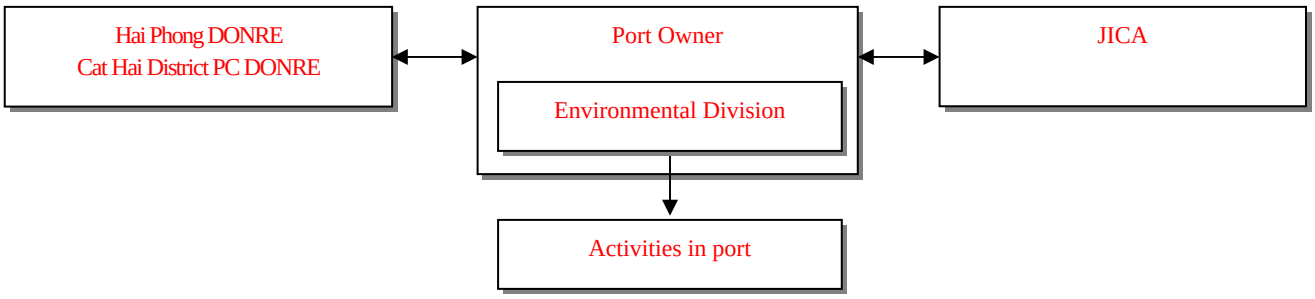


Figure 6.2 Organization chart for environmental management, supervision and safety – Operational Phase

Agencies involved in the environment supervision and management are shown below.

Table 6.2 Name of agencies involving in the environment supervision and management.

No	Agency	Responsibilities
1	Environment supervision and safety Group	Supervise and assess the implementation based on the survey data defined for construction period. Report to the project management board and the Department of Natural Resources and Environment of Hai Phong
2	Independent environment supervision consultant	Undertake the supervision and assessment of environment quality based on the survey data defined for construction and operation perios. Participate in yhe public consultation meetings to take note of feedbacks from local people. Report to the environment supervision and safety Group
3	Department of Natural Resources and Environment of Hai Phong	Monitor and check the compliance with prevention measures as proposed in the Environment Assessment Report by the project management board and check the actual result.

c. Programs for education, training, and awareness raising about environment protection

Vietnam Maritime Administration will conduct and carry out training programs and communication programs, formulate regulations for awareness raising concerning environment protection. These training programs will also touch upon the duties and penalty and measures how to minimize negative impacts to people's health and ecosystem.

The training and communication programs on environment have to tailor for each group of labors and comprises of the following basic contents:

- Law, policy on environment, objectives and criteria for mitigating negative impact of environment pollution
- Environment control system
- Relevant environment standard and guidance
- Other environment issues that may arise during the port construction , operation, and exploitation period
- Technical and organizational structure to minimize the adverse impacts
- Protection of labor environment
- Accounting and assessment of environment quality
- Periodical training programs on scoping with incidents such as oil spreading, fire, etc

6.2.3. Environment monitoring program

Environment survey will be conducted by an authorized agency regularly during the port construction and operation period. But this monitoring program is only tentative. The detailed monitoring program will be formulated separately for engineering construction and operation phases of the project. The survey plan is presented in the table below.

Table 6.3 The environment monitoring programs

No	Content	Criteria	Frequency
	Port construction period		
1	Noise	Immediate noise Leq; L90max	Frequency: 3 months/time Location: - KK1: port construction area - KK2: Near access road from Ben Got to the port area - KK3: Ben Got residential area - KK4: Near the access road from Hai Phong to the port in Luc Do commune - KK5: Near the access road from Hai Phong to the port in Don Luong commune
2	Air quality	VOC; SO_2; NO_2; suspension dust, temperature, wind speed, humidity	Frequency: 3 months/time Location: same as noise monitoring sites
3	Coastal water quality	Temperature, pH; BOD_5; suspension solid, Amoniac; Fe, Cr, Pb, Zn, Cd, As, Hg, Mn; Oil, Total Coliform	Frequency: 3 months/time Location: - NM1: before the port construction area - NM2: in the middle of port construction area - NM3: after the port construction area
4	Quality of underground water	pH, SS, NO_2, NO_3, Total P, Cl, CN; Fe, Cr, Pb, Zn, Cd, As, Hg, Total Coliform	Frequency: 3 months/time Location: - NN1: Residential area near Ben Got - NN2: Residential area near the port construction area
5	Sea-bed alluvial	Hydrocarbon, Fe, Cr, Cu, Pb, Zn, Cd, As, Hg	Frequency: 6 months/time Location: same as the nearshore water quality monitoring sites
6	Ecosystem	Ephemeras flora and fauna, sea-bed species	Frequency: 6 months/time Location: same as the nearshore water quality monitoring sites
7	Erosion, sedimentation	Erosion and sedimentation in the nearshore area	Frequency: 6 months/time Location: nearshore area, port construction area

No	Content	Criteria	Frequency
	Port operation period		
1	Noise	Immediate noise Leq; L90max	Frequency: 6 months/time Location: - KK1: container berth 1 - KK2: container berth 2 - KK3: operation center - KK4: residential area - KK5: residential area near access road
2	Air quality temperature	CO, SO_2, NO_2, suspension dust	Frequency: 6 months/time Location: same as the noise monitoring site
3	Coastal Nearshore water quality	Temperature, pH; BOD_5; suspension solid, Amoniac; Fe, Cr, Pb, Zn, Cd, As, Hg, Mn; Oil, Total Coliform	Frequency: 6 months/time Location: - NM1: before the port construction area, near Ben Got - NM2: between Berth No.1 and 2 - NM3: After container berth 2 - NM4: after breakwater
4	Quality of wastewater	Temperature, pH; BOD_5; suspension solid, Amoniac; Fe, Cr, Pb, Zn, Cd, As, Hg, Mn; Oil, Total Coliform	Frequency: 6 months/time Location: - NT1:discharged sewer in Berth 1 - NT2: discharged sewer between berth 1 and berth 2 - NT3: discharged sewer after berth 2
5	Quality of underground water	pH, SS, NO_2, NO_3, Total P, Cl, CN; Fe, Cr, Pb, Zn, Cd, As, Hg, Total Coliform	Frequency: 6 months/time Location: - NN1: residential area near the port's gate - NN2: residential area near Ben Got - NN3: water supply station
6	Sea-bed alluvial	Hydrocarbon, Fe, Cr, Cu, Pb, Zn, Cd, As, Hg	Frequency: 12 months/time Location: same as nearshore water quality monitoring site
7	Eco system	Ephemeras flora and fauna, sea-bed species	Frequency: 12 months/time Location: same as the nearshore water quality monitoring sites
8	Erosion, sedimentation	Erosion and sedimentation in the nearshore area	Frequency: 12 months/time Location: nearshore area, port construction area

The environment monitoring sites during construction and operation period are shown in the Figure 6.2, 6.3. In addition to the previously monitored points, it is recommendable to cover wider area shown in Figure 6.4.

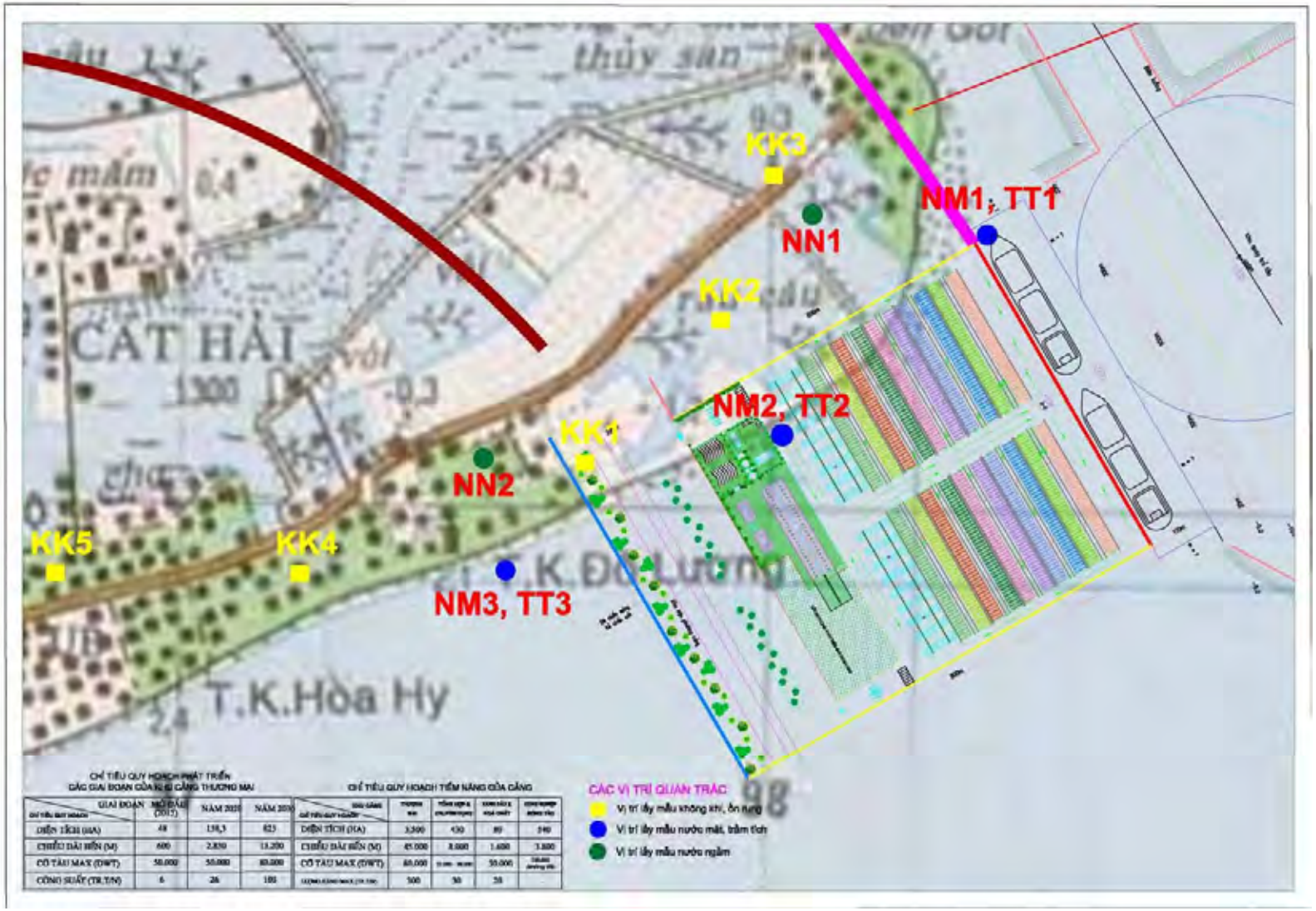


Figure 6.3 Environmental monitoring sites during construction phase

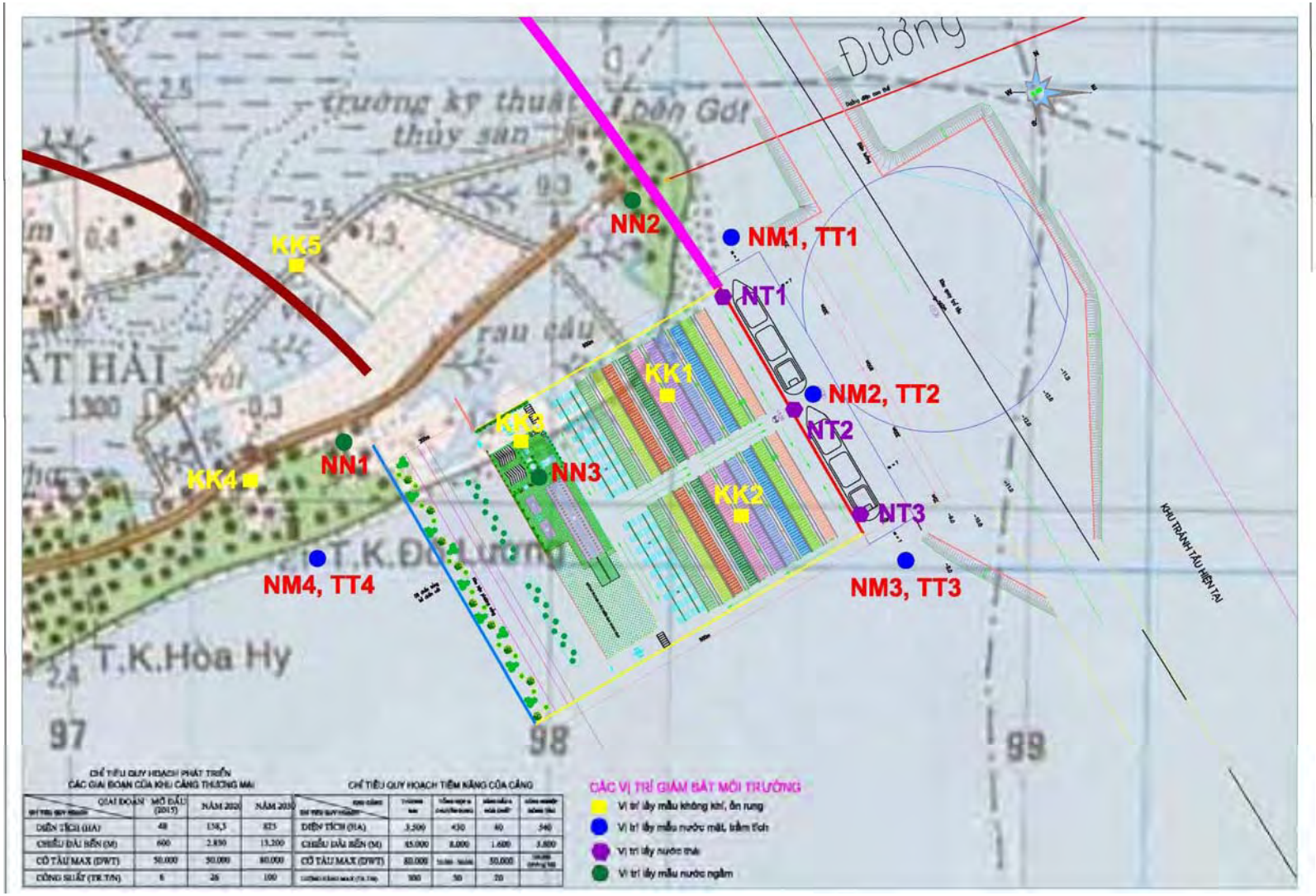


Figure 6.4 Environmental monitoring sites during operation phase (previously monitored port area)

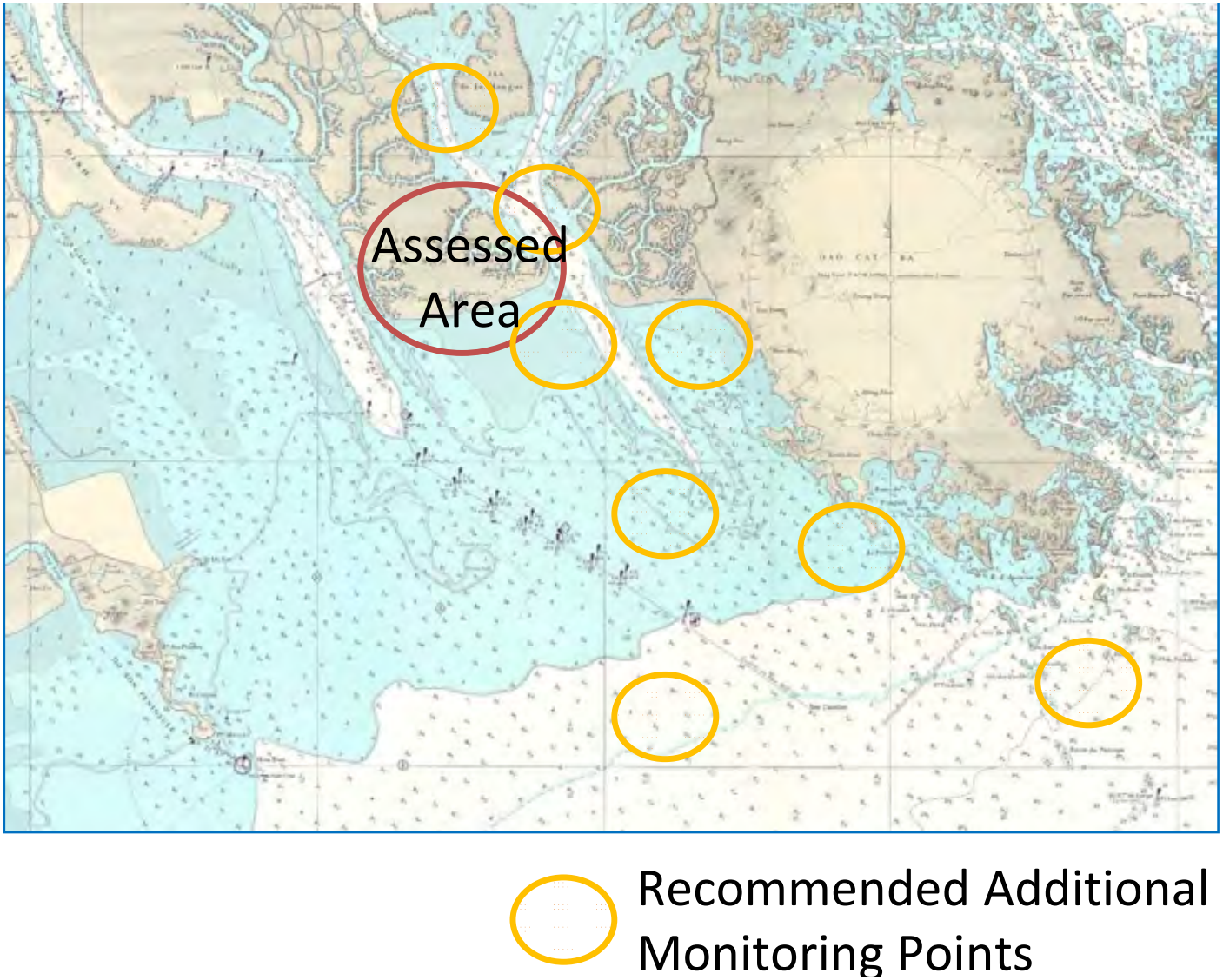


Figure 6.5 Recommended environmental monitoring sites during construction and operation phase (surrounding area)

6.3. Rescue plan in case of emergency

6.3.1. Objectives of the rescue plan in case of emergency

Although the possibilities for such accidents are rare, there are needs to prepare a rescue plan in case of emergency. The objective of the plan is to prepare actions to cope with emergency accidents during port operation both in offshore and seashore. Contents of the plan are:

- Categorize and determine all kinds of accidents possibly happened during the port operation such as fire, oil spreading, ship crashes, etc
- Set up a quick rescue team
- Define the human resources and equipment to mobile in case of emergency
- Define concrete measures to take in order to mitigate the losses.

