(5) Parameters

Table 23.1.1 shows some of the parameters used for this modeling.

Table 23.1.1 Parameters for Calculation (Current Flow Simulation)

Items	Description	Remarks
Eddy Viscosity Coefficient	5.0×10^4 cm^2 / sec	
Effluent from Industrial Origin	a) Present: None b) Future Plan: 17,951.6 m^3 / day (Maximum flow per day)	a) Figure 23.1.3 shows the location of discharging point. b) Volume for the future plan was estimated from Master Plan Level 2 Case scenario.
Time Step	6 sec	
Simulation Period	a) Tidal Current: 240 hours / 10 tide cycle b) Mean Current: 24 hours	

Table 23.1.2 shows some of the parameters used for this modeling.

Table 23.1.2 Parameters for Calculation (Water Pollution Simulation)

Items	Description	Remarks
Diffusion Coefficient	a) K_x, K_y: 5.0×10^4 cm^2 / sec b) K_z: 5.0 cm^2 / sec	
Pollution Loading Amount (COD (Mn))	a) Present: None b) Future Plan: 423.1 Kg / day (Discharging from lower layer) (Maximum flow per day)	a) Figure 23.1.3 shows the location of discharging point. b) Volume for the future plan was estimated from Master Plan Level 2 Case scenario.
Time Step	300 sec	
Simulation Period	1,440 hours (60 tide cycle)	

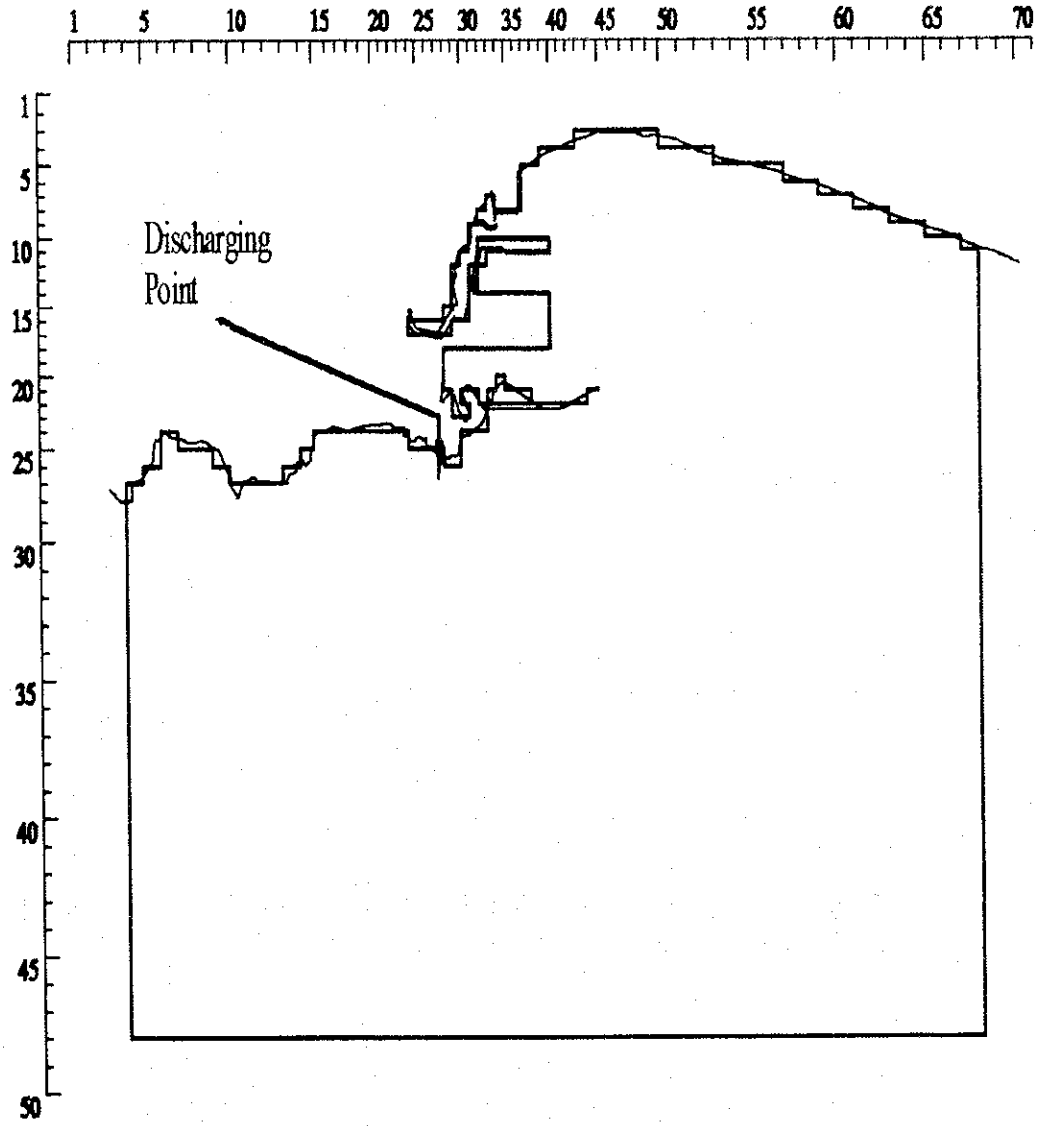


Figure 23.1.3 Location of Discharging Point

23.1.3 Results of Simulation for Current Flow

(1) Present Current Conditions

Based on the previous model setting, the simulation was carried out. The results of simulation and actual current observation data are shown in Figure 23.1.4.

The result of simulation for present current condition was shown in Figure 23.1.5. The area of this figure shows the region around the Salalah Port as centered for the simulation modeling that covers in 10 km to the coastal line around N-S direction and 14 km parallel to the coastal line around E-W direction.

This figure presents the time of tide when the maximum current occurs such as the case of K1 component and the mean current flowed same direction. For simulation case, this is for high tide in Case 1 and low tide in Case 2, respectively.

(2) Future Current Conditions

Current pattern after the completion of the future planning was predicted, and the results are shown in Figure 23.1.6.

(3) Comparison

The difference of current between the future planning and the present current conditions were calculated, and the results are shown in Figure 23.1.7.

(4) Results and Conclusion

Based on the results of previous simulation, the impact of the future plan for the current change was evaluated as follows.

1) Extension of offshore breakwater causes a kind of shelter effect on the current pattern in the area within 5 km northeast of Salalah Port. In this area, about less than 1 cm/s to 10 cm/s of reduction of current speed was predicted.

2) The change of current speed over 5 cm/s was limited to the area within 3 km offshore of breakwater to new container berth area.

Therefore, an adverse effect by the future plan proposed by this Master Plan Study is fairly small, only limited to the area of inside of the breakwater and new container berth area.

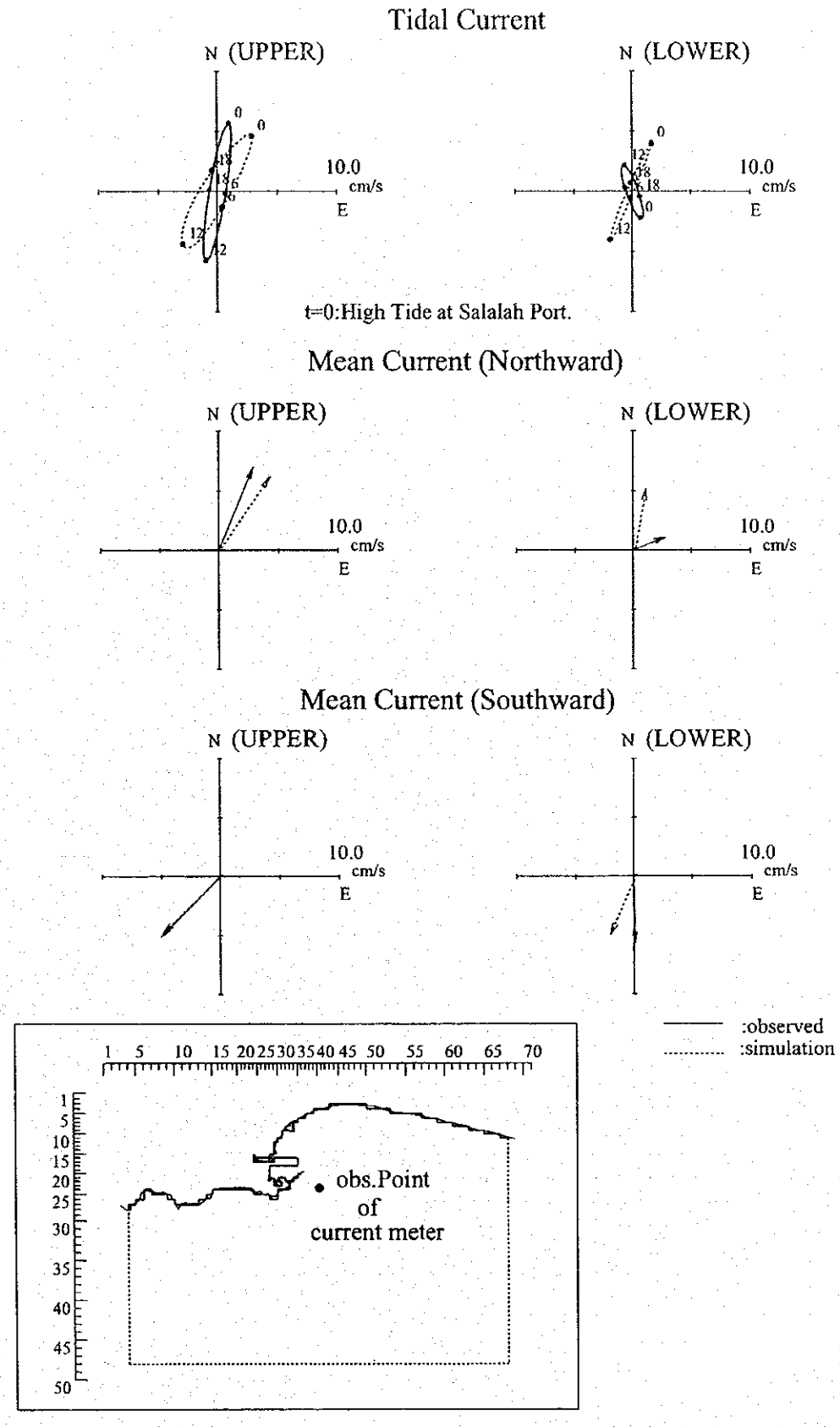


Figure 23.1.4 Results of Comparsion of Actual Current Observation Data and Simulation Modeling

