APPENDICES

Appendix 1. Tables and Supportive Information regarding IEE

Appendix 1.1 Baseline Information on Tg. Bulupandan

1) Environmental and Social Baseline Data

Figure A1.1.1 Water Sampling Point

Table A1.1.1 Water Quality Monitoring Result

WATER ANALYSIS DATA

Laboratorium No. : 100-0670/A/KL/2007
Owner : Biologi ITS
Location : Air Laut, Tanjung Bulupandan, Bangkalan
Sampling Date : Juli 30th 2007

No	Parameter	Unit	Result		Quality Standart Kep.51/MENLH/2004	Analysis Method
			Station 1	Station 2		
	PHYSIC :					
1	Clearness	m	-	-	>3	Secci Dish
2	Smell	-	Not smell	Not smell	-	Organolaptik
3	Suspendent solid	mg/L	24	28	80	Gravimetri
4	Waste	-	negative	negative	Nil	Visual
5	Temperature	°C	27	27	Natural	Termometer
6	Oil layer	-	negative	negative	Nil	Visual
	CHEMISTERY :					
1	pH	-	7.9	7.92	6.5 - 8.5	pH meter
2	Salinitas	‰	34.39	35.59	Alami	Salinometer
3	Amonia Total	mg/L NH3-N	0.012	0.012	0.30	Spektropotometri
4	Sulfida	mg/L H2S	0.00	0.00	0.03	iodometri
5	Hidrokarbon Total	mg/L	-	-	1.00	G.C
6	Substance Fenol total	mg/L	0.01	0.014	0.002	Spektropotometri
7	PCB (poliklorbifenil)	mg/L	-	-	0.01	G.C
8	Surfaktan (detergen)	mg/L LAS	0.95	1.27	1.00	Spektropotometri
9	Minyak dan Lemak	mg/L	0.00	0.00	5.00	Gravimetri
10	TBT (tri butil tin)	mg/L	-	-	0.01	G.C
	Soluble Metal					
1	Mercury	mg/L Hg	0.000	0.000	0.03	AAS
2	Copper	mg/L Cu	0.082	0.094	0.05	AAS
3	Zinc	mg/L Zn	0.104	0.116	0.10	AAS
4	Cadmium	mg/L Cd	0.032	0.040	0.01	AAS
5	Lead	mg/L Pb	0.168	0.172	0.05	AAS
	BIOLOGI					
1	Coliform (total)	MPN/100 ml	2	4	1000	Multi Tube Fermentation

Source: IEE Primary Data, ITS

Table A1.1.2 Original and Associated Species of Mangroves Identified in Tg. Bulupandan

No.	Species	Indonesian Name	Family	Note	Amount
1	*Rhizopora mucronata*	Bakau, tanjang lanang	Rhizoporaceae	Original Mangrove	****
2	*Rhizopora apiculata*	Bakau	Rhizoporaceae	Original Mangrove	***
3	*Rhizopora stylosa*	Bakau	Rhizoporaceae	Original Mangrove	*
4	*Avicennia marina*	Api-api	Avicenniaceae	Original Mangrove	**
5	*Sonneratia caseolaris*	Bogem	Sonneratiaceae	Original Mangrove	****
6	*Sonneratia alba*	Bogem	Sonneratiaceae	Original Mangrove	*
7	*Aegiceras corniculatum*	Teruntun, kacangan	Myrsinaceae	Original Mangrove	**
8	*Xylocarpus moluccensis*	Nyirih, banang-banang	Meliaceae	Original Mangrove	***
9	*Exoecaria agallocha*	Madengan, buta-buta	Euphorbiaceae	Original Mangrove	***
10	*Lumnitzera racemosa*	Truntun, kedukduk	Combretaceae	Original Mangrove	***
11	*Ceriops tagal*	Tengah, mentigi	Rhizoporaceae	Original Mangrove	***
12	*Ceriops decandra*	Tingi, tengar	Rhizoporaceae	Original Mangrove	*
13	*Nypa fruticans*	Nipah	Palmae	Original Mangrove	*
14	*Pemphis acidula*	Setigi	Lythraceae	Original Mangrove	***
15	*Thespesia populnea*	Waru laut, waru-lot	Malvaceae	Associated Mangrove	**
16	*Sesuvium portulacastrum*	Alur	Alzoaceae	Associated Mangrove	****
17	*Spinifex littoreus*	Rumput tikusan	Poaceae	Associated Mangrove	****
18	*Clerodendrum inerme*	Nyamplung	Guttiferae	Associated Mangrove	**

Note: ****: With abundance, ***: above average, **: average, * below average
Source: IEE Primary Data, ITS

Table A1.1.3 Mangrove Species for Land Plantation Identified in Tg. Bulupandan

No.	Species	Indonesian Name	Family	Note
1	*Sesbania grandiflora*	Turi	Fabaceae	****
2	*Morinda citrifolia*	Mengkudu	Rubiaceae	*
3	*Lantana camara*	Kembang telekan	Verbenaceae	**
4	*Leucaena glauca*	Lamtoro	Fabaceae	***
5	*Pluchea indica*	Beluntas	Asteraceae	****
6	*Cynodon dactylon*	Rumput grinting	Poaceae	****
7	*Pogonatherum paniceum*	Rumput merak	Poaceae	****
8	*Themeda gigantea*	Rumput gajah	Poaceae	***
9	*Paspalum commersonii*	Rumput tuton	Poaceae	****

Note: ****: With extreme abundance, ***: above average, **: average, * below average
Source: IEE Primary Data, ITS

Table A1.1.4 Birds Identified in Tg. Bulupandan

No.	Species	Indonesian Name	Family	Note
1	*Tringa hypoleucos*	Trinil pantai	Scolopacidae	
2	*Charadrius javanicus*	Cerek jawa	Charadriidae	**** NT / *****
3	*Egretta garzetta*	Kuntul kecil	Ardeidae	*** / ** LC**
4	*Acrocephalus stentoreus*	Kerakbasi ramai	Acrocephalidae	**** LC**
5	*Zosterops palpebrosus*	Kacamata biasa	Zosteropidae	
6	*Gerygone sulphurea*	Remetuk laut	Pardalotidae	**** LC**
7	*Collocalia esculenta*	Walet sapi	Apodidae	**** LC**

No.	Species	Indonesian Name	Family	Note
8	*Nectarinia jugularis*	Burung madu sriganti	Nectarinidae	*
9	*Streptopelia chinensis*	Tekukur biasa	Columbidae	
10	*Pycnonotus goiavier*	Merbah cerukcuk	Pycnonotidae	
11	*Pycnonotus aurigaster*	Cucak kutilang	Pycnonotidae	
12	*Butorides striatus*	Kokokan laut	Ardeidae	** LC
13	*Todirhampus chloris*	Cekakak sungai	Alcedinidae	*
14	*Alcedo coerulescens*	Raja udang biru	Alcedinidae	* / ** LC / ***
15	*Corvus macrorhynchos*	Gagak kampung	Corvidae	** LC
16	*Merops* sp	Kirik-kirik	Meropidae	
17	*Geopelia striata*	Perkutut	Columbidae	** LC
18	*Rhipidura javanica*	Kipasan belang	Rhipiduridae	*
19	*Lonchura punctulata*	Bondol peking	Passeridae	
20	*Artamus leucorhynchus*	Kekep babi	Corvidae	** LC
21	*Dicaeum trochileum*	Cabai jawa	Nectarinidae	* / ** LC / ***
22	*Lalage* sp	Kapasan	Campephagidae	
23	*Ardea purpurea*	Cangak merak	Ardeidae	** LC
24	*Sterna albifrons*	Dara laut kecil	Sternidae	*
25	*Chlidomas hybridus*	Dara laut kumis	Sternidae	*
26	*Hirundo tahitica*	Layang-layang batu	Hirundinidae	
27	*Bubulcus ibis*	Kuntul kerbau	Ardeidae	* / ** LC
28	*Prinia* sp	Prenjak	Cisticolidae	
29	*Orthotomus* sp	Cinenen	Cisticolidae	

Note: * Protected based on PP RI No. 7 Year 1999
** Status Based on IUCN Red List
LC: (*Least Concern*) if there are plenty of it and are well distributed on natural world
NT :(*Near Threatened*) if it is feared to become threatened on the future
*** Bird species with limited distribution and on the brink of extinction (*Birdlife International – Indonesia Programme* data)

Source: IEE Primary Data, ITS

Table A1.1.5 Water quality criteria based on Diversities Index of Phytoplankton (Carter and Hill, 1981)

No.	Species	Family	Location	
			L1	L2
1	*Fragillariopsis* sp.1	Bacillariaceae	3	9
2	*Fragillariopsis* sp.2	Bacillariaceae	9	6
3	*Ceratium fusus*	Ceratiaceae	12	
4	*Ceratium furca*	Ceratiaceae	3	6
5	*Ceratium trichoceros*	Ceratiaceae	33	6
6	*Ceratium tripos*	Ceratiaceae		3
7	*Bacteriastrum comosum*	Chaetocerotaceae	18	
8	*Chaetoceros mitra*	Chaetocerotaceae	6	3
9	*Chaetoceros curvisetus*	Chaetocerotaceae	57	12
10	*Chaetoceros pseudocurvisetus*	Chaetocerotaceae	36	45
11	*Chaetoceros* sp	Chaetocerotaceae	9	36
12	*Coscinodiscus centralis*	Coscinodiscaceae		24
13	*Coscinodiscus radiatus*	Coscinodiscaceae	45	33
14	*Coscinodiscus* sp	Coscinodiscaceae	57	36
15	*Cyclotella* sp	Coscinodiscaceae	33	3
16	*Dinophysis* sp	Dinophysiaceae	6	

No.	Species	Family	Location	
			L1	L2
17	*Denticula* sp	Epithemiaceae	24	24
18	*Odontella* sp	Eupodiscaceae	9	99
19	*Melosira* sp	Melosiraceae	30	
20	*Pseudo-nitzschia* sp.1	Naviculaceae	6	
21	*Pseudo-nitzschia* sp.2	Naviculaceae	48	
22	*Navicula* sp.1	Naviculaceae	18	
23	*Navicula* sp.2	Naviculaceae	60	
24	*Navicula* sp.3	Naviculaceae	21	
25	*Pleurosigma* sp.1	Naviculaceae	6	3
26	*Pleurosigma* sp.2	Naviculaceae		6
27	*Pleurosigma* sp.3	Naviculaceae		18
28	*Navicula directa*	Naviculaceae	6	3
29	*Noctiluca* sp	Noctilucaceae	12	6
30	*Peridinium* sp	Peridiniaceae	9	12
31	*Dithylium* sp	Raphidiniaceae	15	
32	*Rhizosolenia pungens*	Rhizosoleniaceae	9	
33	*Rhizosolenia* sp.1	Rhizosoleniaceae	18	
34	*Rhizosolenia imbricata*	Rhizosoleniaceae	24	
35	*Rhizosolenia* sp.2	Rhizosoleniaceae	33	72
36	*Guinardia* sp	Rhizosoleniaceae	15	6
37	*Rhizosolenia* sp.3	Rhizosoleniaceae	9	
38	*Stellarima* sp	Stellarimaceae	6	
39	*Thalassionema bacillare*	Thalassionemataceae	15	6
40	*Thalassionema nitzschioides*	Thalassionemataceae	21	6
41	*Lioloma* sp	Thalassionemataceae	9	
42	*Thalassiosira* sp	Thalassiosiraceae	3	
43	*Skeletonema* sp.1	Thalassiosiraceae	30	6
44	*Skeletonema* sp.2	Thalassiosiraceae		3
45	*Ulothrix* sp	Ulothricasceae	12	3
46	*Ulothrix zonata*	Ulothricasceae	6	12
47	*Binucleira tatrana*	Ulothricasceae		24
Total			**801**	**546**
Diversities Index			**3.42**	**2.91**

Source: IEE Primary Data, ITS

Table A1.1.6 Diversities Index of Phytoplankton (Carter and Hill, 1981)

Water Qualities	Diversities Index	
	Phytoplankton	Zooplankton
Very good	> 2.0	> 2.0
Good	1.6 - 2.0	1.6 - 2.0
Normal	1.0 - 1.6	1.4 - 1.6
Bad	0.7 - 1.0	1.0 - 1.4
Very Bad	< 0.7	< 1.0

Table A1.1.7 Water quality criteria based on Diversities Index of Zooplankton (Carter and Hill, 1981)

No.	Species	Family	Location	
			L1	L2
1	*Acartia* sp	Calanidae	18	102
2	*Echinocamptus* sp	Centrocamptidae	18	
3	*Tintinnopsis* sp	Codonellidae	3	6
4	*Diaptomus* sp	Diaptomidae	69	75
5	*Globigerina* sp	Foraminifera		15
6	*Peneropolis* sp	Foraminifera	3	9
7	*Oithona* sp	Oithonidae		36
8	*Ethmolaimus* sp	Rhabditidae		9
9	*Diaphanosoma* sp	Sididae	6	
10	Larva Nauplii Copepoda		15	3
11	Larva Zoea Copepoda		6	
12	Larva Polychaeta 1		9	
13	Larva Polychaeta 2		3	
Total			**150**	**255**
Diversities Index			**1.76**	**1.55**

Source: IEE Primary Data, ITS

Table A1.1.8 Diversities Index of Zooplankton (Carter and Hill, 1981)

Water Qualities	Diversities Index	
	Phytoplankton	Zooplankton
Very good	> 2.0	> 2.0
Good	1.6 - 2.0	1.6 - 2.0
Normal	1.0 - 1.6	1.4 - 1.6
Bad	0.7 - 1.0	1.0 - 1.4
Very Bad	< 0.7	< 1.0

Table A1.1.9 Water quality criteria based on Diversities Index of *makrozoo* benthos (Carter and Hill, 1981)

No.	Species	Family	Location	
			L1	L2
1	*Acrosterigma subrugosa*	Cardiidae		2
2	*Cerithium* sp	Cerithiidae		130
3	*Clibanarius* sp	Coenobitidae		2
4	*Donax* sp	Donacidae		2
5	*Drupella* sp	Muricidae		4
6	*Nassarius albescens*	Nassariidae		2
7	*Natica onca*	Naticidae		2
8	*Nereis* sp	Nereididae	3	
9	*Oliva* sp	Olividae		2
10	*Nerita undata*	Ostreidae		2
11	*Eteone* sp	Phyllodocidae	18	
12	*Telescopium telescopium*	Potamididae	6	
13	*Cerithidea cingulata*	Potamididae	27	
14	*Terebralia sulcata*	Potamididae		114

No.	Species	Family	Location	
			L1	L2
15	*Pyramidella* sp	Pyramidellidae		2
16	*Strombus urceus*	Strombidae		2
17	*Holthuisana* sp	Sundathelphusidae	3	
18	*Tellina* sp	Tellinidae		2
19	*Uca vocans*	Trochidae	3	12
20	*Uca pugilator*	Trochidae		6
21	*Crassostrea* sp	Trochidae		6
22	*Turitella terebra*	Turitellidae	3	2
23	*Paphia undulata*	Veneriidae		2
24	*Gafrarium divaricatum*	Veneriidae		2
Total			**63**	**310**
Diversities Index			**1.52**	**1.63**

Source: IEE Primary Data, ITS

Table A1.1.10 Diversities Level Criteria (Canter & Hill, 1981)

Diversities Index	Variation level
> 2.0	Very high
2.0 - 1.6	High
1.5 - 1.0	Average
0,7 - 1.0	Low
< 0,7	Very Low

Table A1.1.11 Water pollution level criteria based on benthos diversities index (Lee, Wang, and Kuo, 1978)

Water Qualities	Diversities Index
Unpolluted	> 2.0
Lightly polluted	1.6 - 2.0
Polluted	1.0 - 6.0
Very polluted	< 1.0

Table A1.1.12 Population and Population Density

	Area (km2)	Population	Households	Density per ha
Klampis sub-distrcit	67.1	50,416	16,467	7.51
Ko'ol village	1.65	1,877	683	4.1
Tolbuk village	1.33	1,383	461	3.5
Klampis Barat	0.13	3,240	1,016	78

Source: Bangkalan/Klampis in figure (2006)

Table A1.1.13 Population by Age Group of Klampis Sub-District

Age Group	Population	Percentage
< 5 years old	3,684	7
5 - 14 years old	9,613	19
15 - 44 years old	2,1649	43
45 - 64 years old	11,947	24
> 65 years old	3,523	7
Total	**50, 416**	**100**

Source: Klampis in figure (2006)

Table A1.1.14 Age Distribution of the Survey Respondents

Group of Age	Number of People	Precentage (%)
15 - 20	7	11
21 - 30	10	16
31 - 40	14	23
41 - 50	15	24
51 - 70	16	26
Total	**62**	100

Source: IEE Primary data, Field Survey, July, 2007

Table A1.1.15 Land Use Pattern (Ha)

	Agriculture	Fish Pond	Residential land	Others	Total
Ko'ol village	74.8 (45%)	50.8 (30%)	38.4 (23%)	1.6(2%)	165.3(100%)
Tolbuk village	75.8(57%)	24.9(19%)	12.5(10%)	19.7(13%)	132.9(100%)
Tobadung village	95.2(63%)	13.1(9%)	41.7(27%)	0.3(1%)	149.8(100%)
Klampis village	1(8%)	-	11 (84%)	1(8%)	13.0 (100%)

Source: Klampis in figure (2006)

Table A1.1.16 Income Sources of Respondents

Types of employment	Number	Percentages (%)
Farming	27	43
Fishery	21	33
Trading	5	8
Transportation	1	1.5
Secretary Work	1	1.5
Unemployed	7	11
Total	**62**	100

Source: IEE Primary Data, Field survey, July 2007

Table A1.1.17 Major Cultivated Crops in Socah Sub-District

Type of crops	Harvested Area (Ha)	Production (ton)	Productivity (100 kg/Ha)
Paddy	1,239	5, 551	45
Corn	7176	12, 845	18
Cassava	415	4, 571	110
Sweet potato	24	280	117
Green bean	401	241	600

Source: Bangkalan in Figures, 2006

Table A1.1.18 Income Level

Income (Rp.)	Number of People	Precentage (%)
<0.5million	36	58
0.5million-1million	10	16
1million-2million	7	11
2million-2.5million	0	0
>2.5million	5	8
(Refuse to respond)	4	6
Total	**62**	100

Source: Primary data, Field Survey, July, 2007

Poverty Indicator:

Table A1.1.19 Poverty Level in Klampis sub-district

Category	Number of HH	Percentage (%)
Non- privileged (Very Poor)	2,868	**20**
Privileged stage I (Poor)	6,097	**43**
Privileged stage II	4,644	33
Privileged stage III	489	3
Privileged stage III Plus	81	1
Total	14,179	100

Source: Bangkalan in figure, 2006

Poverty level can be categorized into 5 different levels based on using both economic and non-economic indicators. Non-privileged is categorized as “very poor” and Privileged stage I as “poor”. Each privileged category is defined by BKKBN (Coordinative Agency of National Family Planning) as follows;

i) **Non-privileged** (if failed to fulfill any one of them, he/she stays in this category): (Economic) Able to purchase minimum 2,100kcal (or two meals a day) plus other basic needs (ex. basic clothing, home with a floor); (Non-economic) regular religion practice, provision of public health to children.

ii) **Privileged stage I** (if failed to fulfill any one of them, he/she stays in this category): (Economic) consumption of meat/fish/eggs at least once a week, supply of new clothing every year, minimum room space of 8m2 person; (Non-economic) free from sickness for the last three months, regular income, literacy (10 –60 years old), education for children (6-15 years old).

iii) **Privileged stage II** (Those who can fulfill Privileged stage I, but if fail to fulfill any one of them, he/she stays in this category): (Economic and non-economic) regular income and savings; family socialization, recreation/every 6months, frequent religious practice, access to media information, use of transportation.

iv) **Privileged stage III**: Those who can fulfill all Privileged stage II indicators.

v) **Privileged stage III+**: Those who can fulfill all Privileged stage II indicators plus who can give donation and be able to participate in community socialization activities.