6.3.2. Quick rescue team

A quick rescues team will be set up including management staffs and rescue workers to timely provide rescue works in case of accidents. Members of the team will be equipped with mobile phones or text massagers to keep them connected all the time

6.3.3. Actions to be taken in case of accidents

The following scenarios are provided for all members with detailed guidance.

a. Drifted ship

The drifted ship could be the fish-catching ship, cargo ship or oil supply ship, etc. the main cause could be ship hitting to the berth which may cause losses of both human being and property, damage construction works, leak the oil, fire, etc.

Actions to be taken are:

- confirm the location of the ship
- confirm the distance from the ship to the berth
- confirm the weather condition (speed of wind and wind direction)
- confirm the size of the ship
- confirm the timing possibly affect to the berth
- gather all resources
- drag the ship
- call for support from naval forces and other resources

b. Fire

The fire could be happened by oil leakage, chemical leakage or other sources such as papers in the office. The fire will bring in great damage to people and equipment.

Actions to be taken are:

- confirm the location of the fire
- confirm the weather condition (especially wind)
- confirm the impacts of dust and heat wave to surrounding areas

- ensure safety for people
- isolate flammable fuel
- turn on the authomatic fire stopping system
- launch the fire-brigade
- provide support from nearby ships with fire rescue system
- other supports (local fire-brigade, naval forces and other fuel supply company)

c. Evacuation

The evacuation from buildings/ houses are very urgent in any scenario of accidents. *Actions to be taken are:*

- ensure safety for people
- confirm the list of involved people
- confirm the weather condition
- confirm the location for evacuation
- provide necessary medicine
- move people to a safe places and move to another areas if necessary
- re-confirm the list of people involved, continue searching until everyone's safety is confirmed

d. Lost people

The loss could be the case where people fall into the water or fail to locate the place of accidents.

Actions to be taken are:

- gather all people to confirm the missing people
- locate the final place that he/she was seen
- carry out investigation and rescue
- confirm the weather conditions
- mobilize rescue ships/boats

e. Oil spreading

If oil spreading occurs, it will seriuosly pollute the environment. Therefore, it is necessary to prepare a team specializing in oil collection with the following duties:

- being a special team to self-decide how to carry out rescue in any cases
- being provided with rescue training in case of oil spreading
- being equipped with special equipment
- major objectives are to minimize the oil spreading and other chemical (Hydrocacrbon) and ensure the rescue works were provided timely and correctly

Actions to be taken:

- immediately contact with concerned parties at the site to timey stop the fuel leakage and collect information such as: location, timing of the incidents, type and volume of oil spreading, weather conditions (wind) to confirm the direction oil possible spread.
- Confirm the direction of oil spreading and other senstive areas that might be affected in order to launch oil collection equipment
- Notice concerned people and agencies in the area to coordinate and mobilise resources and equipment to provide rescue in a timely manner. Other concerned agencies including the

Department of Natural Resources and Environment, Hai Phong Fire-Bridgate Police. If the level of oil spreading is seriuos, the project owner shall communicate with the national rescue team or international rescue team to seek for support.

- Together with seeking the suport of other rescue teams, the project owner shall also equip necesary equipment such as boat, vehicle to use when the oil level is controllable

CHAPTER 7

7. Cost Estimation for Environmental Facilities, Environment Management and Monitoring Programs

7.1. Cost estimation for environment treatment facilities

Based on the lists of environment protection works as mentioned in chapter 6, the cost for conducting the environment treatment facilities is estimated. This cost estimation was made according to the market price in quarter II of 2010 and it is very tentative. Because of fact that market price is very changeable so this cost should be different in the period of project construction and operation. The estimation is described in table below:

Table 7.1 Total cost for Environmental Treatment Works

No	Work items	Quantity	Amount (VND)
I	Construction period		96,000,000
1	**Daily waste storage tank 200 l**	**05**	**36,000,000**
2	**Oil sludge storage tank 150 l**	**05**	**30,000,000**
3	**Mobile WC 200 l**	**05**	**30,000,000**
II	Operation period		25,536,600,000
1	**Waste collection baskets along canal and in the port**	**30**	**18,000,000**
2	**Waste water treatment system**	**01**	**97,000,000**
3	**Water supply system**	**01**	**2,815,000,000**
4	**Drainage system**	**01**	**16,339,000,000**
5	**Fire extinguish system**	**01**	**2,940,000,000**
6	**Grass and trees**	**3,640 m^2**	**327,600,000**
7	**Oil spreading prevention equipment system** - **01 tugboat 1000 – 2000 HP** - **01 tugboat 400 HP** - **Small boat** - **Oil protective buoy** - **Oil storage bag**		**3,000,000,000**
	Total		**25,632,600,000**

7.2. Cost estimation for operating environment treatment facilities

Refering to the environment treatment facilities mentioned in chapter 6 and Section 7.1 above, cost estimation for operating environment treatment facilities which is mainly for port operation period is shown in Table below.

Table 7.2 Cost estimation for operating environment treatment facilities

No	Contents	Operation cost (VND)
1	**Collection, transportation, and treatment of solid waste**	**3,600,000 đ/month**
2	**Collection of rainy water, cleaning of WC and drainage sewer**	**1,200,000 đ/month**

No	Contents	Operation cost (VND)
3	**Collection of waste water, cleaning of WC and drainage sewer**	**1,200,000 đ/month**
4	**Operation of waste water treatment system**	**18,000,000 đ/month**
5	**Repair water piping system, valve**	**2,400,000 đ/month**
6	**Trees and environment hygiene**	**3,600,000 đ/month**
	Total	**30,000,000 đ/month**

This cost estimation for operating environmental treatment facilities was made according to the market price in quarter II of 2010 and it is very tentative. Because of fact that market price is very changeable so this cost should be different in the period of project construction and operation.

7.3. Cost estimation for environment monitoring

Cost estimation for environmental monitoring during construction and operation of the Hai Phong international port is summarized as follow:

Table 7.3 Cost estimation for environmental monitoring during construction and operation stage

No	Monitoring works	Amount (VND)
I	**Construction stage**	**242,600,000**
1	Noise (540.000 VND x 2 times/site x 5 site x 4 times/year)	21,600,000
2	Air environment quality (650.000 VND x 2 times/site x 5 site x 4 times/year)	26,000,000
3	Quality of seashore water (1.800.000 VND x 3 times/site x 5 site x 4 times/year)	108,000,000
4	Quality of underground water (1.200.000VND x 5 sites x 4 times/year)	24,000,000
5	Bottom alluvial (1.500.000VND/site x 5 sites x 2 times/year)	15,000,000
6	Ecosystem (12.000.000 VND/time x 2 times/year	24,000,000
7	Erosion, sediment (12.000.000VND/time x 2 times/year)	24,000,000
II	**Operation stage**	**157,300,000**
1	Noise (540.000VND x 2 times/site x 5 site x 2 times/year)	10,800,000
2	Quality of air environment (650.000VND x 2 times/site x 5 sites x 2 times/year)	13,000,000
3	Quality of seashore water (1.800.000VND x 3 times/site x 5 sites x 2 times/year)	54,000,000
4	Waste water (1.800.000VND x 2 times/site x 5 sites x 2 times/year)	36,000,000
5	Quality of underground water (1.200.000VND x 5 sites x 2 times /year)	12,000,000
6	Bottom alluvial (1.500.000VND x 5 sites x 1 time/year)	7,500,000
7	Ecosystem (12.000.000VND/time x 1 time/year	12,000,000
8	Erosion, sediment (12.000.000VND/time x 1 time/year)	12,000,000
	Total	**399,900,000**

This cost estimation for environmental monitoring during construction and operation stage was made

according to the market price in quarter II of 2010 and it is very tentative. Because of fact that market price is very changeable so this cost should be different in the period of project construction and operation.

CHAPTER 8

8. Public Consultation

8.1. Implementation of public consultation

Following the stipulations of the Environment Protection Law 2005 dated November 29th 2005 and took effect since July 1st 2006, Decree No.80/2006/ND-CP dated August 9th, 2006 of the Government on guiding the implementation of the Environment Protection Law and the Circular No.08/2006/TT-BTNMT dated September 8th 2006 of the Ministry of Natural Resources and Environment guiding the implemtation of strategic environment, environment impact assessment and environment committment. The Maritime PMU I, represents the project owner of the Hai Phong international Gateway Port project, has sent its letter Ref.No.231/BQLDA1-DA2 to all concerned People's Committee including Cat Hai town, Hoang Chau commune, Dong Bai commune, Van Phong commune, Nghia Lo commune of Cat Hai district, Hai Phong city to inform the project briefs and the environment impact as well as the mitigation measures. Experts from HYMENET in cooperation with Experts from the Maritime PMU I have conducted discussions with representatives of People Committees and Fatherland Front of above mentioned communes and town on the project objectives, beneficiaries, possible social and environmental impacts as well as other issues related to the project.

Further more, in October, 2007 experts from HYMENET have conducted public hearing in Cat Hai town, Dong Bai, Nghia Lo, Hoang Chau, Van Phong communes. For this purpose, a questionair sheet was designed with the aim to get important informations from interviewees and their opinion on the project. In total, 293 households were interviewed. The results of this public hearing will resumed in next sections.

8.2. Public consultation at the People's Committee of Cat Hai town

8.2.1. Opinions of the People's Committee of Cat Hai town

The People's Committee of Cat Hai town, Cat Hai district, Hai Phong city has received, from the project owner of the Hai Phong international Gateway port construction project, the official letter informing the contents of the project, beneficiaries for local and regional development, possible impacts to local environment, culture, community life and mitigation measures to prevent and reduce negative impacts. The discussion with representatives of Cat Hai People Committee was conducted by HYMENET and project owner experts in meeting room of PC on April 19th, 2007.

On April 19th 2007, after constructive discussion, the People's Committee of Cat Hai town has issued its letter Ref.No.62/CV-UBND with the following opinions:

- Totally agreed to and support the investment and construction of the project and welcome the opportunity to boost socio-economic development, improve people's living standard
- Requested the project owner and concerned authorities to inform people about the land acquisition, relocation, resettlement and provide the job opportunities for income restoration for local people; equip enough infrastructure facilities in the resettlement area, and maintain good living condition for project affected people.
- Requested the project owner and concerned authorities to prioritize job opportunities for people living in the project area
- Requested the project owner to carry out duly and strictly committment on environment protection and monitoring plan in compliance with rules and regulations
- The project received a great support of the local people and considered this is a good chance for

development in all aspects, and proposed higher authority to grant the approval to the project in order to soon put the project into implementation.

8.2.2. Opinions of the Fatherland Front of Cat Hai town

Project owner of the Hai Phong international Gateway port construction project has sent the official letter informing the contents of the project, beneficiaries for local and regional development, possible impacts to local environment, culture, community life and mitigation measures to prevent and reduce possible negative impacts. The discussion with representatives of Cat Hai Fatherland Front was conducted by HYMENET and project owner experts in meeting room of PC on April 19th, 2007.

Upon receiving of the project owner's information and discussion , on April 19th 2007, the Fatherland Front of the Cat Hai town sent its letter Ref.No.45/CV-MTTQ with the following opinions:

- Agreed to and support the implementation of the Hai Phong International Gateway port construction project
- Requested to prioritize job opportunities for local poeple when the project puts into operation
- Requested to have an appropriate land compensation for affected people to help them to stabilize their life, income after resettlement
- Requested the project owner to fulfill committment on environment protection following applicable rules and regulations
- In general, the implementation of the project will bring in many opportunities for the town to improve their living standard, and requested competent agencies to soon give approval to this project.

8.2.3. Results of public hearing

The HYMENET experts have coducted interview with households in Cat Hai Town in October, 2007. Experts had visited, discussed and introduced to each household the contents of the project, beneficiaries for local and regional development, possible impacts to local environment, culture, community life and mitigation measures to prevent and reduce possible negative impacts and other related issues. The collected informations from each household were written down to the sheet. In total, 107 households with 464 members in Cat Hai Town were interviewed. The interview results show that average household annual income is about 25 million VND and varies from 3mill. VND to 120mill. VND. All households use well and rain water for drinking and everyday need. From interviewed households, 95.4% agreed with the project and reasonable compensation and support in money and material form for relocation, but 16.8% do not like to be relocated. The most of people consider that the project will bring new opportunities for improvement of their living standard.

8.3. Public consultation at the People's Committee of Hoang Chau commune

8.3.1. Opinions of the People's Committee of Hoang Chau commune

Project owner of the Hai Phong international Gateway port construction project has sent the official letter informing the contents of the project, beneficiaries for local and regional development, possible impacts to local environment, culture, community life and mitigation measures to prevent and reduce possible negative impacts. The discussion with representatives of Hoang Chau People Committee was conducted by HYMENET and project owner experts in meeting room of PC on October 2nd, 2007.

The People's Committee of Hoang Chau commune, upon receipt of the project owner's letter briefing the project and possible impacts as well as mitigation measures, and after discussion with experts has replied in letter Ref.No.25/CV-UBND dated October 2nd 2007 which agreed to the scope of works of the Hai Phong International Gateway port construction project. When the project starts its operation, it will bring many investors to come to Cat Hai island and thus the local economic situation will be

further developed.

8.3.2. Opinions of the Fatherland Front of Hoang Chau commune

Project owner of the Hai Phong international Gateway port construction project has sent the official letter informing the contents of the project, beneficiaries for local and regional development, possible impacts to local environment, culture, community life and mitigation measures to prevent and reduce possible negative impacts. The discussion with representatives of Hoang Chau Fatherland Front was conducted by HYMENET and project owner experts in meeting room of PC on October 4th 2007.

In response to the project owner's letter regarding the implementation of Hai Phong International Gateway port construction project, the Fatherland Front of Hoang Chau commune has issued its reply dated October 4th 2007:

- Agreed to the investment and construction of the project and confirmed the project will bring great opportunities for economic development for the island in particular and for the country in general
- Asked the project owner to apply take the market price for when working on the land and other compensation rate to ensure the fairness for project affected people.

8.3.3. Results of public hearing

The HYMENET experts have coducted interview with households in Hoang Chau commune in October, 2007. Experts had visited, discussed and introduced to each household the contents of the project, beneficiaries for local and regional development, possible impacts to local environment, culture, community life and mitigation measures to prevent and reduce possible negative impacts and other related issues. The collected informations from each household were written down to the sheet. In total, 36 households with 159 members in Hoang Chau commune were interviewed. The interview results show that average household annual income is about 15 million VND and varies from 6mill. VND to 120mill. VND. All households use well and rain water for drinking and everyday need. From interviewed households, 94.4% agreed with the project and reasonable compensation and support in money and material form for relocation, but 30.5% do not like to be relocated. The most of people consider that the project will bring new opportunities for improvement of their living standard.

8.4. Public consultation at Dong Bai commune

8.4.1. Opinions of the People's Committee of Dong Bai commune

Project owner of the Hai Phong international Gateway port construction project has sent the official letter informing the contents of the project, beneficiaries for local and regional development, possible impacts to local environment, culture, community life and mitigation measures to prevent and reduce possible negative impacts. The discussion with representatives of Dong Bai People Committee was conducted by HYMENET and project owner experts in meeting room of PC on October 2nd, 2007.