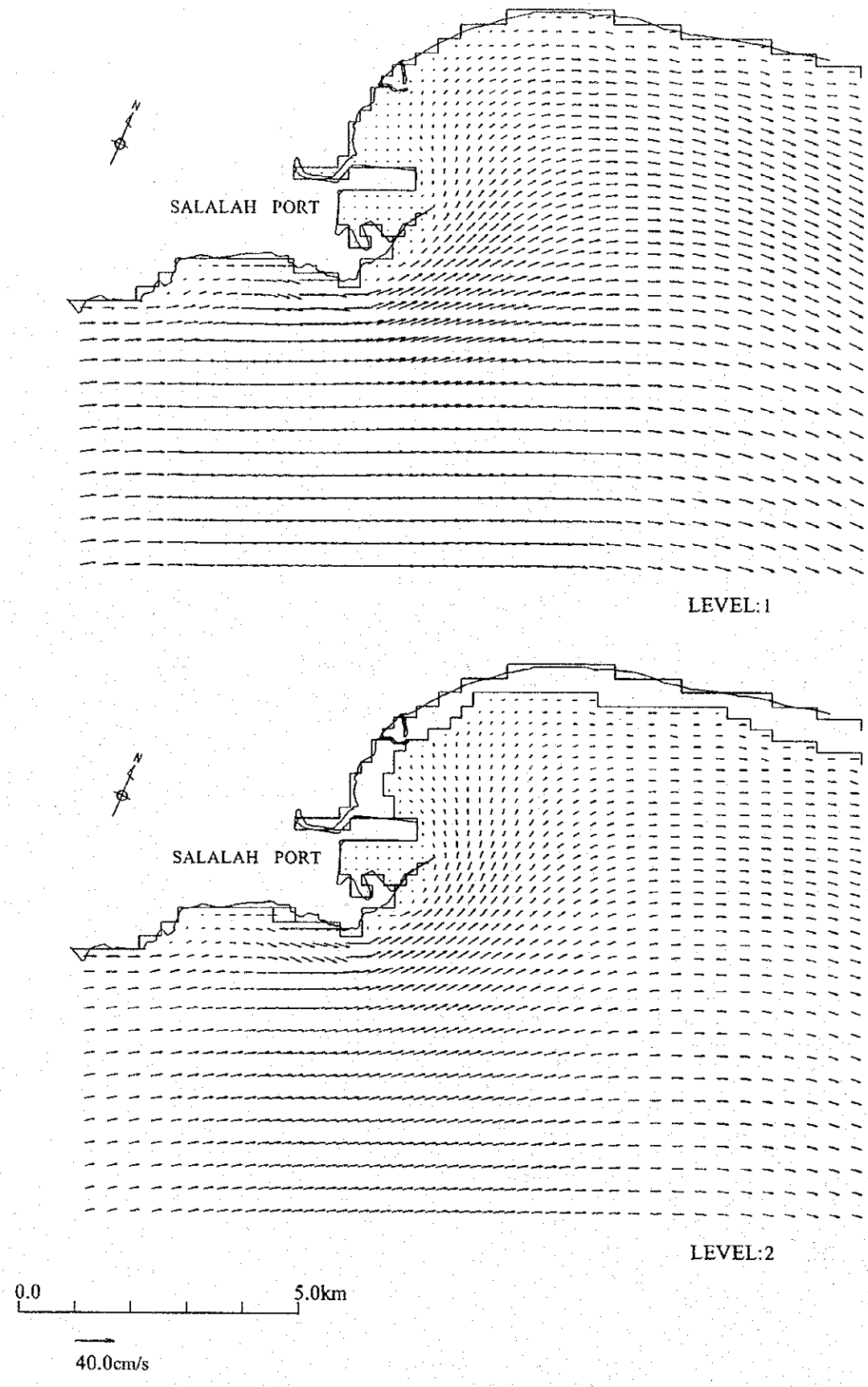


Figure 23.1.5 (1) Results of Simulation for Present Current Conditions (Northward:High Water)

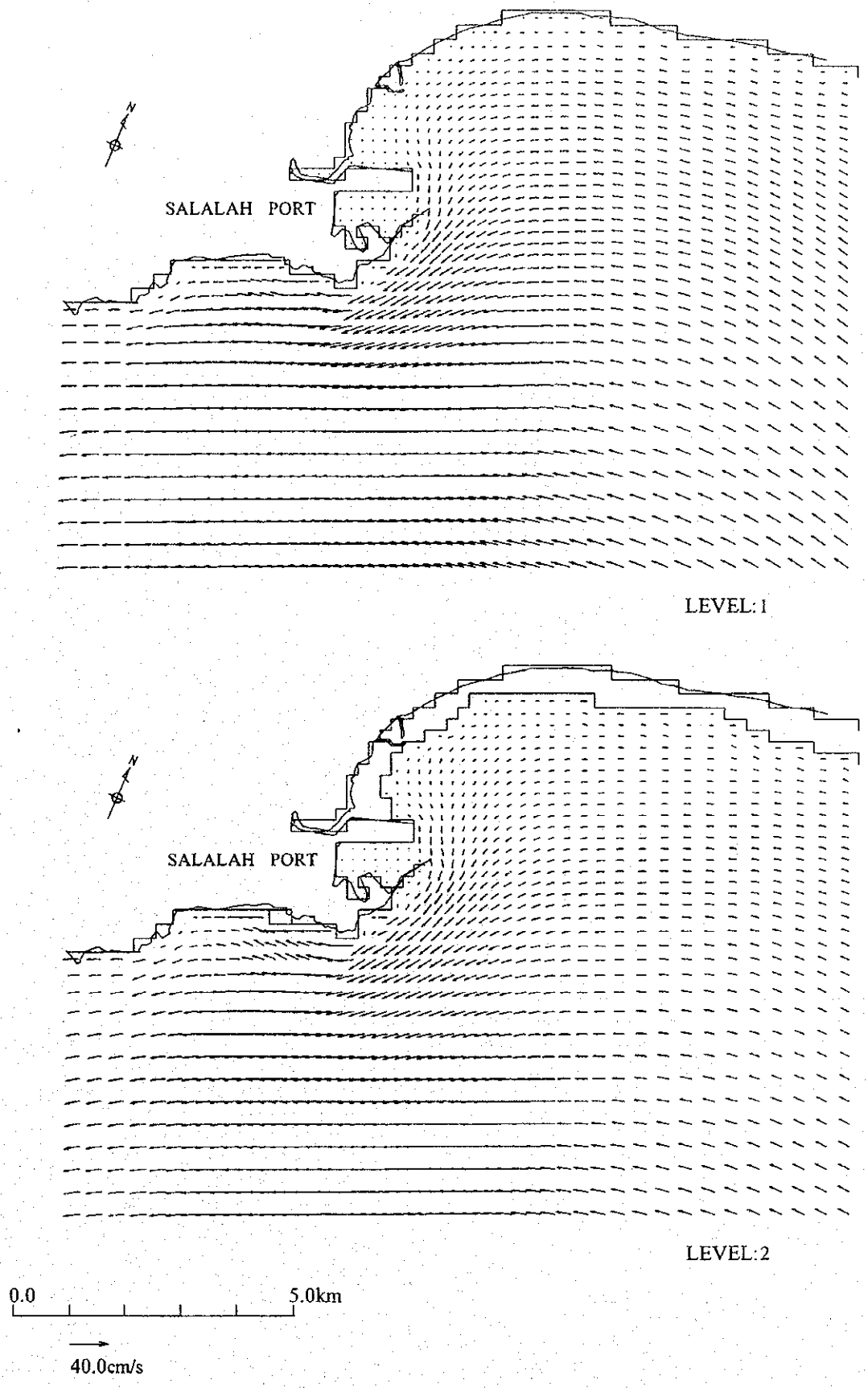


Figure 23.1.5 (2) Results of Simulation for Present Current Conditions (Southward:Low Water)

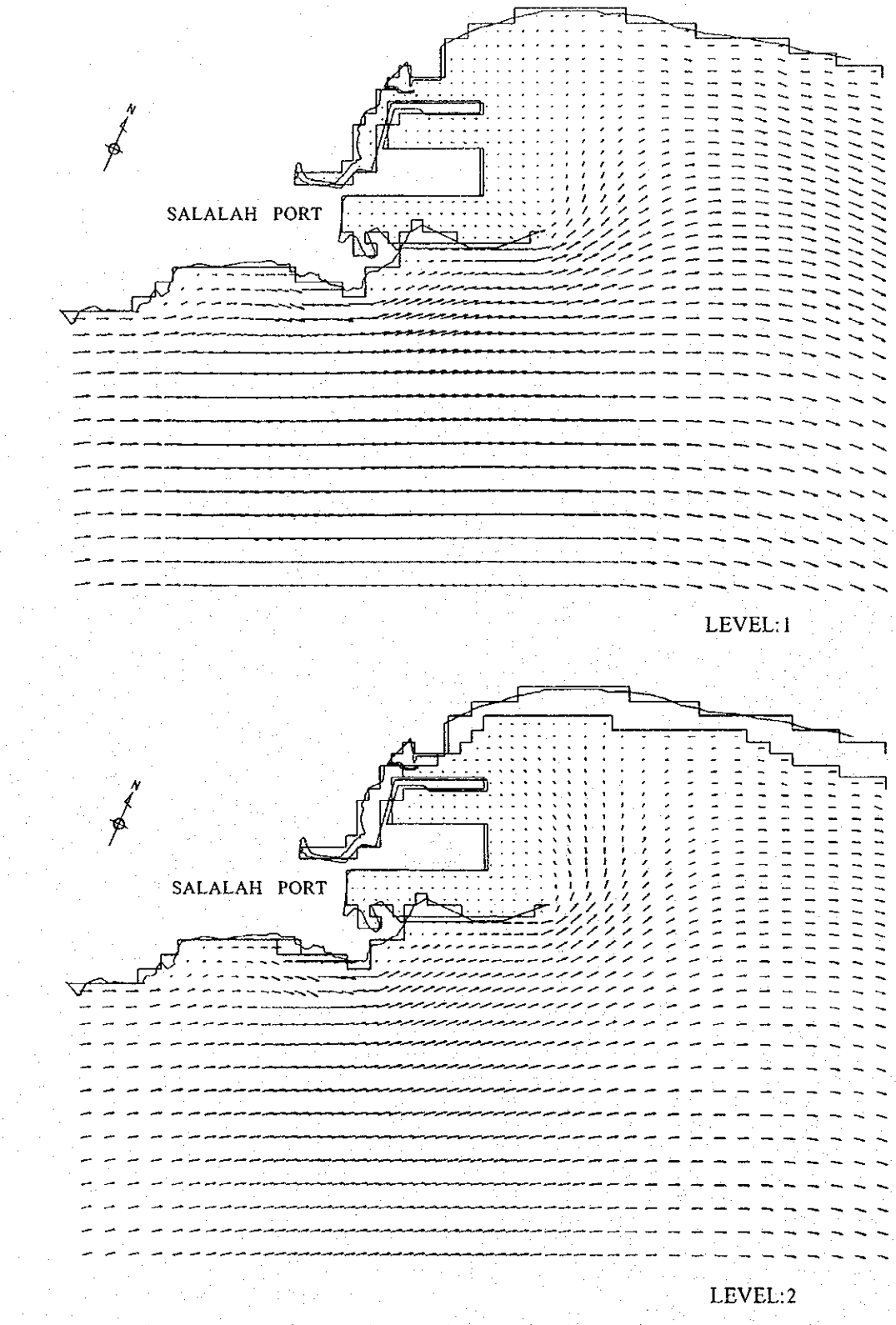


Figure 23.1.6 (1) Results of Simulation for Future Plan Current Conditions (Northward:High Water)