Table A1.1.20 Educational Institutes in Klampis Sub-District

Type of Schools	Number of Schools	Number of Teachers	Number of Students
Elementary schools	33	139	5,944
Government middle schools	1	25	365
Private middle schools	3	34	91
High Schools	-	-	-
Madrasah Diniyah	73	373	8,450
Madrasah Ibtidaiyah (Islamic elementary schools)	2	18	244
Madrasah Tsanawiyah (MTs, Islamic middle schools)	3	18	426
Madrasah Aliyah (Islamic High schools)	1	17	157

Source: Bangkalan in Figures, 2006

Table A1.1.21 Education Level of the Survey Respondents

Educational Level	Number	Percentage (%)
Elementary Graduate	37	60
Middle School	9	14
Islamic High School	1	2
No Educational Back ground	9	14

Source: Field survey, July, 2007

Table A1.1.22 Availability of Clean Water in the Surveyed Villages

Village	Tapped Water	Well	Total
Tolbuk	-	461	461
Ko'ol	-	683	683
Klampis Barat	235	781	1,016

Source: Klampis in Figure, 2006

Table A.1.1.23 Household Energy Resources in the Sample Villages

Village	Wood/Coal	Kerosene	Electricity/Gas
Tolbuk	352	70	39
Ko'ol	561	72	50
Klampis Barat	759	192	65

Source: Klampis in Figure, 2006

Table A.1.1.23 Sanitation Environment in Kalmpis Sub-district

Sewage System	Number of Population
Septic Tank	1,925
Goose neck	6,790
Pit	16,595

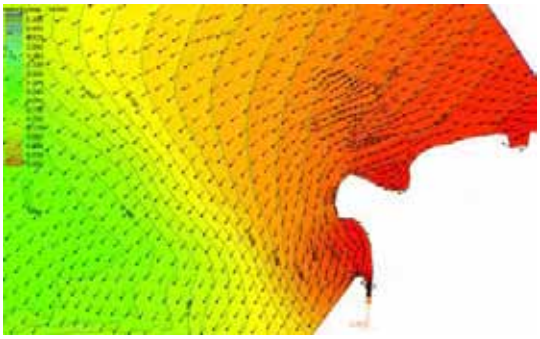
Source: Klampis in Figure, 2006

2) Hydrodynamic Simulation

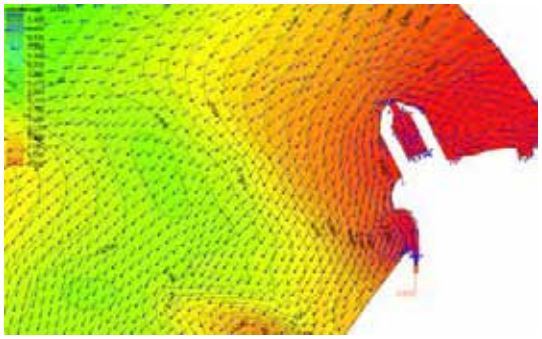
The hydrodynamic simulation on a qualitative level was carried out based on the "with" and "without" the project scenario to analyze the current, sediment concentration, seabed etc.

Current Flow:
With regards to the current conditions, under "without the project" scenario, the current conditions will remain as it is, while if we take a look at the "with the project" scenario, the current interaction with the harbor structure will change the original hydraulic and sediment transportation regimes of the area. It can also be observed that the current velocity is reduced on the east side of the harbor structure when the current is moving towards the west and vice versa, when the current is moving towards the east.

Figure A1.1.2 Comparative Analysis on Current Flow (East-West Current Flow)

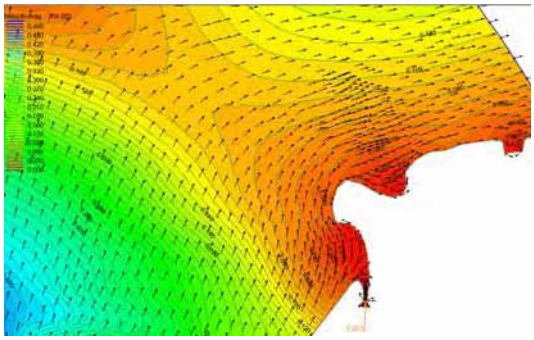


"Without" the Project Scenario

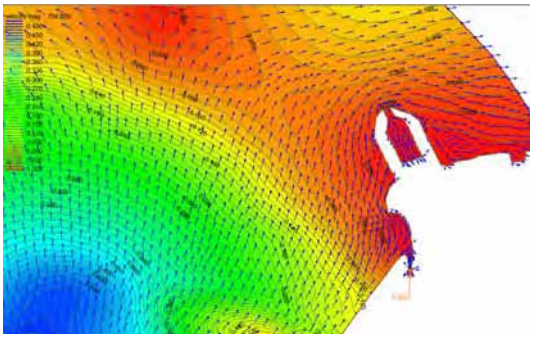


"With" the Project Scenario

Figure A1.1.3 Comparative Analysis on Current Flow (West-East Current Flow)



"Without" the Project Scenario

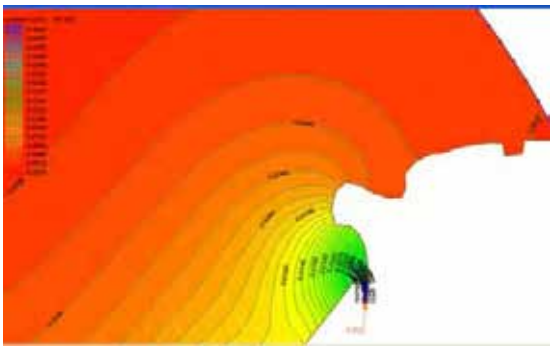


"With" the Project Scenario

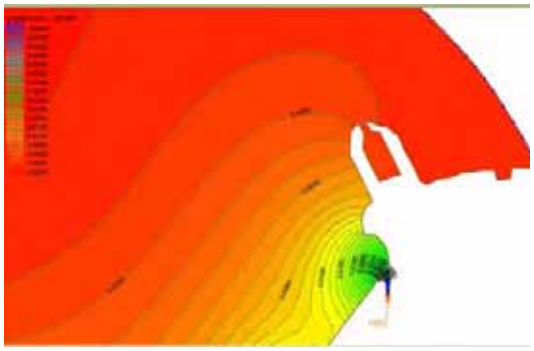
Sedimentation:
With regards to the sediment concentration, under "without the project" scenario, the current conditions will remain as it is, while if we take a look at the "with the project" scenario, the construction of harbor structure will block the transportation of the sediment towards the breakwater zone. Under East-West waver-current environment, the transportation velocity of bed sediment movements on the east side of the structure is reduced or on halt, therefore, sedimentation will occur before the structure. On the other hand, the sediment transportation to the west side of the structure will be reduced, and cause erosion. The situation is vise-versa under West- East waver-current environment; the only difference is that because

the current amount is larger under East-west waver-current environment, the sedimentation amount may be larger on the eastern side.

Figure A1.1.4 Comparative Analysis on Sediment Concentration (West-East Current Flow)



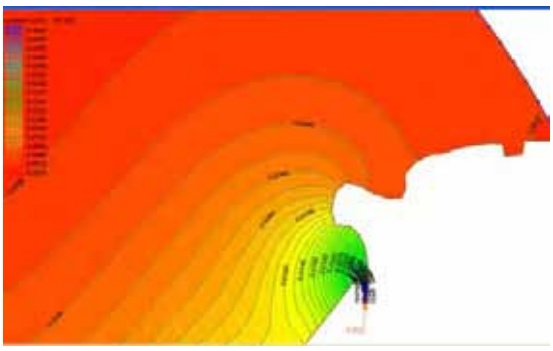
"Without" the Project Scenario



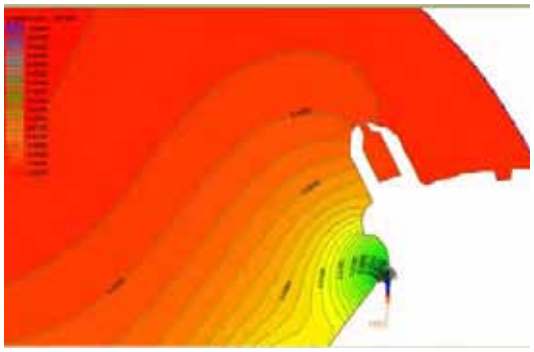
"With" the Project Scenario

Change in Sea Bed Conditions:
With regards to change in sea bed, under "without the project" scenario, the current conditions will remain as it is, while if we take a look at the "with the project" scenario, the change in seabed condition may occur due to increase in sediment deposits on both side of the harbor structure as explained above.

Figure A.1.1.5 Comparative Analysis on Change in Sea Bed Condition



"Without" the Project Scenario



"With" the Project Scenario

It is recommended to numerically model wave and tie induced currents and associated sediment distribution in the harbor basin and in the entrance channels. Such study would enable to quantify harbor siltation and to identify critical areas of the design, which requires further investigation.

3) Summary of Mitigation Measures

Environmental Items and Potential Impacts	Proposed Mitigation	Location	Time Frame
Permits			
Required environmental assessment	Full- scale EIA is required at feasibility study stage.		
Physical Environmental			
Impacts on Hydrodynamic environment (Dredging and Reclamation)			
• Change in current flow/ sediment transportation/ sea bed	• Dredging shall be controlled and limited to area required. • Adopting good dredging practices by selecting the right equipment (ex. TSDH) and right dredging, loading and placement methods. • Reclaimed land area should be carefully examined based on the result of the hydrodynamic modeling study to minimize the impacts on hydrology. • Comprehensive monitoring required in relation to hydrodynamic affects	Dredging and reclamation sites	During Construction/ Post Construction
• Impacts from deep-sea disposal	• Disposal of dredged materials should be put in place to prevent distribution of suspended solids in the waters outside of disposal sites. • Contents of spoiled materials should be analyzed regularly before dumping to make sure they do contain toxic components. • Conduct sampling and seawater quality analysis in the dumping area.	Off-shore disposal site	During construction/operation
• Impacts on reclamation	Reclamation material to be obtained should be analyzed to verify its conformity. In Tg. Bulupandan, the dredged materials are planned to use for reclamation purposes. In such case, sediment quality of the seabed should be analyzed.	Construction site	During construction
Deterioration of air quality	• Using vehicles that have passed emission tests, spraying water on construction sites etc. • Regular air quality monitoring to meet the required standards.	Construction site Harbor area access road	During construction During operation
Increased noise and vibration	• Ensuring the noise emission is within the allowable level. Use of well maintained machines and plants and silencers/ mufflers for construction equipments, if required. • Implementation of proper traffic management practices and road maintenance during transport.	Construction site Access road area	During construction During Operation
Impacts on water flow/quality			
• Surface water runoff	Accommodation of proper drainage system on a reclaimed land	Port terminal areas	During Operation
• Deterioration of water quality due to increased	Adopting good dredging practices by selecting the right equipment (ex. TSDH)	Construction site in the	During construction

Environmental Items and Potential Impacts	Proposed Mitigation	Location	Time Frame
SS and turbidity	and right dredging, loading and placement methods.	bay area	
• Deterioration of water quality due to increased pollutants spreading into the sea.	• Ensure the adoption of loading/unloading, handling and storage practices. • Each terminal will be required to have a proper waste management plan. Storage and disposal have to follow existing regulations.	Port terminal areas	During operation
Biological Environment			
Impacts on Terrestrial/Marine ecology			
• Permanent loss of mangroves	Re-plantation/ remedial action is to be taken to minimize the impacts.	Surrounding the bay area	Before/post construction
• Loss of other habitats	Adopt best dredging practice and disposal of dredged materials by following appropriate engineering design and monitoring and feedback system to limit any possible disruption of ecological processes.	Surrounding the bay area/ offshore sea area	Before/post construction
Impacts on land use			
• Change in land use, visual effects	The change in the land use is likely to be significant. It should be in keeping with the nature of a site to as a port activity zone to a possible extent.	Port terminal and the surrounding areas	All phases
• Archaeological and Historical sites	Identification of remains and cultural assets including graves should be confirmed before construction.	Access road construction area	All phases
Impact on Resettlement	• Resettlement impact is to be minimized for port construction area. Further efforts are required to minimize the resettlement impacts for access road construction sites. • In case resettlement takes place, proper compensation and assistance should be provided to the PAPs based on resettlement action plan prepared by the project authority.	Port construction and access road sites	Before construction
Economic activities /Labor			
• Loss of livelihood / income generating activities	• Local intentions including PAPs should be incorporated into project planning. • PAPs facing economic displacement are also entitled for compensation for their losses. • Priorities should be given to locals for port construction related activities • Provision of training programs for locals.	Affected land area in Klampis and fishing grounds used for fisheries	All phases
Women /Vulnerable Groups			
• Increased risk of chronic diseases / loss of livelihood activities of the poor	• Provision of livelihood support programs for women/ vulnerable. • Infectious disease prevention program for contractors. • Provision of social awareness program for women.	Administrative area of affected villages in Klampis sub-district	All phases

Environmental Items and Potential Impacts	Proposed Mitigation	Location	Time Frame
Culture and interaction/Conflict of interests			
• Conflicts of interests stemming from land dispute, socio-economic reasons	• A Good co-ordination with project authorities and local community leaders. • Utilization of local knowledge into project planning. • Provision of land registration promotion programs	Administrative area of affected villages in Klampis sub-district	During / post construction
Equity of Benefits and losses			
• Increased socio-economic disparities and regional divide	Monitoring of local socio-economic conditions	Administrative area of Klampis	During / post construction
Safety			
• Increased risk of maritime insecurity due to off shore pipelines / increase traffic accident risks due to increased traffic volume	• Improved provision of maritime security and safety measures. • Improved navigation aids to ensure safe transit inside the port including the potential risks that existing /to be constructed pipelines posses. • Traffic safety enhancement for increased traffic.	Port and access road area / vessels navigation route	During / post construction

Appendix 1.2 Baseline Information on Socah

1) Environmental and Social Baseline Data on Socah area

Figure A1.2.1 Water Sampling Point

Table A1.2.1 Water Quality Monitoring Result

PARAMETER	Unit			Standard
		1	2	
Physic				
Clearness	m	-	-	>3
Smell		No smell	No smell	
Suspended Solid	mg/l	**376**	**312**	**80**
Waste		**positive**	**positive**	**nil**
Temperature	c	26	26	
Oil layer		negative	negative	nil
Chemistry				
PH	-	8.14	7.82	6.5-8.5
Salinity	%o	21.03	20.33	Alami
Ammonia	mg/l	0.07	0.08	0.3
Sulfida	mg/l	0	0	0.03
COD	mg/l	-	-	1.00
Substance Phenol	mg/l	0.001	0.001	0.002
PCB	mg/l	-	-	0.01
Detergent	mg/l	**1.71**	**1.65**	**1.00**
Mineral Oil	mg/l	0.00	0.00	5.00
TBT		-	-	0.01
Heavy Metal	mg/l			
Mercury	mg/l	0.000	0.000	0.03
Copper	mg/l	0.041	0.032	0.05
Zn	mg/l	0.096	0.092	0.10
Cadmium	mg/l	**0.046**	**0.032**	**0.01**
Lead	mg/l	0.032	0.028	0.05
Biology				
Colifrom	MPN	16	8	1000

Source: IEE Primary data, ITS, 2007

Table A1.2.2 Air Condition

Location	PARAMETER					
	NO_x (ppm)	SO_2 (ppm)	CO (ppm)	HC (ppm)	Dust (mg/m^3)	Pb (mg/m^3)
Sembilangan-Bangkalan	0.0192	0.0041	0.8661	0.0087	0.0432	0.0003
Air Standard (SK. GUBERNUR KDH. TK. I JATIM NO. 129-1996)	**0.05**	**0.1**	**20**	**0.24**	**0.26**	**0.06**

Source: Survey and Analysis Channel, ITS (2000)

Table A1.2.3 Original and Associated Species of Mangroves Identified in Socah

No	Species	Indonesia Name	Family	note	Amount
1	*Avicennia alba*	api-api	Avicenniaceae	Original mangrove	****
2	*Avicennia marina*	api-api	Avicenniaceae	Original mangrove	***
3	*Avicennia officinalis*	api-api	Avicenniaceae	Original mangrove	*
4	*Ceriops decandra*	tingi, tengar	Rhizoporaceae	Original mangrove	*
5	*Ceriops tagal*	tengah, mentigi	Rhizoporaceae	Original mangrove	***
6	*Exoecaria agallocha*	madengan, buta-buta	Euphorbiaceae	Original mangrove	****
7	*Lumnitzera racemosa*	truntun, kedukduk	Combretaceae	Original mangrove	***
8	*Rhizopora apiculata*	bakau	Rhizoporaceae	Original mangrove	**
9	*Rhizopora mucronata*	bakau, tanjang lanang	Rhizoporaceae	Original mangrove	****
10	*Sonneratia alba*	bogem	Sonneratiaceae	Original mangrove	*
11	*Sonneratia caseolaris*	bogem	Sonneratiaceae	Original mangrove	****
12	*Acanthus ilicifolius*	jeruju	Acanthaceae	Associated mangrove	****
13	*Calotropis gigantea*	biduri	Asclepiadaceae	Associated mangrove	**
14	*Ipomoea pes-caprae*	teracak kambing	Convolvulaceae	Associated mangrove	***
15	*Sesuvium portulacastrum*	alur	Alzoaceae	Associated mangrove	***
16	*Spinifex littoreus*	rumput tikusan	Poaceae	Associated mangrove	****

Note: ****: With extreme abundance, ***: with abundance, **: average, * below average
Source: IEE Primary Data, ITS

Table A1.2.4 Mangrove Species for Land Plantation Identified in Socah

No.	Species	Indonesian Name	Family	Note
1	*Sesbania grandiflora*	Turi	Fabaceae	****
2	*Leucaena glauca*	Lamtoro	Fabaceae	***
3	*Pluchea indica*	Beluntas	Asteraceae	****
4	*Cynodon dactylon*	Rumput grinting	Poaceae	****
5	*Pogonatherum paniceum*	Rumput merak	Poaceae	****
6	*Themeda gigantea*	Rumput gajah	Poaceae	***
7	*Paspalum commersonii*	Rumput tuton	Poaceae	****

Note: ****: With abundance, ***: with abundance, **: average, * below average
Source: IEE Primary Data, ITS

Table A1.2.5 Birds Identified in Tg. Bulupandan

No.	Species	Indonesian Name	Family	Note
1	*Alcedo coerulescens*	raja udang biru	Alcedinidae	*** / ** LC / *****
2	*Butorides striatus*	kokokan laut	Ardeidae	**** LC**
3	*Collocalia esculenta*	walet sapi	Apodidae	**** LC**
4	*Dicaeum trochileum*	cabai jawa	Nectarinidae	*** / ** LC / *****
5	*Egretta garzetta*	kuntul kecil	Ardeidae	*** / ** LC**
6	*Gerygone sulphurea*	remetuk laut	Pardalotidae	
7	*Lalage* sp	kapasan	Campephagidae	
8	*Lonchura punctulata*	bondol peking	Passeridae	
9	*Passer montanus*	burung gereja erasia	Passeridae	
10	*Prinia* sp	prenjak	Cisticolidae	
11	*Pycnonotus aurigaster*	cucak kutilang	Pycnonotidae	
11	*Pycnonotus goiavier*	merbah cerukcuk	Pycnonotidae	
12	*Rhipidura javanica*	kipasan belang	Rhipiduridae	*****
13	*Streptopelia chinensis*	tekukur biasa	Columbidae	
14	*Todirhampus chloris*	cekakak sungai	Alcedinidae	*****
15	*Tringa totanus*	trinil kaki merah	Scolopacidae	**migran**

Note: * Protected based on PP RI No. 7 Year 1999
** Status Based on IUCN Red List
LC: (*Least Concern*) if there are plenty of it and are well distributed on natural world
NT :(*Near Threatened*) if it is feared to become threatened on the future
*** Bird species with limited distribution and on the brink of extinction (*Birdlife International – Indonesia Programme* data)