The People's Committee of Dong Bai commune has replied to the project owner with following opinions:

- Peoples of Dong Bai commune fully agreed to the directive of the Party and the Government regarding the investment into the Hai Phong international Gateway port project, and confirmed this project is very important and plays a strategic role for development of the region's economic, socio-culture, and security and defense.
- Impact to the sea water environment during the construction and operation stage, escpecially to the aqua culture activities by local people

- Provide job opportunities for local people

8.4.2. Opinions of the Fatherland Front of Dong Bai commune

Project owner of the Hai Phong international Gateway port construction project has sent the official letter informing the contents of the project, beneficiaries for local and regional development, possible impacts to local environment, culture, community life and mitigation measures to prevent and reduce possible negative impacts. The discussion with representatives of Dong Bai Fatherland Front was conducted by HYMENET and project owner experts in meeting room of PC on October 2nd, 2007.

On October 2nd, 2007 the Fatherland Front of Dong Bai commune has replied to the project owner stating their opinions as below:

- Fully agreed to the investment of the Lach Huyen Hai Phong international gateway port construction project
- Agreed to the relocation where the land required for project implementation
- Some people disagreed to the relocation of the residential area
- Requested the project owner to try to avoid the residential areas, cemetary as much as possible
- The project owner shall ensure the resettlment conditions for project affected people are better than before
- Provide job opportunities for local people
- The land acquisition shall be carried out effectively

8.4.3. Results of public hearing

The HYMENET experts have coducted interview with households in Dong Bai in October, 2007. Experts had visited, discussed and introduced to each household the contents of the project, beneficiaries for local and regional development, possible impacts to local environment, culture, community life and mitigation measures to prevent and reduce possible negative impacts and other related issues. The collected informations from each household were written down to the sheet. In total, 51 households with 234 members in Dong Bai commune were interviewed. The interview results show that average household annual income is about 11 million VND and varies from 3mill. VND to 80mill. VND. All households use well and rain water for drinking and everyday need. From interviewed households, 100% agreed with the project and reasonable compensation and support in money and material form for relocation, but 11.8% do not like to be relocated. The most of people consider that the project will bring new opportunities for improvement of their living standard.

8.5. Public consultation at Nghia Lo commune

8.5.1. Opinions of the People's Committee of Nghia Lo commune

Project owner of the Hai Phong international Gateway port construction project has sent the official letter informing the contents of the project, beneficiaries for local and regional development, possible impacts to local environment, culture, community life and mitigation measures to prevent and reduce possible negative impacts. The discussion with representatives of Nghia Lo People Committee was conducted by HYMENET and project owner experts in meeting room of PC on October 3rd, 2007.

On October 3rd, 2007, after open discussion, the People's Committee of Nghia Lo commune sent its letter Ref.No.36/CV-UBND in reply to the project owner with the following opinions:

- Agreed to and support the investment of Hai Phong international gateway port project
- Requested the Government to soon put the project into construction and operation in order to help Hai Phong city, and northern provinces to boost economic development
- The impact to the dyke system is quite obvious which may affect the people living in Cat Hai

island
- Requested the project owner to not discharge oil, waste water, causing adverse impact to aqua culture activities in the island
- Asked the project owner to carry out measures to mitigate noise, dust during the materials transportation and ensure safety.

8.5.2. Opinions of the Fatherland Front of Nghia Lo commune

Project owner of the Hai Phong international Gateway port construction project has sent the official letter informing the contents of the project, beneficiaries for local and regional development, possible impacts to local environment, culture, community life and mitigation measures to prevent and reduce possible negative impacts. The discussion with representatives of Nghia Lo Fatherland Front was conducted by HYMENET and project owner experts in meeting room of PC on October 4th, 2007.

On October 4th, 2007, the Fatherland Front of Nghia Lo commune issued its letter in response to the project owner with the following opinions:

- Agreed to the directive of the Party and the Government for the investment of the Hai Phong international gateway port construction project
- Asked the project owner to consider providing job opportunities for local people; ensure environment hygiene, and strictly comply with rules and regulations on labor safety.

8.5.3. Results of public hearing

The HYMENET experts have coducted interview with households in Nghia Lo commune in October, 2007. Experts had visited, discussed and introduced to each household the contents of the project, beneficiaries for local and regional development, possible impacts to local environment, culture, community life and mitigation measures to prevent and reduce possible negative impacts and other related issues. The collected informations from each household were written down to the sheet. In total, 50 households with 194 members in Nghia Lo commune were interviewed. The interview results show that average household annual income is about 8 million VND and varies from 2mill. VND to 60mill. VND. All households use well and rain water for drinking and everyday need. From interviewed households, 100% agreed with the project and reasonable compensation and support in money and material form for relocation, but 32% do not like to be relocated. The most of people consider that the project will bring new opportunities for improvement of their living standard.

8.6. Public consultation at Van Phong commune

8.6.1. Opinions of the People's Committee of Van Phong commune

Project owner of the Hai Phong international Gateway port construction project has sent the official letter informing the contents of the project, beneficiaries for local and regional development, possible impacts to local environment, culture, community life and mitigation measures to prevent and reduce possible negative impacts. The discussion with representatives of Van Phong People Committee was conducted by HYMENET and project owner experts in meeting room of PC on April 19th, 2007.

In reply to the project owner's inquiry, on April 19th, 2007 the People's Committee of Van Phong commune has replied as below:

- Agreed to the implementation of Hai Phong international gateway port construction project
- Requested the project owner and other concerned authorities to notify the project affected people the land acquisition and resettlement plan as soon as possible
- The resettlement area need to be equipped with basic infrastructure to enable resettled people's life

- Requested the project owner to seriously undertake committment on environment protection, and to conduct environment monitoring programs
- Cconfirmed that the project will help to boost economic development, improve people's living standard
- Requested the competent authorities to put this project into implementation soon, in order to contribute to the industrialization and modernization process of the country as a whole.

8.6.2. Opinions of the Fatherland Front of Van Phong commune

Project owner of the Hai Phong international Gateway port construction project has sent the official letter informing the contents of the project, beneficiaries for local and regional development, possible impacts to local environment, culture, community life and mitigation measures to prevent and reduce possible negative impacts. The discussion with representatives of Van Phong Fatherland Front was conducted by HYMENET and project owner experts in meeting room of PC on April 19th 2007.

On April 19th 2007, the Fatherland Front of Van Phong commune has replied to the project owner with the following commenst:

- Agreed to the implementation of the project
- Requested the project owner and the city authorities to issue an appropriate policy on land acquisition and compensation in order to stabilize local people's life after resettlement
- Asked to provide job opportunities to local people, especially the young labor forces
- Asked the project owner to committed to protect the environment
- Requested concerned authorities to grant approval to the project in order to soon kick-off the project, contributing to the socio-economic development for the region and for the country.

8.6.3. Results of public hearing

The HYMENET experts have coducted interview with households in Van Phong commune in October, 2007. Experts had visited, discussed and introduced to each household the contents of the project, beneficiaries for local and regional development, possible impacts to local environment, culture, community life and mitigation measures to prevent and reduce possible negative impacts and other related issues. The collected informations from each household were written down to the sheet. In total, 49 households with 226 members in Van Phong commune were interviewed. The interview results show that average household annual income is about 17 million VND and varies from 3mill. VND to 72mill. VND. All households use well and rain water for drinking and everyday need. From interviewed households, 98% agreed with the project and reasonable compensation and support in money and material form for relocation, but 10.2% do not like to be relocated. The most of people consider that the project will bring new opportunities for improvement of their living standard.

8.7. Opnions of the Project Owner (MPMU3 in 2008)

With all the above-mentioned opinions from the relevant People's Committee, Fatherland Front and habitants of communes in Cat Hai district, we fully agreed to and took note all the comments and requests. We promised to undertake seriously requirements to minimize adverse impacts to environment. And at the same time we will coordinate with the environment monitoring agencies to carry out mitigation measures as mentioned in chapter 4,5, and 6 of this report.

We will also work with Departments of the city regarding the implementation of land acquisition and resettlement works in order to help local people to stabilize their life and economic activities.

8.8. Public consultation at Cat Hai town by MPMU2 in 2010

Although the responsibility of the public consultation is the commune level people's committee under

the law on environmental protection, MPMU2 conducted a public consultation on 19 April, 2010 for the official response to the MOD dated March 19 between JICA and the government of Vietnam. Due to the JICA's special instruction for the consultation style, MPMU2 conducted the meeting style consultation at a meeting hall of the Peoples Committee of Cat Hai town. Summary of the public consultation is as follows:

Date & time	21 April, 2010, 9h00-11h30
Venue	Meeting Hall of the Peoples Committee of Cat Hai town
Announcement	• Cat Hai town speaker system (morning and evening announcement between 18 and 20 April) • Invitation letter for the representative of the Cat Hai town block leaders
Purpose	Announcement of approved EIA report and Public Consultation with local residents in project area
Stakeholders	<Host> The Peoples Committee of Cat Hai District Vinamarine MPMU 2 SAPROF study team <Participants> Fatherland Front of Cat Hai Town Representatives of local residents in project area
Number of attendees	30 people, roughly 50% of the attendees are related to public authorities and the rest of the 50% are the representatives of the local communities.
Introduction	1. MPMU2: Explanation of port development project, EIA and accessibility of the EIA report 2. SAPROF: Explanation of Japanese ODA policy and necessity of people's involvement 3. the Fatherland Front committee of Cat Hai town: Supportive opinion of the project and expectation of the project out come 4. Peoples Committee of Cat Hai district: Supportive opinion of the project and announcement of its responsibility for the land aquisition

8.8.1. Opinions of the Attendees at the Meeting

This section is reported based on the official record by MPMU2 of the public consultation and notes taken by the SAPROF experts.

1) Opinions on possible negative impacts to socio-economical and natural conditions:

- Consensus opinions with respective explained contents of Project Owner's presentation: Fully agree with the contents of approved EIA.
- Residents of the Cat Hai island have been very exited about the potentical opportunities for the economic development and job creation from the port and highway project. However, local people are also concerned about project implementation schedule for their own plans on farming activities and other investment.
- The district cemetery area will be affected by the project, so the local peoples are also worried that before project start where they can burry a new body because in Vietnam the dead person should be buried in the same place for 3 years.
- It is noted that these days the coastal fishing activities are not so profitable because of less products, so local people hope that project would bring better economic development as well

as more jobs for their children. Now, most of young peoples go to urban towns to work or they never come back homeland to work after graduation.

2) Opinions on countermeasures to mitigate the possible negative impact of the project to socio-economical and natural conditions:

- Consensus opinion with respective explained contents of Project Owner's presentation: Agree with the contents and mitigation countermeasures explained by MPMU 2.
- The project was informed two years ago. After that people are not confident to invest in salt and acuaculture activities.
- People are expecting start of the project soon and waiting for fair compensation as well as hoping that the construction of the port and highway is able to employ the jobless people during the implementation and operation.

3) Proposals to Project Owner: (requests, proposals of the community to Project Owner related to commitment of countermeasures to mitigate possible negative impact of the project to socio-economical and natural conditions and other related proposals, if any):

- Big interest on the project because the Project will contribute to the economic development of Cat Hai district and bring new jobs for the local peoples.
- It is expected that the project can start soon in order to contribute to the economic development of the area
- Is expected that the project can realize to bring infrastructure development as well as service development and better conditions for young generations.
- It was requested to inform the starting time of the project to keep local people's mind in their existing farming works and business.
- The delay of Project commencement caused negative effects to the local peoples' expectation for the project.
- By port development, roughly 200 of fishmen will loose job because they can not do fishing in coastal area anymore and they don't have enough money to invest in fishing facilities for off-shore fishing. Safegard shall be considered for such directly affected people who do not have any other working skill rather than fishing.
- Many residents are worried that our traditional life will be affected by a large numbers of peoples who will come here for project construction and operation and worried about food, water and other supplies.
- Please consider to provide vocational training for local peoples so that they can take part in port-related activities in the future.

4) Proposals to Project Owner:

- In order to prepare for land acquisition, please start necessary actions and procedures.
- Please consider how to arrange and organize vocational training courses for local people to adapt the new opportunities.

- Since the announcement of the project, local people can not concentrate their mind in farming and business activities because they are not sure about project implementation schedule. It is requested to accnounce the official implementation schedule.

8.8.2. Response of the impremention agency - MPMU2

MPMU II agrees with the opinions and comments raised by the people. The Project is planned to be taken up by Japanese ODA Loan. It is expected to start during June of 2012. MPMU2 has been working hard to take necessary procedures in order to meet the uconstruction schedule and meet the expectation of local people.

CHAPTER 9

9. Sources of References, data and Assessment methods

9.1. Sources of Data and Information

9.1.1. Sources of References

1) List of references

During the preparation of the EIA report for the project, the Consultant has referred to the references as listed in the Table 9.1 below"

Table 9.1 Sources of refernces

No	Title of the references	Sources
1	Document No 330/BGTVT-KHDT dated January 18th 2010 on appointing task on management of Hai Phong international gateway port	Ministry of Transport
2	Decision No.1601/QD/TTg of Prime Minister dated October 15, 2009, approving marine transport development plan of Viet Nam up to the year 2020 and orientation to the year 2030.	Prime Minister
3	Decision No.2190/QD/TTg of Prime Minister dated December 24, 2009, approving system of marine port planning of Viet Nam up to the year 2020 and orientation to the year 2030.	Prime Minister
4	Decision No 3793/QD-BGTVT dated December 22th 2008 on approval of Hai Phong international gateway port investment project	Ministry of Transport
5	Decision No 2231/QD-BTNMT dated October 31th 2008 on approval of EIA Report for Lach Huyen gateway port infrastructure construction project for the period 2010-2015 at Cat Hai District, Hai Phong city	Ministry of Natural resources and Environment
6	Document No.2702/UBND-GT dated May 19th 2008 on pending issues in appraising the EIA report of Hai Phong international gateway port project	Hai Phong People Committee
7	Document.No.500/SXD-QLQH dated May 5th 2008 on proposal for dumping site for dredged materials	Hai Phong Department of Construction
8	Document No.544/KHDT-CNDV dated May 6th 2008 On proposal for dumping site for dredged materials, sources of construction materials mentioned in EIA report of Hai Phong international gateway port	Hai Phong Department of Planning and Investment
9	Ref.No.565/STNMT-KSMay 7th 2008	Hai Phong DONRE
10	Document No.431/GTCC-TDXD dated May 9th 2008 Re: Pending issues in EIA report of Hai Phong international gateway port	Hai Phong Department of Transport

No	Title of the references	Sources
11	Document No.811/CHHVN-KHDT dated May 12, 2008 on asking Hai Phong PC's opinion regarding several issues in EIA report of Hai Phong international gateway port project	VINAMARINE
12	Decision No.2561/QD-BGTVT dated August 25, 2004 on agreement to start up the preparation of the Feasibility Study of the Hai Phong international Gateway Port Construction Project	Ministry of Transport
13	Decision No.766/QD-CHHVN dated December 31, 2004 on Assigning the Maritime Project Management Unit I to represent the project owner to prepare the Feasibility Study of the Hai Phong international Gateway Port Construction Project	VINAMARINE
14	Decision No.694/QD-CHHVN dated October 23, 2007 on Transfering all projects under the Maritime Project Management Unit I to the Maritime Project Management Unit III	VINAMARINE
15	Document No.4534/UBND-GT dated August 3rd 2007 on proposing dumping sites for dredged materials	Hai Phong People Committee
16	Document No.5239/UBND-GT dated September 6th 2007 on dumping sites for Hai Phong international gateway port construction project	Hai Phong People Committee
17	Document No.216/BQL1-DA2 dated September 4th 2007 on proposing to Hai Phong PC for approval in principle the dumping sites for Hai Phong international gateway port	Project Management Unit – Project 2
18	Document No.8327/TTr-BGTVT dated December 25th 2007 to Prime Minister on proposal for approving in principle the investment of Hai Phong international gateway port construction project	Ministry of Transport
19	Decision No.412/QD-TTg dated April 11th 2007 on Approving the list key transport infrastructure project to the year 2010	Prime Minister
20	Decision No.202/1999/QD-TTG dated October 12th 1999 on approving the master plan on the development of Vietnam's seaport system till the year 2010	Prime Minister
21	Decision No.885/QD-TTg dated August 12th 2004 on Approving the detailed master plan on the development of northern sea-port group (Group 1) to 2010 and Orientation to 2020	Prime Minister
22	Document No.495/TB-BGTVT dated September 28th 2005 on noticing conclusion by Vice Minister Tran Doan Tho in the review meeting of inception report of Lach Huyen gateway port construction project	Ministry of Transport
23	Document No.35/TB-BGTVT dated November 11th 2006 on noticing Conclusion by Vice Minister Tran Doan Tho in the review meeting of the 1st interim report of Lach Huyen gateway port construction project	Ministry of Transport
24	Circular No.08/2006/TT-BTNMT dated September 8th 2006 of the Ministry of Natural Resources and	Ministry of Natural Resources and Environment

No	Title of the references	Sources
	Environment	
25	Pollution control measures and wastes management – Environment Administration, February 1998	Environment Administration, Minisry of Science, Technolgy, Environment, 1998
26	Regulations on environment protection, Vol.1 to Vol.6	Environment Protection Administration, Thanh Nien Publishing House, 2004
27	Decree No.80/2006/ND-CP dated August 9th 2006 of the Government	Decree of the Government
28	Level of violation in accordance with the environment protection law, Vol.1	Environment Protection Administration. Legal Science Institute, Thanh Nien Publishing House, 2003
29	Environment Protection Law	National Political Publishing House, 2006
30	Construction Law and its guiding regulations	Construction Publishing House, 2005
31	Decree No.16/2005/ND-CP dated February 7th 2005 of the Government on management of construction investment projects	Decree of the Government
32	Decree No.12/2000/ND-CP dated May 5th 2000 of the Government and Decree No.07/2003/ND-CP dated January 30th 2003 of the Government on construction and investment management mechanism	Decree of the Government
33	Letter No.216/BQLDA1-DA2 dated Sepetmber 4th 2007 of the Maritime Project Management Unit I to Hai Phong City People's Committee proposing the dumping site for Lach Huyen Gateway Port Construction Project	Letter of the Maritime PMU
34	Letter No.5239/UBND-GT dated September 6th 2007 of the People's Committee of Hai Phong city on the dumping site for Lach Huyen Gateway Port Construction Project	Letter of the Hai Phong city People's Committee
35	Letter No.4534/UBND-GT dated August 3rd 2007 of the People's Committee of Hai Phong city on the planning of the dumping site for Lach Huyen Gateway Port Construction Project	Letter of the Hai Phong city People's Committee
36	Pollution control measures and waste management, February 1998	Ministry of Science, Technology, Environment, February 1998
37	Executive report on Cat Hai socio-economic development master plan to 2020	The People's Committee of Cat Hai district
38	Climate and hydrographical data of Cat Hai district	Department of Science, Technology, Environment of Hai Phong and Northeast

No	Title of the references	Sources
		Hydrography and Meteorology Station, 2001
39	Cat Hai Master Plan	Planning Institute, Hai Phong Department of Construction Nov.2000
40	Decision No.22/2006/QD-BTNMT dated December 18th 2006 on compulsory application of Vietnamese standards on environment	Decision of the Ministry of Natural Resources and Environment
41	Standards on construction and design	Construction standards 2005
42	Methodology for pollution assessment	WHO 1987
43	MIKE 21-MT model	Denmark Hydrography Institute
44	Calculation model	Mase 1998

2) Accuracy, Reliability, and Updatability of sources of references

The above-mentioned references are issued by competent agencies of Vietnam and international and therefore, very much reliable for environment impact assessment.