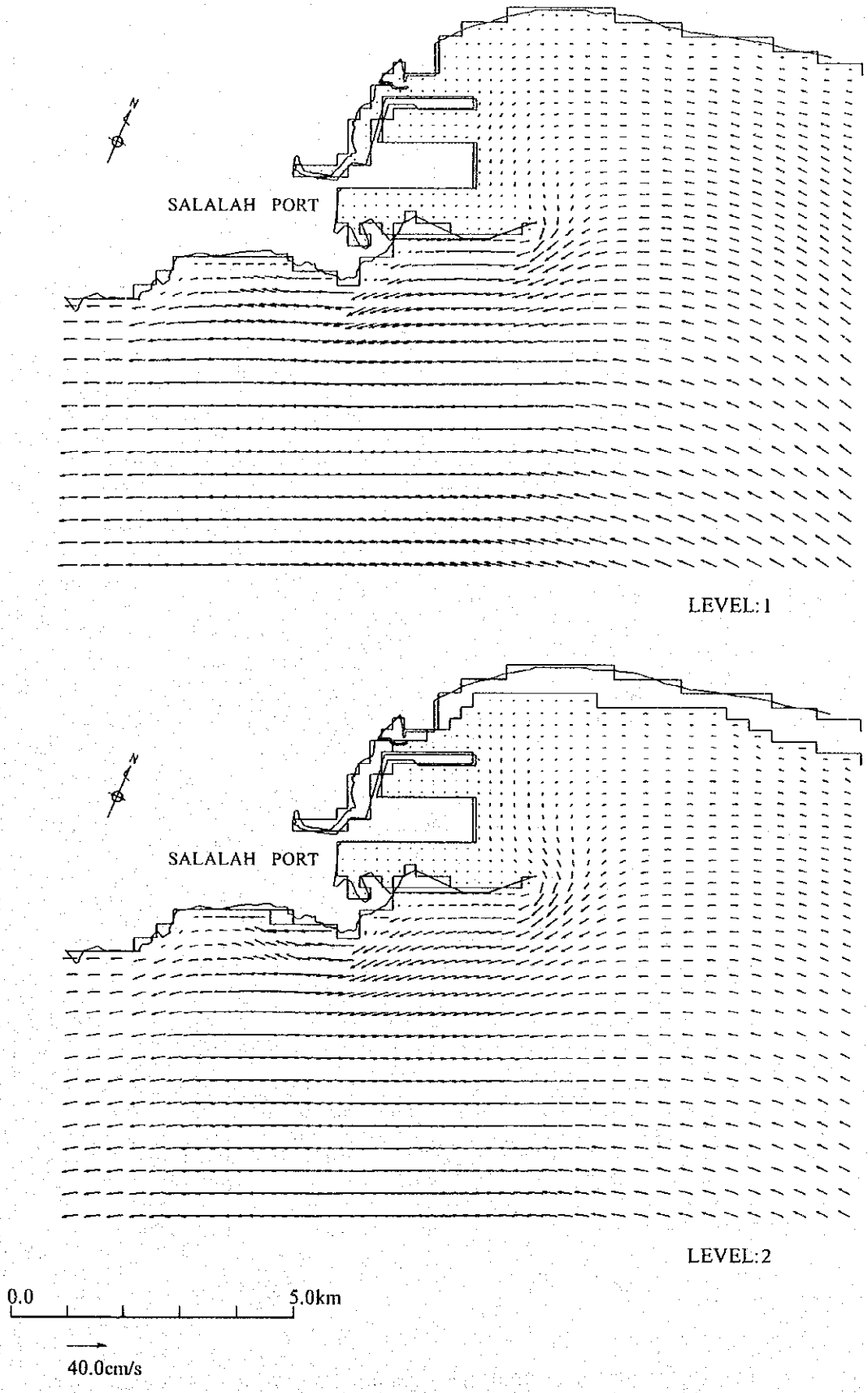
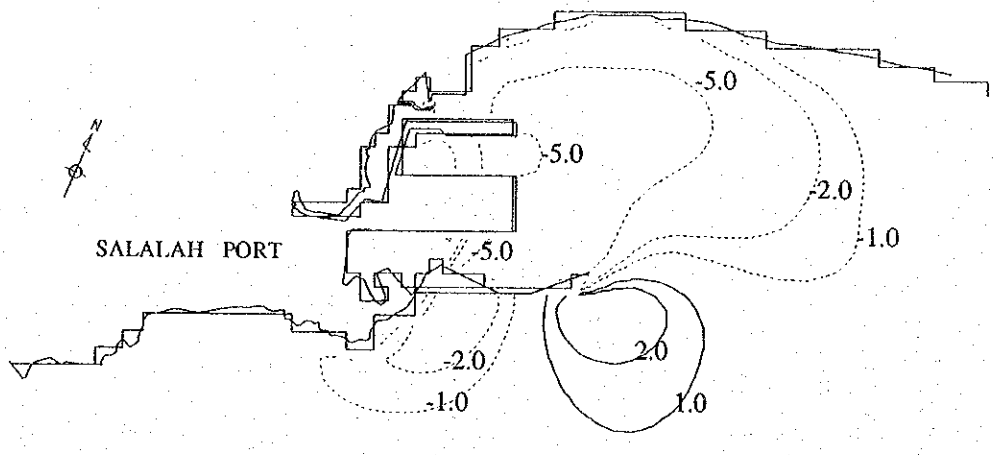
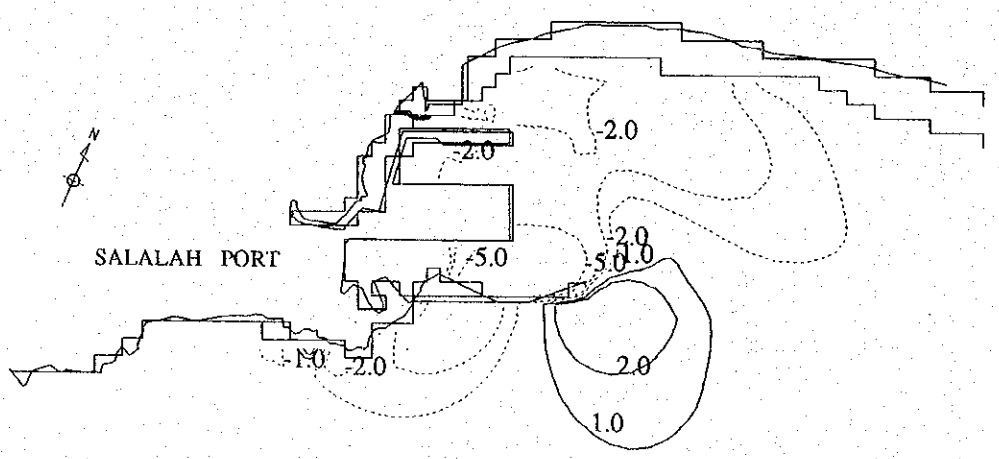


Figure 23.1.6 (2) Results of Simulation for Future Plan Current Conditions (Southward:Low Water)



LEVEL:1



LEVEL:2

Remarks:
Red Solid Line: (Future) - (Present) > 0
Bule Broken LIne: (Future) - (Present) < 0

(Velocity : cm/s)

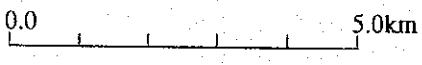
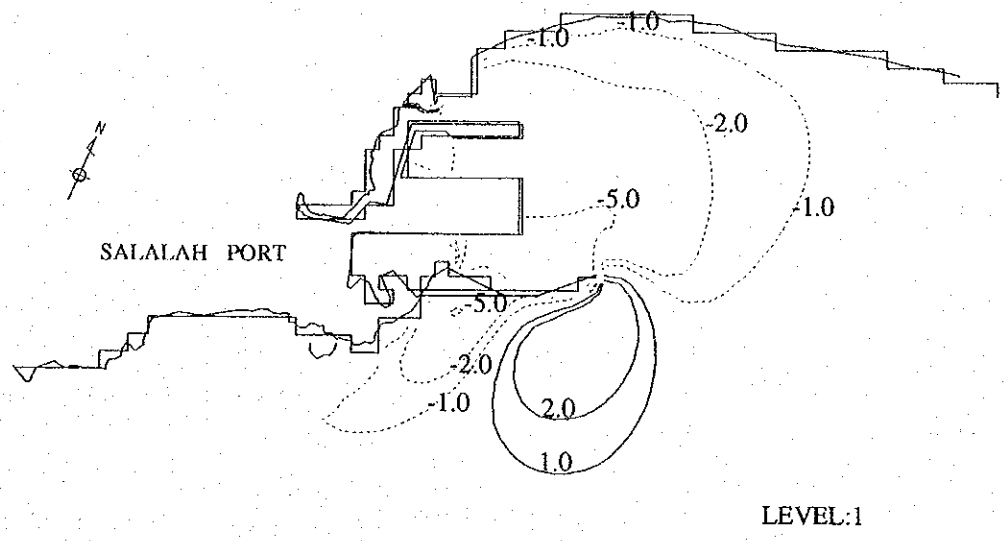
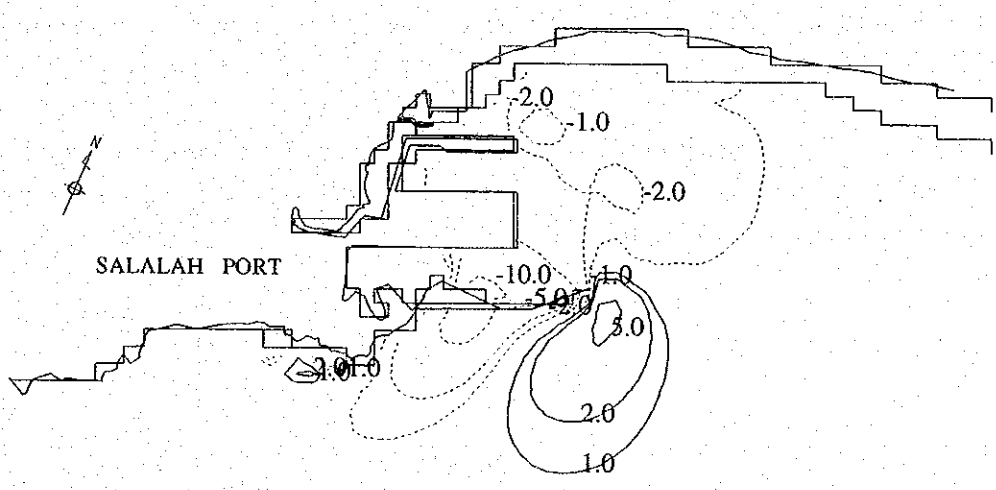