Source: IEE Primary data, ITS

Table A1.2.6 Water quality criteria based on Diversities Index of Phytoplankton (Carter and Hill, 1981)

No.	Species	Family	Location	
			Junganyar	Da'iring
1	*Fragillariopsis* sp	Bacillariaceae	7	-
2	*Ceratium furca*	Ceratiaceae	4	3
3	*Microcystis* sp	Chroococcaceae	-	5
4	*Coscinodiscus* sp.1	Coscinodiscaceae	42	-
5	*Coscinodiscus* sp.2	Coscinodiscaceae	23	12
6	*Cyclotella* sp	Coscinodiscaceae	10	6
7	*Denticula* sp	Epithemiaceae	-	2
8	*Odontella* sp	Eupodiscaceae	3	9
9	*Navicula* sp.1	Naviculaceae	6	-
10	*Navicula* sp.2	Naviculaceae	3	-
11	*Pleurosigma* sp.1	Naviculaceae	6	5
12	*Pleurosigma* sp.2	Naviculaceae	2	4
13	*Noctiluca* sp.1	Noctilucaceae	2	-
14	*Noctiluca* sp.2	Noctilucaceae	1	-
15	*Peridinium* sp	Peridiniaceae	1	2
16	*Dithylium* sp	Raphidiniaceae	2	-
17	*Rhizosolenia pungens*	Rhizosoleniaceae	14	-
18	*Rhizosolenia* sp.1	Rhizosoleniaceae	2	44
19	*Rhizosolenia* sp.2	Rhizosoleniaceae	1	-
20	*Sphaeroplea* sp	Sphaeropleaceae	2	6
21	*Stellarima* sp	Stellarimaceae	-	1

22	*Thalassionema nitzschioides*	Thalassionemataceae	6	2
23	*Triceratium* sp	Triceratiaceae	-	1
24	*Binucleira tatrana*	Ulothrichaceae	4	2
25	*Ulothrix* sp	Ulothrichaceae	4	7
Total			**145**	**111**
Diversities Index			**2.46**	**2.17**

Source: IEE Primary Data, ITS

Table A1.2.7 Diversities Index of Phytoplankton (Carter and Hill, 1981)

Water Qualities	Diversities Index	
	Phytoplankton	Zooplankton
Very good	> 2.0	> 2.0
Good	1.6 - 2.0	1.6 - 2.0
Normal	1.0 - 1.6	1.4 - 1.6
Bad	0.7 - 1.0	1.0 - 1.4
Very Bad	< 0.7	< 1.0

Table A1.2.8 Water quality criteria based on Diversities Index of Zooplankton (Carter and Hill, 1981)

No.	Species	Family	Location	
			Junganyar	Da'iring
1	*Acartia* sp	Calanidae	10	-
2	*Diaptomus* sp	Diaptomidae	4	12
3	Globigerina	Foraminifera	2	8
4	*Peneropolis* sp	Foraminifera	2	-
5	*Oithona* sp	Oithonidae	8	2
6	*Ethmolaimus* sp	Rhabditidae	13	7
7	Larva Nauplii Copepoda		1	-
Total			**40**	**29**
Diversities Index			**1.66**	**1.25**

Source: Primary Data, IEE by ITS

Table A1.2.9 Diversities Index of Zooplankton (Carter and Hill, 1981)

Water Qualities	Diversities Index	
	Phytoplankton	Zooplankton
Very good	> 2.0	> 2.0
Good	1.6 - 2.0	1.6 - 2.0
Normal	1.0 - 1.6	1.4 - 1.6
Bad	0.7 - 1.0	1.0 - 1.4
Very Bad	< 0.7	< 1.0

Table A1.2.10 Water quality criteria based on Diversities Index of makrozoo benthos (Carter and Hill, 1981)

No.	Species	Family	Location	
			Da'iring	Junganyar
1	*Anadara granosa*	Arcidae	-	1
2	*Cerithidea cingulata*	Potamididae	-	35
3	*Cerithidea djadjariensis*	Potamididae	16	32
4	*Clibanarius* sp	Coenobitidae	3	2
5	*Cymatium* sp	Ranellidae	1	-
6	*Drupa* sp	Muricidae	1	-
7	*Libitina rostrata*	Trapeziidae	1	-
8	*Nassarius* sp.1	Nassaridae	4	3

Source: IEE Primary Data, ITS

Table A1.2.11 Diversities Level Criteria (Canter & Hill, 1981)

Diversities Index	Variation level
> 2.0	Very high
2.0 - 1.6	High
1.5 - 1.0	Average
0,7 - 1.0	Low
< 0,7	Very Low

Table A1.2.12 Water pollution level criteria based on benthos diversities index (Lee, Wang, and Kuo, 1978)

Water Qualities	Diversities Index
Unpolluted	> 2.0
Lightly polluted	1.6 - 2.0
Polluted	1.0 - 6.0
Very polluted	< 1.0

Table A1.2.13 Population and Population Density

	Area (km2)	Population	No. household	Density per ha
Socah sub-distrcit	53.8	55,493	12,196	10.3
Da'iring village	3.31	2,168	406	6.5
Junganyan village	0.86	2,830	592	15.3
Socah	1.15	5,208	1,266	4.6

Source: Bangkalan in figure (2006)

Table A1.2.14 Population by Age Group of Socah Sub-District

Age Group	Population	Percentage
< 5 years old	4 249	7.65
5 - 14 years old	11 561	20.83
15 - 44 years old	25 273	45.55
45 - 64 years old	10 251	18.47
> 65 years old	4 159	7.5
Total	**55, 493**	**100**

Source: Socah in figure (2006)

Table A1.2.15 Age Distribution of the Survey Respondents

Group of Age	Number of People	Precentage (%)
< 30	4	6.45
31 - 40	15	24.19
41 - 50	15	24.19
51 - 60	20	32.25
> 61	8	12.92
Total	**62**	100

Source: Primary data, Field Survey, July,2007

Table A.2.16 Land Use Pattern (Ha)

	Agriculture	Fish Pond	Residential land	Others	Total
Da'iring village	207 (53%)	57 (14 %)	41 (11%)	83 (21%)	388 (100%)
Junganyan village	14 (17%)	- (0%)	19 (22%)	53 (62%)	86 (100%)
Socah	31 (26%)	13 (12%)	68 (60%)	3 (2%)	115 (100%)

Source: Klampis in figure (2006)

Table A1.2.17 Income Sources of Respondents

Types of employment	Number	Percentages (%)
Farming & Fisheries	35	56
Private Sector	12	20
Unemployed / secondary job	11	18
Refuse to respond	4	6
Total	**62**	100

Source: IEE Primary Data, ITS

Table A1.2.18 Major Cultivated Crops in Socah Sub-District

Type of crops	Harvested Area (Ha)	Production (ton)	Productivity (100 kg/Ha)
Paddy	2,918	12,652	43
Corn	1,630	3, 056	19
Cassava	159	1, 895	120

Source: Bangkalan in Figures, 2006

Table A1.2.19 Income Level

Income (Rp.)	Number of People	Percentage (%)
1million-2million	29	47
2million-2.5million	0	0
2.5million-5million	28	45
5million-10million	5	8
Total	**62**	100

Source: IEE Primary data, Field Survey, July,2007

Table A1.2.20 Poverty Level in Socah sub-district

Category	Number of HH	Percentage (%)
Non- privileged (Very Poor)	1, 959	**15**
Privileged stage I (Poor)	5, 285	**40**
Privileged stage II	2, 050	15
Privileged stage III	3, 676	28
Privileged stage III Plus	3	2
Total	12,973	100

Source: Bangkalan in figure, 2006

Table A1.2.21 Educational Institutes in Klampis Sub-District

Types of Schools	**Number of Schools**	**Number of Teachers**	**Number of Students**
Elementary schools	42	301	6754
Government middle schools	1	30	308
Private middle schools	1	12	68
High Schools	-	-	-
Madrasah Diniyah	45	399	6979
Madrasah Ibtidaiyah (Islamic elementary schools)	2	26	221
Madrasah Tsanawiyah (MTs, Islamic middle schools)	5	80	486
Madrasah Aliyah (Islamic High schools)	1	19	70

Source: Bangkalan in Figures, 2006

Table A1.2.22 Education Level of the Survey Respondents

Educational Level	Number	Percentage (%)
Elementary Graduate	31	50
Middle School	15	24
High School	10	16
University Graduate	6	10
Total	62	100

Source: IEE Field survey, July, 2007

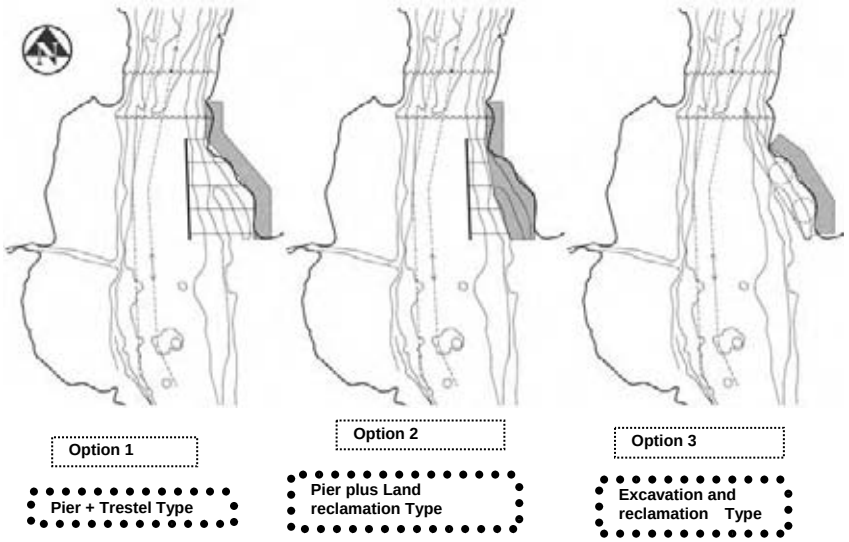
2) Hydrodynamic Simulation

The hydrodynamic simulation on a qualitative level was carried out based on the "with" and "without" the project scenario to analyze the current, sediment concentration, seabed etc.

In the project planning, at first three alternative designs were considered to assess their impacts.

- Existing Condition (without the project)
- Option 1: Pier (length: 3km) with trestles;
- Option 2: Reclamation up to 0 m seawater level area plus pier construction (length: 3km);
- Option 3: Dredging (water depth: 14m) plus land reclamation using the existing land area.

Figure A1.2.2 Three Design Alternatives at Socah area



Since no specific construction methods or activities or sites are specified, input conditions for the simulation was confined to parameters such as sediment contents, limits on high tide/low tide, river stream and its estuary etc., to carry out qualitative analysis on change of flow of current, sediment concentration, seabed etc.

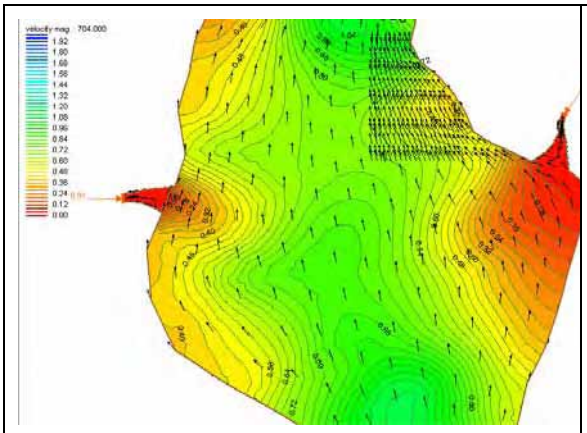
Current /Sedimentation/Sea bed:

The table is the result of the comparative analyses on the change in current condition for the four (including with out the project option) alternative layouts.

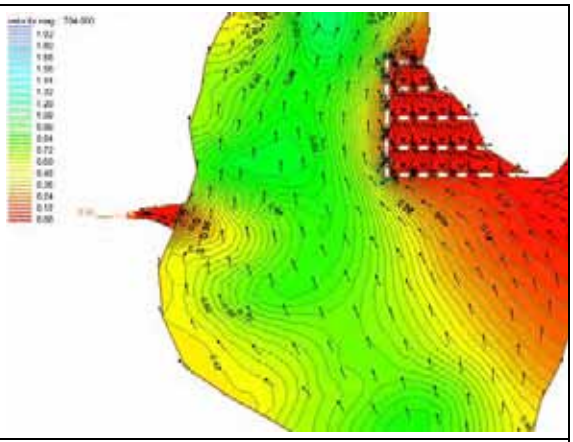
- "Without" the project option: No action alternative is the situation where no development activity is implemented, therefore, the current will continue to flow both from the north and the south.
- Option 1: The current flows into the planned port location will be reduced in amount compared to the existing condition because the trestles to be constructed will interrupt the current flow. On the other hand, current that flow around the sailing route will increase because the port will reduce the width of the bay, enabling the current velocity on the sailing route to increase. However, because the trestles do not completely block current movement and allows the current to move from gaps in between the trestles.

- Option 2: the simulation result is somehow similar with the option 1 result, but in option 2, the current speed on the sailing route experience greater increase than option 1. This condition brings advantage on the sailing route, however, it slows down the sedimentation, because the reclamation creates a distraction on the shore, and as a result, there will be sedimentation on the on one side of the structure and erosion on the other side (depending on the direction of current movement). In addition, river end in the south of the port encounters may carry sediment into the sea basin.
- Option 3: An excavation decreases the base elevation around the future port. Such decreased elevation causes a gradient change on the river end along the harbor basin and increases the current speed from the river end towards the harbor basin. This increase in current also creates an increase in sediment transportation from the river end towards the harbor basin. Reclamation work will also bring changes to the current flow and increase sediment on one side of the structure and decrease on the other.

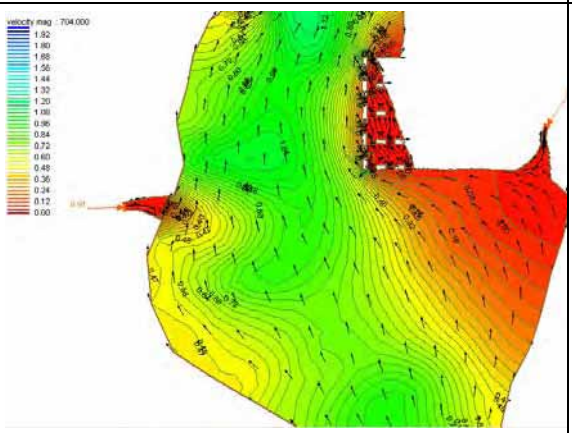
Figure A1.2.3 Comparative Analysis on Change in Current Flow



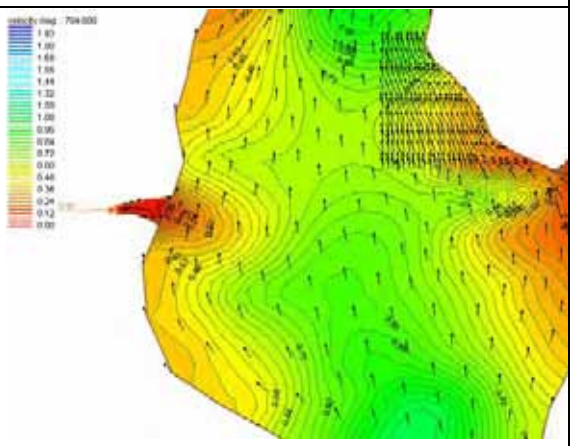
Without the project Snenario



Option 1



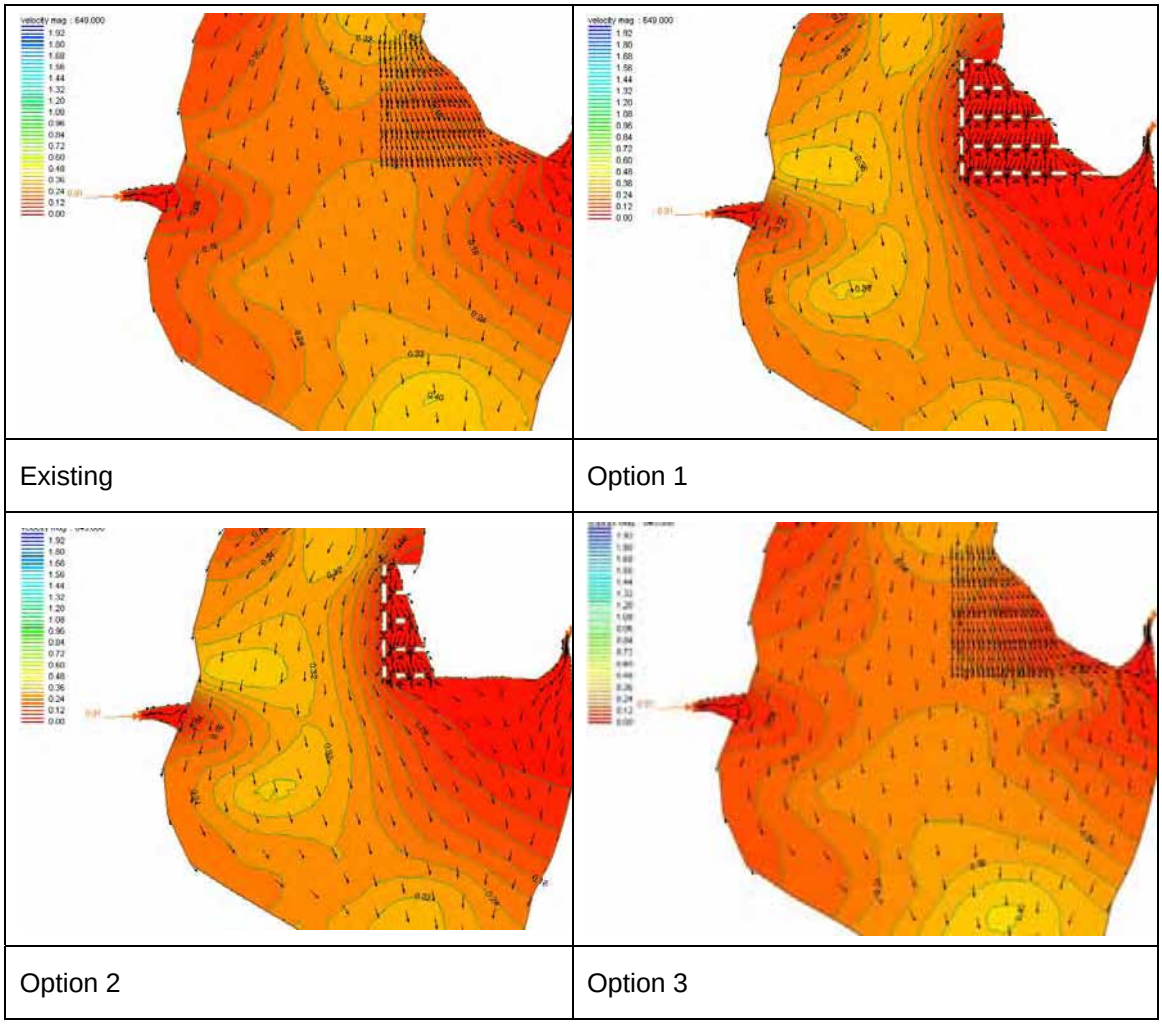
Option 2



Option 3

(South Current created by simulation on t = 649 hours)