9.1.2. Data and document prepared by the Project Owner

1) List of data and references

Data and references prepared by the Project Owner are summarized in the Table 9-2 below:

Table 9.2 Sources of data, references prepared by the Project Owner

No	Title of the references	Sources
1	Final report, Feasibility Study of Lach Huyen Gateway Port Construction Project	Transport Engineering Design Incorporation (TEDI)
2	Basic design, of Lach Huyen Gateway Port Construction Project	TEDI
3	Report on hydrography and meteorology data collection	TEDI
4	Report on geography survey	TEDI
5	Report on topography survey	TEDI
6	Report on hydrography survey	TEDI
7	Report on wave survey	TEDI
8	Draft Final report, The Preparatory Survey on Lach Hyyen Port Infrastructure connstruction in Veit Nam	SAPROF Team (Oriental Consultants/PADECO)

2) Accuracy, reliability, and updatability of references prepared by the Project Owner

The references from the Project Owner provided by the reputable consulting companies such as:

- ORIENTAL CONSULTANTS Co., Ltd.
- Center for Hydrography, Meteorology and Environment

All data and references are reliable and most updated as of May 2010.

9.2. Methods applied in EIA process

9.2.1. Methods

The EIA report was prepared applying the following methods:

- Statistical method: this method is to collect and screen meteorological, hydrological, socio-economic data in the project site.
- Sociological survey method: this method is to interview to get comments of leaders of People's Committee of project-involved authorities including Cat Hai town, Hoang Chau commune, Dong Bai commune, Van Phong commune, and Nghia Lo commune, Cat Hai district, Hai Phong city and community people in the project srea.
- Survey and sample method: this method is to define survey location and sample taking location for environment conditions assessment in the project area.
- Laboratory analysis and treatment method: this method is to analyze environment data following Vietnamese Technical Regulations and standards TCVN-1995.
- Comparison method: for assessment of project impacts based on Vietnamese Technical Regulations and standards (TCVN-1995- TCVN - 2005).
- Quick assessment method: in accordance with regulations of WHO to predict volume of pollution parameters on air and waste water for project impact assessment.
- Modeling method: use model to calculating sediments and oil spreading
- Analyzing and summarizing report method: analyze and summarize project impacts to the environment composition, natural condition as well as socio-economic condition in the project area.

9.2.2. Survey equipment applied for water environment analysis

- For EC: PHOS-930 by ELLE, water sampling equipment by ELLE
- For DO: Oxygen-92 by WTW
- For heavy metals: ASS-320 by PERkin ELMER USA
- For Ion NH4, NO2, NO3: DR/2000 by HACH USA
- For pH concentration: UC-203 by CKC Japan
- For biological and chemical – BOD: BOD5 by WTW Germany
- For chemistry oxygen – COD: COD Model HE307 by CKC Japan and COD Reactor by HACH USA
- For CH oil: BR/2000 by HACH USA
- For chemistry parameters: Palin Test – Eng, HP-6890, HP-US
- For Coliform and other microorganism: Coliform counter SUNTEX, Model 560 Colo, Analyzer Total Colifor, by HACH USA

9.2.3. Survey equipment applied for air environment analysis

- **Temperature (t), Humidity (e), Wind Velocity (v), Atmospheric Pressure (Pkq):** Thermohygrometer Type 4510, TESTO Franco Germany, Thermoannenmometer Type 4500, TESTO
- SPM: Digital Dust Indicator P5-H2, SIB Low volume Air Sampler SL30. Air Sampler Anderson Model AN-200 SIBATA. BUCH Air Sampler
- CO, CO2, SO2, NO2, HC, VOC, etc: Spectrophometer Model HP-8453 HP US

9.2.4. Survey equipment for noise

- Integrating Sound Level Meter Type NL-04 RION
- Integrating Sound Level Meter Cirrus Japan

9.3. Evaluation on the reliability of the methodology applied in EIA Report

- Statistics and comparison method: the result is accurate and reliable
- Method incl. survey, investigation, sampling, analysis, data processing in laboratory, sociology interview: the accuracy very much depends on skillful of the consultants. In this report, all surveys were done by the consultants of the Center for Hydrography, Meteorology, and Environment, the data collected were accurate and reliable.
- Quick assessment method: following WHO regulations to define the volume of pollution parameters. This method gives result very quick and accurate.
- Modeling method: to calculate sediments and oil spreading in order to assess impact to the environment. The model applied was mathematical model followed applicable environmental standards, and the results are highly accurate and reliable. However, there might need to have some modification during the implementation period as the current condition keep changing.

In general, all the above-mentioned methods have been applied for impact assessment. These methods are utilized and recommended in various studies of the Ministry of Natural Resources and Environment and therefore the accuracy and reliability is ensured.

9.4. Comments on the detail and reliability of the assessment results.

9.4.1. On the detail of the assessment

The project impact assessment has been done following the steps below:

- Define and quantify sources of impact in each period of project
- Define the spatial and timing of the affected subject
- Assess impact based on scope and sources of impact, spatial and timing and sensitivity of the affected subject

All the assessment results are specified, and thanks to that, the mitigation measures have been given in order to prevent adverse impact and to cope with environment incident in a practical manner.

9.4.2. On the reliability of the assessment

Methodology applied for assessment as mentioned in the above section are reliable. The impact assessment in each period of the project is practical. The Project Owner has committed to undertake mitigation measures as described in Chapter 5 of this report.

CONCLUSION AND RECCOMENDATION

I. Conclusion

The desk review of the Approved EIA and the draft final report of "The Preparatory Survey on Lach Huyen Port Infrastructure Construction in Viet Nam" by SAPROF study team concluded that the potential impacts on natural and social environment of the SAPROF's change in port design would not be significant compared to the TEDI's port design except the management of the maintenance dereging material in the long-run. In addition, some potential impacts, which were not addressed in The Approved EIA, and insufficiency of the baseline survey on natural environment were identified in this SUPPLEMENTAL EIA report.

The summary of the environmental impact assessment relevant to the SAPROF's change in port design are shown below:

Table - Summary of the SAPROF Port Design and Potential Impacts Identified by the SUPPLEMENTAL EIA

Item	SAPROF' Design	Potential Impacts
EIA of the SAPROF Port Design		
1. Design vessel for container berth	Fully loaded 50,000DWT vessel Partial loaded 100,000DWT	• No significant impacts are expected.
2. Extension of channel Long, Width and Depth	160m to 210m wide, -14m deep below CDL	• Due to the sufficient capacity of disposal site, no significant impacts are expected for the initial dredging though there is significant increase in volume. • Due to the higher requirement of maintenance dredging, alternative and sustainable solution(s) shall be critically needed within ten (10) years.
3. Extension of sand protection dyke	Applying till -5m	• Based on the results of the sedimentation simulation model, no significant impacts are expected. However due to the difficulties to simulate the detailed/localized phenomena, continuous monitoring will be required. • Based on the results of the oil spill simulation model, fewer impacts were shown. However due to the complex environment of the study area, both The APPROVED EIA results and this SUPPLEMENTAL EIA results may contain some errors. Evaluation of the simulation model and further consideration is recommendable in the following ADDITIONAL EIA.
4. Public related facilities and service/common berth	1) Land reclamation 2) Service boats berth, 3) Port Admin. Bld., 4) Amenity Bld. 5) Pavement	• Due to the least land use activities in the land clearance area, no significant impacts are expected. However, timely implementation of the land acquisition including grave resettlement and land acquisition shall be

Item	SAPROF' Design	Potential Impacts
		essential to meet the critically scheduled project implementation.
Potential Impacts Identified by the SUPPLEMENTAL EIA		
5. Insufficiency of the ecological baseline survey	Recommending additional ecological monitoring at widely allocated additional monitoring points	• Because of the single ecological baseline survey in close area, it is hardly to evaluate the potential impacts in the region by season. Additional ecological survey at additional monitoring points is recommended in the following ADDITIONAL EIA.
6. Impacts on coastal fishing	Recommending development of a safeguard policy and reasonable care for project affected people	• Though the Approved EIA evaluated minimal impacts on the coastal fishing activities, SAPROF study has confirmed the regular fishing activities in the project area. Consideration for the loss of the coastal fishing activities and limited capability to adapt the expected new job opportunities were confirmed in the potentially affected communities.

In addition to the SUPPLEMENTAL EIA, the Approved EIA pointed the potential impacts as follows:

- Cause instability to the socio order and security due to the high density of population in the project area, bring in direct impact to the daily life of residents when their land acquired by the State for the project,
- Pollute the environment in the project area: air, noise, and wastewater during the construction,
- Pollute the environment in the project area: air and noise during the operation, and
- Pollute the coastal environment in the project area due to the wastewater discharged from port's operation.

The Project Investor has committed to seriously conduct mitigation measures as mentioned in Chapter 4 and 5 in order to comply with standards as per Vietnamese standards on environment. Specifically, the Project Investor has declared the following commitment:

- Mitigation measures during planning stage
- Mitigation measures during construction stage
- Mitigation measures to prevent air pollution, noise, wastewater pollution, and solid waste during operation stage
- Conduct management and supervision program as proposed during the construction stage as well as operation stage.

Development of the Hai Phong International Gateway Port will definitely enable the economic development of the northern Viet Nam, but the identified impacts on natural and social environment shall be addressed in the following ADDITIONAL EIA to achieve such potential impacts with smart ways. Though the identified impacts may not be serious issues at the initial stage of the project implementation, such issues may possibly turn critical abstraction in the future. Historical records proved that the PROACTIVE actions to solve the hidden/potential impacts with REASONABLE manner are likely to avoid the potential further loss of POST-Actions such as delay of project implementation and higher costs of compensation with further social disturbance.

II. Recommendations

Not only for the fulfillment of the Vietnamese authorities' appraisal of the following ADDITIONAL EIA but also the active appeal for JICA's smooth appraisal of the project, it is highly recommendable

to reasonably address the potential impacts identified in the Approved EIA and this SUPPLEMENTAL EIA as early stage as possible. Followings are the list of the items/potential issues to be addressed in the ADDITIONAL EIA stage.

Natural Environment

9.4.2.1. Additional ecological survey in the wider area

9.4.2.2. Reasonable evaluation of the potential oil spill

9.4.2.3. Consideration for the sustainable management measures for the maintenance dredging, specifically security of the alternative dump site and/or valuable use of the dredged material

Socioeconomic Environment

9.4.2.4. VINAMARINE/MPMU2's consistent communication and collaboration with local authorities to secure the on time delivery of the required land

9.4.2.5. VINAMARINE/MPMU2's active communication with the People's Committee of Hai Phong to stimulate the development of a new safeguard policy for potentially affected people including the coastal fishermen and those who will not be eligible under the effective law but likely to be affected by the project

9.4.2.6. Public and private* collaboration to develop meaningful vocational training, provide such training for the directly and indirectly affected people as well as potential candidates, and efficiently distribute the job opportunities in the communities

* Private represents not only the private port operators but also expected investors/businesses starting operation adjusent to the new port and the coastal development region where the businesses would benefit from the new port development.

Lastly, it is highly recommendable to start preparing the ADDITIONAL EIA, which is likely to take a half year period to complete and roughly one (1) month to acquire the final approval of the ADDITIONAL EIA if there are no serious issues, to meet the critically scheduled implementation plans. Though this SUPPLEMENTAL EIA report is not sufficient to cover the all requirements of the ADDITIONAL EIA contents, it is highly recommendable to extend this SUPPLEMENTAL EIA study to shorten the preparation of the ADDITIONAL EIA. Due to the active involvements of centralized and local authorities for the approval of the ADDIIONAL EIA, it is also recommendable for VINAMARINE and MPMU2 to consistently communicate and collaborate with responsible authorities to identify the potential issues on the ADDITIONAL EIA report and develop the reasonable consensus for the project approval.

Appendix24-1

戦略的環境評価及び環境影響評価、環境保護責任に関する回覧 05/2008/TT-BTNMT

THE MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT

CIRCULAR

Guiding the Strategic Environment Assessment, Environmental Impact Assessment and Environmental Protection Commitments

<Extracted for the consideration of an EIA report approval>

Ha Noi, 2008

THE MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT

No.: 05/2008/TT-BTNMT

SOCIALIST REPUPLIC OF VIETNAM
Independence – Freedom - Happiness

Ha Noi, 08 December 2008

CIRCULAR

Guiding the Strategic Environment Assessment, Environmental Impact Assessment and Environmental Protection Commitments

Pursuant to the Law on Environmental Protection, 29 November 2005;

Pursuant to Government's Decree No. 80/2006/NĐ-CP dated 09 August 2006 on detailed regulations and guidelines for implementing some articles of the Environmental Protection Law;

Pursuant to Government's Decree No. 81/2007/NĐ-CP dated 23 May 2007 on defining professional environmental-protection organizations and sections in state agencies and state enterprises

Pursuant to Government's Decree No. 21/2008/NĐ-CP dated 28 February 2008 on modification and supplementation of some articles of the Government's Decree No. 80/2006/NĐ-CP dated 09 August 2006 on detailed regulations and guidelines for implementing some articles of the Environmental Protection Law;

Pursuant to Government's Decree No. 25/2008/ND-CP dated 04 March 2008 on functions, duties, powers and organizational structure of the Ministry of Natural Resources and Environment;

The Ministry of Resources and Environment hereby provides the detailed guidelines for implementation of several contents of strategic environmental assessment, environmental effect assessment and environmental protection commitment as follows:

<Extracted for the consideration of an EIA report approval>

III. ELABORATION, APPRAISAL AND APPROVAL OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS AND ADDITIONAL ENVIRONMENTAL IMPACT ASSESSMENT REPORTS; IMPLEMENTION, EXAMINATION AND CERTIFICATION OF THE IMPLEMENTATION OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS, ADDITIONAL ENVIRONMENTAL IMPACT ASSESSMENT REPORTS AND SATISFACTION OF REQUIREMENTS SET IN APPROVING DECISIONS.

1. Elaboration of environmental impact assessment reports

1.1. Organizations and individuals that are project owners of investment projects subject to elaboration of an environmental impact assessment reports (hereinafter referred to as project owners) shall carry out by themselves environmental impact assessment and elaborate environmental impact assessment report or hire qualified consultancy service organizations as stipulated in Article 8 of Decree No. 80/2006/ND-CP to do this job.

1.2. The environmental impact assessment report must follow the structure and qualify the requirements of contents mentioned at Annex 4 of this **Circular**.