Figure 23.1.7 (1) Difference of Current Speed Comparing Present and Future Plan (Northward:High Water)



LEVEL:1



LEVEL:2

Remarks:
Red Solid Line: (Future) - (Present) > 0
Bule Broken LIne: (Future) - (Present) < 0

(Velocity : cm/s)

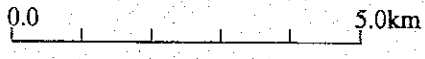


Figure 23.1.7 (2) Difference of Current Speed Comparing Present and Future Plan (Southward:Low Water)

23.1.4 Results of Simulation for Water Pollution

Distribution on COD (Mn) concentration were calculated on the following two (2) conditions:

(1) Mean COD (Mn) Concentration within One (1) Tide Cycle
(2) Maximum COD (Mn) Concentration

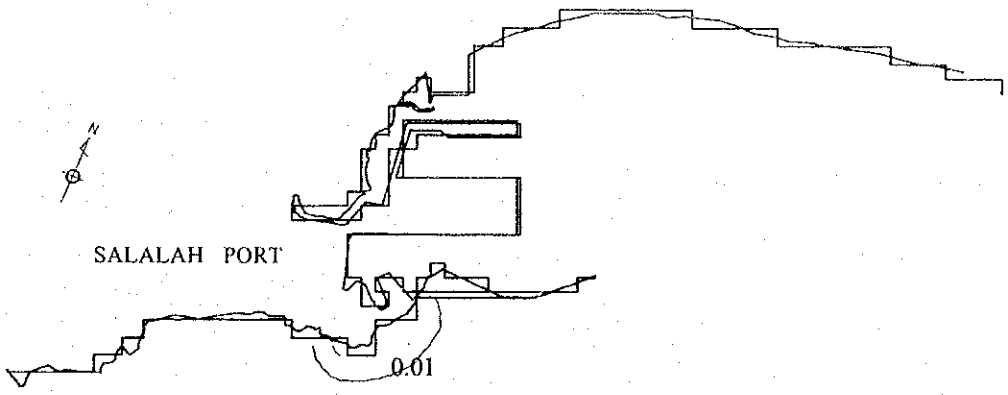
These results are shown in Figure 23.1.8 and Figure 23.1.9, respectively. The area of this figure shows the region around the Salalah Port as centered for the simulation modeling that covers in 10 km to the coastal line around N-S direction and 14 km parallel to the coastal line around E-W direction.

Based on these results, the impact of the future plan for the water pollution was evaluated as follows.

(1) Since the location of discharging point faced to the open sea, there was no significant impact on the Study Area by the future plan of the Port as well as its hinterland development.

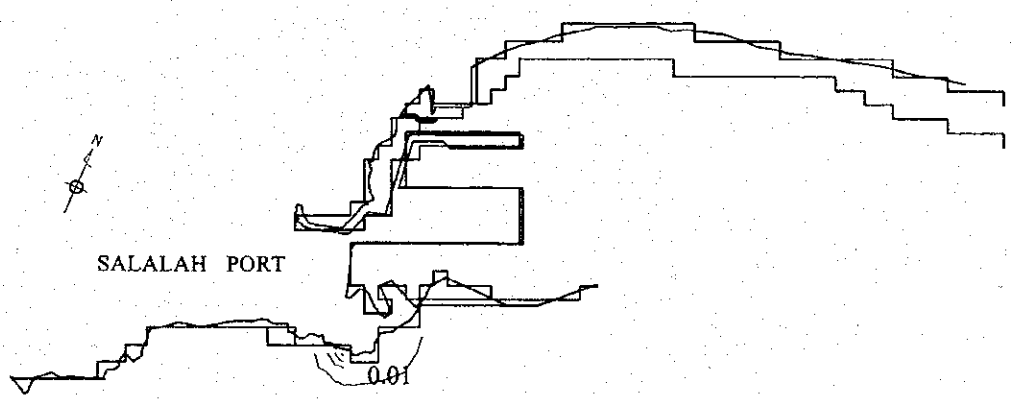
(2) A slight increase of COD (Mn) concentration was predicted; however, it was an order of 0.2 mg/l in the entire Study Area.

(3) As predicted in the current flow simulation, the inside of the breakwater area becomes a closed water area after completion of extension; however, there was almost no increase of COD (Mn) concentration in this area.



Max :0.07 mg/L

LEVEL:1



Max :0.16 mg/L

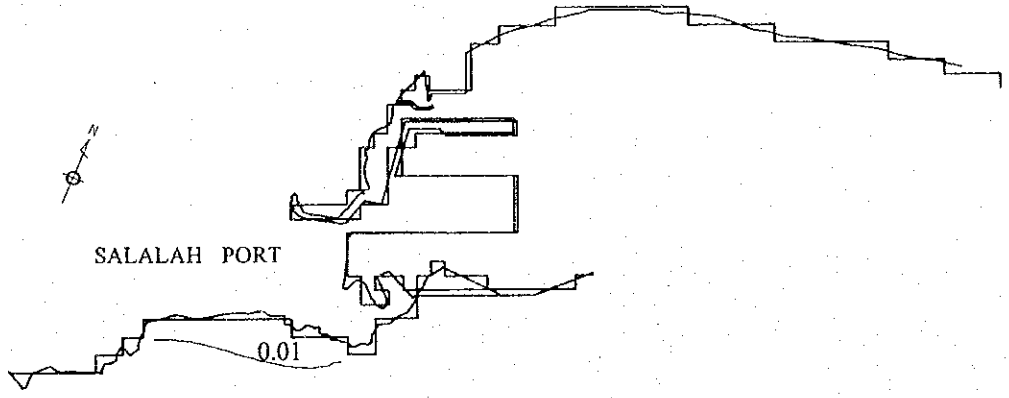
LEVEL:2

Contour Interval of COD (Mn) and Conversion Table to COD (Cr)						
COD (Mn)	0.01	0.05	0.10	0.15	0.20	0.30
COD (Cr)	0.27	1.35	2.70	4.05	5.40	8.11
Remarks: Conversion factor: COD (Mn) to COD (Cr) is 27.027						

(Unit: mg/L)

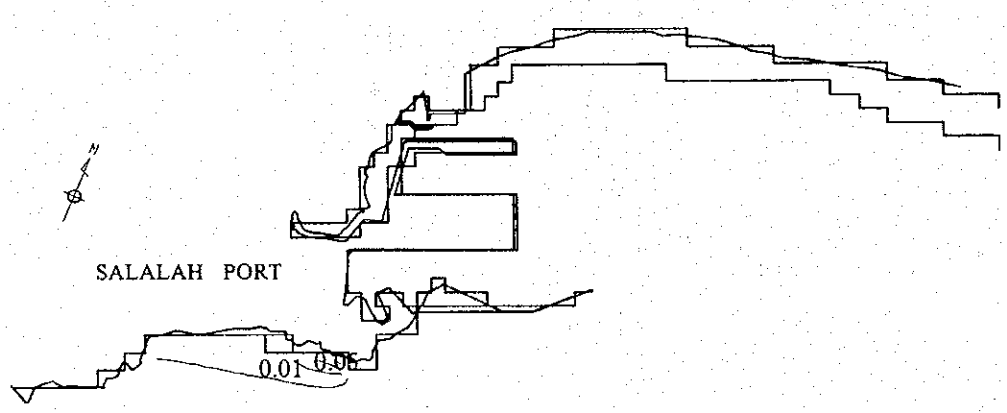
0.0 5.0km

Figure 23.1.8 (1) Distrbution for Mean COD (Mn) Consentration within One Tide Cycle (Norathward)



Max :0.04 mg/L

LEVEL:1



Max :0.18 mg/L

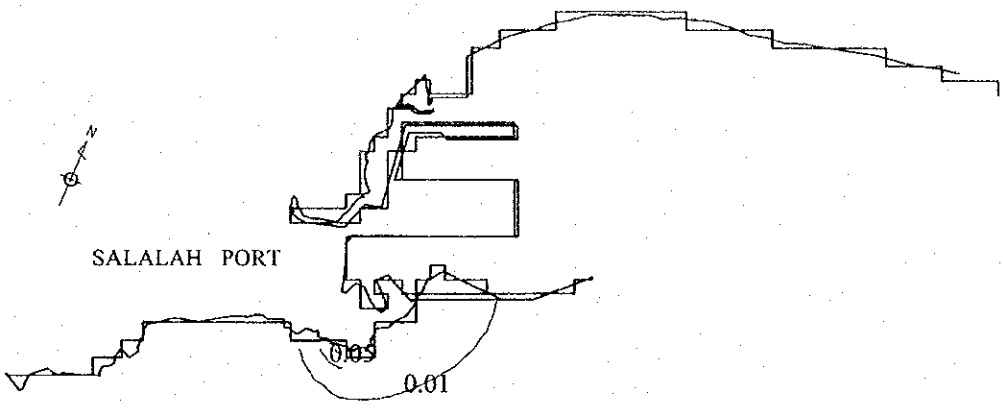
LEVEL:2

Contour Interval of COD (Mn) and Conversion Table to COD (Cr)						
COD (Mn)	0.01	0.05	0.10	0.15	0.20	0.30
COD (Cr)	0.27	1.35	2.70	4.05	5.40	8.11
Remarks: Conversion factor: COD (Mn) to COD (Cr) is 27.027						

(Unit: mg/L)

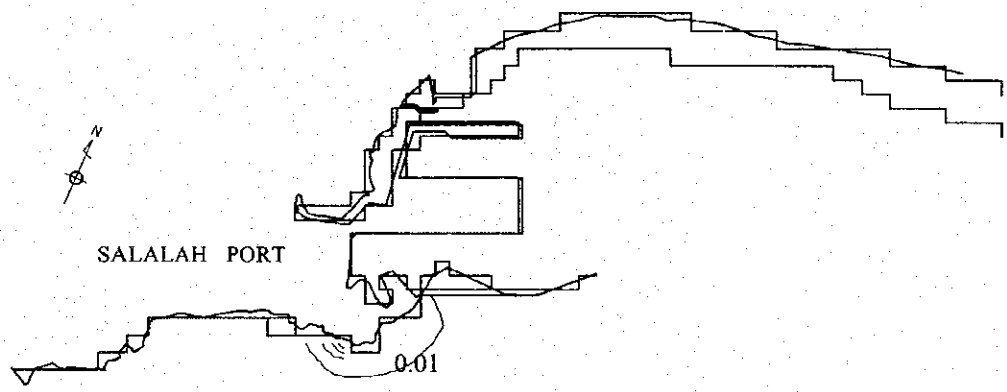
0.0 5.0km

Figure 23.1.8 (2) Distrbution for Mean COD (Mn) Consentration within One Tide Cycle (Southward)