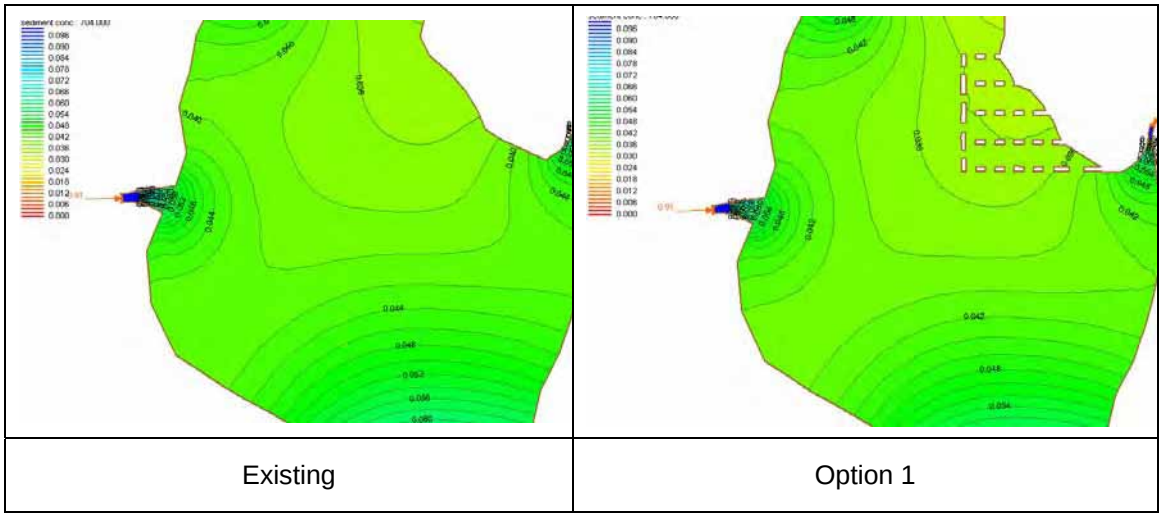
Figure A1.2.4 Comparative Analysis on Change in Current Flow



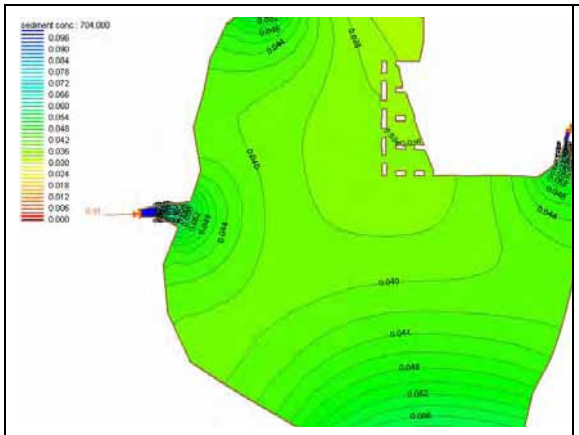
Existing	Option 1
Option 2	Option 3

(North Current created by simulation on t = 649 hours)

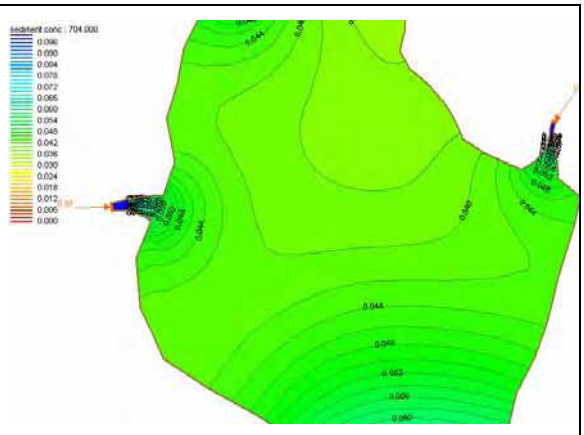
Figure A1.2.5 Comparative Analysis on Change in Sedimentation Concentration



Existing	Option 1

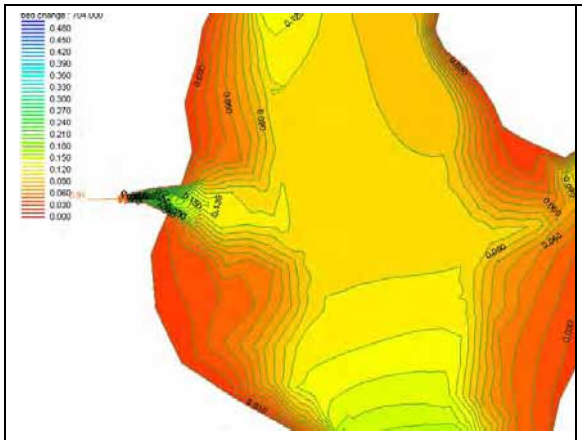


Option 2

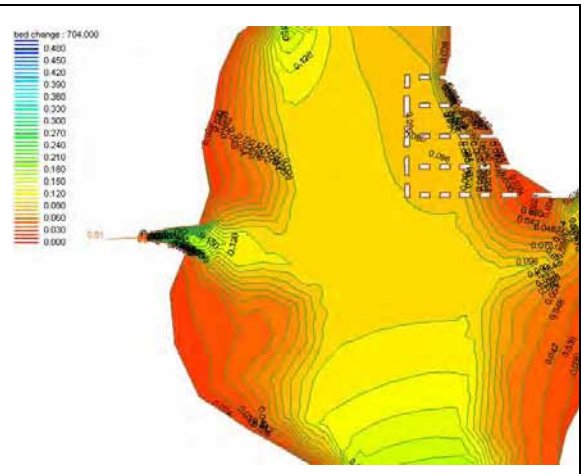


Option 3

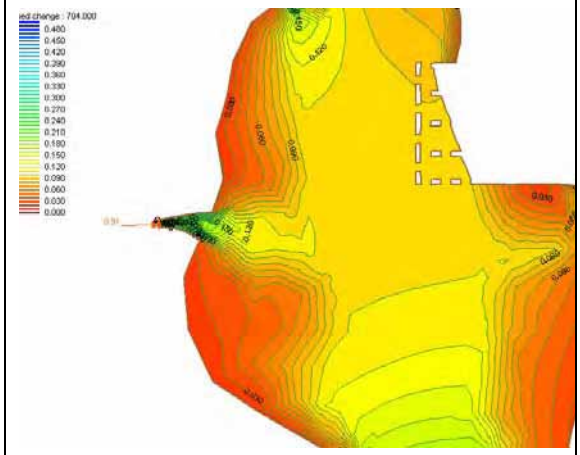
Figure 1.2.6 Comparative Analysis on Change in Sea Bed Condition



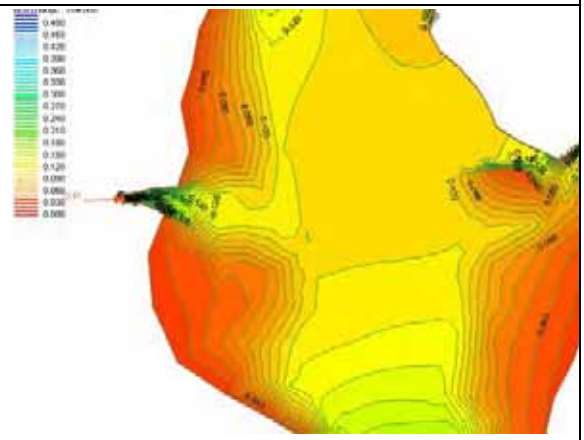
Existing



Option 1



Option 2



Option 3

3) Summary of Mitigation Measures

Environmental Items and Potential Impacts	Proposed Mitigation	Location	Time Frame
Permits			
Required environmental assessment	Full- scale EIA is required at feasibility study stage.		
Physical Environmental			
Impacts on Hydrodynamic environment (Dredging and Reclamation)			
• Change in water flow due to reclamation	• Reclaimed land area should be carefully examined based on the result of the hydrodynamic modeling study to minimize the impacts on hydrology. • Comprehensive monitoring required in relation to hydrodynamic affects	Reclamation sites	During construction /Post construction
• Impacts from deep-sea disposal	• Disposal of dredged materials should be put in place to prevent distribution of suspended solids in the waters outside of disposal sites. • Contents of spoiled materials should be analyzed regularly before dumping to make sure they do contain toxic components. • Conduct sampling and seawater quality analysis in the dumping area.	Off-shore disposal site	During construction/operation
Deterioration of air quality	• Using vehicles that have passed emission tests, spraying water on construction sites etc. • Regular air quality monitoring to meet the required standards.	Construction site Harbor area/ access road	During construction During operation
Increased noise and vibration	• Ensuring the noise emission is within the allowable level. Use of well maintained machines and plants and silencers/ mufflers for construction equipments, if required. • Implementation of proper traffic management practices and road maintenance during transport.	Construction site Access road area	During construction During operation
Impact on water			
• Deterioration of water quality due to increased SS and turbidity	Adopting good dredging practices by selecting the right equipment (ex. TSDH) and right dredging, loading and placement methods.	Construction site	During construction
• Deterioration of water quality due to increased pollutants spreading into the sea.	• Ensure the adoption of loading/unloading, handling and storage practices. • Each terminal will be required to have a proper waste management plan. Storage and disposal have to follow existing regulations.	Port terminal areas	During operation
Biological Environment			
Impacts on Terrestrial/Marine ecology			
• Permanent loss of mangroves	Re-plantation/ remedial action is to be taken to minimize the impacts.	Along the coastline	Before/post construction
• Loss of other habitats	Adopt best dredging practice and disposal	Surrounding	Before/post

Environmental Items and Potential Impacts	Proposed Mitigation	Location	Time Frame
	of dredged materials by following appropriate engineering design and monitoring and feedback system to limit any possible disruption of ecological processes.	the bay area/ offshore sea area	construction
Impacts on land use			
• Change in land use, visual effects	The change in the land use is likely to be significant. It should be in keeping with the nature of a site to as a port activity zone to a possible extent.	Port terminal and the surrounding areas	All phases
• Archaeological and Historical sites	Identification of remains and cultural assets including graves should be confirmed before construction.	Access road construction area	All phases
Impact on Resettlement	• Resettlement impact is to be minimized for port construction area. Further efforts are required to minimize the resettlement impacts for access road construction sites. • In case resettlement takes place, proper compensation and assistance should be provided to the PAPs based on resettlement action plan prepared by the project authority.	Port construction and access road sites	Before construction
Economic activities /Labor			
• Loss of livelihood / income generating activities	• Local intentions including PAPs should be incorporated into project planning. • PAPs facing economic displacement are also entitled for compensation for their losses. • Priorities should be given to locals for port construction related activities • Provision of training programs for locals.	Affected land area at Socah and fishing grounds used for fisheries	All phases
Women /Vulnerable Groups			
• Increased risk of chronic diseases / loss of livelihood activities of the poor	• Provision of livelihood support programs for women/ vulnerable. • Infectious disease prevention program for contractors. • Provision of social awareness program for women.	Administrative area of affected villages at Socah sub-district	All phases
Culture and interaction/Conflict of interests			
• Conflicts of interests stemming from land dispute, socio-economic reasons	• A strong anti-development feeling was expressed by part of the residents due to absence of information dissemination and consultation process in the planning. Open consultations with the stakeholders are required at the early planning stage. • A Good co-ordination with project authorities and local community leaders. • Utilization of local knowledge into project planning.	Administrative area of affected villages at Socah sub-district	During / post construction

Environmental Items and Potential Impacts	Proposed Mitigation	Location	Time Frame
	• Provision of land registration promotion programs		
Equity of Benefits and losses			
Increased socio-economic disparities and regional divide	Monitoring of local socio-economic conditions	Administrative area of Socah	During / post construction
Safety			
Increased risk of maritime insecurity due to off shore pipelines / increase traffic accident risks due to increased traffic volume	• Improved provision of maritime security and safety measures. • Improved navigation aids to ensure safe transit inside the port including the potential risks that existing /to be constructed pipelines posses. • Traffic safety enhancement for increased traffic.	Port and access road area / vessels navigation route	During / post construction

Appendix 1.3 Related Information on Social Consultation

Minutes of Meeting from the Consultation Meeting

Date) July12th, 2007
Location) Klampis sub district, Ko'ol village
Meeting Place) Ko'ol village head's residence
Number of Attendants) 40 from Ko'ol and Tolbok village

Outline of the meeting:

- Opening remarks was made by the official from Klampis sub district (Pak Ilyas). IEE Study team leader explained about objective and the outline of the project and the scope of IEE social survey.
- Social survey was carried out using a questionnaire form in a separate room for men and women.

Main point discussed:

- (The meeting was held in a calm and tranquil atmosphere)
- Most villagers expressed their support for the port construction.
- Some participants expressed concern about the negative impacts on the fisheries activities and compensation to be offered.
- Respondents anticipated that the project might disturb the social solidarity in the community

Date) July12th, 2007
Location) Klampis sub district, Klampis Barat village
Meeting Place) Klampis Barat village head's residence
Number of attendants) 22 from Klampis Barat village

Outline of the meeting:

- Opening remarks was made by the official from Klampis sub district (Pak Ilyas). IEE Study team leader explained about objective and the outline of the project and the scope of IEE social survey.
- Social survey was carried out using a questionnaire form (all attendants were male).

Main points discussed:

- Respondents asked about the project plan and its mitigation measures to be taken especially for the social impacts.
- Specific minitagory measures to be taken by the project were addressed by one of the local NGO (who is also a secretary of the village head).
- A concern was expressed was by fishermen that the project plan may disturb their net-fishing activities in /out side the bay, the construction methodology should be considered not to disturb
- It was also pointed that fishing route for the crafts may be affected due to construction activities.

Date) August 24th, 2007
Location) Socah sub district, Socah village
Meeting Plave) Socah sub-district office
Number of attendants 62) from Da'iring, Junganyar and Socah village

(The original consultation meeting planned in July 2007 was suspended for over a month because of the anti-development feelings surged by some of the villagers (such as in Junganyar villagers) and for social security reasons, the meeting was putt off until the situation had settled down)
Outline of the meeting:

- Opening remarks made by the official from Socah sub district (Pak Chandra) following by a speech from Bappeda Bangkalan (Pak Yoyok). IEE Study team leader explained about objective and the outline of the project and the scope of IEE social survey.
- Social survey was carried out using a questionnaire form (all attendants were male).

Main points discussed:

- There was a anti-development feelings prevailing among some of the attendants, as village leader (Junganyar) and other followers (including local NGO) critically mentioned about the negative social impacts on the local people to be imposed, and that tried to persuade other attendants to reject any development planning in the area including this study.
- Most of the villagers from Junganyar village opposed to the project planning and asked a voting to be carried out.
- (After a tough session with some of the participants, the team was allowed to go on to a survey session, where individuals were given more freedom to give whatever their views are opinions were).

Questionnaire Form
For Socio-economic Survey

I. RESPONDENT IDENTITY

Name …… Address …… - RT / RW …… - Kelurahan …… - Kecamatan …… - Kabupaten …… Age : …… Last Education Level : ……	Sex Male / Female Religion …… Respondent Status: 1. Prominent Figure 2. Religion Figure 3. Lead of RT/RW 4. Member of DPRD 5. Member of BPD/LPM 6. Member of PKK 7. NGO 8. Locals 9. Others …… Working eminent: 1. Government officer 2. Farmer 3. Local vendor 4. Fisherman 5. Teacher 6. Army Forced / Policeman 7. Private 8. Others……

I. HOUSE, YARD AND LAND OWNER STATUS

1.1. House condition:

1. Permanent 2. Non permanent 3. Semi permanent

House Broad : .....

Commodious of yard : .....

1.2. House and land owner status:

1. Certificate of Right Own Possession / petok: yes/ no (not yet)
2. Own of relative
3. Right Property Use : Certificate yes/ no.
4. Rent house
5. Others.....

1.3. Yard owner status :

1. Certificate of Right Own Possession / petok: yes/ no (not yet)
2. Own of relative
3. Right Property Use : Certificate yes/ no.
4. Rent house
5. Others.....

II. OCCUPATION AND SALARY

2.1. Respondent occupation type:

1. Farmer, ……
2. Farmer Laborer
3. Local vendor, ……
4. Fisherman
5. Breeder .....
6. Tukang, buruh bangunan .....
7. Government officer .....
8. Army .....
9. Private/Labour .....
10. Retired .....
11. Transportation Service .....
12. Others .....

2.2. Respondent salary per month:
1. < Rp. 500.000,-
2. between Rp. 500.000 – Rp. 1.000.000,-
3. between Rp. 1.000.000 – Rp. 2.000.000,-
4. > Rp. 2.500.000,-

2.3. Do you have other activity ?
1. yes 2. no

2.4. If "Yes", howmuct salary per month?.
1. < Rp. 500.000,-
2. between Rp. 500.000 – Rp. 1.000.000,-
3. between Rp. 1.000.000 – Rp. 2.000.000,-
4. > Rp. 2.500.000,-

2.5. How many animal husbandry do you have?
1. Chiken .....
2. Goat .....
3. Cow .....
4. .....

2.6. How many vehicle do you have?
1. Bicycle .....
2. Motor cycle .....
3. Car .....
4. .....

III. SOCIAL LIVING AND TRANQUILLITY

3.1. Social living condition
1. Peacefull 2. Sometime intruding 3. No peaceful, always intruding.

3.2. What kind of social problem does society have?
.....

.....

3.3. What is your action if outside labour join in the project?
1. Full accepting
2. Suspicious
3. Do not care
4. Reject with negotiation
5. Full reject.

3.4. What kind of means will you take if there is a social conflict: ……
1. Meeting and discussion with the prominent figure (RT/RW or others)
2. Jurisdiction
3. Negotiation
4. With brutal action
5. Others.....

3.5. In your opinion, who is the prominent figure?
1. Village chief 2. Village official 3. Clergyman 4.RT/RW
5. others.....

3.6. What is your perception on the social relationship in the community

1. good
2. harmonious
3. do not care with other
4. not harmonious

3.7. When do you socialize with the locals? :

1. Arisan
2. People wish
3. Others .....
4. pengajian
5. regular social gathering
6. after pray

IV. PERSEPTION AND ATTITUDE OF DEVELOPMENT PLAN

"Initial Environmental Evaluation (IEE) Study"

4.1. How did you obatin the information of the development plan?

No.	Source	Yes	No
A	Radio		
B	Television		
C	Magazine		
D	Government formal information		
E	Project information		
F	Others citizen		

4.2. After hearing the information about the project development, how is the social live condition?

a. Nothing happen

b. Change with:
   1. Negative reaction of society
   2. Become fidgety
   3. Emergence of society group
   4. Create dispute
   5. Others .....

4.3. Do you agree with the development plan?

1. Agree, because…….....

2. Agree, but …….....

3. Do not agree, because.....

4.4. What is your opinion about the benefits of the development? If any.

1. For oneself and family .....

2. For the society .....

3. For the government .....

4.5. What is your hopes about the development plan? (you can answer more then one)

1. Want to be engaged in port labour
2. Want to be engaged in labor work during construction phase
3. Development plan shall improve the socio-environmental condition
4. Development plan may develop human resource quality
5. Other, ……

4.6. Suggestion for tackling of negative perception of port development.
.....

V. HEALTH of ENVIRONMENT

5.1. Type of disease which often happened in this place
1. Disease of respiration of tabletop
2. Disease of respiration of underside
3. Disease of intestine infection
4. Disease of digestive channel
5. Disease of eye
6. Disease of tuberculosis
7. Disease of skin
8. The Others . . . . . ?

5.2. Do around location have a facility to medicinize . . . . . ?
1. Yes, there is
2. No, there isn't

If there is, What kind of facility . . . ?
1. Posyandu
2. Public Hospital
3. Puskesmas
4. Doctor practice
5. Medication of Alternative

5.3. Where does the respondent usually go to medicine . . . . ?
1. Cured by themselves
2. In Puskesmas closest
3. Go to the doctor
4. In hospital closest
5. Medication of Alternative
6. The Others . . . ?

VI. UTILITY SERVICE AND INFRASTRUCTURE

A. CLEAN WATER

6.1. What about the condition of used water here . . . . ?
1. Clear and transparent, with no smell and taste
2. Clear and transparent with smell and taste
3. Turbid with no smell
4. Turbid with smell

6.2. Source of water around respondent location for cooking and drinking
1. Water work
2. Well water
3. Hydrant / Water Pump
4. Water cistern of rain
5. Water buying

6.3. Source of Water around respondent location for bathing and washing
1. Water work
2. Well water
3. Hydrant / Water Pump
4. Water cistern of rain
5. Water buying

B. GARBAGE SERVICE

6.4. The way of dismissal of house garbage in this time
1. Thrown to available garbage box
2. Thrown to the available river or drain
3. Thrown and piled up
4. Burned and piled up
5. The Others . . . . ?