2. Community consultation

2.1. The project owner shall send documents on the project's principal investment items, environmental issues, and environmental protection measures and request the People's Committee and the People Council at commune level of place where the project is to be executed to give their written opinion on these matters. Such a document states the project's basic contents, its adverse impacts on the natural environment and social-economical situation (specifying the category of waste types, concentration, amount of wastes), solutions and measures to minimize negative impacts shall apply and another project owners commitment on environmental protection (among them mention clearly technology, equipment and works of waste treatment, treatment level of typical parameters of wastes compared with current regulation standards; other environmental protection measure) attached with diagrams (map, drawing) detail description of the project location in relation with natural, social and economic factors around the project location; master plan diagrams (drawings) of project with main construction components of project and waste treatment and waste management construction works of project; construction works of environmental treatment for non-waste factors (clear description of infrastructure connect points, included waste treatment and waste management construction works of project with infrastructure system and natural objects outside the project area barrier)

2.2. Within the time duration as stipulated on Clause 4, Article 1 of Decree No 21/2008/ND-CP, the People Committee and the People Council at commune level is responsible:

- Announce publicly to local people know and shall give to project owners their opinions in writing which are elaborated to follow form as stipulated in Annex 5 of this Circular.

- Announce in writing required project owners to implement coordinately for dialogue in the necessary case. Dialogue results of project owner, People Committee, Fatherland Front Committee at commune level and related parties are be expressed under the form of minutes, in which lists of participants and all dialogue comments are reflected completely, including project owners' agree

and disagree opinions; the minutes must have signatures (name, title) of representatives of project owners and representatives of participants attend the dialogue.

2.3. Agree and disagree opinions made by the People Committee and Fatherland Front Committee at commune level and participants of the dialogue must be synthesized and expressed truthfully in the contents of environmental impact assessment reports.

2.4. Documents of community consultation of project owners, written comment documents made by the People Committee and Fatherland Front Committee at commune level, dialogue minutes and other community consultations (if any) must be copied and attached to the annex of the project environmental impact assessment report.

2.5. Circumstances which is not required to collect consultation of commune, ward or township People's Committees and representatives of communities in the process of making environmental impact assessment reports as stipulated on Clause 4, Article 1 of Decree No 21/2008/ND-CP

3. Sending dossiers for appraisal of environmental impact assessment reports.

3.1. Projects owners send dossiers for appraisal of environmental impact assessment reports to competent authorities on appraisal environmental impact assessment as stipulated in Point a and b Clause 7 of Article 21 of Law on Environmental Protection and Clause 5, Article 1 of Decree No 21/2008/ND-CP.

3.2. Numbers and form of dossiers for appraisal are stipulated as follows:

a) 01 (one) writing document of request from project owners for appraisal and approval environmental impact assessment reports as stipulated in Annex 6 of this **Circular**;

b) 07 (seven) stapled copies of environmental impact assessment reports as stipulated in Annex 7 of this **Circular**, including names, signatures and titles of project owners and stamp at supplemental cover of each report.

In case that the appraisal committee has more than 07(seven) members, or in other necessary cases for appraisal, project owners must provide more strategic environmental assessment reports as requirement of appraisal agencies.

c) 01 (one) draft of investment report, or technical and economic report, or investment project or equivalent draft of project including names, signatures and titles of project owners and stamp at supplemental cover of each report

3.3. The time of submission of environmental impact assessment reports for appraisal and approval of projects as stipulated Clause 5, Article 1 of Decree No 21/2008/ND-CP.

4. Appraisal of environmental impact assessment reports through Appraisal Council

4.1. The competent agencies of appraisal for appraisal of environmental impact assessment reports appointed specialized agencies for the standing member of the appraisal council.

4.2. Organization and operation of the appraisal councils for environmental impact assessment reports, assignment of the standing member of the appraisal council shall operate according to regulations issued by the Minister of Natural Resources and Environment.

4.3. Upon receipt of the valid and qualified application dossiers for appraisal, appraisal agencies set up Appraisal Council for EIA reports; the number of members of the Appraisal Council is decided in accordance with provisions on Clause 2,3 and 4 of Article 21, the Law on Environmental Protection, and the project quality, scale and environmental requirements, but includes at least 07 (seven) members.

4.4. Within 5 (five) working days after receiving results from Appraisal Council, the standing member of the appraisal council must have written documents reporting appraisal results of Appraisal Council to project owners and related requirements of finalizing environmental impact assessment reports dossiers.

5. Appraisal of environmental impact assessment reports through Appraisal services organizations.

Appraisal of environmental impact assessment reports through Appraisal services organizations shall be processed under the provisions of Regulation on the conditions for provision of the service of appraising environmental impact assessment reports promulgated together with Decision No.19/2007/QD-BTNMT dated 26th, November 2007 issued by Ministry of Natural Resources and Environment (hereinafter called as Regulation 19)

6. Finalization of environmental impact assessment reports

6.1. Case of appraisal through Appraisal Council.

Project owners conduct modifying environmental impact assessment reports according to request of appraisal agencies, sign at the left bottom of each page of 01 (one) report has been finalized, copy, sew to hard spine volume with following numbers to send to appraisal agencies and attached with explanatory documents for the modification for examination and approval:

a) For environmental impact assessment reports belonging to approval competence of Ministry of Resources and Environment, the number of reports must be enough to send to: Ministry of Natural Resources 03(three) copies and 01(one) copy recorded on CD; The Department of Resources and Environment where project is executed 01 copy; Sectoral Ministries/agencies govern the

project 01(one) copy; Management boards of economic zones, management boards of industrial parks, export processing zones of hi-tech parks (hereinafter called as management boards) for investment projects of economic zones, industrial parks, export processing zones of hi-tech parks 01 (one) copy; project owners 01 (one) copy

In case project site belonging to 02(two) or more provinces, cities directly belonging to Central, the number of environmental impact assessment reports is increased equal to the number of additional provinces.

b) For environmental impact assessment reports under approval of Ministries, ministerial-level agencies, Government agencies, the number of reports must be provided enough to send to following addresses: Authority-related Ministries, line ministries 03 (three) copies and 01 (one) copy recorded on CD; The Department of Resources and Environment where project is located 01(one) copy; Ministry of Natural Resources and Environment 01(one) copy; Management boards for investment projects of economic zones, industrial parks, export processing zones of hi-tech parks 01 (one) copy; project owners 01 (one) copy.

c) For environmental impact assessment reports under authority of provincial People Committee, the number of reports must be provided 03(three) copies and 01(one) copy recorded on CD to send to Provincial People Committee where project is located 01 (one) copy; The Department of Resources and Environment 01(one) copy; Management boards for investment projects of economic zones, industrial parks, export processing zones of hi-tech parks 01 (one) copy; project owners 01 (one) copy.

6.2. In case of Appraisal through Appraisal services organizations.

a) Finalization of environmental impact assessment reports through Appraisal services organizations as stipulated on Clause 14, Clause 15 and Clause 16 of Regulation No 19.

b) Environmental impact assessment reports have been finalized required to ensure quality and requirement as raised on Point 6.1 Section 6 Part III of this Circular.

6.3. In case that environmental impact assessment reports finalization extends over 24 (twenty four) months from the time receiving documents of the standing member of the appraisal council announce about appraisal results of Appraisal Council and requirements relating to environmental impact assessment reports dossiers finalization or on the environmental impact assessment reports finalization progress, if there is one of primary changes of technology, capacity or implementation location of project, project owners need re - elaborate appraisal dossier of environmental impact assessment reports for project.

6.4. The finalization time of environmental impact assessment reports of project owners is not included in the appraisal time as stipulated Article 12 of Decree No 80/2006/ND-CP

7. Reappraisal of environmental impact assessment

7.1. In case environmental impact assessment reports are not approved by Appraisal Council or Appraisal services organizations or projects there are modifications as raised on Point 6.3 Section 6 Part III of this Circular, reappraisal of environmental impact assessment is conducted under request of project owners.

7.2. Reappraisal of environmental impact assessment reports is conducted by the earlier Appraisal Council or Appraisal Service Organization; in necessary case, competent environmental impact assessment approval agencies set up new Council or select new appraisal organization for reappraisal.

7.3. Expenses to reappraisal environmental impact assessment reports on project owners paying at current regulations and systems

8. Approval of environmental impact assessment reports

8.1. Approval of environmental impact assessment reports are expressed of decision on approval granting of environmental impact assessment report is followed form as stipulated in Annex 8 enacted with this **Circular**.

8.2. In case that possibility negative impacts to environment have not been fully reflected in environmental impact assessment due to objective reasons such as not available detailed project data or existing situation and environmental capacity, unreliable risk analysis and other unavoidable situation, competent approval agencies must pay attention to attached requirement of approval decision.

9. Certifying and sending dossiers of approved environmental impact assessment reports

After approval of environmental impact assessment report, competence approval agencies (or agencies are authorized by competence approval agencies) have responsibilities:

- Certify at the back of supplement cover of each environmental impact assessment report as form stipulated in Annex 9 enacted with this **Circular**.

- Sending certified environmental impact assessment reports enclosed with approval decision to project owners and other related agencies as stipulated in Point 6.1 Item 6 Part III of this Circular;

- Sending approval decision of environmental impact assessment report is stipulated at Clause 1 and 2, Article 15 of Decree No. 80/2006/NĐ-CP.

10. Elaboration, appraisal and approval of additional environmental impact assessment reports

11. Responsibilities of the project owners after environmental impact assessment reports are approved

11.1. Reports to District People's committees where implementing the project on contents of approval decisions of environmental impact assessment reports as form stipulated in Annex 15 enacted with this Circular within 15 (fifteen) day after the day receiving approved decisions of environmental impact assessment reports of projects

11.2. Elaborating and posting publicly summary of approved environmental impact assessment reports as form stipulated in Annex 16 enacted with this Circular at the head office of the People Committee at commune level where previously collected community consultations. The time posting publicly within 05 (five) days after the day receiving approved decisions environmental impact assessment reports, approved decisions of additional environmental impact assessment reports (if any) and extend until projects are operated officially

11.3. Preparing and sending to the agencies that approved environmental impact assessment reports and Department of Natural Resources of province, city where projects use of land following reports, documents:

a) Report on plan of building environmental treatment and protection works is elaborated as form stipulated in Annex 17 enacted with this Circular.

b) Announcement on plans of experimental operation of environmental treatment and protection works must follow form stipulated in Annex 18 enacted with this Circular.

c) Report on implementation of contents and requirements of approval decision on environmental impact assessment report before projects are operated officially enclosed with documents to request certifying is elaborated as corresponding form stipulated in Annex 19 and Annex 20 enacted with this Circular.

11.4. In case projects have additional environmental impact assessment reports approved, project owners must

report to District People's committees where implementing the project on contents of additional environmental impact assessment reports in term as mentioned on Point 11.1Article 11 Part III of this Circular and update, add in reports mentioned on Point 11.3 Article 11 Part III of this Circular contents related to approved additional environmental impact assessment reports and request of approved decision of additional environmental impact assessment reports.

11.5. Implementing requests as stipulated in Clause 14 of Decree No.80/2006/ND-CP

12. Responsibilities of the approval agencies of environmental impact assessment reports after environmental impact assessment reports are approved

12.1. Monitoring, verifying implement of contents on environmental impact assessment reports, additional environmental impact assessment reports (if any) are approved and requests of approved decision before operating officially of projects based on studying, considering reports, appraisal application dossiers sending by project owners.

In necessary case, set up the verification group as form stipulated in Annex 21 enacted with this Circular to coordinate with related agencies to conduct verification at place where project is executed. Verification results is presented in proceedings as form stipulated in Annex 22 enacted with this Circular and must be signed, named by representatives from competent verifying agencies, project owners and verifying coordinated agencies

12.2. Issue certification paper for implementing contents of reports and requirements of approval decision on environmental impact assessment reports, approval decision on additional environmental impact assessment reports (if any) before projects are operated officially as form stipulated in Annex 23 enacted with this Circular in term since the day receiving suggestion enclosed with complete and qualified dossiers of project owners as stipulated on Point 11.3Article 11 Part III of this Circular, namely as follow:

a) At the latest 15 (fifteen) working days in case not to carry on activities to examine, measure, take environmental analyzed samples at place where project is executed.

b) At the latest 25 (twenty-five) working days in case must carry on activities to examine, measure, take environmental analyzed samples at place where project is executed and projects are qualified for certifying.

In case projects are unqualified for certifying, inform in writing specifying reasons and requests to project owners to continue implementing. The time project owners complete these requests of approval agencies on environmental impact assessment reports is not included in the term 25 (twenty-five) days as mentioned above.

12.3. In the verifying, certifying progress for implementing contents of reports and requirements of approval decision on environmental impact assessment reports, if observed, analyzed environmental parameter on project owners reports not ensure reliable degree, certified agencies coordinate with agencies having professional, technical qualification to conduct measure, taking samples, analyzing to verification; expenses to conduct verification, taking samples, analyzing on environmental parameter to verification is taken from certified agencies finance according to regulations of the current Law

12.4. Implementing regulations as stipulated on Clause 15 of Decree No.80/2006/ND-CP

13. Technical examination for environmental treatment and protection works

13.1. Technical examination for environmental treatment and protection works must comply with legal regulation on investment and building.

13.2. Organizations that designed, built environmental treatment and protection works or components of works are not allowed to conduct technical examination of that works or components of works.

14. Authorising to appraise and approve environmental impact assessment reports of investment project in economic zones, industrial parks, export processing zones, hi-tech parks

Appendix24-2

VINAMARINEコメントに対する回答及び対応案

VINAMARINE's Comments	SAPROF Team Reply	Action to be taken
1 Port Development Plan		
The Draft Final Report is only studied for Medium Term Development Plan (up to 2020), however, currently all the port plans (general plan and detailed plan) are studied for Long Term Development up to 2030. Therefore, in order to synchronize with the general plan and to be the base for berth development, building layout and public facilities suitable with the development of next stage, the Draft Final Report should provide additional study on berth development orientation for Lach Huyen up to 2030.	SAPROF study is conducting following the Scope of the Preparatory Study (TOR) provided by JICA and the TOR requests to study the issues up to 2020. The TOR was presented in Section 2: Scope of the Preparatory Study in our Inception Report and the TOR was also included in the Minutes of Meetings signed on July 23, 2009 by MOT, MPI, VINALINES and JICA.	**No action** will be taken.
Arranging berths in a port has to maintain the continuity, creating advantages for arranging handling equipments and effective operation. Therefore, arrangement of service berth among container berths is not reasonable, so it is suggested to reconsider.	We provided a barge berth basin between Container Berth No.3&4 and Berth No.5&6 for inland waterway or coastal waterway transportation and for public service boat berth by the following considerations: (1) At least 2 container berths are arranged continuously already and further continuity is not always necessary. (2) If barge berth is arranged on the same face line of main berth, the effective container handling and safe berthing operation will be disturbed. (3) Barge berth and public service boats don't require deep water and it is not economical to arrange barge berth on the same face line of main berth. (4) By providing the barge berth basin, 500m long (or more) waterfront become available but only 100m long waterfront can be available if barge berth is arranged on the same face line. However, it is also true that if barge berth basin is deleted, length of main berth can be extended from 375m/berth to 400m/berth which means more number of container vessels can be accepted and barge operation will be done at the main berth during when large vessels are not at berth. Therefore, if cargo volume to be transported by barges is large, our plan is preferable, however, if cargo volume by barges is small, continuous plan will be better. It will be the matter to be determined by the developers/investors for	**Alternative port layout plan will be added**

	container berths No.3&4 and berth No.5&6. We will prepare the port layout plans for both cases as alternative.	
Currently Ministry of Transport has assigned for Vietnam Railway Administration to establish the railway investment and construction to the gateway port in Hai Phong, it is suggested that the survey team should update the proposals for the railway positions of Lach Huyen port.	In interviewing to agencies concerned, it was the answer that the development of railway for Lach Huyen Port will not commence before 2020. Therefore, we didn't include it in our plan since it is beyond our TOR. However, our opinion regarding the railway system for Lach Huyen Port is as follows: The space for introduction of railway in Lach Huyen Port in future (after year 2020) is reserved behind the terminal yard. However, it is considered that the railway should not be introduced into the container terminals or multi-purpose terminals. If railway lines are introduced in the container terminal, the railway lines and roads in and out of terminal have to cross each other that will disturb traffic flow significantly and cargo handling efficiency of the port will down. To eliminate this disturbance, all crossings should be converted to flyovers which will require additional spaces and high construction costs. Even if railway is introduced in the terminal, tractor-trailers should be used for transporting the containers between stacking yards to railway wagons. Therefore, if there is railway station in the outside but in the vicinity of container terminal, the transportation time and cost are not so much different but it is obviously more advantageous than construction of flyover. In case of multipurpose terminal, it is not economically viable for railway transportation if one item of bulk cargo to be handled at the port occupy less than 50% of the total port cargo and the transportation distance by railway is less than 200km – 300km Therefore, the potential is in transportation between inland destinations of China and Lach Huyen Port. However, potential cargo item and volume of China are not clear yet and should be determined at the implementation stage after 2020. In the present port layout plan, there are 400m wide land space is reserved behind the multi-purpose terminal. Therefore, it is recommendable to introduce railway into that space and bulk cargo storage yard is also arranged in that space and between the storage yard and ship at berth will be transported through belt conveyor system.	**No action** will be taken.