Max :0.12 mg/L

LEVEL:1



Max :0.19 mg/L

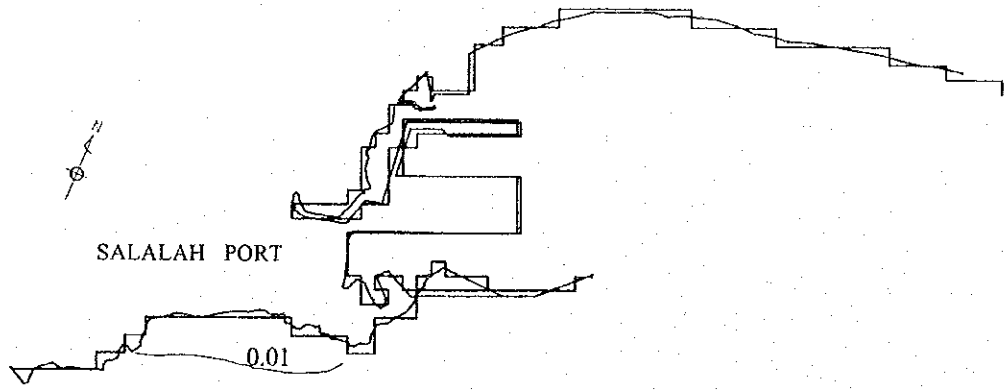
LEVEL:2

Contour Interval of COD (Mn) and Conversion Table to COD (Cr)						
COD (Mn)	0.01	0.05	0.10	0.15	0.20	0.30
COD (Cr)	0.27	1.35	2.70	4.05	5.40	8.11
Remarks: Conversion factor: COD (Mn) to COD (Cr) is 27.027						

(Unit: mg/L)

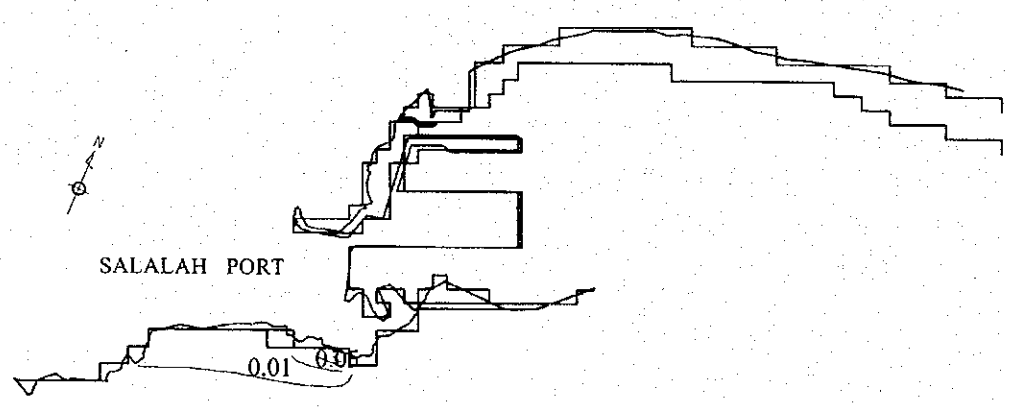
0.0 5.0km

Figure 23.1.9 (1) Distribution for Maximum COD (Mn) Consentration (Northward)



Max :0.05 mg/L

LEVEL:1



Max :0.20 mg/L

LEVEL:2

Contour Interval of COD (Mn) and Conversion Table to COD (Cr)						
COD (Mn)	0.01	0.05	0.10	0.15	0.20	0.30
COD (Cr)	0.27	1.35	2.70	4.05	5.40	8.11
Remarks: Conversion factor: COD (Mn) to COD (Cr) is 27.027						

(Unit: mg/L)

0.0 5.0km

Figure 23.1.9 (2) Distribution for Maximum COD (Mn) Consentration (Southward)

23.2 Coastal Erosion

23.2.1 General

A computer simulation modeling was used to predict long-term coastal erosion and shoreline change whether it is caused by the port expansion of Salalah Port proposed by the Master Plan of this Study.

This primarily evaluates the impact on change of coastal line near the Salalah Port by developing the Port facility that is based on the future plan up to the year of 2020 and beyond this target year.

23.2.2 Modeling

For the initial shoreline of bathymetry and topography for modeling, the nautical chart published by the Hydrographic Office of the U.K. in 2000 (Chart No. 2896) was adopted.

(1) Area

Area for calculation was set in 12 km to the coastal line roughly oriented to N-S direction and 18 km parallel to the coastal line roughly oriented to E-W direction.

(2) Grid Size

1) Spacing: $\Delta S = 100$ m

2) Number of Grid: 180 (100 m × 180 = 18,000 m) in X-direction
120 (100 m × 120 = 12,000 m) in Y-direction

Figure 23.2.1 shows the grid size and the area for modeling.

(3) Model

A model based on the one-line theory was adopted for this simulation. Equation for modeling used for this simulation is shown in Equation 23.2.1.

Equation 23.2.1

(1) Equation of Continuity for Sediment Transport

$$\frac{\partial Q}{\partial x} + h \cdot \frac{\partial y}{\partial T} = 0$$

where Q: Sediment transport rate per unit time
h: Beach profile height
T: Time for calculation

(2) Sediment Transport Rate

$$Q = A_1 \cdot E_b \cdot C_{Gb}\left(\sin 2\alpha_b - A_2 \frac{\partial H_b}{\partial x} \cot \beta \cos \alpha_b \right)$$

where Q: Sediment transport rate per unit time
A_1, A_2: Coefficient of sediment transport rate
E_b: Energy by wave per unit area
C_{Gb}: Group velocity
α_b: Angle between shoreline and wave crest
H_b: Wave height
β: Inclination of seabed

(3) Coefficient of Sediment Transport Rate (Kozasa and Brampton's)

$$A_1 = \frac{0.385}{\gamma_s},,, A_2 = 3.24$$

These coefficients were fit to the area for modeling during the test run of simulation model.

(4) Angle of breaker to shoreline

$$\alpha_b = \alpha_x - \tan^{-1} \frac{\partial y}{\partial x}$$

(4) Wave Conditions

The mean energy wave was adopted as exerting force for the simulation modeling. Since there was no reliable data of wave observation for calculating the mean energy wave for this purpose, the data of wave hindcast by JWA-3G, WAM model described in Chapter 8.2.4 was used. The following table shows the incidents wave parameters for this simulation.

Table 23.2.1 Incident Wave Parameters

Wave Condition	Wave Height (m)	Period (Sec)	Incident Angle (Deg.)
Mean Energy Wave **S - direction**	2.0	6.4	S±0.0

On Table 23.2.1, the south direction of wave was selected that was predominant wave direction among the wave appearance in the Study Area.

(5) Simulation Cases

The following three (3) cases were simulated for this Study, and these are shown in Figure 23.2.2, respectively.

Table 23.2.2 Simulation Cases

CASE	Port Layout	Purpose
CASE 0	Year 1980	Nautical chart of U.S. of 1980 (No. 62313) was selected as the initial shoreline of bathymetry and topography for the modeling. 20 years span of shoreline change up to year 2000 was simulated, and the results of this simulation were checked by the survey results of coastal erosion conducted during Phase 2 Study.
CASE 1	Short Term Plan: Plan B (Year 2005)	Nautical chart of U.K. in 2000 (Chart No. 2896) was selected as the initial shoreline of bathymetry and topography for the modeling. 15 years span of shoreline change staring year 2005 and up to year 2020, the target year of the future plan completion, was simulated.
CASE 2	Future Plan (Year 2020)	5 years and 10 years span of shoreline change after the completion of future plan, year 2020, were simulated.