6.5. If the area has been served by garbage wagon, how many times garbage transported . . . ?
1. Everyday
2. Once of two days
3. Once of three days
4. Not certainly

C. DRAINAGE SERVICE

6.6. Network drainage around the houses
1. The house have never been flooded
2. There's a network of drainage but it's not function well because it's closed by garbage or land
3. There's no network of drainage but not flooded
4. Flooded, if there's a big rain
5. The Others . . . .

D. SANITATION and DISMISSAL of WASTE

6.7. Where you defecate . . . ?
1. Water closet
2. not in water closet . . .

6.8. The way of dismissal of sanitation at home . . .
1. Using basin of septic tank
2. Thrown to public toilet
3. Thrown to the river
4. Toilet in wasteland or fishpond
5. The others . . . .

E. INFRASTRUCTURE

6.9 What kind of road network around your house ?
1. Land Road
2. Rock Road
3. Street of Paving
4. Asphalt Pavement

6.10 What kind of road to go to your house ?
1. Land Road
2. Rock Road
3. Street of Paving
4. Asphalt Pavement

6.11 Is there any electrics network at your house ?
1. Yes, there is
2. No, there is not

Table List of Attendants for the Consulation Meeting (Tg. Bulupandan)

No	RESPONDENT IDENTITY						
	Nama	Alamat	Kelurahan	Kecamatan	Kabupaten	Umur	Agama
1	Wasiah		Ko'ol	Klampis	Bangkalan	20	Islam
2	Mochtar		Ko'ol	Klampis	Bangkalan	34	Islam
4	Sarifah	Ko'ol Barat	Ko'ol	Klampis	Bangkalan	35	Islam
5	Muria	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	45	Islam
6	Suhani	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	30	Islam
7	Muhammad	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	20	Islam
8	Sukainah	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	19	Islam
9	Wardha	Ko'ol Barat	Ko'ol	Klampis	Bangkalan	22	Islam
10	Sulaimah	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	22	Islam
11	Jumriyah	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	25	Islam
12	Khasinah		Ko'ol	Klampis	Bangkalan	45	Islam
13	Saoede		Ko'ol	Klampis	Bangkalan	48	Islam
14	Munise	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	45	Islam
15	Khosiah	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	20	Islam
16	Saleh	Ko'ol Timur	Ko'ol	Klampis	Bangkalan	55	Islam
17	Syamsul Arifin	Tolbu	Tolbu	Klampis	Bangkalan	41	Islam
18	H. M Naqib	Ko'ol Barat	Ko'ol	Klampis	Bangkalan	42	Islam
19	Hamdan	Tolbu	Tolbu	Klampis	Bangkalan	62	Islam
20	M. Rafiq	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	36	Islam
21	Assam	Ko'ol Barat	Ko'ol	Klampis	Bangkalan	45	Islam
22	M. Sama'in HS	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	58	Islam
23	Abdul Manaf	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	57	Islam
24	Supa'i	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	39	Islam
25	Busri	Ko'ol Timur	Ko'ol	Klampis	Bangkalan	32	Islam
26	Maadin	Tolbu	Tolbu	Klampis	Bangkalan	53	Islam
27	Azis	Tolbu	Tolbu	Klampis	Bangkalan	25	Islam
28	Muji	Tolbu	Tolbu	Klampis	Bangkalan	40	Islam
29	Na'im	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	40	Istram
30	Marzuki	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	45	Islam
31	Sohib	Tolbu	Tolbu	Klampis	Bangkalan	17	Islam
32	Zaini	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	45	Islam
33	Alwi	Tolbu	Ko'ol	Klampis	Bangkalan	42	Islam
34	Kabi	Ko'ol Barat	Ko'ol	Klampis	Bangkalan	52	Islam
35	Salama	Ko'ol Barat	Ko'ol	Klampis	Bangkalan	57	Islam
36	Ahman	Tolbu	Ko'ol	Klampis	Bangkalan	20	Islam
37	Nedi	Ko'ol	Ko'ol	Klampis	Bangkalan	70	Islam
38	Moneri	Ko'ol	Ko'ol	Klampis	Bangkalan	70	Islam
39	Matnahi	Tolbu	Tolbu	Klampis	Bangkalan	60	Islam
40	Sidi	Ko'ol Barat	Ko'ol	Klampis	Bangkalan	60	Islam
41	Saimin	Kampung karang anyar	Klampis Barat	Klampis	Bangkalan	29	Islam
42	M. Subhi	Kampung karang anyar	Klampis Barat	Klampis	Bangkalan	35	Islam
43	Bpk. Zaini	Kampung makam	Klampis Barat	Klampis	Bangkalan	30	Islam
44	Mustajib	Parteker	Klampis Barat	Klampis	Bangkalan	26	Islam
45	H. Abdul Rasyid	Kampung karang anyar	Klampis Barat	Klampis	Bangkalan	46	Islam
46	Muhammad Ali	Kampung Klampis Barat	Klampis Barat	Klampis	Bangkalan	40	Islam
47	Ansori		Klampis Barat	Klampis	Bangkalan	36	Islam
48	H. Abdul Halil		KM Parteker	Klampis	Bangkalan	50	Islam
49	Sohib		KM Parteker	Klampis	Bangkalan	45	Islam
50	Ahmat	Kampung karang anyar	Klampis Barat	Klampis	Bangkalan	65	Islam
51	Sadali	Klampis Barat	Klampis Barat	Klampis	Bangkalan	60	Islam
52	H. Mar'um	Klampis Barat	Klampis Barat	Klampis	Bangkalan	55	Islam
53	Jamil	Klampis Barat	Klampis Barat	Klampis	Bangkalan	40	Islam
54	Dul Rosyid	Loh makam	Klampis Barat	Klampis	Bangkalan	35	Islam
55	H. Imam	Klampis Barat	Klampis Barat	Klampis	Bangkalan	55	Islam
56	Muji	Klampis Barat	Klampis Barat	Klampis	Bangkalan	30	Islam
57	H. Munir	Klampis Barat	Klampis Barat	Klampis	Bangkalan	50	Islam
58	H. Hasan	Klampis Barat	Klampis Barat	Klampis	Bangkalan	52	Islam
59	Syamsul	Klampis Barat	Klampis Barat	Klampis	Bangkalan	32	Islam
60	Haji Hasan	Kampung makam	Klampis Barat	Klampis	Bangkalan	49	Islam
61	Hadi Irianto	Kampung makam	Klampis Barat	Klampis	Bangkalan	37	Islam
62	H. Azis	Kampung makam	Klampis Barat	Klampis	Bangkalan	30	Islam
63	Abdul Latif	Ko'ol Tengah	Ko'ol	Klampis	Bangkalan	20	Islam

Table List of Attendants for the Consulation Meeting (Socah)

No	RESPONDENT IDENTITY								
	Name	Address	Village	District	Sub of Province	Age	Education	Sex	Religion
1	Masyhur	Bargan	Socah	Socah	Bangkalan	47	Elementary	M	Islam
2	Muslimin	Ps. Gunonijan	Dakiring	Socah	Bangkalan	40	Elementary	M	Islam
3	Hosen, SH	Raya Pedeng	Socah	Socah	Bangkalan	34	Elementary	M	-
4	Ali Mulyono	Dakiring	Dakiring	Socah	Bangkalan	37	-	M	Islam
5	Abdul Samar	Dakiring	Dakiring	Socah	Bangkalan	34	Senior	M	Islam
6	Subandi	Dakiring	Dakiring	Socah	Bangkalan	50	-	M	Islam
7	Urip Supriyadi	Kauman	Socah	Socah	Bangkalan	40	Bachelo r	M	Islam
8	Bunali	Pasar Socah	Socah	Socah	Bangkalan	60	Elementary	M	Islam
9	Nasir	Bargan Socah	-	Socah	Bangkalan	48	-	M	Islam
10	Moh Naji	Pasar Socah	-	Socah	Bangkalan	51	Elementary	M	-
11	Musyaffar	Bargan Socah	Socah	Socah	Bangkalan	57	Junior	M	Islam
12	Latip	Socah	Socah	Socah	Bangkalan	51	Elementary	M	-
13	Bungkel	Junganyar	Socah	Socah	Bangkalan	53	Elementary	M	-
14	Halilih	Junganyar	Junganyar	Socah	Bangkalan	52	Elementary	M	-
15	Suharto	Junganyar	Junganyar	Socah	Bangkalan	31	Junior	M	-
16	Suharni	Junganyar	Junganyar	Socah	Bangkalan	62	Elementary	M	-
17	Nitin	Kauman	Junganyar	Socah	Bangkalan	23	Senior	W	Islam
18	Munawwir	Socah	Socah	Socah	Bangkalan	60	-		-
19	Muc. Rofi	Junganyar	Junganyar	Socah	Bangkalan	-	-	M	-
20	Dainankocri	Junganyar	Junganyar	Socah	Bangkalan	49	Senior	M	-
21	Ach. Djufri	Kauman	Socah	Socah	Bangkalan	65	Elementary	M	Islam
22	Holifin	Bargan	Socah	Socah	Bangkalan	50	Elementary	M	Islam
23	Eka Rusmiati, SH	Kauman	Socah	Socah	Bangkalan	35	Bachelor	W	Islam
24	Drs.H.Abdul Muhit	Kauman	Socah	Socah	Bangkalan	58	Bachelor	M	Islam
25	Rupian. S	Junganyar	Junganyar	Socah	Bangkalan	57	Elementary	M	Islam
26	Ansori	Dakiring	Dakiring	Socah	Bangkalan	43	Senior	M	Islam
27	Hasnain	Dakiring	Dakiring	Socah	Bangkalan	70	Elementary	M	Islam
28	Selamet	Dakiring	Dakiring	Socah	Bangkalan	56	Elementary	M	Islam
29	Solihan	Kejawan	Socah	Socah	Bangkalan	56	Senior	M	-
30	Abd Rahman	Kejawan	Socah	Socah	Bangkalan	54	Elementary	M	-
31	M Ghazali	Junganyar	Junganyar	Socah	Bangkalan	60	Elementary	M	Islam
32	Pendere Sumri	Junganyar		Socah	Bangkalan			M	-
33	Nurhomsin	Maritim Socah	Socah	Socah	Bangkalan	42	Senior	M	Islam
34	Adb Wahid	Kauman	Socah	Socah	Bangkalan	65	Elementary	M	Islam
35	Solihain	Socah	Socah	Socah	Bangkalan	47	Junior	M	Islam
36	Mat Saini	Junganyar	Junganyar	Socah	Bangkalan		Elementary	M	Islam
37	Isyanto	Junganyar RT06/RW02	Junganyar	Socah	Bangkalan			M	Islam
38	Bukhori	Junganyar RT06/RW02	Junganyar	Socah	Bangkalan	36	Junior	M	Islam
39	Zainul	Junganyar RT06/RW02	Junganyar	Socah	Bangkalan		Elementary	M	Islam
40	Mahfudz	Junganyar RT06/RW02	Junganyar	Socah	Bangkalan		Elementary	M	Islam
41	Asmari	Kauman RT05/RW01	Socah	Socah	Bangkalan		Junior	M	Islam
42	Marhasan	Timur Pasar RT02/RW05	Socah	Socah	Bangkalan	52		M	Islam
43	M. Nasir	Jungayar	Junganyar	Socah	Bangkalan	32	Junior	M	Islam
44	M. Haris	Junganyar RT03/RW01	Junganyar	Socah	Bangkalan	34	Junior	M	Islam
45	Ali Rosidin	Kejawan RT02/RW06	Socah	Socah	Bangkalan	34	Senior	M	Islam
46	Zainal Arifin	Kejawan RT02/RW06	Socah	Socah	Bangkalan	43	Senior	M	Islam
47	Modjo	JunganyarRT04/RW02	Junganyar	Socah	Bangkalan	48	Bachelor	M	Islam
48	Fathoni	Junganyar RT02 /RW01	Junganyar	Socah	Bangkalan	41	Junior	M	Islam
49	Bungkel	Gunungan RT04/RW04	Junganyar	Socah	Bangkalan	52	Elementary	M	Islam
50	Akhsin	Dusun Pesisir RT07/RW03	Dairing	Socah	Bangkalan	49	Elementary	M	Islam
51	H. Ashari	Dairing RT07/RW03	Dairing	Socah	Bangkalan	61	-	M	Islam
52	Moh Makruf	Kauman RT 01/RW 01	Socah	Socah	Bangkalan	63	Junior	M	Islam
53	Syamsuri	Buluh Dairing RTII/RW I	Dairing	Socah	Bangkalan	67	Senior	M	Islam
54	Abdul Azis	Junganyar RT02/03	Junganyar	Socah	Bangkalan	40	Junior	M	Islam
55	Rofii	Dairing RT02/RW02	Dairing	Socah	Bangkalan	32	Senior	M	Islam
56	Suhri	Dairing RT 02/RW 02	Dairing	Socah	Bangkalan	40	Elementary	M	Islam
57	M. samsul	Junganyar RT01/03	Junganyar	Socah	Bangkalan	50	Elementary	M	Islam
58	Musrian	Dairing RT 05/ RW02	Dairing	Socah	Bangkalan	61	Elementary	M	Islam
59	Abdul Mukti	Dairing RT 01/RW01	Dairing	Socah	Bangkalan	36	Junior	M	Islam
60	Subiryanto	T. Pasar RT03/RW05	Socah	Socah	Bangkalan	44	Elementary	M	Islam
61	Abdul Rohim	T. Pasar RT03/RW05	Socah	Socah	Bangkalan	52	Junior	M	Islam
62	Manito	T. Pasar RT03/RW05	Socah	Socah	Bangkalan	48	Junior	M	

Appendix 2. Origin and Destination Port of Domestic Shipping Cargoes to/from Surabaya Port

(1) Container : Loading

(1000 TEU)

Destination Port		Case 1				Case 2				Case 3			
		2005	2010	2020	2030	2005	2010	2020	2030	2005	2010	2020	2030
6	Belawan	33	44	67	96	33	47	79	118	33	47	86	149
30	Palembang	0	0	-	-	0	0	-	-	0	0	-	-
34	Panjang	7	8	11	16	7	9	14	19	7	9	15	24
36	Tanjung Priok	8	12	21	32	8	13	25	39	8	13	27	49
55	Benoa	20	26	41	59	20	28	48	73	20	28	52	92
61	Kupang / Tenau	5	8	13	19	5	9	15	23	5	9	17	29
63	Ende	0	0	-	-	0	0	-	-	0	0	-	-
65	Kalabahi	1	0	-	-	1	0	-	-	1	0	-	-
78	Banjarmasin	51	19	-	-	51	21	-	-	51	21	-	-
80	Balikpapan	40	53	83	123	40	56	99	152	40	57	107	192
81	Samarinda	58	78	125	187	58	83	148	230	58	83	161	290
82	Tarakan	7	16	30	46	7	17	36	57	7	17	39	72
84	Bitung	65	82	118	166	65	87	140	204	65	88	152	258
86	Gorontalo	0	0	-	-	0	0	-	-	0	0	-	-
87	Pantoloan	1	2	4	5	1	2	4	7	1	2	5	9
89	Ujung Pandang	136	172	251	354	136	183	297	435	136	184	322	550
92	Ambon	4	8	13	17	4	8	15	21	4	8	16	26
94	Ternate	0	0	-	-	0	0	-	-	0	0	-	-
95	Sorong	7	14	29	46	7	15	34	56	7	15	37	71
96	Jayapura	9	12	20	31	9	12	23	38	9	13	25	48
Total		452	555	826	1,198	452	591	979	1,471	452	594	1,060	1,859

(2) Container : Unloading

(1000 TEU)

Origin Port		Case 1				Case 2				Case 3			
		2005	2010	2020	2030	2005	2010	2020	2030	2005	2010	2020	2030
6	Belawan	64	85	132	191	64	91	157	235	64	92	170	297
34	Panjang	26	39	59	83	26	41	70	101	26	41	76	128
36	Tanjung Priok	10	16	27	41	10	17	32	50	10	17	35	63
44	Banten	17	24	40	60	17	26	48	74	17	26	52	93
55	Benoa	1	2	4	6	1	2	4	7	1	2	5	9
59	Bima	1	0	-	-	1	0	-	-	1	0	-	-
61	Kupang / Tenau	4	6	11	17	4	7	13	21	4	7	15	27
78	Banjarmasin	88	37	-	-	88	39	-	-	88	40	-	-
80	Balikpapan	2	2	4	5	2	3	4	6	2	3	5	8
81	Samarinda	34	49	77	111	34	52	92	136	34	53	100	172
84	Bitung	12	17	30	46	12	19	35	56	12	19	38	71
87	Pantoloan	1	2	4	5	1	2	4	6	1	2	5	8
89	Ujung Pandang	207	292	461	667	207	311	547	819	207	312	592	1,036
92	Ambon	0	0	0	0	0	0	0	0	0	0	0	1
95	Sorong	0	0	0	0	0	0	0	0	0	0	0	0
96	Jayapura	2	4	8	13	2	4	9	15	2	4	10	19
Total		470	577	858	1,246	470	615	1,018	1,529	470	618	1,102	1,933

(3) Break Bulk : Loading

(1000 MT)

Destination Port		Case 1				Case 2				Case 3			
		2005	2010	2020	2030	2005	2010	2020	2030	2005	2010	2020	2030
6	Belawan	70	39	25	29	70	41	30	35	70	41	33	44
12	Dumai	0	0	-	-	0	0	-	-	0	0	-	-
14	Pekanbaru	22	17	24	40	22	18	28	49	22	18	31	62
17	Bagan Siapi-api	1	0	-	-	1	0	-	-	1	0	-	-
20	Tembilahan	0	0	-	-	0	0	-	-	0	0	-	-
21	Rengat	4	1	3	8	4	1	4	10	4	1	4	13
25	Teluk Bayur	107	74	62	72	107	79	74	88	107	79	80	112
26	Kuala Tangkal	4	4	5	7	4	4	6	9	4	4	6	11
29	Pulau Baai	24	17	18	27	24	18	21	33	24	18	23	42
30	Palembang	7	7	9	14	7	7	11	17	7	7	12	21
31	Pangkal Balam	1	0	-	-	1	0	-	-	1	0	-	-
32	Tanjung Pandang	0	0	0	0	0	0	0	1	0	0	0	1
33	Muntok	7	7	9	13	7	7	11	16	7	7	12	20
34	Panjang	30	22	21	29	30	23	25	35	30	23	27	44
36	Tanjung Priok	86	55	53	77	86	58	63	95	86	59	68	120
44	Banten	11	15	16	15	11	16	19	19	11	16	20	24
45	Semarang	3	1	-	-	3	1	-	-	3	1	-	-
46	Cilacap	15	15	21	32	15	16	25	40	15	16	27	50
48	Surabaya	0	0	-	-	0	0	-	-	0	0	-	-
49	Gresik	31	28	36	55	31	30	43	68	31	30	47	86
50	Probolinggo	333	329	422	618	333	350	501	759	333	352	542	959
51	Meneg / Tanjung Wangi	1	0	-	-	1	0	-	-	1	0	-	-
54	Kalianget	3	1	-	-	3	1	-	-	3	1	-	-
55	Benoa	2	1	-	-	2	1	-	-	2	1	-	-
58	Lembar	10	8	8	10	10	8	10	13	10	9	10	16
59	Bima	1	0	-	-	1	0	-	-	1	0	-	-
60	Badas	1	0	3	7	1	0	3	9	1	0	4	11
61	Kupang / Tenau	57	35	27	32	57	37	32	40	57	38	35	50
62	Waingapu	22	19	21	29	22	20	25	35	22	20	27	45
63	Ende	76	70	101	163	76	75	119	201	76	75	129	254
64	Maumere	8	8	11	17	8	9	13	21	8	9	14	26
65	Kalabahi	8	11	17	25	8	12	20	30	8	12	21	38
66	Pontianak	5	2	4	10	5	2	5	13	5	2	5	16
70	Sampit	7	7	9	15	7	7	11	18	7	7	12	23
74	Pangkalan Bun	1	0	-	-	1	0	-	-	1	0	-	-
76	Kumai	57	53	67	100	57	56	80	122	57	57	86	154
78	Banjarmasin	253	422	609	858	253	450	723	1,053	253	452	783	1,331
79	Kotabaru	19	19	22	31	19	20	26	38	19	20	28	48
81	Samarinda	75	55	52	67	75	59	62	82	75	59	67	104
82	Tarakan	52	15	-	-	52	16	-	-	52	16	-	-
84	Bitung	0	0	-	-	0	0	-	-	0	0	-	-
86	Gorontalo	4	6	8	12	4	6	10	15	4	6	11	19
87	Pantoloan	22	20	11	0	22	21	13	0	22	21	14	0
88	Toli-toli	0	0	-	-	0	0	-	-	0	0	-	-
89	Ujung Pandang	124	84	65	69	124	89	77	85	124	90	83	108
91	Kendari	18	19	28	45	18	20	34	55	18	21	36	70
92	Ambon	67	35	19	18	67	37	22	22	67	37	24	27
94	Ternate	36	28	28	34	36	30	33	42	36	30	35	53
95	Sorong	36	11	-	-	36	11	-	-	36	11	-	-
96	Jayapura	23	12	13	23	23	13	16	28	23	13	17	36
97	Biak	0	0	-	-	0	0	-	-	0	0	-	-
99	Manokwari	5	5	8	12	5	5	9	15	5	5	10	19
115	Jawa Timur	1	0	-	-	1	0	-	-	1	0	-	-
119	Kalimantan Selatan	35	34	41	59	35	36	49	72	35	36	53	91
120	Kalimantan Timur	19	16	18	27	19	17	22	33	19	17	24	41
123	Sulawesi Tengah	27	28	39	60	27	30	46	74	27	30	50	93
125	Sulawesi Tenggara	1	0	-	-	1	0	-	-	1	0	-	-
126	Nusa Tenggara Barat	60	55	76	122	60	59	91	149	60	59	98	189
128	Maluku	48	40	40	50	48	42	47	61	48	42	51	78
129	Maluku Utara	2	1	3	8	2	1	4	10	2	1	4	12
130	Irian Jaya/Papua	5	4	9	19	5	4	11	24	5	4	12	30
Total		1,949	1,755	2,085	2,959	1,949	1,870	2,472	3,633	1,949	1,880	2,677	4,591