2	**Demand forecast and calculation of berth scale:**		
	According to the cargo volume forecast of Lach Huyen Port in 2015 (about 463 mil TEU), only one berth still can handle all cargo volumes. Therefore, the Draft Final Report needs to clarify the investment necessary for the first stage, including 2 container berths.	It is true that container volume to be handled in 2015 will be 463,000TEU which can be handled in 1 berth but in 2016 the volume will become 826,000TEU and in 2017 it will be 1,191,000TEU which is more than the capacity of Berth No.1& No.2. Therefore, it is obvious that 2 container berths are necessary for the first stage development. We made “Financial Analysis” and “Economic Analysis” for 2 berths in the first stage and for 5 berths in medium term (2020) in Chapter 18 of DFR and the both results had proved that the Project is financially and economically viable.	**No action** will be taken.
	Regarding to berth demand for period of 2020, the forecasts: (i) the rates of ship call 20,000 DWT – 50,000 DWT – 80,000 DWT – 100,000 DWT are respectively 20% - 30% - 20% - 30%; (ii) cargo in the ship only take 50% of the capacity; (iii) the berth occupancy ratio is 60%...Then the scale of berth will be much more than cargo demand. Therefore, it is needed the detailed evidences accordance with above forecasts in order to ensure reasonable scale in respect of economic and technical factors.	In the port planning of container berth, it is accepted internationally to apply 60% to 70% of Berth Occupancy Ratio (BOR). Generally speaking, the container handling capacity of main container ports in the world is around 1,000TEU/m (berth length). In this plan, the adopted capacity is 1,226TEU/m (= 2,299,000TEU ÷375m÷5Berth) which is larger than the above standard value and the comment that the scale of berth is much more than the container demand is not correct. In this connection, Cai Mep ODA container terminal adopted the capacities of 1,000TEU/m for 2015 and 1,233TEU/m for 2020. While, the exchange cargo volume was adopted 1,500TEU/ship-call (37.5%) for design vessel of 50,000DWT in Cai Mep ODA container terminal planning and actual exchange volume of VICT in Saigon port is around 20% for 15,000DWT container vessel. As known from these figures, our adopted exchange volume is not small at all.	**No action** will be taken.
3	**Demarcation of scope of works**		
	The dredging volumes and wharf slope dredging treatment includes in the slope dredging works underneath the berth and combines with berth construction, so the draft final report should be revised and recalculated the volumes in component B (works belong to private sector).	We will check again the volume of dredging and revise the demarcation of scope of dredging under wharf structure from public sector to private sector in our Final Report.	**Related portion of FR will be amended.**

4	**Demarcation of contract packing**		
	Demarcation of works includes 2 contract packages with the scope of each package over 300 million USD will decrease the completion in the contract packing, especially not encouraging the participation of domestic contractors. Therefore, the draft final report should study to demarcate packages suitable to Vietnamese law on bidding and increasing the competition.	It was determined that this project will be implemented by applying the STEP loan of Japanese ODA system which means that the leading contractors of all contract packages should be Japanese contractors. However, of course, the leading Japanese contractors have to cooperate with domestic contractors as much as possible; otherwise the Japanese contractor will not win the bidding since bidding prices become expensive. Therefore, number of contract packages has no relation with opportunity of domestic contractor's participation and total amount of works to be sublet from Japanese contractors to domestic contractors. The number of contract packages should be determined from the viewpoints of smooth implementation of works, reliability of performance, elimination of troubles on responsibility of interface works, minimum project cost (small number of contract packages can save field management cost and temporary work cost), etc. From these view points, small number, 2 of contract packages was recommended.	**No action** will be taken.
5	**Operation and maintenance belongs to Public sector works**		
	The report should be revised at page 17-13 "the operation and maintenance after soil improvement and reclamation will be carried out by Vinamarine". In addition, the report should not appoint any specific organizations that will implement the operation and maintenance.	In MOT Decision No. 3793/QD-BGTVT dated 22 December 2008, it is mentioned that the compensation, land clearance and resettlement shall be approved by Hai Phong PC and executed in conformity with regulations as a Subproject A2 of Hai Phong international gateway seaport construction investment project. Therefore, we assumed all responsibilities related with land will be in hand of Hai Phong PC but if not, please show us amended decision by MOT. In the TOR of SAPROF study, we are requested to show the responsible agencies/ organizations for O&M of project facilities and their capability, experience, organization structure, etc. So, if our description in DFR is mistaken, please let us know correct agencies/ organizations with their supporting information or at least, let us know how to describe in our final report on this matter as early as possible.	If additional information is obtained from VM, FR of this portion will be amended.
6	**Scope of port management:**		
	The report should analyze in details the disadvantages and conditions when applying the proposed model (page 20-25) (attention to	Followings are job descriptions of the divisions proposed by the study team for a new PMB. (1) Administration Division:	**Explanation will be added in FR**

regulations in current Vietnamese law).	- **General Affairs**: Responsible for general affairs matters concerning PMB and shall assume a coordinating function to adjust businesses handled by the other PMB divisions. - **Finance and Accounting**: Dealing with financial matters of PMB including the collection of facility rentals, Budget compilation, Management of the incomes and disbursements. - **Personnel**: Management of human resources including recruitment and staff training of PMB personnel. - **Port Authority**: Representing public sector to deal with private sector enterprises to protect public interests, Assuming ownership of infrastructure and port assets and their administrative management, Overseeing maritime safety in the port including activities vessels traffic management, Port security including fire fighting, dangerous cargo storage, international requirements in respect of the ISPS codes. Implementing the environment protection. (2) Business Division: - **Port Planning**: Making up a port development plan in accordance with the national port development master plan and in coordination with the relevant central ministerial agencies. - **Business**: Negotiating a berth lease/concession contract and execution of an agreement, Conclusion of the lease/Concession contract, Selection of a terminal operator, Port tariff management to ensure competitiveness of the port. - **Operations Center**: Overseeing and controlling operations of each port facility, Coordinating overall operations activities to maximize port capability, (3) Engineering and Technology Division: - **Port Master Plan**: Preparing a short term overall port maintenance schedule. - **Construction and Mechanic**; Responsible for construction, expansion and renovation of the public facilities, Overseeing maintenance works handled by the facility lessees to protect public interests and for integrity, - **Labor Safety**: Supervising labor practices to assure no labor casualties.	

	(4) International Business Division; - **International Business**: Maintaining an international relationship with other foreign ports and port industry organizations, Participating international conventions, conferences and agreements in regard to the port administration and management. - **Marketing and Promotion**: Promotion activities to invite additional port customers, shipping lines, cargoes, logistics businesses into the port. (5) IT Support Division; - **Systems Support and EDI**: Providing IT support and facilitating EDI networks with port related governmental agencies and port users. - **Information & Statistics**: Establishment of IT based port statistics collection system. As long as Lach Huyen Container Berth 1 and 2 are concerned it has been decided that the MPMUII is assigned to execute the project until the completion of the ODA project in 2015 and VINALINES and its JV companies are appointed as a terminal operator, it is recommended for VINAMARINE and their regional agency to form a preparatory department with about 50 staffs to work out a concrete and realistic plan in order to set up an effective PMB organization for Lach Huyen middle term project that includes 5-6 container berths and 3 multi-purpose berths aiming at being operational in 2020 in full swing. If it is intended to follow PAT as a model case for the landlord type port administration and management scheme it may need about 200 PMB staffs to fulfill responsibilities. A size of PMB depends on; - The scope of responsibilities which a PMB will cover, - The size of port and a type of berths, public general cargo berths, dedicated container berths, passenger, bulk cargoes, industrial private berths, vehicle, etc., - The amount of cargoes in tonnage or TEU,	

	- Share of responsibilities between public and private in case of lease/concession contract, - Either to execute the technical engineering works by own PMB employees or by contracting out to outside, - Use of IT technology to rationalize daily routine business. There is no universal benchmark for a size of staff to be employed by a PMB. At Laem Chabang that is referred as a model case of the typical landlord container port in this study employs about 200 to handle 5.2 Mil TEU containers. The most significant factor to affect the size of PMB in case of the landlord type container port may be an alternative to carry out the engineering works. In case of Hamburg Port Authority it employs 439 engineering mechanics and skilled labor for maintenance dredging and other civil engineering works over road, bridges, embankment, etc. of public facilities out of total 1,716 PMB staffs. Port of Rotterdam on the other hand has only 10-11 engineering staffs who engage in the inspection and supervisory role over the contractors that are hired to do pubic facilities maintenance works. Yokohama Port and Harbor Bureau has 316 total staff including 127 engineering staff. Yokohama Port Development Public Corporation which specializes to administer and manage 10 container berths and 8 general cargo liner terminals has 42 staffs. The size of PMB varies by port by port and is not liable for comparison. For an initial period current MA may take care of PMB functions under the present laws and regulations for the time being but for an implementation of full responsibilities it should need a specific legislative framework to justify the rights and obligations of PMB.	
7 Technical matters		
In the study of sedimentation stimulation, it is needed to clarify the sediment density distributing by the depth of channel. Therefore	This issue was already explained in page 14-5 to 14-8. The top elevation of +4.0m (Case 7) and +2.0m (Case 7b) were compared and obtained the difference of sedimentation volume of about 20% only. On the other hand, the	**No action** will be taken.

<table>
<tr>
<td>explain clearly how to select the top elevation of the dyke is +2m.</td>
<td>difference of construction cost is more than 40%. Economic analysis was also conducted for 50 years period and Case 7b was concluded more economical than Case 7.</td>
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<td>The sand is expected to supply from Hai Duong but it is required big sand volumes of 10,000 m3/days so the Survey team should investigate, evaluate and propose other sand supply sources and provide more options for sand transportation in order to meet project schedule.</td>
<td>According to the information obtained from DONRE as well as the local sand supplier in Hai Duong, they are capable of supplying the sand of 10,000m3/day. At the same time, there is information that around 100,000m3 of the sand can be purchased around Hai Phong city which is equivalent to 4,000m3/day (considering 25 working days).
SAPROF team made the list of possible sources as below. However, further investigation will be done in detailed design stage regarding the sand sources, capacity as well as the transportation method (possibility of mobilizing larger dredging vessel instead of small barges which is commonly used in Northern Viet Nam).
<table>
<tr><th>No</th><th>Name of Quarries</th><th>Location</th><th>Distance to LH(km)</th><th>Remarks</th></tr>
<tr><td>1</td><td>That Hung</td><td>Kinh Mon District, Hai Duong Province</td><td>93</td><td>-</td></tr>
<tr><td>2</td><td>Nhan Hue</td><td>Chi Linh District, Hai Duong Province</td><td>122</td><td>-</td></tr>
<tr><td>3</td><td>Yen Lap</td><td>Yen lap District, Quang Ninh province</td><td>90</td><td>-</td></tr>
<tr><td>4</td><td>Cau Cam</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>5</td><td>Dong Trieu</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>6</td><td>Ha Bac</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>7</td><td>Uong Bi</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>8</td><td>Song Lo</td><td>-</td><td>150</td><td>150km from LH</td></tr>
<tr><td>9</td><td>Viet Tri</td><td>-</td><td>150</td><td>150km from LH</td></tr>
<tr><td>10</td><td>Phu Tho</td><td>-</td><td>150</td><td>150km from LH</td></tr>
<tr><td>11</td><td>Kinh Mon</td><td>-</td><td>-</td><td>visited but no detail information was obtained</td></tr>
<tr><td>12</td><td>Kinh Thay & Thai Binh River</td><td>Hai Duong</td><td>70</td><td>visited</td></tr>
</table>
</td>
<td>No action will be taken.</td>
</tr>
</table>

The Report has proposed the disposal at Nam Dinh Vu; however, this site needs to be negotiated with MPMU II and depends on the materials after dredging. The dredging volumes are 32,300,860m3, the team needs to explain how to calculate the volumes, proposed dredging facilities. The disposal site will affect on dredging cost so it is proposed that the survey team should study more and collect ideas and approval from authorities.	Nam Dinh Vu is one of the sites officially approved in EIA report as a dumping ground of dredged material from Lach Huyen project. Design dredging volume was calculated by average cross section method. The cross sections by certain interval along the access channel were processed by Auto CAD based on the latest seabed sounding survey data carried out by SAPROF team. The average area (m2) of two sections was calculated and the interval distance was multiplied to it in order to calculate the dredging volume. All the cross sections were already submitted to MPMU2. Proposed dredging equipment shall be cutter suction dredger as stated in the DFR. SAPROF team is proposing to investigate the possibility of offshore dumping site as early as possible. It is more economical and efficient than transporting the dredged clay all the way to the land sites in communes or dumping in the Nam Dinh Vu area of which existing seabed is shallow. During the Hai Phong rehabilitation phase2 project, there was one off shore dumping site approved by authorities, which the clay material has been dumped actually. It is strongly recommended to consider availability of the off-shore dumping site for Lach Huyen.	**No action** will be taken.
The top elevation of berth and yard elevation is +5.5 CD to +6.0 CD. The team expects to reclaim to top elevation of +5.5 to +6.0, not considering the yard structure, please explain this. How about Provision for settlement in the implementation stage of reclamation and operation stage, it is suggested that the report should contains measures for settlement provision.	The top elevation ob berth is indicated as CD+5.5m in JICA report. In the first paragraph in page 12-9, it is indicated that “Reclamation area is planned to fill up to CD+5.5 to +6.0m. JICA Study Team considers that the top elevation of yard is +5.5m as the finished level of yard pavement for reclamation area. The description on the elevation “to+6.0m” is referred to a tentative suggestion/idea by JICA Study Team as regard of ground elevation of specific spot area such as substation, which may be better to elevate a little bit higher than the normal ground elevation of the yard for preclusion of possible adverse effect by yard flood.	**No action** will be taken.
The structure of service berth that uses sheet piled vertical wall, Steel sheet pipe pile wall with length of 14m may not meet the condition to operate, so please reconsider this matter.	The stability of sheet pile wall is primary dependent upon the design evaluation for subsoil strengths of in-situ clayey layers. The preliminary design by JICA Study Team will be reviewed in detailed design stage through data analysis of additional subsoil investigation, estimate of possible increase of cohesion by subsoil improvement, etc., but so far, in preliminary design by JICA Team, the wall embedment into subsoil will be safe enough as briefed in the following: Berth Elevation is positioned at CDL +5.5m. But, owing to the presence of	**No action** will be taken.

<table>
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<td>relieving platform immediately behind the wall, active earth pressure will work on the wall from the elevation CDL+3.5m which is equal to the elevation of the lower face of relieving platform.
In case the sheet pile wall is embedded up to the elevation of CDL-11.0m, the design by JICA Study Team for sheet pile wall embedment with relieving platform is outlined as follows:
(1) Design Method: Free Earth Support Method
(2) Moment around the tie rod by Active Earth Pressure (below CDL+3.5m) on the wall: Ma1=3,691kN-m/m
(3) Ditto, but by Residual Water Pressure (RWL=CDL+2.5m) on the wall: Ma2=1,890kN-m/m
(4) Total Moment on the wall: Ma1+Ma2=5,581kN-m/m
(5) Moment around tie rod by Passive Earth Pressure on the wall Mp=8,518kN-m/m
(6) Safety Factor for the designed embedment (CDL-11.0m) of the sheet pile wall: SF=Mp/Ma=8,518/5,581=1.53>1.5 Safe
The safety factor for sheet pile wall embedment into subsoil is normally required 1.5 or more in ordinary condition.</td>
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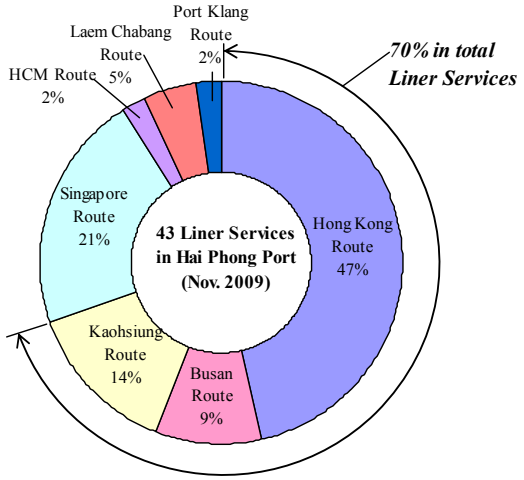
<td>Barge berth structure 500 DWT is focused on safety too much, and can receive ship sizes of 5,000-10,000DWT, barge draft 500DWT (full load) is about 2.4m in order to select the bottom elevation -5.0 is necessary and uneconomical, so please reconsider this mater.</td>
<td>In general, the barge berth is designed & constructed by Private Sector for the intended purpose of the facility. According to METI 2010 Study, it is intended to accommodate container barges ranging minimum 24 TEU to maximum 96 TEU loading capacity for domestic transportation of container through Lach Huyen new container port.
Data on container barge currently used in the neighboring seaborne area indicates that the maximum size of container barge of 96 TEU capacity is as follows:
<table>
<tr><th>Name of Barge</th><th>Capacity (TEU)</th><th>Loa (m)</th><th>Breadth (m)</th><th>Draft (m)</th></tr>
<tr><td>Port of Haiphong</td><td>36</td><td>54</td><td>9.4</td><td>2.8</td></tr>
<tr><td>Port of Haiphong</td><td>24</td><td>32</td><td>6.8</td><td>1.4</td></tr>
<tr><td>Port of Haiphong</td><td>24</td><td>32</td><td>6.8</td><td>1.4</td></tr>
<tr><td>Vinh An JSC</td><td>72</td><td>72</td><td>10.5</td><td>3.2</td></tr>
<tr><td>Gemadept</td><td>36</td><td>54</td><td>9.4</td><td>2.8</td></tr>
<tr><td>Gemadept</td><td>36</td><td>54</td><td>9.4</td><td>2.8</td></tr>
</table>
</td>
<td>No action will be taken.</td>
</tr>
</table>