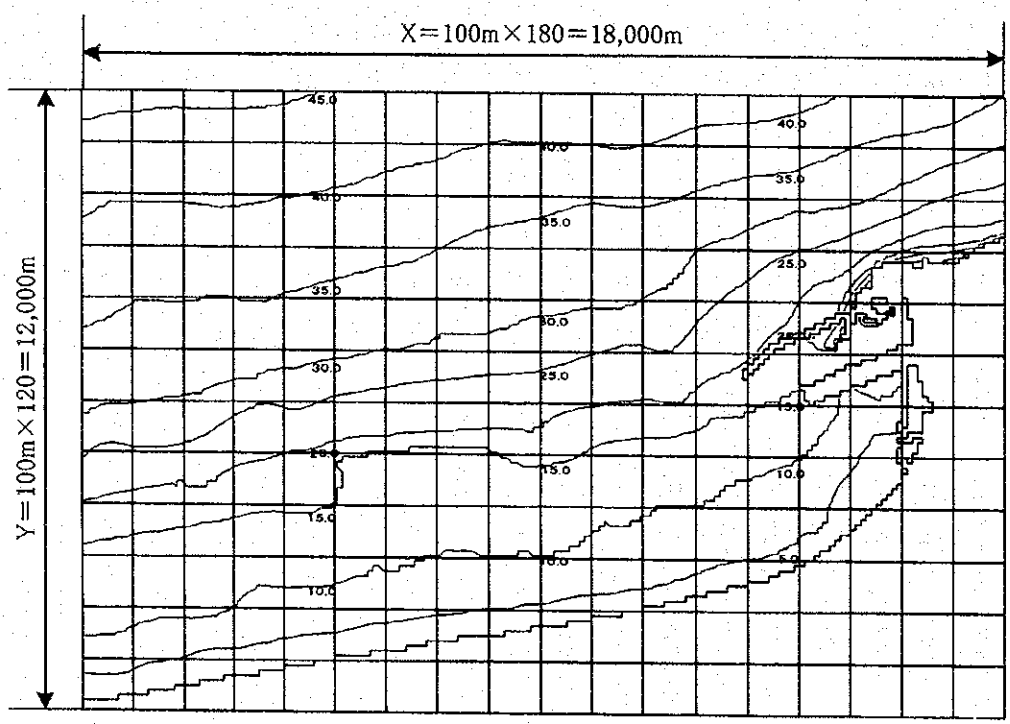


Figure 23.2.1 Grid Size and Area for Modeling

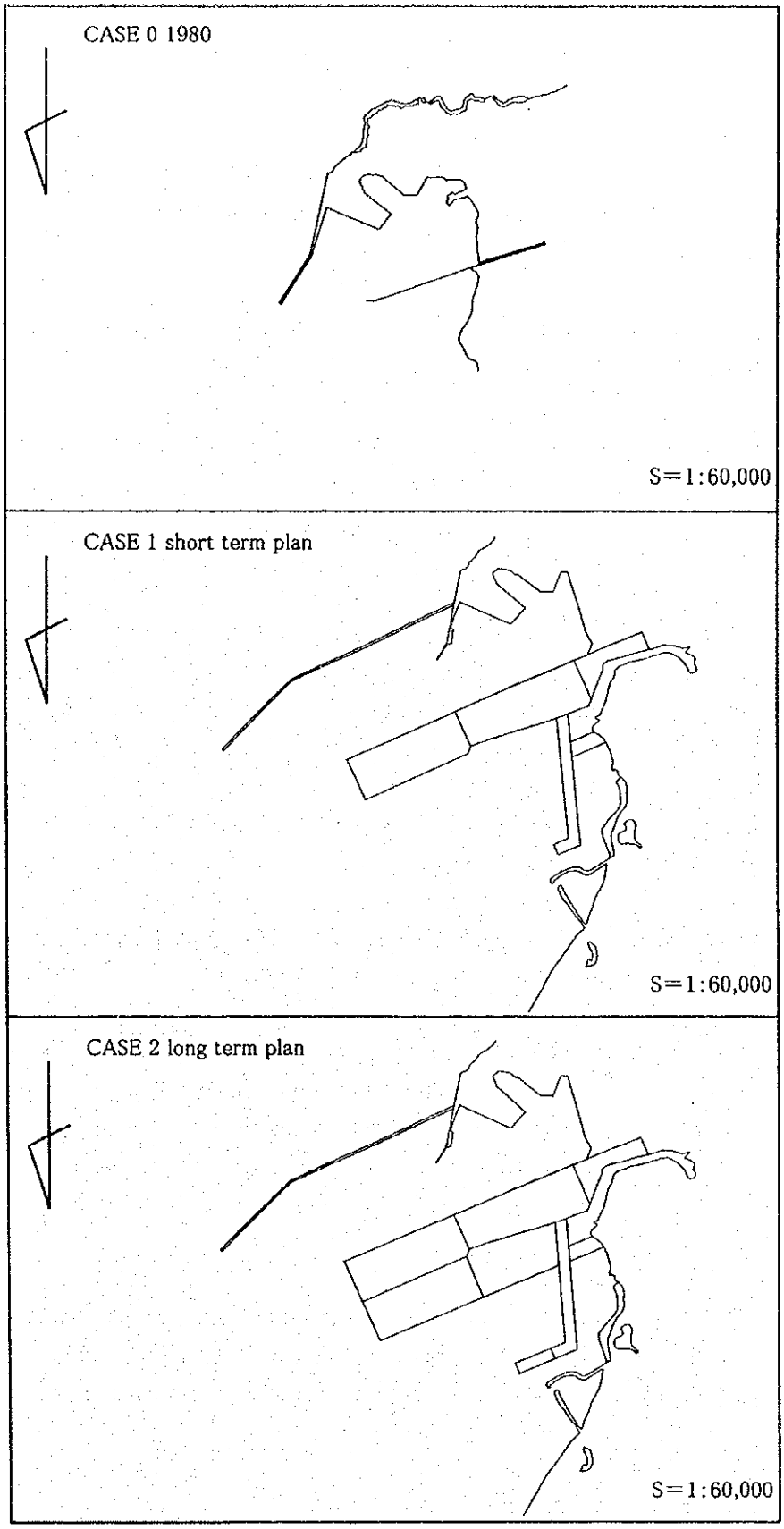


Figure 23.2.2 Case of Simulation Modeling

23.2.3 Results of Simulation

(1) CASE 0

Figure 23.2.3 shows the shoreline change between year 1980 and year 2000 that was based on the nautical chart data in 1980 and the survey results of this Study in 2000. Figure 23.2.4 shows the results of simulation of this period.

Based on Figure 23.2.3, almost no shoreline change was recognized; and the simulation result in Figure 23.2.4 also showed the same trends.

Therefore, this model well simulated and matched to the conditions of shoreline in the Study Area.

(2) CASE 1

Figure 23.2.5 shows the results of the simulation. Generally, the shoreline change was predicted as very small, a small scale one; therefore, the impact on the shoreline change by Short Term Plan is considered to be small. Some of the trends of simulation results are as follows.

1) The shoreline that faces to the breakwater of the Salalah Port (Y = 126 to 147) showed a slight advancing trend.

2) The center of the modeling area (Y = 50 to 126) showed a slight retreating trend of shoreline. The cause of this retreat trends is as follows.

   (a) The breakwater of the Port brought about a sheltering area at its backside.
   (b) Appearance of sheltering area caused the change of wave energy propagation toward the backside of breakwater area; therefore, it deflected wave energy propagation and reduced the current speed toward coast.

(3) CASE 2

Figure 23.2.6 shows the results of the simulation. Almost no shoreline change was predicted, showing stable conditions. This is because the shoreline became stable in the period of CASE 1 as the results of reaching equilibrium state of the sediment transport at this period.

(4) Conclusion

As the results of above simulations, the adverse effect is very slight and only recognized right after the Port expansion by the Short Term Plan; however, the shoreline change will be subsided after this stage of Master Plan.

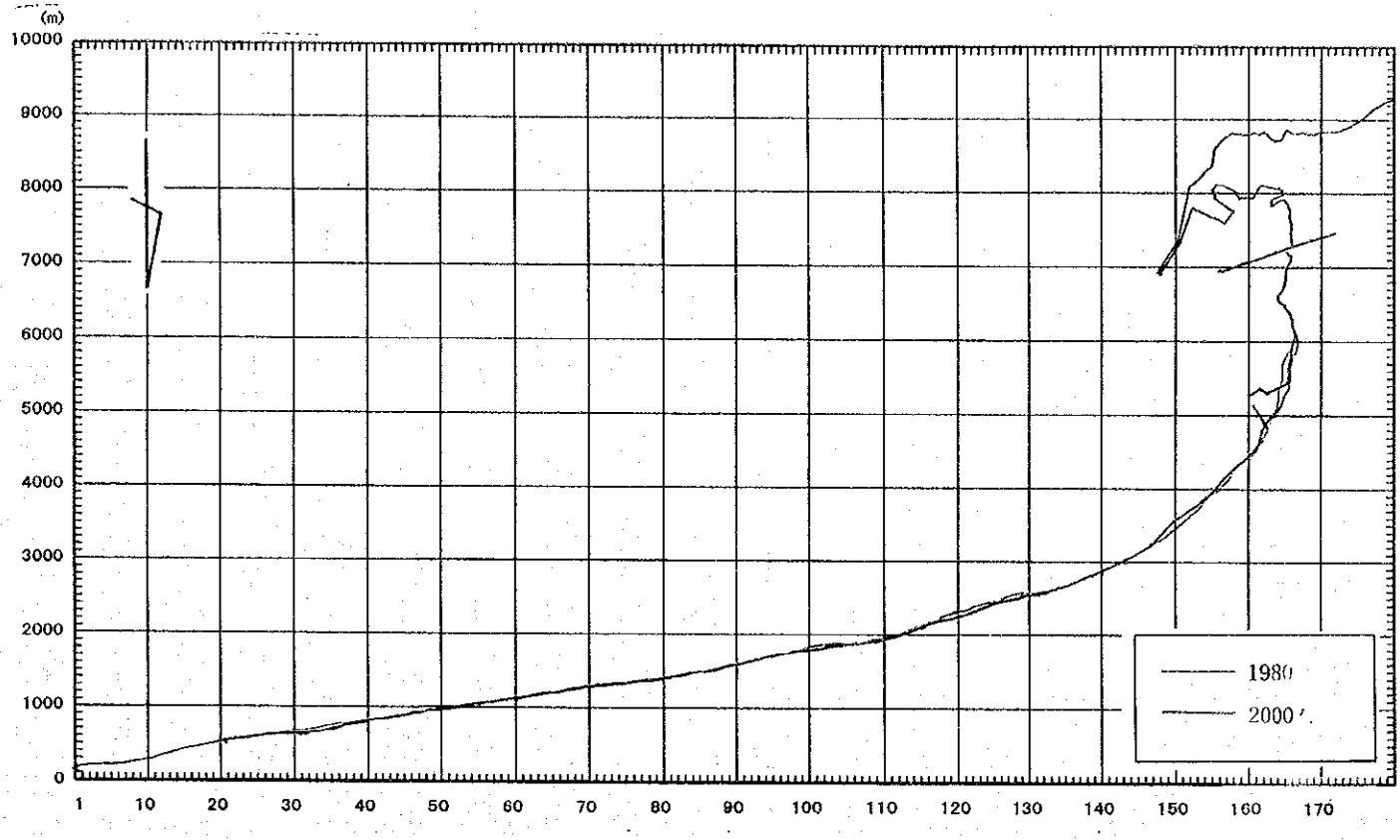


Figure 23.2.3 Results of Simulation:CASE0(1980 vs.2000 shore line)