(4) Break Bulk : Unloading

(1000 MT)

	Origin Port	Case 1				Case 2				Case 3			
		2005	2010	2020	2030	2005	2010	2020	2030	2005	2010	2020	2030
2	Lhokseumawe	7	7	9	13	7	7	11	16	7	7	11	21
6	Belawan	2	1	-	-	2	1	-	-	2	1	-	-
9	Kuala Tanjung	1	0	3	9	1	0	4	11	1	0	4	14
14	Pekanbaru	31	33	42	59	31	35	50	73	31	35	54	92
26	Kuala Tangkal	8	9	12	18	8	9	14	22	8	9	16	28
27	Talang Dukuh / Jambi	5	6	8	12	5	6	10	15	5	6	10	19
29	Pulau Baai	0	0	0	1	0	0	0	1	0	0	0	2
30	Palembang	1	0	-	-	1	0	-	-	1	0	-	-
32	Tanjung Pandang	5	8	12	19	5	8	15	23	5	9	16	29
33	Muntok	2	2	2	4	2	2	3	4	2	2	3	6
34	Panjang	28	24	28	40	28	25	33	50	28	25	36	63
36	Tanjung Priok	8	7	10	16	8	7	12	20	8	7	13	25
43	Cirebon	1	0	4	10	1	1	4	13	1	1	5	16
45	Semarang	1	0	-	-	1	0	-	-	1	0	-	-
48	Surabaya	25	25	38	63	25	27	45	78	25	27	49	98
55	Benoa	1	0	-	-	1	0	-	-	1	0	-	-
57	Celukan Bawang	5	6	10	17	5	6	12	21	5	6	13	27
60	Badas	1	0	-	-	1	0	-	-	1	0	-	-
61	Kupang / Tenau	6	3	2	1	6	3	2	2	6	3	2	2
62	Waingapu	6	3	3	3	6	4	3	4	6	4	3	5
63	Ende	0	0	0	1	0	0	0	1	0	0	0	1
64	Maumere	2	2	4	6	2	2	4	8	2	2	5	10
65	Kalabahi	0	0	0	0	0	0	0	0	0	0	0	0
70	Sampit	78	51	38	39	78	54	45	48	78	55	48	61
74	Pangkalan Bun	23	15	10	11	23	15	12	13	23	16	13	17
76	Kumai	148	102	87	104	148	109	103	128	148	109	112	162
78	Banjarmasin	253	454	744	1,127	253	484	883	1,384	253	487	956	1,749
79	Kotabaru	11	8	7	8	11	8	8	10	11	8	9	13
81	Samarinda	76	47	31	31	76	50	37	38	76	50	40	48
82	Tarakan	53	34	24	24	53	36	29	30	53	36	31	38
83	Nunukan	86	95	144	232	86	102	171	285	86	102	185	360
86	Gorontalo	2	2	3	6	2	2	4	7	2	2	4	9
87	Pantoloan	6	6	3	-	6	7	3	-	6	7	3	-
89	Ujung Pandang	354	386	573	914	354	411	680	1,122	354	414	736	1,419
91	Kendari	2	1	0	0	2	1	0	0	2	1	0	1
92	Ambon	0	0	-	-	0	0	-	-	0	0	-	-
94	Ternate	3	3	4	6	3	3	5	8	3	3	5	10
96	Jayapura	3	1	-	-	3	1	-	-	3	1	-	-
101	Nanggore Aceh Darussalam	0	0	0	0	-	-	-	-	0	0	0	0
107	Kepulauan Bangka Belitung	-	-	-	-	1	0	-	-	-	-	-	-
111	Jawa Barat	1	0	-	-	-	-	-	-	1	0	-	-
118	Kalimantan Tengah	5	2	-	-	5	2	-	-	5	2	-	-
119	Kalimantan Selatan	8	10	16	26	8	11	19	32	8	11	20	40
120	Kalimantan Timur	1,284	904	781	932	1,284	963	927	1,144	1,284	968	1,003	1,446
121	Sulawesi Utara	19	39	63	91	19	41	74	112	19	42	80	142
125	Sulawesi Tenggara	10	11	18	30	10	12	21	37	10	12	23	46
126	Nusa Tenggara Barat	5	7	11	17	5	8	13	20	5	8	14	26
128	Maluku	5	9	14	20	5	9	16	25	5	9	18	31
129	Maluku Utara	0	0	1	1	0	0	1	2	0	0	1	2
130	Irian Jaya/Papua	16	15	20	30	16	17	24	36	16	17	26	46
	Total	2,599	2,341	2,780	3,946	2,599	2,494	3,297	4,845	2,599	2,508	3,571	6,123

(5) Liquid Bulk : Loading

(1000 MT)

	Destination Port	Case 1				Case 2				Case 3			
		2005	2010	2020	2030	2005	2010	2020	2030	2005	2010	2020	2030
6	Belawan	1	1	0	0	1	1	1	0	1	1	1	0
12	Dumai	0	0	0	0	0	0	0	0	0	0	0	0
20	Tembilahan	0	0	0	0	0	0	0	0	0	0	0	0
25	Teluk Bayur	1	1	1	1	1	1	1	1	1	1	1	1
28	Muara Sabak	0	0	0	0	0	0	0	0	0	0	0	0
30	Palembang	0	0	0	0	0	0	0	0	0	0	0	0
36	Tanjung Priok	0	0	0	0	0	0	0	0	0	0	0	0
44	Banten	89	54	67	108	89	58	76	121	89	58	80	135
48	Surabaya	0	0	0	-	0	0	0	-	0	0	0	-
51	Meneg / Tanjung Wangi	2	1	1	2	2	1	1	2	2	1	1	2
61	Kupang / Tenau	20	28	30	20	20	30	34	22	20	30	35	25
78	Banjarmasin	676	943	1,315	1,664	676	1,008	1,485	1,862	676	1,013	1,564	2,086
81	Samarinda	41	57	89	132	41	61	101	147	41	61	106	165
84	Bitung	2	3	3	2	2	3	4	2	2	3	4	2
115	Jawa Timur	0	0	0	-	0	0	0	-	0	0	0	-
126	Nusa Tenggara Barat	1	1	1	1	1	1	1	1	1	1	1	1
	Total	834	1,090	1,509	1,929	834	1,165	1,705	2,159	834	1,171	1,795	2,418

(6) Liquid Bulk : Unloading

(1000 MT)

	Origin Port	Case 1				Case 2				Case 3			
		2005	2010	2020	2030	2005	2010	2020	2030	2005	2010	2020	2030
6	Belawan	43	68	85	83	43	72	95	91	43	72	99	101
12	Dumai	1,838	2,806	3,576	3,936	1,838	2,962	3,969	4,348	1,838	2,975	4,151	4,814
14	Pekanbaru	0	0	0	1	0	0	0	1	0	0	0	1
20	Tembilahan	349	495	654	895	349	522	726	988	349	525	759	1,094
21	Rengat	18	21	31	64	18	22	34	70	18	22	36	78
26	Kuala Tangkal	0	1	2	6	0	1	2	6	0	1	2	7
27	Talang Dukuh / Jambi	31	48	128	400	31	50	142	442	31	51	149	490
30	Palembang	1,329	1,712	1,942	1,912	1,329	1,807	2,156	2,113	1,329	1,815	2,255	2,339
31	Pangkal Balam	3	4	9	23	3	4	9	26	3	4	10	28
34	Panjang	55	68	71	52	55	72	79	57	55	72	82	63
36	Tanjung Priok	51	72	86	82	51	76	95	91	51	77	100	100
44	Banten	257	317	564	1,411	257	335	626	1,559	257	336	654	1,726
46	Cilacap	4	5	10	28	4	5	11	31	4	5	12	34
51	Meneg / Tanjung Wangi	38	75	84	10	38	79	93	11	38	79	98	12
66	Pontianak	5	8	17	49	5	8	19	54	5	8	20	60
76	Kumai	57	94	270	870	57	99	300	962	57	99	314	1,065
78	Banjarmasin	0	0	0	1	0	0	0	1	0	0	0	1
80	Balikpapan	2,158	3,540	4,525	4,481	2,158	3,737	5,024	4,950	2,158	3,754	5,254	5,481
81	Samarinda	47	79	228	736	47	83	253	813	47	83	265	900
84	Bitung	25	34	72	198	25	36	80	219	25	36	84	243
89	Ujung Pandang	5	6	11	28	5	7	12	31	5	7	13	34
99	Manokwari	-	-	-	-	1	1	3	8	-	-	-	-
101	Nanggore Aceh Darussalam	1	1	2	7	-	-	-	-	1	1	3	9
107	Kepulauan Bangka Belitung	-	-	-	-	0	0	0	-	-	-	-	-
111	Jawa Barat	0	0	0	-	3	8	9	2	0	0	0	-
115	Jawa Timur	3	7	8	2	-	-	-	-	3	8	10	2
119	Kalimantan Selatan	3	4	4	7	3	4	5	8	3	4	5	9
120	Kalimantan Timur	816	1,245	1,649	2,057	816	1,314	1,830	2,273	816	1,320	1,914	2,516
126	Nusa Tenggara Barat	0	0	1	2	0	1	1	2	0	1	1	3
130	Irian Jaya/Papua	2	3	7	21	2	3	8	24	2	3	8	26
	Total	7,138	10,712	14,037	17,362	7,138	11,308	15,582	19,180	7,138	11,358	16,297	21,237

(7) Dry Bulk : Loading

(1000 MT)

Destination Port		Case 1				Case 2				Case 3			
		2005	2010	2020	2030	2005	2010	2020	2030	2005	2010	2020	2030
6	Belawan	431	596	883	1,146	431	619	957	1,241	431	621	991	1,349
12	Dumai	388	369	270	170	388	384	293	184	388	385	303	200
14	Pekanbaru	7	21	41	53	7	22	44	57	7	22	46	62
26	Kuala Tangkal	2	2	3	5	2	3	4	5	2	3	4	5
30	Palembang	52	67	95	123	52	69	103	133	52	70	106	145
44	Banten	60	30	-	-	60	31	-	-	60	31	-	-
63	Ende	6	3	-	-	6	3	-	-	6	3	-	-
80	Balikpapan	1	0	-	-	1	0	-	-	1	0	-	-
81	Samarinda	1	1	-	-	1	1	-	-	1	1	-	-
84	Bitung	0	1	2	3	0	1	3	3	0	1	3	4
107	Kepulauan Bangka Belitung	127	163	232	301	127	170	251	326	127	170	260	354
126	Nusa Tenggara Barat	1	0	-	-	1	0	-	-	1	0	-	-
Total		1,076	1,254	1,527	1,801	1,076	1,303	1,654	1,950	1,076	1,307	1,713	2,119

(8) Dry Bulk : Unloading

(1000 MT)

Origin Port		Case 1				Case 2				Case 3			
		2005	2010	2020	2030	2005	2010	2020	2030	2005	2010	2020	2030
6	Belawan	8	33	92	115	8	34	100	125	8	34	103	135
12	Dumai	2	5	13	16	2	5	14	18	2	5	15	19
14	Pekanbaru	8	11	18	23	8	12	20	25	8	12	20	27
30	Palembang	14	60	199	289	14	62	215	314	14	62	223	341
31	Pangkal Balam	2	4	7	9	2	4	8	10	2	4	8	11
32	Tanjung Pandang	155	226	386	482	155	235	418	523	155	236	433	568
34	Panjang	144	103	-	-	144	107	-	-	144	108	-	-
36	Tanjung Priok	44	31	-	-	44	32	-	-	44	32	-	-
54	Kalianget	72	134	275	344	72	139	298	373	72	140	308	405
62	Waingapu	16	11	-	-	16	12	-	-	16	12	-	-
63	Ende	9	6	-	-	9	6	-	-	9	6	-	-
64	Maumere	0	0	-	-	0	0	-	-	0	0	-	-
78	Banjarmasin	224	446	771	737	224	463	835	798	224	465	865	867
79	Kotabaru	19	41	74	70	19	43	80	76	19	43	83	82
80	Balikpapan	0	0	0	0	0	0	0	0	0	0	0	0
81	Samarinda	35	62	102	104	35	64	111	112	35	65	115	122
87	Pantoloan	6	5	-	-	6	5	-	-	6	5	-	-
88	Toli-toli	1	1	-	-	1	1	-	-	1	1	-	-
89	Ujung Pandang	16	70	194	243	16	72	210	263	16	73	217	286
91	Kendari	5	4	-	-	5	4	-	-	5	4	-	-
94	Ternate	16	12	-	-	16	12	-	-	16	12	-	-
96	Jayapura	1	5	14	18	1	5	16	20	1	5	16	21
101	Nanggore Aceh Darussalam	-	-	-	-	9	19	42	52	-	-	-	-
107	Kepulauan Bangka Belitung	9	18	39	48	-	-	-	-	9	19	43	57
118	Kalimantan Tengah	5	4	-	-	5	4	-	-	5	4	-	-
119	Kalimantan Selatan	261	415	753	929	261	432	815	1,006	261	433	844	1,093
121	Sulawesi Utara	831	594	-	-	831	618	-	-	831	620	-	-
126	Nusa Tenggara Barat	115	82	-	-	115	86	-	-	115	86	-	-
128	Maluku	184	132	-	-	184	137	-	-	184	137	-	-
129	Maluku Utara	0	0	-	-	0	0	-	-	0	0	-	-
130	Irian Jaya/Papua	205	291	481	602	205	302	522	652	205	303	540	709
Total		2,409	2,806	3,418	4,030	2,409	2,916	3,703	4,365	2,409	2,925	3,834	4,743

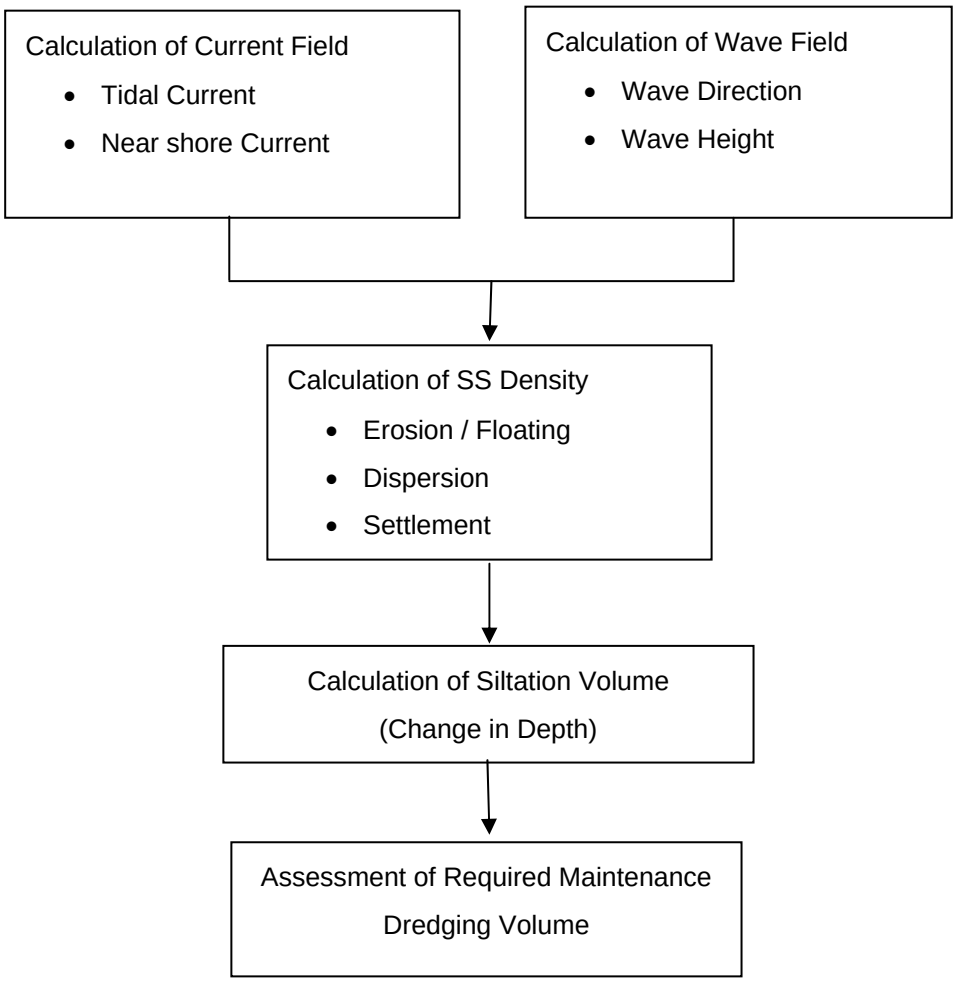
Appendix 3. Simulation Works for Siltation

1) Model for Channel Siltation Simulations

Siltation volume accompanied by widening and deepening of the Surabaya West Channel is assessed by channel siltation simulations. It was carried out by utilizing “PHRI-JPC” model.

The methodology of the simulation is illustrated in Figure A.3.1.