		Hai Long JSC	68	55	9.4	2.9	
		Nam Duong JSC	72	72	10.5	3.2	
		Nam Duong JSC	72	72	10.5	3.2	
		Nam Duong JSC	68	54	9.4	2.8	
		Trung Dung	96	87	12.2	4.0	
		Navico	36	54	9.5	2.9	
		Navico	36	54	9.5	2.9	
		Source: Additional Study on Hai Phong International Gateway Port (Lach Huyen) Development Project in the Socialist Republic of Viet Nam, Final Report March 2010 prepared by METI (METI 2010 Study) The above list of container barge is a basis for determination of design vessel for the proposed barge berth. The largest size of barge berth (Trung Dung) may be equivalent to around 1,350 DWT barge. The water depth of barge berth planned by Private Sector is: Planned depth: CDL-4.5m, which equals to 1.1x d=1.1x 4.0 approximately Design depth: CDL-5.0m, which is CDL-4.5m +0.5m with allowance of 0.5m for excess over-dredging depth. The JICA Study Team considers that the water depth of barge berth planned by Private Sector is reasonable so far.	
8	**Cost estimation:**		
	It is proposed that the team should clarify the unit cost off some items in VND and foreign currency.	Unit price of each work item is already divided into VND and foreign currency portion.	**No action** will be taken.
	Cost estimation was based on current regulations of Centre and Hai Phong City, however, some unit cost of some items are too high, the team should check as followings: • Temporary yard: 4,356,402 VND/m2 • Dredging: 159,300 VND/m2 • Dredging slope under the deck: 223,127 VND/m2 • Reclamation: 203,042 VND/m2 • Pavement: 1,071,745 VND/m2	The unit price used in the cost estimation is as of May 2010, the latest market price in Hai Phong City. Work items as pointed out are already checked again carefully and proved to be reasonable according to the latest market price and the current regulations.	**No action** will be taken.
	Price escalation: 10.3%	JICA establishes the rate of price escalation for each country once a year. As for the rate of VietNam for this year was set as 10.3% reflecting the recent	**No action** will be taken.

	inflation and booming economy in the country.	
The consultancy cost needs to separate by work items, if the project only has domestic consultants so the cost should be follow regulations of Ministry of Construction; If the project has foreign consultants so it needs to reconsider the cost. In the report, the consultant cost for a domestic engineer is 42 million VND/month and for a foreign engineer is JPY 3 million (approximately 33,482 USD/month) are too high, so please reconsider this mater.	According to the condition of STEP, the consultancy service is tied to Japanese enterprises. So the project is supervised by consultants headed by Japanese companies collaborating with local consultants. As for the consulting fee, we already reconsidered considering the latest man-power schedule and reflected it in the cost estimation. The total consulting fee accounts for 1% of project cost. It is noted that the consulting fee includes price escalation and physical contingency, and the interest rate for it is quite low, 0.01% per annum.	**No action** will be taken.
The report should be added land clearance cost and explain more which is the base of management cost 5%?	The land acquisition cost is already included in the cost estimation. In general, a rate of administration cost of 5% is used in JICA project. Administration cost is obtained by multiplying the rate (5%) by the total of Construction cost, Price escalation, Physical contingency, Consulting service, and Land acquisition cost.	**No action** will be taken.

Appendix24-3

TEDIPORT コメントに対する回答及び対応案（1）

TEDI's Comments	SAPROF Team Reply	Action to be taken
1 Demand Forecast		
Cargo distribution among 3 major ports Hai Phong, Cai Lan and Lach Huyen: **SAPROF:** Cargo volume exceeding the capacity of existing ports will be handled at Lach Huyen Port (10% and 20%) **TEDI PORT:** The above assumption is correct only for container cargo of long distance that should be transited at Hong Kong, Singapore… ports. Other cargo should be distributed among ports based on vessel size, origin and destination of cargo and transportation cost by roadway, railway or inland waterway. This will result in more reasonable results.	In general, vessel size, origin and destination of cargo and transportation cost by roadway, railway or inland waterway are very important points when considering the cargo ~~for~~ distribution among 3 major ports. Strategy of shipping agency in Vietnam is also very important factor. Based on the interviewing with shipping agencies in Vietnam for their strategies, most of the container cargo handled in Lach Huyen Port will be for East Asia-North America Trunk Line and for regular services within Asian region. Likewise, this strategy is already applied to deep-sea port in southern Vietnam. Therefore, the other container cargoes for west-bound route, short-sea shipping and domestic services will be distributed to the ports of Hai Phong and Cai Lan. In November 2009, 43 liner services in Hai Phong Port consist of Hong Kong route (47%), Singapore(21%), Busan route (9%), Kaohsiung route (14%) and other routes (9%). There is a high possibility that 70 % (Hong Kong, Busan and Kaohsiung route) in total of liner services is gradually converted to Lach Huyen Port from 2015 to 2020, serving South East Asia/USA Trunk Line. (See Fig. 1)  **Figure 1 Liner Services in Hai Phong Port (Nov. 2009)**	**No action** will be taken.

<table>
<tr>
<td></td>
<td>We considered that our estimated cargo volume of Lach Huyen port is rather conservative. Because, after Lach Huyen port is opened and left for free competition among the existing ports, most of the cargoes will be likely to shift from the existing ports to Lach Huyen port, where all kinds of vessels from small size to large size can enter at any tidal conditions with shortest distance from ocean route.
In addition, only users of Lach Huyen port can enjoy the economy of scale and reduce transshipment cost and time at Hong Kong or Kaohsiung, etc by direct liner services of Trans Pacific routes.</td>
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<td>Table 5.9.4:
SAPROF: Containers of 40’ and 20’ are the same (50- 50).
TEDI PORT: At present, containers of 40’ account for 60-70% and getting higher (by data of Hai Phong Port).</td>
<td>The 40’ and 20’ ratio of SAPROF is Box number basis but the ratio of TEDI Port may be TEU basis. The following Table 1 and Table 2 show 20’ and 40’ container ratios by Box No. and TEU. In case of Box No. base (Table 1), containers of 40’ and 20’ are almost same as 50-50. In case of TEU base (Table 2), container of 40’ account for 60-70%.

Table 1 20’ and 40’ Container Ratio by Box No.
<table>
<tr><td rowspan="3">Year</td><td colspan="2">Export</td><td colspan="2">Import</td><td colspan="2">Domestic</td><td></td></tr>
<tr><td colspan="2">Box No.</td><td colspan="2">Box No.</td><td colspan="2">Box No.</td><td></td></tr>
<tr><td>20'</td><td>40'</td><td>20'</td><td>40'</td><td>20'</td><td>40'</td><td>20'</td></tr>
<tr><td>2000</td><td>39,496</td><td>30,728</td><td>42,120</td><td>33,883</td><td>4,478</td><td>1,785</td><td>86,094</td></tr>
<tr><td>2001</td><td>34,984</td><td>23,134</td><td>36,060</td><td>25,211</td><td>25,127</td><td>17,149</td><td>96,171</td></tr>
<tr><td>2002</td><td>51,808</td><td>39,681</td><td>54,450</td><td>41,541</td><td>46,602</td><td>14,362</td><td>152,860</td></tr>
<tr><td>2003</td><td>57,675</td><td>45,727</td><td>59,524</td><td>47,033</td><td>47,839</td><td>13,043</td><td>165,038</td></tr>
<tr><td>2004</td><td>57,069</td><td>46,157</td><td>57,384</td><td>45,203</td><td>70,004</td><td>15,420</td><td>184,457</td></tr>
<tr><td>2005</td><td>63,683</td><td>50,552</td><td>62,361</td><td>48,760</td><td>53,203</td><td>23,135</td><td>179,247</td></tr>
<tr><td>2006</td><td>71,704</td><td>55,386</td><td>70,525</td><td>56,004</td><td>55,079</td><td>21,906</td><td>197,308</td></tr>
<tr><td>2007</td><td>89,094</td><td>90,236</td><td>90,359</td><td>90,842</td><td>70,994</td><td>36,114</td><td>250,447</td></tr>
<tr><td>2008</td><td>101,880</td><td>98,969</td><td>103,581</td><td>107,009</td><td>90,242</td><td>50,261</td><td>295,703</td></tr>
<tr><td>2009 until Oct.</td><td>81,935</td><td>83,087</td><td>86,335</td><td>88,501</td><td>103,466</td><td>76,654</td><td>271,736</td></tr>
</table>
Source: Hai Phong Port</td>
<td>No action will be taken.</td>
</tr>
</table>

Table 2 20’ and 40’ Container Ratio by TEU

Year	Export TEU		Import TEU		Domestic TEU			
	20'	40'	20'	40'	20'	40'	20'	
2000	39,496	61,456	42,120	67,766	4,478	3,570	86,094	
2001	34,984	46,268	36,060	50,422	25,127	34,298	96,171	
2002	51,808	79,362	54,450	83,082	46,602	28,724	152,860	
2003	57,675	91,454	59,524	94,066	47,839	26,086	165,038	
2004	57,069	92,314	57,384	90,406	70,004	30,840	184,457	
2005	63,683	101,104	62,361	97,520	53,203	46,270	179,247	
2006	71,704	110,772	70,525	112,008	55,079	43,812	197,308	
2007	89,094	180,472	90,359	181,684	70,994	72,228	250,447	
2008	101,880	197,938	103,581	214,018	90,242	100,522	295,703	
2009 until Oct.	81,935	166,174	86,335	177,002	103,466	153,308	271,736	

2 Port Layout Plan		
TEDI PORT: Table 11.1.2 shows number of 80-100 thousand DWT vessels account less than 30%, therefore, arrangement of 5 (or 6) containers for 100 thousand DWT vessels is wasteful. According to TEDI Port, 2 container berths for 100 thousand DWR vessels are good enough, other berths are for 50 thousand DWT vessels.	In medium term development of Lach Huyen Port, following the construction of container berth No.1＆No.2, the container berth No.3 to No.5 or No.6 should be constructed by 2020. The investors for berth No.3 to No.6 will not accept to construct their berths with the capacity for 50,000DWT vessels because in order to keep competitiveness against Berth No.1&2 the investors for Berth No.3 to No.6 want to construct the same size or larger size of berths. Because, once berth structure is constructed it will be used for more than 50 years and investors will consider for future trend of shipping market. These phenomena are already seen in Vung Tau – Cai Mep port in south Vietnam where many container berths are under developing with the similar capacities for around 100,000DWT container vessels.	**No action** will be taken.
Also, those 2 container berths should be arranged in the outer of the port, container and general cargo berths for vessels of 50 thousand DWT should be arranged in the inner of the port.	This issue was already explained on 15 March 2010 in the meeting with VINAMARINE, MOT, MPMU II, etc. for Interim Report and our opinion (attached at the end of this reply document) was 100% accepted by GOV side and the conclusion was explained in Section 11.6.1.3).	**No action** will be taken.
In Table 11.1.2, berth occupancy by container vessels of 60% is too high leading to long waiting, more rationale rate is 45-50% for containers vessels and 60-70% for general cargo vessels.	For the international gateway port like a Lach Huyen Port, it is usual pattern that container vessels will call at fixed schedule as liner service and the schedule is established considering the operation conditions of destination port not to wait before berthing. Therefore, such a container berths can be used up to 70% - 80% of berth occupancy ratio without demurrage.	**No action** will be taken.

	In case of developing countries, it is not unusual that the growth ratio of container cargo will reach several tens percents per annum. Nevertheless, the demand forecast is used to be conservative and as a result constructed container berth will be saturated well before target year and the required expansion of port facilities in developing countries couldn't be implemented soon. Therefore, in case of construction of new container terminal, the port planning will carried out including some margin. In such a case, the container berth needs to be planned applying 40% - 50% of berth occupancy ratio (BOR). However, in case of Vietnam of nowadays, the construction investment environment for container terminal is very favorable and it is expected that many investors will participate ant time in the construction of container terminal. Therefore, we believe that such a conservative berth occupancy ration needs not to be applied for planning. On the other hand, it is common that many trampers will call for the general cargo berths and even if 50% - 60% of BOR, demurrage will happen. Therefore, in case of multi-purpose berth of 3 berths of Lach Huyen Port, the BOR of 55% is recommendable ratio. However, the ship waiting cost for general cargo ship is not so high like a container vessel and 62% of BOR was applied in this study.	
Barge berth should be arranged between container berth terminal and general cargo berth terminal.	One barge berth is enough for 2 container berths (L=750m) and one barge berth is enough for 3 multi-purpose berths (L=750m). In this study, therefore, the barge berth for Berth No.1 & 2 is arranged at north side of Berth No.1&2 and barge berths for Berth No.3&4 and Berth No.5&6 are arranged between Berth No.3&4 and Berth No.5&6. The barge berth for Multi-purpose Berth No.1&2&3 is arranged at south side of Multi Berth No.1&2&3 since if it is arranged between Container Berth No.5&6 and Multi Berth No.1&2&3 and used by general cargo barges, there will be some waist space and requires higher construction cost. Therefore, a barge berth for Multi-purpose Berth No.1&2&3 is allocated at south side of Multi-terminal. Until berth construction of next stage development, this barge berth is influenced by waves from SE. However against waves from S – SW	**No action** will be taken.

	there are sand protection dyke which will function as small breakwater. Therefore, considering the limited attack of waves and such unfavorable period until next stage development, location of this barge berth can be acceptable.	
Railway link to the port should be studied and planned (for the period after 2020) especially for general cargo berth.	The space for introduction of railway in Lach Huyen Port in future (after year 2020) is reserved behind the terminal yard. However, it is considered that the railway will not be introduced into the container terminals or multi-purpose terminals. If railway lines are introduced in the container terminal, the railway lines and roads in and out of terminal have to cross each other that will disturb traffic flow significantly and cargo handling efficiency of the port will down. To eliminate this disturbance, all crossings should be converted to flyovers which will require additional spaces and high construction costs. Even if railway is introduced in the terminal, tractor-trailers should be used for transporting the containers between stock yards to railway wagons. Therefore, if there is railway station in the outside but in the vicinity of container terminal, the transportation time and cost are not so much different but it is obviously more advantageous than construction of flyover. In case of multipurpose terminal, it is not economically viable for railway transportation if one item of bulk cargo to be handled at the port occupy less than 50% of the total port cargo and the transportation distance by railway is less than 200km – 300km Therefore, the potential is in transportation between inland destination of Chine and Lach Huyen Port. However, potential cargo item and volume of China are not clear yet and should be determined at the implementation stage after 2020. In the present port layout plan, there are 400m wide land space is reserved behind the multi-purpose terminal. Therefore, it is recommendable to introduce railway into that space and bulk cargo storage yard is also arranged in that space and between the storage yard and ship at berth will be transported through belt conveyor system.	**No action** will be taken.