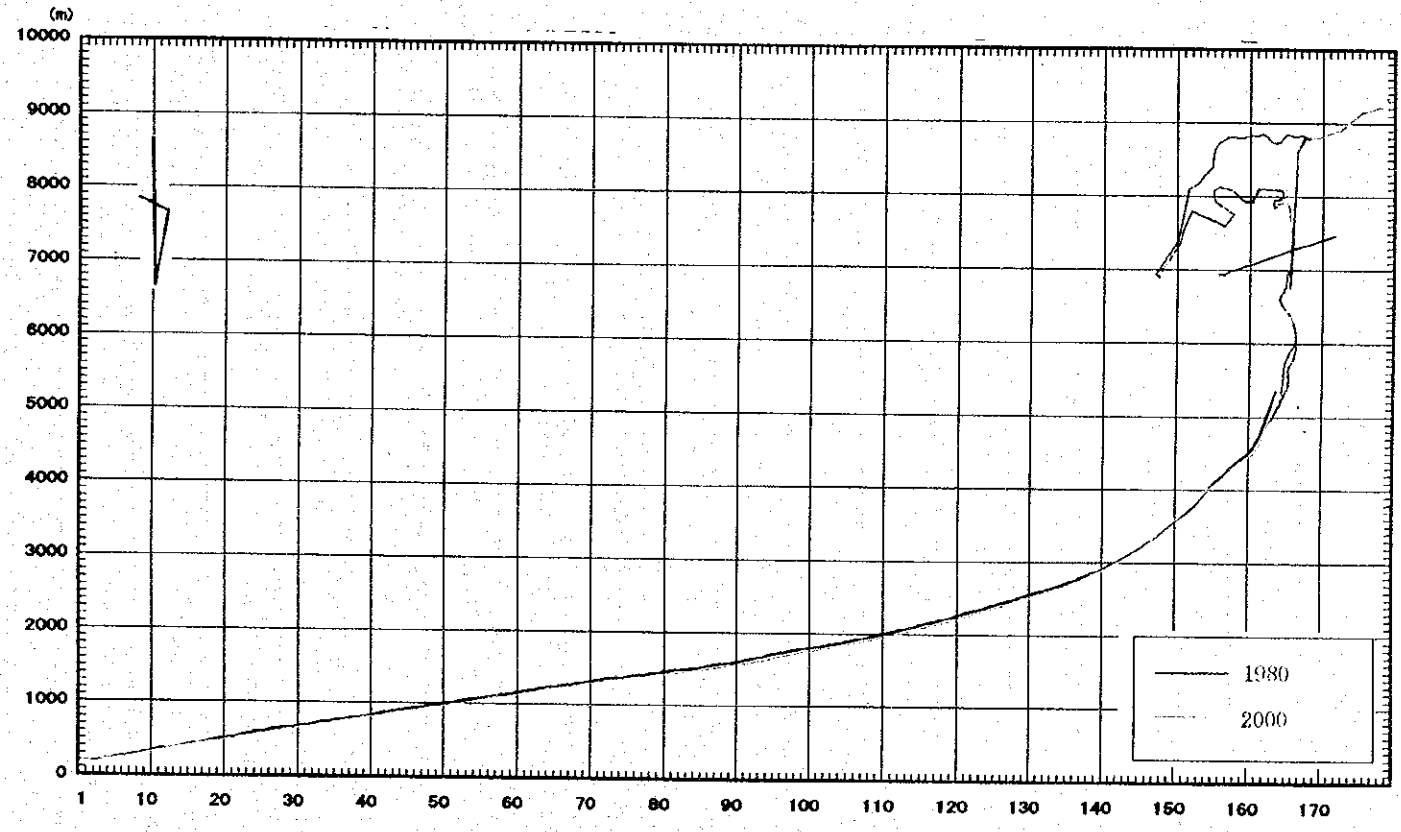


Figure 23.2.4 Results of Simulation:CASE0

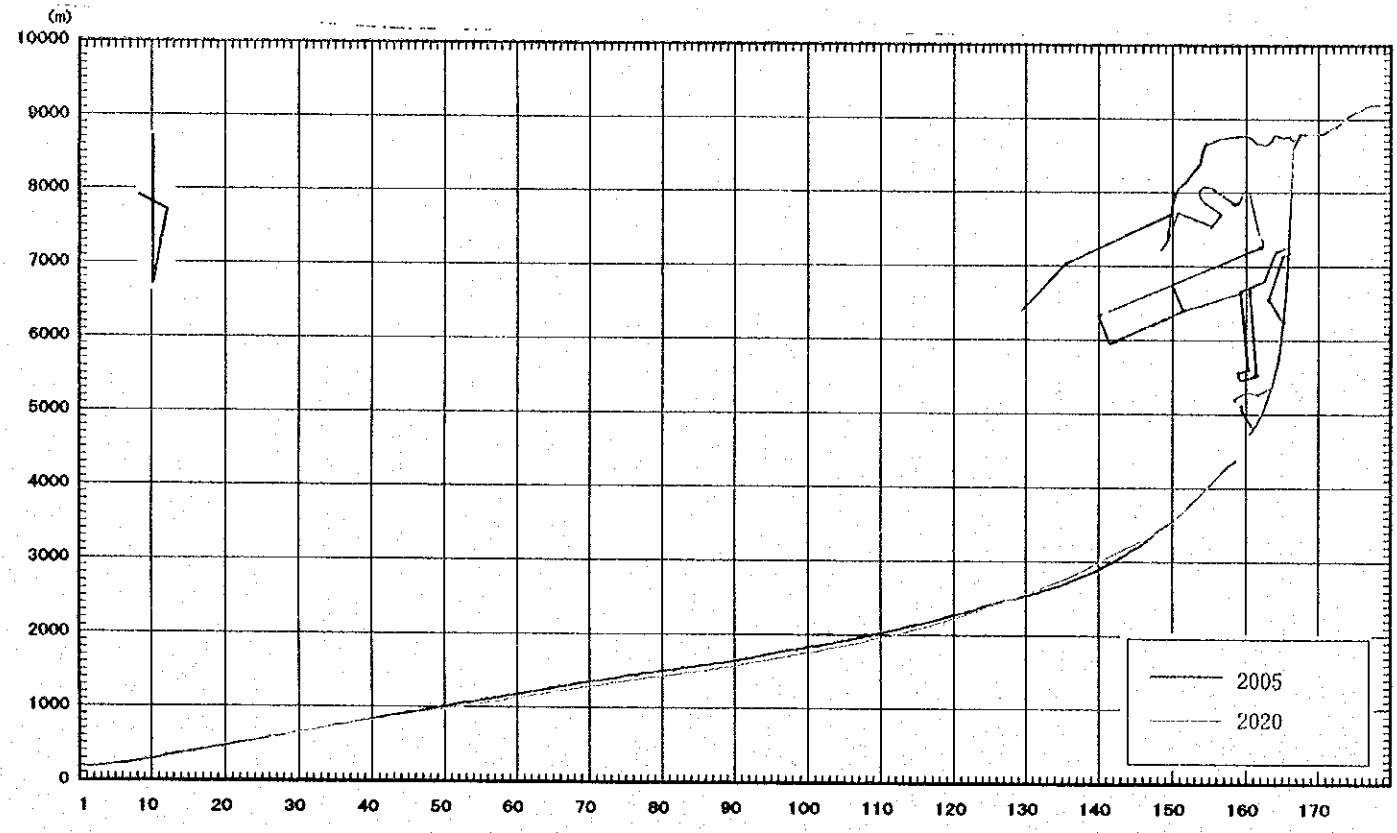


Figure 23.2.5 Results of Simulation:CASE1

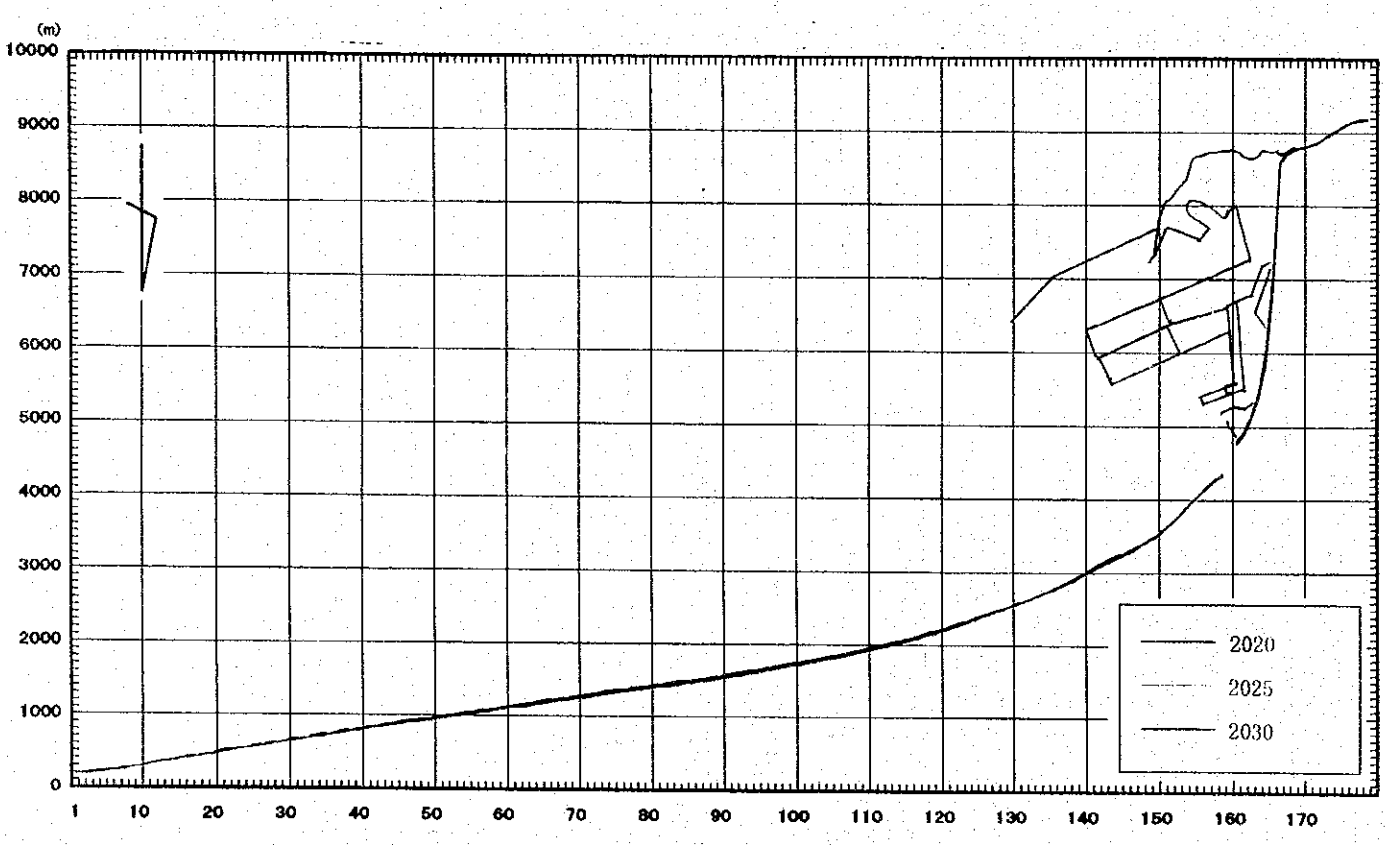


Figure 23.2.6 Results of Simulation:CASE2

23.3 Mangrove and Aqua Culture

23.3.1 Existing Situation and Their Impacts

Mangrove and its aqua culture have been exposed to their surroundings that may have some potential threat to their presence for over decades although they have currently been protected by Royal Decree 49/97 and also by fence.

There are several key factors that threaten their presence at the coastal region of the Study Area. These are classified into the following three (3) groups:

(1) Change of Shoreline due to Natural and/or Man Made Origin

A large scale advancing shoreline may cause a decrease or subsidence of fresh seawater charge directly from the sea and/or through the ground that threaten their habitat niche under dry climate.

(2) Human Activities utilizing Mangrove Lagoon

1) Dumping Spot for Construction Debris and Waste Materials
2) Grazing Land for Goat and Camel
3) Recreational Place for Rolling Boat, Walk, etc.

These present conditions may or already cause the following situations.

1) Deteriorating water quality by dumping or litter hazardous or other waste materials
2) Diminution of their habitat niche by grazing camel, including migration from inland
3) Deteriorating their suitable ambient by people intruding inside the fence, a protection area.

(3) Increasing Human Activities of their Surroundings

Urbanization and/or increasing traffic volume of road nearby the protection area cause the degrading their environment for their habitat by increasing noise, vibration, and dust.

In this part of report, the above factors are evaluated based on the future plan scenario of Master Plan whether they have a potential impact to the Mangrove area and its habitat.

23.3.2 Evaluation for Potential Impact

(1) Change of Shoreline due to Natural and/or Man Made Origin

In the previous section, the following two (2) cases of simulation modeling were calculated:

1) Short Term Plan (Year 2005)
2) Future Plan (Year 2020 or more)

For Short Term Plan, a slight advancing trend was recognized around the shoreline of Mangrove area; however, the long-term simulation, Future Plan, shows almost no influence of the shoreline change by the port facility construction within the Study Area.

Therefore, it is not expected a potential impact such as a decrease or subsidence of fresh seawater charge by large scale shoreline advancing by the construction of Port development by the Master Plan.

(2) Human Activities utilizing Mangrove Lagoon

There are no measures currently established for protecting these situations although these facts have already been pointed out and recommended to improve the deterioration of their environment by several reports.

The present activities utilizing mangrove lagoon was intermittent or seasonally and mostly related to local residence or neighbor of the mangrove lagoon and not expecting an increase such activities related to the future plan. Therefore, it is not expected large impact by these utilizations of mangrove by the future plan.