Figure A3.1 Flow of Siltation Simulation Work



Source: JICA Study Team

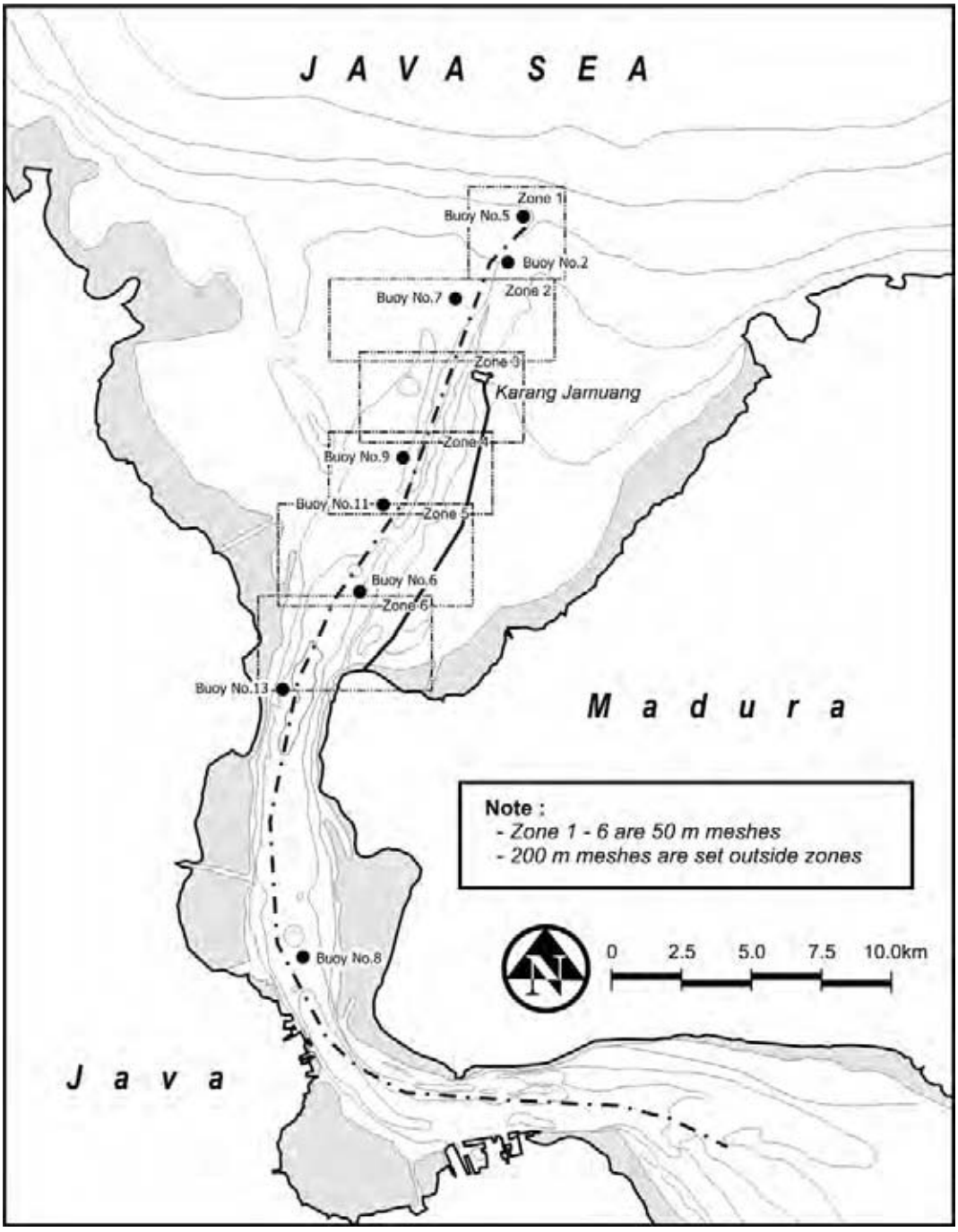
2) Conditions and Parameters employed in the Simulations

Table A3.1 Conditions and Parameters Employed for the Simulation Work

Item	Condition
Channel	Planned depth: CDL-12m, CDL-14m, CDL-16m Width: 200m, 300m, 350m Side slope: 1/5 1/5 1/5
Wave	Seasonal average in terms of wave energy Dry season: H=0.87m, T=4.0s, Wave direction: 82.4° Rainy season: H=0.54m, T=4.3s, Wave direction: 302.0° Unusual wave conditions Dry season: H=2.00m, T=5.0s, Wave direction: 90.0° Rainy season: H=2.00m, T=5.0s, Wave direction: 270.0°
Tide	Offshore border $M_2+S_2+0.5 \times (K_1+O_1)$
Sea water level	Mean sea water level: CDL+1.4m
Bottom materials (Figure A.3.3)	Density: 2.65t/m^3 Clay and Silt: Water content = 200% Settlement speed = 0.26 cm/s Sand: Void ratio: 0.4 Medium particle size: 0.2mm Settlement speed = 2.5 cm/s Composition ratio: Zone 1: Clay and Silt: 70%, Sand: 30% Zone 2 and 3: Clay and Silt: 60%, Sand: 40% Zone 4 and 5: Clay and Silt: 70%, Sand: 30% Zone 6 and 8: Clay and Silt: 90%, Sand: 10%
SS density of the Solo River	Dry season: 20 ppm Rainy season: 1,750 ppm
Evaluation area	Outer Channel : Buoy 5 – Buoy 6 (16km) Inner Channel : Buoy 6 – Karang Pisang (21km)
Grid interval (Figure A.3.2)	Overall Zone: 200m by 200m Zone 1, 2, 3, 4, 5, 6, 7, and 8 : 50m by 50m
Layers	Upper layer: Sea water surface to -2.5m Middle layer: -2.5 m to - 4.0m Lower layer: -4.0 m to sea bottom
Horizontal eddy viscosity coefficient	100,000cm^2/s
Vertical diffusion coefficient	1.0cm^2/s
Friction coefficient	Middle layer: 0.001, Lower layer: $gn^2/h^{1/3}$ Manning's roughness coefficient: n=0.025

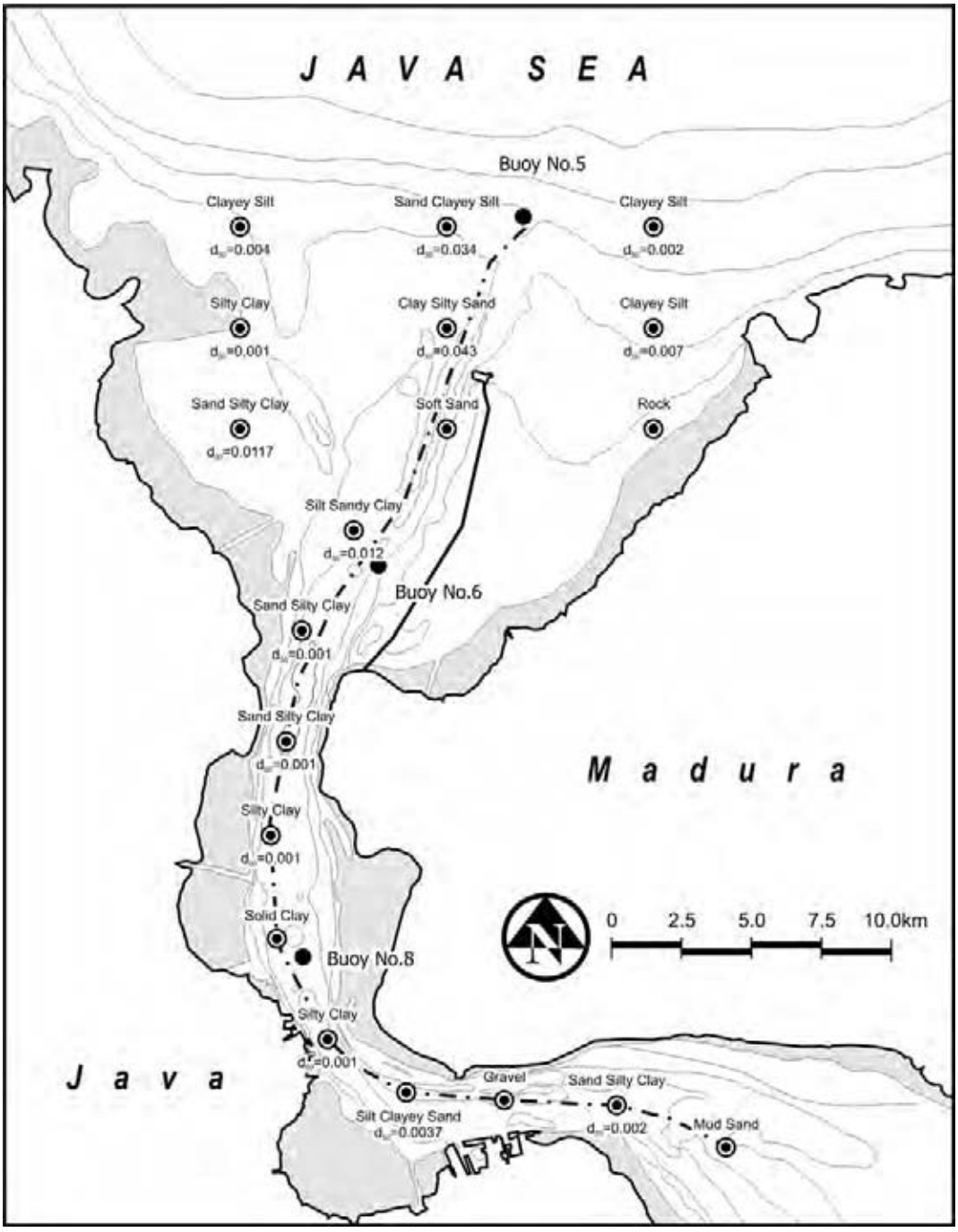
Note: Wave direction is indicated clockwise in degree from North

Figure A3.2 Calculation Areas with Grid Interval of 200m and 50m



Source: JICA Study Team

Figure A3.3 Soil Classification and Median Particle Diameter



Source: JICA Study Team

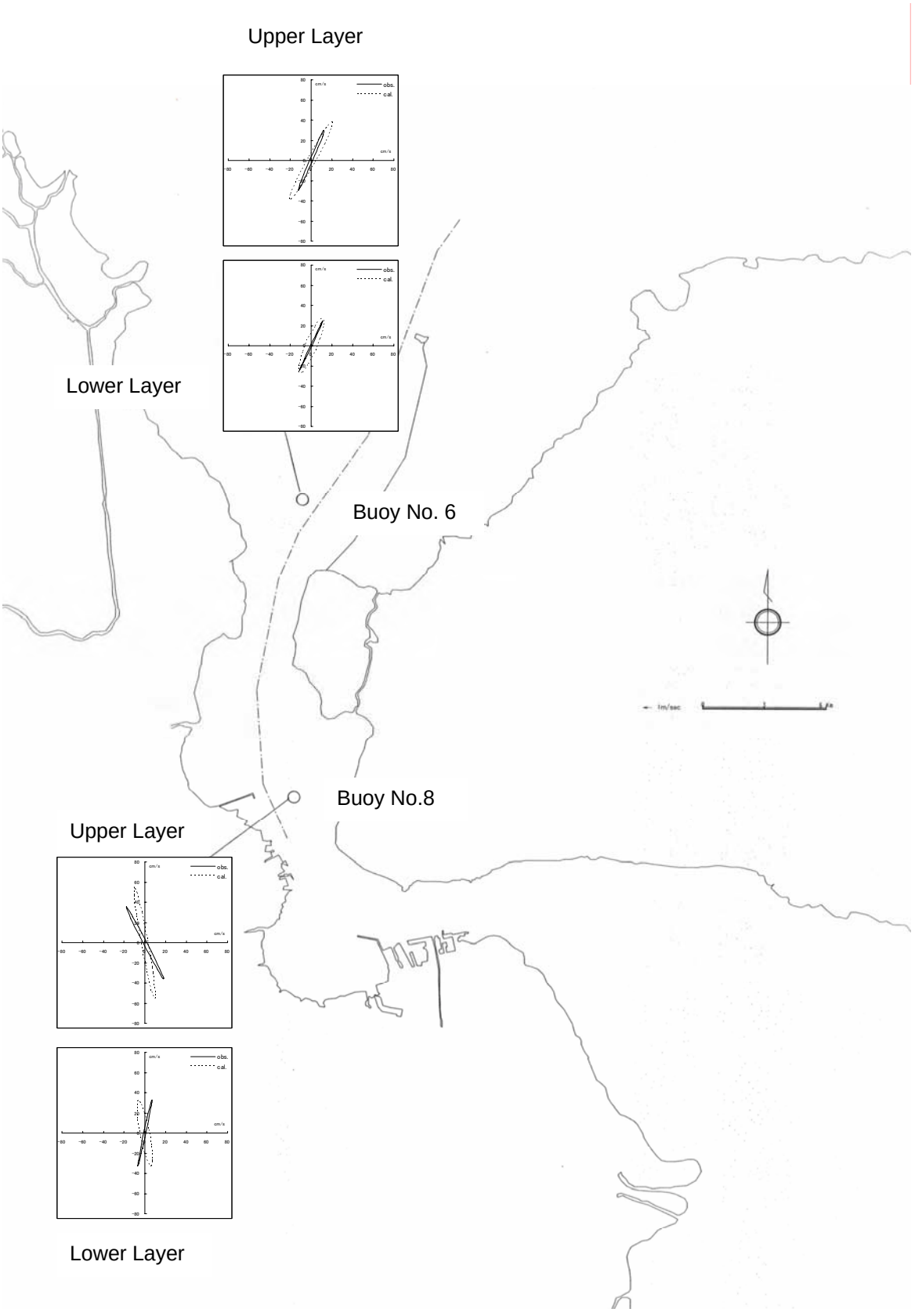
3) Re-production of Current Field

Comparison of the harmonic analysis of tidal currents between the observed tide ellipses and simulated ones at Buoy No. 6 and Buoy No. 8 is shown in Figure A.3.4. The re-production accuracy is considered very well.

Current vector distribution diagrams are drawn for all the cases of the simulations. The results for the strongest ebb and flood currents are summarized and presented in Figure A.3.5 to 8.

Figure A3.4 Comparison of Tidal Ellipses by Harmonic Analysis

(M2+S2 Components)

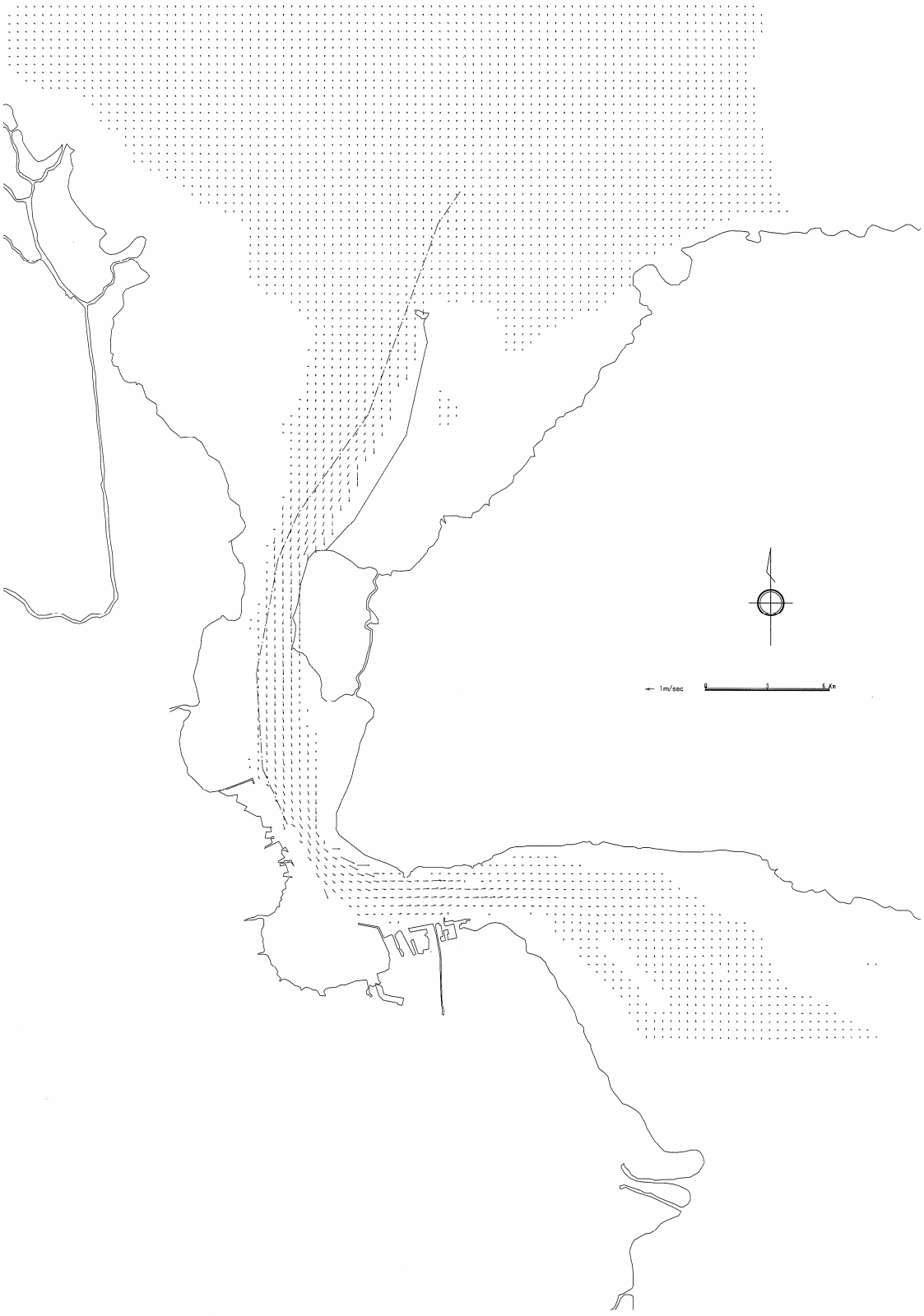


Source: JICA Study Team

Figure A3.5 Currents of Upper Layer for the Maximum Flood Current in Rainy Season

Source: JICA Study Team

Figure A3.6 Currents of Bottom Layer for the Maximum Flood Current in Rainy Season

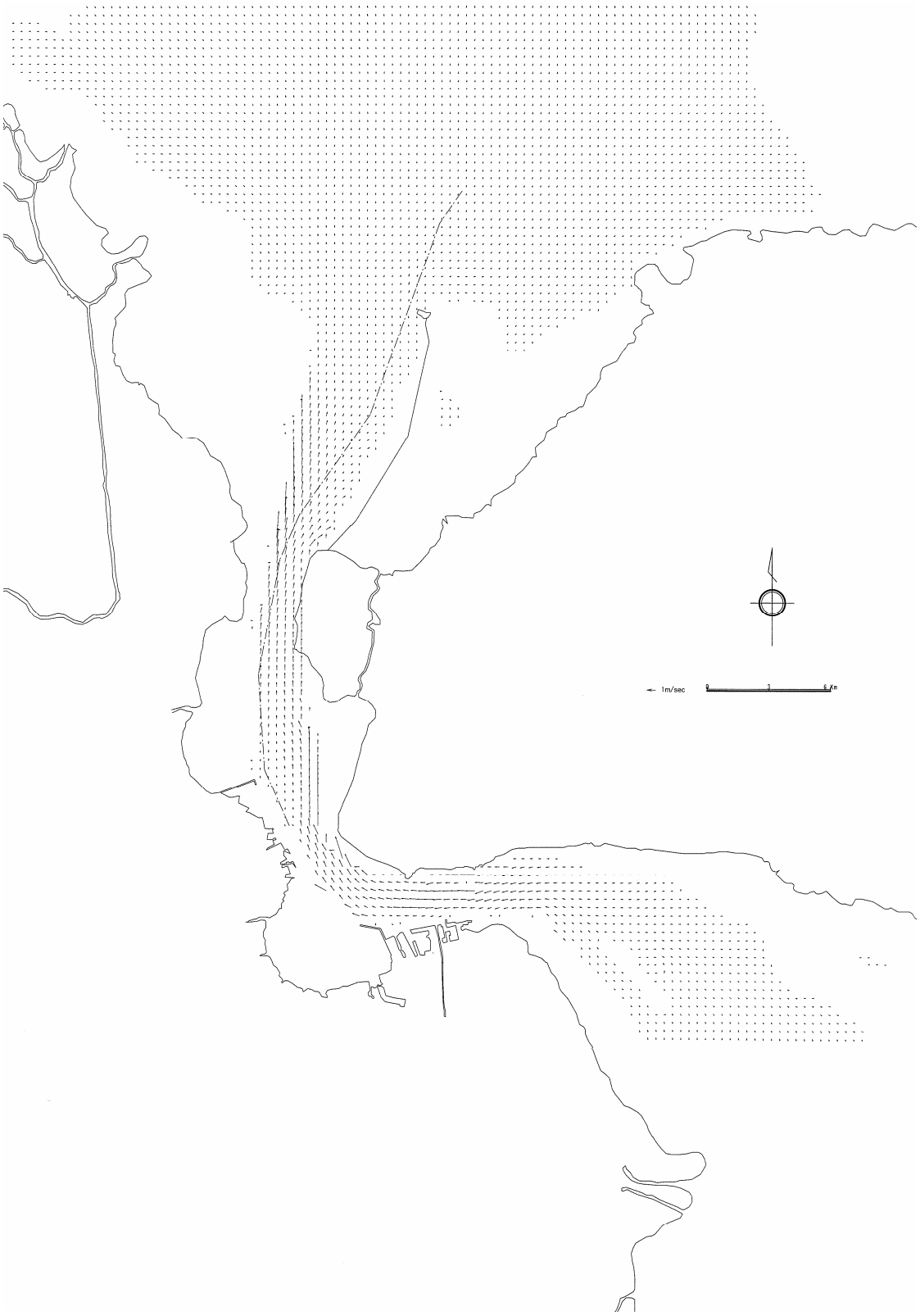


Source: JICA Study Team

Figure A3.7 Currents of Upper Layer for the Maximum Ebb Current in Rainy Season

Source: JICA Study Team

Figure A3.8 Currents of Bottom Layer for the Maximum Ebb Current in Rainy Season



Source: JICA Study Team

4) Re-production of Wave Fields

Wave conditions are simulated by applying the Global Wave Hindcast Method to the Java Sea. The calculations are carried out for a period of five years form January 2002 to December 2006, the result of which is summarized in Table A.3.2 and Table A.3.3.