3 Preliminary Design		
Earth retaining wall behind berth: According to TEDI Port, structural solution by SAPROF will ensure the stability in case earth retaining wall is constructed after the completion of barge berth. In the other case, the implementation of slope dredging beneath the berth and piling work of barge berth might lead to serious displacement of wall crown. Therefore, independence of the structure is not high. TEDI Port suggested to select Option C proposed by JETRO study in 2010.	The earth retaining wall proposed by SAPROF Study Team is sheet pile wall, which is independently stable by its self-standing nature of the wall. In TEDI port comment indicates the suggestion to select "Option C proposed by JETRO study in 2010", but JETRO study has never proposed any Options for barge berth construction as well as the retaining wall. SAPROF Team considers that this self-standing wall is ensured its structural stability during the succeeding barge berth construction by applying such optional sequence of barge berth construction as follow: 1) The construction is initiated by the reclamation fill with subsoil improvement work around the barge berth area and, thereafter, the earth retaining wall will be installed by on-land operation. 2) After the completion of the retaining wall construction, open type of barge berth structure proposed for Private Sector in the report JETRO 2010 Study is succeeded. 3) Option A On-land piling work: Piling work will be carried out under proper coverage protection of already-reclaimed fill in front of the wall so that the self-standing type of sheet pile wall maintains its structural stability during piling work. Then, excavation in front of the wall is succeeded for the formation of seabed slope under the barge berth deck structure. 4) Option B On-deck piling work: Excavation in front of the retaining wall precedes the piling work. After forming the designated sea-bed slope under the deck, piling work is carried out by driving operation on temporary deck. Alternative C: Anchored Steel Sheet Pipe Piled Wall for barge berth structure is proposed by SAPROF Study for reference. This type of structure functions as earth retaining wall as well. But, JETRO 2010 Study has selected open type of piled deck structure for barge berth to be constructed by Private Sector. Therefore, this structural solution by JETRO Study decisively forms prerequisite for SAPROF Study in designing earth retaining wall for barge berth construction so far. **The structural type of barge berth for construction is dependent upon the Private Sector' selection and will be**	**No action** will be taken.

	finalized by Private Sector through the technical judgment of the contractor who may be selected for construction under Engineering, Procurement and Construction (EPC) base of Contract with Private Sector.	
Channel and turning basin: Water level for vessel operation: Selection of "0" sea chart seems too safe since this water level almost doesn't appear. It is recommended to select low water level with frequency of 99% of hourly water level.	It is sure that considering the occurrence frequency of LWL (+0.4m)and CDL (0m), the LWL can be applied as base elevation for channel design. In this aspect, CDL applied by SAPROF study can be said as safe side. In the other hand, however, to determine the channel depth PIANC guidelines recommended to apply the multiplier factor of 1.15 for design draft but SAPROF study applied minimum value 1.1. If SAPROF apply the PIANC factor of 1.1.5, the required channel depth is calculated as 14.6m which is 0.6m deeper than that of SAPROF. In this aspect, SAPROF study can be said as unsafe side. Sea charts are prepared based on the CDL and SAPROF study put priority to use CDL for base elevation and the channel depth is determined applying multiplier factor of 1.1 with due consideration for the occurrence frequency of LCL in total.	**No action** will be taken.
Channel depth of -14m is appropriate, however, there is no consideration on sedimentation contingency between 2 times of maintenance dredging. Dredging: Contingency dredging at 2 different levels of 0.5m and 1.4m is not appropriate. According to actual dredging work at Hai Phong Channel (Figure 8.1.17), partial deep dredging locations will suffer from sedimentation rapidly. It is better to conduct contingency dredging for whole channel at 0.5m. Sedimentation later on will be included into annual maintenance dredging volume.	SAPROF study recommended to apply the excess dredging depth of 1.4m for some part and 0.5m for other part of channel as dredging contingency but it is true that the accuracy of mathematical sedimentation simulation still have some scientific limitations. Therefore, we have proposed in Section 24.17.1) that "In order to establish a reliable maintenance dredging plan, check surveys on actual sedimentation phenomena and marine conditions should be carried out at every three (3) months during capital dredging period and mathematical sedimentation analysis should be conducted by the Consultant." Therefore, under the condition that above our proposal for maintenance dredging plan study will be conducted, we will accept the dredging contingency proposed by TEDI Port.	Related explanation in **Chapter 8** and Cost estimation of **Chapter 16** will be modified.
Soft soil treatment: Proposal by SAPROF team is appropriate, however, soil cement pile method requires much bigger cost than PVD	As commented by TEDI Port, Cement Deep Mixing method is costly in general. Therefore among others, row rate of replacement Cement Column method (ALiCC) is applied to minimize its construction cost by reducing the	**No action** will be taken.

method.	rate of replacement in subsoil mass. This ALiCC method is restrictively applied only for the back-of-berth area of 50m wide immediately behind the berth structure.As described in SAPROF Study, the purpose of this method of application is intended: 1) To handover the back-of-berth area to Private Sector for succeeding terminal construction work as earlier as practically possible, 2) To make earth retaining wall stable by reducing active earth pressure working on the wall, 3) To shorten working period for subsoil improvement work and complete overall construction work in or on time. These intended purposes of subsoil improvement are never achieved by application of PVD method though it is less costly than ALiCC method.	
4 Total Cost Estimates		
Pls see the PDF file. We can see that there are differences between our work quantities and TEDI Port's ones, some are big, some are minor. In short, their total work quantity is smaller than us, resulting in smaller total project cost 17,433.67 thousand billion VND compared to ours 18,396.94 thousand billion VND.	The differences in work quantities affecting the total cost estimate between TEDI port and SAPROF are mentioned in the following **Item 5**.	Cost estimation of **Chapter 16** will be modified.
5 Conclusions and Recommendations		
DFR prepared by SAPROF team is good. However, there are some inappropriate points for which SAPROF team is kindly requested to consider for modification or further explanation in FR, especially for the followings:		
(1) Reconsidering the port layout plan by 2020 and proposing the port development orientation after 2020.	This issue was explained in Item 2 above. Regarding the port layout plan orientation after 2020 is out of scope of SAPROF study.	**No action** will be taken.
(2) Rechecking the work quantities especially those with big differences between SAPROF team and TEDI Port.	**Earth Retaining Wall for Container Terminal (per 100m)** I. a) Steel Pipe Pile of D=800, L=27m ; 100 x 1/4 ÷ 0.98 = 26nos/100m I. b) Steel Pipe Pile of D=800, L=16m ; 100 x 3/4 ÷ 0.98 = 77nos/100m →**SAPROF quantity is correct.** II.1 Coping Concrete and II.2 Formwork →**TEDI Port quantity is correct.**	Necessary actions mentioned in **Item 4** above will be taken.

	Earth Retaining Wall for Barge Berth (per 100m) II.1 Coping Concrete and II.2 Formwork →**TEDI Port quantity is correct.** **Dredging of channel and turning basin** Extra dredging →SAPROF quantity is calculated based on bottom width x length x depth (0.4m) V1 = 9,950 x 160 x 0.4 = 636,800m3 V2 = (17,400-9,950) x 210 x 0.4 = 625,800m3 V = V1 + V2 = 636,800 + 625,800 = 1,262,600m3 **The calculation method of TEDI is not sure.** **Outer revetment (per 1m)** Type B (2350m) Core rubble 15-150kg/pcs →**TEDI Port quantity is correct.** **Sand Protection Dyke (per 1m)** Rubble Rock (100 - 200kg) SAPROF quantities include the material loss due to possible settlement of sand dyke mentioned in page 12-40 of DFR. **If the material loss should not be taken into account in quantity calculation, TEDI port quantity will be applied.**	
(3) It is better to set the depth of additional sedimentation dredging for the whole channel of 0.5m.	This issue was explained in item 3 above.	Necessary actions mentioned in **Item 3** above will be taken.
(4) Slope dredging under the container berths should be included into private portion.	This slope dredging is close related with stability of terminal yard which is responsibility of public sector. Therefore it is preferable to be implemented by public sector. In addition, this project will be implemented by PPP which is the first experience of port development funded by Japan ODA loan, therefore, it is preferable to be implemented by public sector as a one of incentives for private sector in order to assist private investor to save their initial investment This is exceptional instance for private sector for the success of PPP scheme and the same procedure need not to be applied for all other	If GOV determines that any exception from marine code is not allowed even for PPP project, SAPROF study will follow its decision and will conduct

	future projects.	necessary modification required for the Final Report.
(5) Providing basis for establishment of unit costs of materials imported from Japan and construction equipment from foreign countries.	In general, the unit costs of materials imported from Japan are based on the market price as of April 2010. As for the steel material, the unit price is multiplied by 1.2, considering the price increase of iron ore. **Steel Sheet Pipe Pile (Steel Pipe Pile + Joint)** Steel Pipe Pile : JPY 115,000 / ton Additional price due to the length (22m to 30m): JPY 4,000 / ton Joint: JPY 393,000 / ton Therefore, (115,000+4,000+393,000) x 1.2 =JPY 614,400 / ton **Steel Sheet Pile (SY295 U-shape)** Steel Sheet Pile: JPY 110,000 / ton Additional price due to the Shape (u-shape) : JPY 3,000 / ton Therefore, (110,000+3,000) x 1.2 =JPY 135,600 / ton **Structural Steel for Wailing (SS400, [-12 x 300 x 90)** Structural Steel : JPY 84,000 x 1.2 = JPY 100,800 / ton **Tie Rod** Dia 70mm, 690kN: JPY 356,000 x 1.2 = JPY 427,200 / one tie-rod Dia 36mm, 690kN: JPY 106,000 x 1.2 = JPY 127,200 / one tie-rod **Rubber Fender (V-300H)** Rubber Fender : JPY 252,000 / m Accessories (steel) : JPY 48,600 / m Therefore, 252,000+48,600 x 1.2 =JPY 310,320 / m **Mooring Bollard (350kN)** Mooring Bollard : JPY 282,000 x 1.2 = JPY 338,400 / one bollard	**No action** will be taken.

Appendix24-4

TEDIPORT コメントに対する回答及び対応案（2）

TEDI's Comments	SAPROF Team Reply	Action to be taken
1 The depth of channel, turning basin and water area in front of the berth		
The depth of channel, turning basin and water area in front of the berth: is 14.0m for container vessel 50.000 DWT full loaded. This depth is determined according to PIANC guidelines: Depth of water area = Designed draft x 1.1=12.7 x1.1 = 14.0m With water level is "0" sea chart (CDL), the depth of channel and water area is estimated as -14.0m, is still inappropriate: a) The depth of -14m is the minimum requirements to ensure for the vessel transportation in the channel and it is not included the depth provision for sedimentation between 2 times of maintenance and dredging (usually proposed > 0.4m). So the dredging depth is -14.4m. b) Water level for vessel operation: Selection of "0" sea chart seems too safe since this water level almost doesn't appear (only 1-2h in the chain of data in many years). According to Vietnamese standard, it is recommended to select low water level with frequency of 99% of hourly water level (LWL) and +0.4m for survey area. Therefore, the water level for vessel transportation is +0.4m (considered as not utilizing the tidal level) and the depth of sedimentation provision is 0.4m so the dredging elevation of the channel and water area is 14.0m.	(1) The vessel moored at berth will not influenced so much by wave actions and the depth of berth may be determined using the depth - coefficient of 1.1. However, the vessels navigating in the access channel will be more influenced by wave actions and the depth of berth is recommendable to be determined using the depth – coefficient of more than 1.1, that was recognized already by TEDI in their FS study and they proposed -14.9m for a fully laden 50,000DWT vessel for middle term development (2020). This TEDI's comment has no consistency with their opinion in FS report. (2) As explained in Chapter 8: Sedimentation, the sedimentation analysis at present technical level is inevitable to have some error in accuracy. Therefore, in Chapter 24: Conclusions and Recommendations, we have proposed to conduct actual field surveys and further analysis for sedimentation phenomena during 3 years construction stage and establish a Maintenance Dredging Plan. Considering such a fact of sedimentation, it is recommendable to keep some budgetaly allowance for excess dredging of 0.4m in this preparatory study stage and the maintenance dredging plan may be established considering all issues including this comment.	**No action** will be taken.

2 Locations of the first 2 container berths:		
The option of container berth which is located outside would reduce the initial dredging, maintenance and dredging of water area and channel. It leads to be able to save a hug amount of cost. Investment cost for road connecting with container berth (2 berths) actually is the preinvestment (not the additional investment amount and using for comparison) will create advantages for private investors for construction investment of other inside berths in the future.	(1) It can be said that the construction cost of a part of access road is the Preinvestment for TEDI's plan and the capital and maintenance dredging cost of a part of access channel is the Preinvestment for SAPROF plan. We already conducted an economic comparison for both cases in March this year and obtained the results that SAPROF plan is more economical than TEDI's plan. (2) Immediate after initial stage development, additional 3 to 4 container berths and 3 multi-purpose berths should be developed in Lach Huyen Port. At that time, it is surely preferable for private investors if access channel is already existence and it is also favorable for public sector since following port development need not to prepare budgetary arrangement for the channel and can be implemented at any time and quickly. From this viewpoint, we believe that relocation of first 2 berths is not necessary. (3) The investor of Berth No.1&2 is strongly requesting to construct a barge berth along the side periphery of terminal yard and rejecting to use main container berth with barges from safe maneuvering and efficient cargo handling operation view points. If first 2 berths are situated at offshore side, the continuity of container berths which is requested by another comment made by VINAMARINE couldn't be rearised. In order to satisfy the requirements of both parties, the first 2 berths must be located at land side. (4) The location of Berth No.1&2 was originally proposed in TEDI FS and MOT was also accepted in the Decision No. 3793 dated 22 December 2008. (5) This location plan was also 100% agreed in the general meeting on 17 March 2010 among JICA FF mission, MOT, VINAMARINE, MPMU II, etc.	**No action** will be taken.
3 Structure of barge berth:		
According to TEDI, it is suggested to choose Option C in **Table 15.2.9**. The berth wall invested by Public Sector is actually to lengthen the earth retaining wall behind the container berth. Some facilities such as: Mooring Bollard, Rubber Fender, water supply and electricity	We have no objection to your comment as far as proper consent with private sector could be obtainable in the type of berth structure and the corresponding share in construction work and cost by private sector. The construction cost is roughly broken down into the following:	Following explanation will be added in FR: "Application of Option C and its demarcation of

supply, dredging the water area in front of berth will be invested by private sector.		investment between public and private sectors will be determined in DD stage.”

	Option A: (Open Piled Deck + Earth Retaining Wall)			Option C: (Anchored SSPP Wall)		
	Work Item	Cost (mil VND)	Share	Work Item	Cost (mil VND)	Share
Berth	Open Piled Deck including berth fittings	199,312	●	SSPP Wall	101,452	○
				Berth Fittings (*)	11,641	●
				Apron Pavement	3,717	●
Dredging under the deck	30m wide area	1,506	●	(Nil)		
Earth Retaining Wall	Self Standing Sheet Piled Wall	14,072	○	(Nil)		
Cost Total		**214,890**			**116,810**	
Cost by Public(○)		14,072			101,452	
Cost by Private(●)		200,818			15,358	

(*) Berth fittings includes 1) Docking Fenders, 2) Bollard, 3) Berth apron pavement

4 Structure of service berth:		
The design of relieving platform, tie rod arrangement and Anchor plate for sheet pile wall are not appropriate. According to TEDI, the structure of head beam and relieving platform should be designed as continuous concrete so the relieving platform is not only reducing the active earth pressure on the sheet wall but also working as anchor system (the tid	Your suggested structure may be one of applicable type of alternative for service boat berth among other types of structure including the one proposed by SAPROF Study Team. It considers better for us to propose that: (1) It is believed that the structure proposed by SAPROF Study Team is designed to be sound in structural stability, so far, and is deemed to consider one of suitable type of structure for its implementation. Therefore, the structure proposed by SAPROF Study is applied for the service boat berth in the final report of SAPROF Study.	**No action** will be taken for FR but will be considered in DD.

rod system and anchor plate is not necessary to invested in). However, the installed at 2 sectional pile row should be added for Supporting Pile to reduce the lateral resistance by earth pressure.	(2) Your suggested type of structure should be subjected to structural review and design for its dimensioning and structural stability. In the succeeding detailed design stage for this Project, therefore, in-depth comparative study on the type of structure for service boar berth is made among those suggested by you, proposed by SAPROF Team and other alternatives. The study will be carried out in such technical points of view as structural stability, suitability of subsoil condition, construction method and cost, etc. for final conclusion on the selection of the best suited type of structure to your satisfaction.	
5 Unit cost of installation and use of imported equipment:		
The report should propose the establishment and base of unit cost of installation and use of import equipments and facilities such as: sheet pile, piped pile, tie rod, morring bollard, Rubber Fender… or the foreign technology for dredging by large capacity vessel, soft soil improvement or ALiCC method.	As described in our cost estimation sheets, unit cost of installation and / or use of imported materials and / or equipment are as follows: **Dredging** Cost of **Cutter Suction Dredger**: JPY 11,185,000 per 1 operation day Cost of **Anchor Boat**: JPY 491,000 per 1 operation day Cost of **Pusher Boat**: JPY 764,000 per 1 operation day Cost of **Barge**: JPY 1,173,0000 per 1 operation day Above figures include the costs of labors, consumable goods, fuel and depreciation **Soil Improvement work by ALiCC method** Transportation Cost of Equipment for ALiCC method: JPY 76,800,000 (round trip) Equipment for ALiCC method includes leader, stirring device, winch and mixing plant Base machine is local. Lease fee of floating Barge (Local): JPY 4,800,000 per month Outfitting and dismantling of equipment on a floating Barge: JPY 11,200,000 **Steel Sheet Pipe Pile (Steel Pipe Pile + Joint)** Driving Equipment: Local equipment (and manpower) Driving cost: VND 75,972,250 per 1 pile with a length of 27m : VND 45,020,591 per 1 pile with a length of 16m	**No action** will be taken.

	Steel Sheet Pile (SY295 U-shape) Driving Equipment: Local equipment (and manpower) Driving cost: VND 5,326,911 per 1m **Structural Steel for Wailing (SS400, [-12 x 300 x 90)** Installation: Local equipment and manpower Installation cost: VND 4,129,527 per 1m **Tie Rod** Installation: Local equipment and manpower Installation cost: VND 8,070,333 per 1 tie rod with a diameter of 70mm : VND 4,116,475 per 1 tie rod with a diameter of 36mm **Rubber Fender (V-300H)** Installation: Local equipment and manpower Installation cost: VND 4,025,090 per 1 fender **Mooring Bollard (350kN)** Installation: Local equipment and manpower Installation cost: VND 5,589,130 per 1 bollard	