Then, the average wave height of 0.87m and 0.54m are applied in the simulations for the dry season and the rainy season, respectively, as the case of the average maritime conditions.

Table A3.2 Average Energy Usual Waves at Offshore of Middle Java

Season	Month	Wave Height H_0 (m)	Wave Period T_0 (sec)	Direction (degrees)	Remarks
Dry	May - Oct.	0.87	4.0	82.4	
Rainy	Nov. - Apr.	0.54	4.3	302.0	

Note: Simulated period: Jan. 2002 to Dec. 2006. Wave direction is measured clockwise from the north.
Source: JICA Study Team

Table A3.3 Unusual Waves at Offshore of Middle Java

Season	Days	Wave Height H_0 (m)	Wave Period T_0 (sec)	Direction (degrees)	Remarks
Dry	5	2.00	5.0	90.0	
Rainy	5	2.00	5.0	270.0	

5) Result of Siltation Simulations in the Surabaya West Channel

The results of siltation simulations under the average wave conditions and the unusual wave conditions are shown in Figure A.3.9 to 12 at Zone 1 to 6.

The estimated soil volumes to be deposited in the channel are shown in Table A.3.4. Accumulation of soil is expected to occur form the entrance of the Surabaya West Channel (Zone 1 to Zone 6). Major reasons why large scale siltation can occur from Zone 1 to 6 are:

1. Due to sudden expansion of the flow after the water mass flows into the outer channel from the inner channel through the narrow outlet of the inner channel, the current slows down and loses the power to keep the suspended particles, resulting in sedimentation,
2. The composition of the bed materials at this area is mostly clay, and floating/movement of the particles is easy to occur, and
3. The current crosses the channel perpendicularly in this zone from relatively shallow water area to deeper channel with a depth of 12m, 14m and 16m, which is also accompanied by decrease in current speed, or loss of particle carrying capacity of water mass, resulting in settlement of suspended particles in the channel.

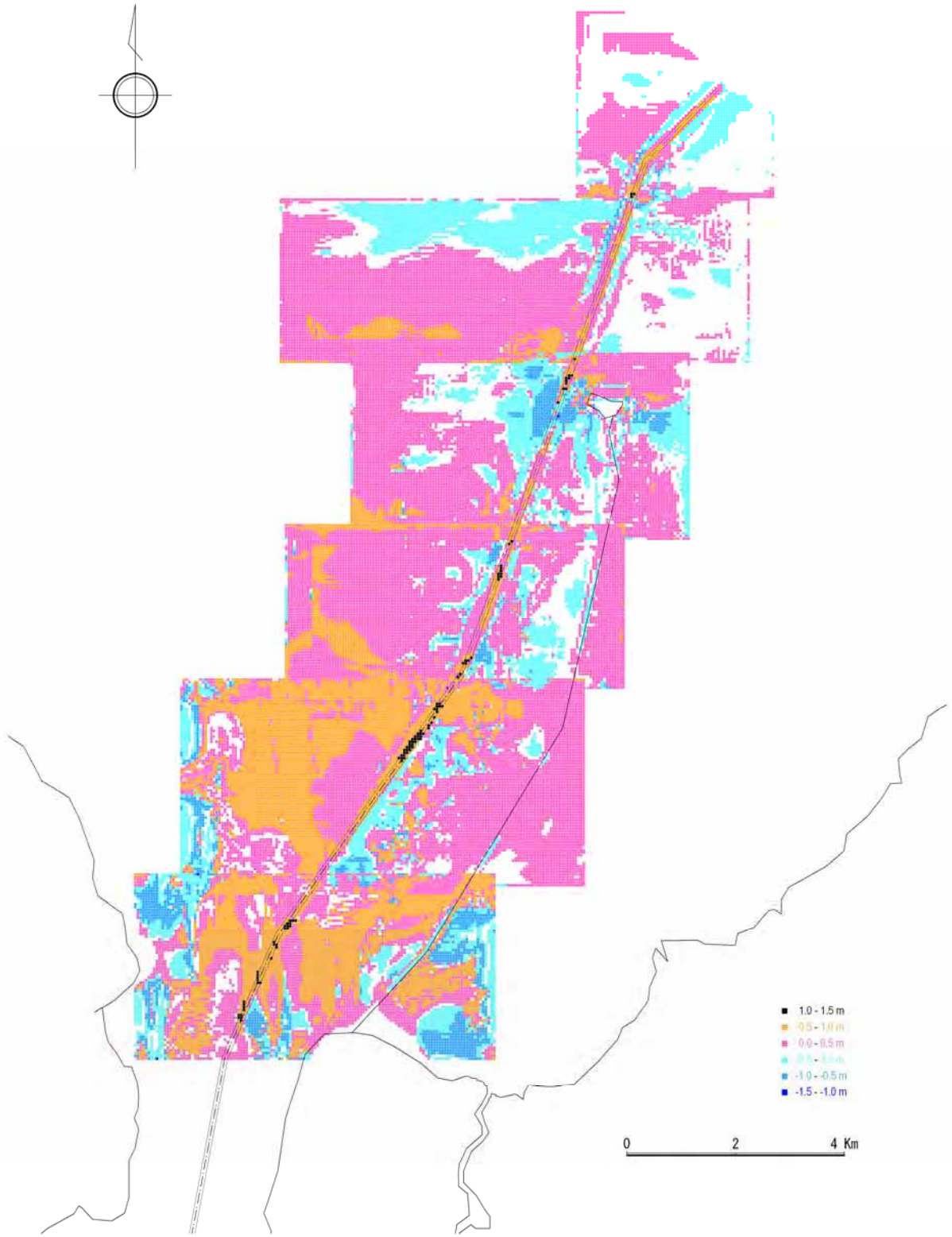
Table A3.4 Estimate of Soil Volume Deposited in the Surabaya West Channel

Zone	Estimated Total Siltation Volume (million m^3 p.a.)			Required Maintenance Dredging Volume (million m^3 p.a.)			Remarks
	W: 200m D: -12m	W: 300m D: -14m	W: 350m D: -16m	W: 200m D: -12m	W: 300m D: -14m	W: 350m D: -16m	
1	0.3	0.5	0.7	0.3	0.5	0.7	Buoy No.5, No.2
2	0.4	0.8	1.2	0.4	0.9	1.2	Buoy No.7
3	0.6	1.0	1.4	0.6	1.0	1.4	Karang Jamuang
4	0.6	0.9	1.5	0.6	0.9	1.5	Buoy No.9, No.11
5	0.5	0.8	1.1	0.5	0.8	1.1	Buoy No.6
6	0.5	0.6	0.7	0.01	0.1	0.3	Buoy No.13
Total	2.9	4.6	6.6	2.4	4.2	6.2	

Source: JICA Study Team

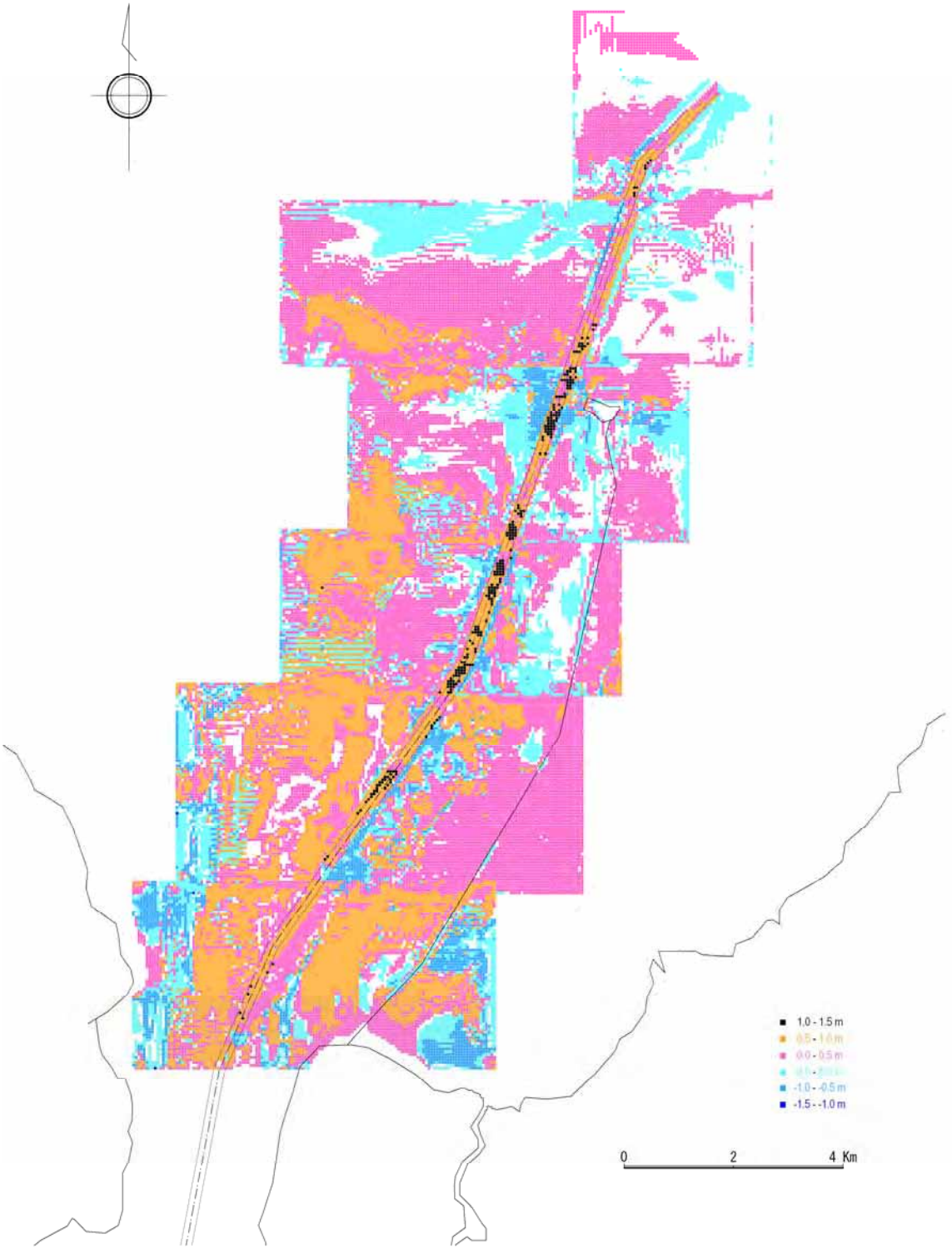
Figure A3.9 Distribution Chart of Water Depth Change

(Channel Depth: -10m, Channel Width: 100m)



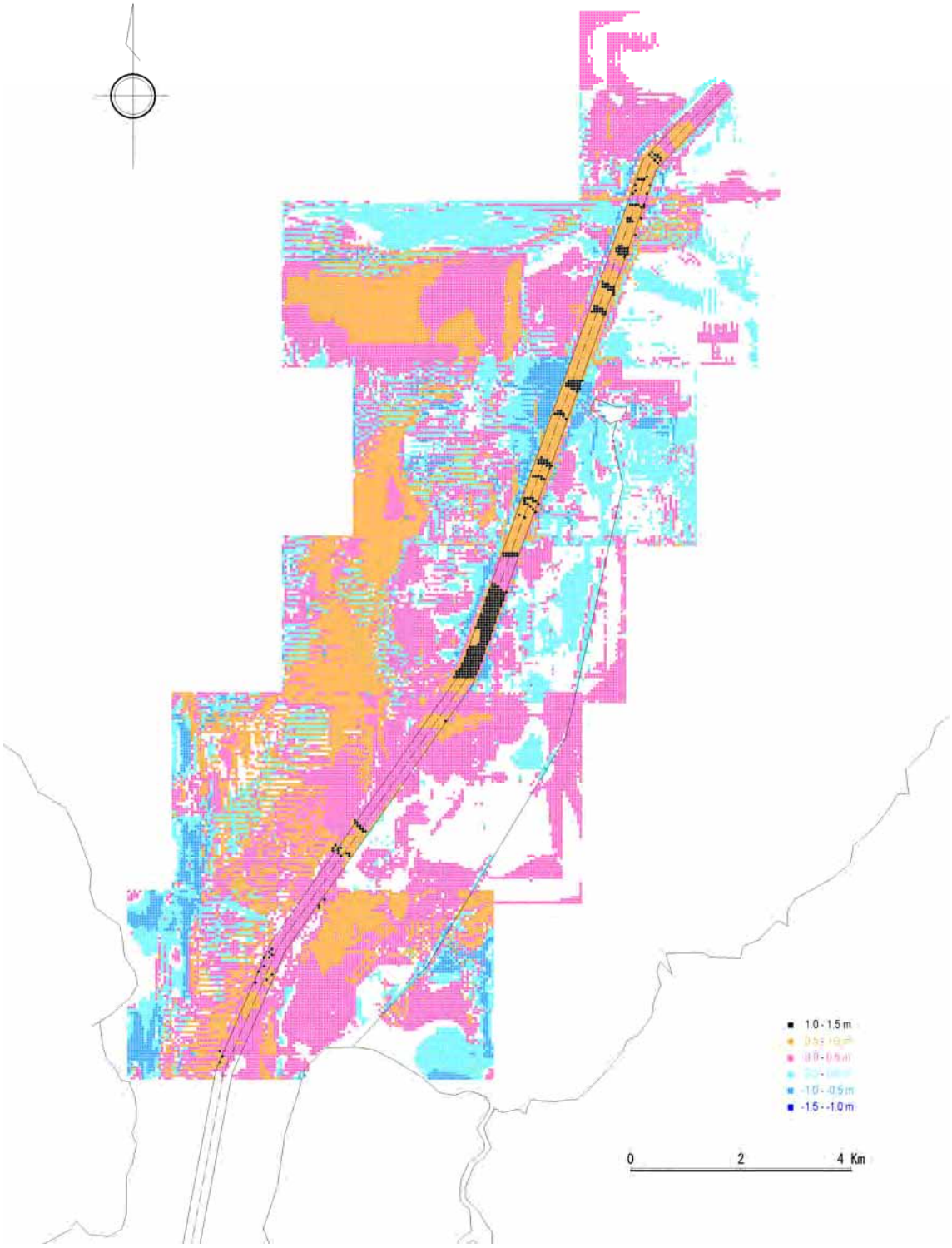
Source: JICA Study Team

Figure A.3.10 Distribution Chart of Water Depth Change
(Channel Depth: -12m, Channel Width: 200m)



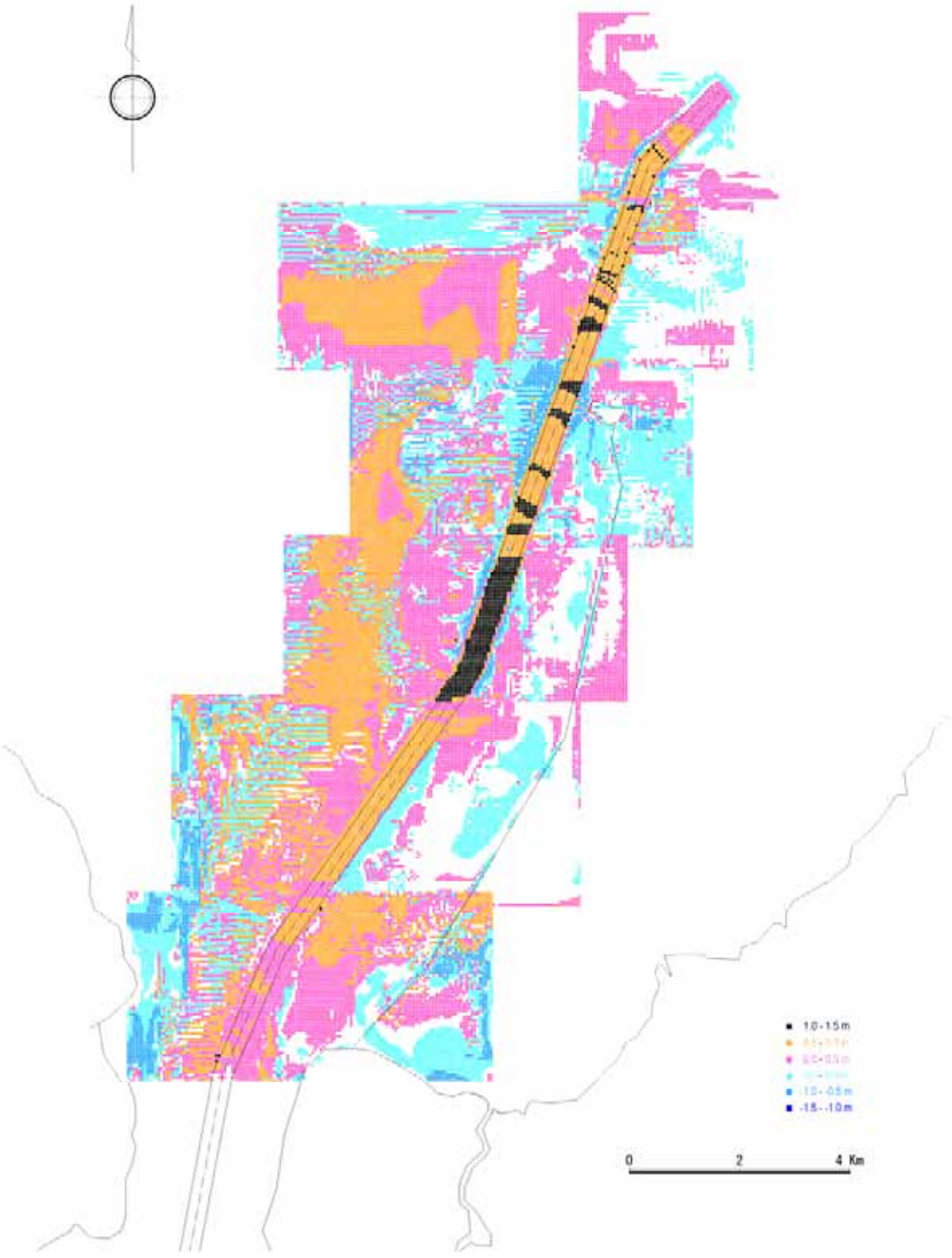
Source: JICA Study Team

Figure A.3.11 Distribution Chart of Water Depth Change
(Channel Depth: -14m, Channel Width: 300m)



Source: JICA Study Team

Figure A.3.12 Distribution Chart of Water Depth Change
(Channel Depth: -16m, Channel Width: 350m)



Source: JICA Study Team