For measures to local residence or neighbor, a well fenced with some measures improving the ambient to more segregated and some educational program raise environment concern of residence implemented effectively may be indispensable for mangrove protection.

(3) Increasing Human Activities of their Surroundings

Most of the developing areas (I.E.) proposed by the future plan are located north to west of Salalah Port. The shipment of products from I.E. may pass the trunk road connecting the I.E. and Port directly, not related and used the road nearby the mangrove lagoon that connects between the area of Raysut Industrial Estate - Salalah Port – I.E. and Salalah City.

However, it is expected a increase of traffic for commuting the residence area of Salalah City and the I.E. and Port; therefore, it is recommend the traffic volume census in associate with the survey for mangrove inhabitant and its ambient.

23.4 Landscape and Land Use

23.4.1 Landscape

(1) Existing Situations and their Impact

The impact on the visual appearance of the existing Salalah Port and its hinterland facilities have already been emerged since their operation and given a large impact on their surroundings that was featureless terrain of vast waste dry land.

The facility of Salalah Port is in visible from the shoreline of Salalah City near the east boundary of the Study Area that is about 10 km distance in visible range directly; however, it is not likely to be of major significance since its distance.

On the other hand, the closest area that is the outskirts of residential area west of Salalah City near Salalah Hilton Hotel can be seen rather large impression of the Port as well as its hinterland facilities since its distance. From the nearest sites, the distance are in about 3km and 5 km, and silos and tall gantry cranes are rather massive impression and of major significance already.

(2) Visual Impacts by Future Plan

1) Salalah Port

Based on the existing situations analysis, a northward port expansion from the existing Port facilities toward the west boundary of Salalah City along the coast gives much visual impact to its surroundings, especially closest residential area and existing hotel facilities near the coast as described previously.

2) Industrial Estate

At this stage of the Study, a plot for future expansion is proposed but not completely planned any layout and facilities yet; therefore, greater impact likely occurs in associated with hinterland development is not fully known.

The visual impact of the development may be considered much of significance but relatively limited to the area of western part of Salalah where the new Port development and the Industrial Estate are planned.

23.4.2 Land Use

(1) Existing Situations

As described in Chapter 18.5, the Salalah Structure Plan by MOH has already proposed the land use and development plan of entire Salalah including the Study Area of Master Plan in 1998. This Structure Plan is a comprehensive study for regional development plan up to year 2015 that embodied the existing and past committed plan in Salalah.

Concerning the Study Area of Master Plan, most of the land use have been proposed by the Structure Plan; furthermore, it have already committed as a future development partly except the western area that starts from Raysut Industrial Estate (R.I.E.) where a vast dry wasteland extends inland ward.

At the present situations in the Study Area, some of the management of land use has been committed to control or minimize impact based on the Structure Plan and/or their predecessors.

1) No residential development has been proposed within a distance of 3 km from the Raysut Industrial Estate.

   A segregation of the areas between the residential area and industrial area has been committed already.

2) Area of northwest of Raysut Industrial Estate has been reserved for heavy/hazardous industrial development.

   This has been in progress already at the site. Some factories of R.I.E. considered as H.P.I.A., Highly Polluted Industry Area, have already started their operation.

   Furthermore, facilities for waste managements such as solid waste dumping site and the stabilizing pond for household wastewater have already started their operations.

   A complete isolation from the residential area as well as some other factories in the view of the environment concern has already been implemented.

3) Raysut Industrial Estate (R.I.E.)

   Master plan for R.I.E. in 1989 was prepared, and it has been already implemented to use land effectively with minimizing environmental impact to its surroundings.

However, the buffer zones separating industry and housing areas as recommended and also pointed out by MOTH and MRME have not seen at present except above-mentioned areas.

(2) Evaluation on Impact by Future Plan

The developing area by the Future Plan of the Master Plan Study is the Salalah Port and the western area that starts from Raysut Industrial Estate (R.I.E.) where a vast dry wasteland extends inland ward.

There are two kinds of utilization of land for this area in the future plan of the Master Plan Study. These are divided into two sectors of development areas:

1) Salalah Port and Free Trade Zone area

This is the area of Salalah Port and its adjacent area of port facility.

2) Hinterland of Salalah Port as Industrial Estate (I.E.) developing area

This is the area west of Raysut Industrial Estate, mostly.

Most of the development area by this Study is a vast wasteland and/or wadi where none to less vegetation and residence are recognized; moreover, it is totally isolated from the residential area such as Salalah City.

Therefore, it is expected that there is no significant impact of land use by the Future Plan as long as the planning of actual implementation stage follows the some of land use management currently committed as described previous section and some proposed measures and recommendations by the Salalah Structure Plan.

23.5 Car Traffic

(1) Existing Situations

Based on the present traffic volume census by this Study, the maximum traffic volume was around 430 cars in 24-hour base census; and most of them are a passenger car commuting from/to the Salalah City.

The traffic volume related to the Raysut Industrial Estate (R.I.E.) is quite few and mostly a bulk cargo not a container. This is because the Salalah Port is a kind of transship terminal at present except the old port facility that deals with a bulk cargo of flower mill and cement product from R.I.E.

At this Study results, the present traffic volume gave no significant impact to the environment such as air pollution, not a detectable level, around the port and future developing area planned by this Study. This is because less traffic volume and their natural settings facing to the sea that easily diffuses exhausted gas from vehicle to the open air.

Another factor of impact such as vibration and noise were not significant at present since most of the areas where the trunk road passes were non residential area, vacant space with vast waste land mostly and also isolated from major concerned area of environment.

(2) Impact of Future Plan

The expected traffic of Salalah Port as well as the Industrial Estate will increase as its development. This is because increasing an oppotunity of container shipment use for their cargos at the hinterland I.E. as its industry development projected by the Master Plan scenario as High Risk developments at the year of 2020.

Estimated traffic volume in the year of 2020 will be around 400 vehicles per hour that is close to the present level of the traffic observed by the Study. This volume is estimated based on the NESPAK overall growth rate and the preliminary design for Salalah by-pass project with port activities on 24 hours base transportation rate related to the future plan.

Therefore, the impact on the increasing traffic is not expected and not significance to their environment in terms of the air pollution, noise, vibration, and dust as the development of the I.E. and Port Salalah.

23.6 Recommended Mitigation and Monitoring

23.6.1 General

The Future Plan of this Master Plan Study was evaluated in terms of the environmental impact at the previous section.

The purpose of this entire Study is to clarify whether it is feasible or plausible whether it could be implemented as actual project in the Sultanate of the Oman in the long term up to year of 2020, and several factors and views with respect to the port planning as well as hinterland development of this Project are discussed in the pervious Parts in this report.

From the point of environmental aspect, this Future Plan of Master Plan is not given significant impact to the environment in the Study Area after its operation in and after the target year of 2020 according to the evaluation in the previous section.

However, some aspects recommended to be mitigated at the next stage such as Feasible Study and/or detail engineering stage after this Master Plan; moreover, and it is also recommended that the implementation of monitoring of the Study Area.

The following sections describe the recommended mitigation and the monitoring for the next stage after this Master Plan.

23.6.2 Mitigation

After the completion of the Future Plan at year 2020, Salalah Port will expand about five times of existing port facility area, about 204 ha in total and also expand up to 813 ha and 488 ha on the land for hinterland and for FTZ about 1.2 to 1.5 times of expansion of the area at the present, respectively.

Based on the results of the impact evaluation in the previous section, the following mitigation is recommended to consider at the next stage.

1) Land Scape and Land Use in Salalah Port

Since the entire Port facility is exposed and inevitably seen from the seaside as well as land portion giving rather massive and an artificial impression to their surroundings, the following mitigation is recommended.

Adoption of an appropriate architectural treatment into design such as the massing, size, treatment and coloring of the plant including lighting during the nighttime is recommended. This treatment depends on the relative evaluated between the Port facility and the background of the sea as well as the land or terrain on the different viewpoints and concept.

Vegetation of inside the Port facility is also carefully selected and well planted with enough area ratios to the facility total area.

An introduction of appropriate architectural design such a conceptual unity or some ideal integrity among the port facility is recommended for land scape and land use planning for port facility layout.

2) Land Scape and Land Use in Hinterland

The well-coordinated master plan like a R.I.E is recommended and prepared for the hinterland development in the view of environmentally unsound manner.

For entire designing of the facility, an appropriate architectural design such a conceptual unity or some ideal integrity among facilities is recommended.

For each plot in the hinterland, an appropriate plot with zone separating factories by vegetation is recommended. This vegetation is carefully selected and well planted with enough area ratios to the facility total area.

Since this Study is Master Plan Study as described previously, the exact and/or detailed construction method with equipment to be used only known likely one not known yet exactly; therefore, such details and the mitigation relevant to the construction with engineering study will not be evaluated and excluded from this part of the Study.

However, some consideration for standard mitigation related to the construction of port as well as land development at the hinterland that match to the engineering design and construction plan is recommended at the next stage.

23.6.3 Monitoring

As described in Chapter 19, the environmental related data describing present Port area as well as its hinterland are none to scarce mostly. Regarding present conditions of data sources as baseline data, some of the monitoring program as implemented in the course of the Study are recommended; moreover, some of the items listed in Table 22.1.2 in Chapter 22 is recommended to review at the realization stage of each plan and select to implement so that the adverse effect on to its surroundings can be monitored as an essential data for impact evaluation and measures for adverse effect at the construction and operation stage.

Part 5 Conclusions and Recommendations

24. Conclusions and Recommendations

24.1 Port Development

24.1.1 Development Target

The Study Team concludes that the targets of Salalah port development will basically remain unchanged from the present policy, that is, to develop a container transshipment hub, to act as an impetus for the development of new industries, and to handle increasing import/export cargo.

While the above mentioned targets are instruments of development, the success of the development of Port Salalah depends on whether it will answer the urgent need for Oman to decrease dependence on oil exports through diversifying its economy. Consequently, development scenarios were formulated placing emphasis on the following parameters: development target of a container transshipment hub, harmonized use of the port area by a variety of port-related activities, and an appropriate phasing plan.

It is also important to determine an appropriate demarcation of the roles among the ports in Oman. Since Mina Qaboos has been playing a dominant role in Oman and a new industrial port is being created in Sohar, careful examination is needed to avoid duplication of investments and to materialize balanced regional development of the country.

Diversified port users and increased volume of export/import cargo are needed to ensure economic development of the Hinterland. Given the port's strategic location, Port Salalah can become a leading container port in the Indian Ocean Rim. And this is a justifiable target.

Since the newly created bulk terminal has a large spare capacity, the Study Team concludes that the conceivable industrial development in the hinterland will not require major expansion of the conventional terminals except some additional handling equipment.

24.1.2 Demand Forecast

Transshipment container

Demand forecast was carried out according to the two economic development scenarios, high growth and low growth, for the surrounding regions. As the first step, regression analyses were carried out to find a co-relation between GDP and container throughput in the region. Then, the future throughput in the region up to 2020 was calculated. The transshipment demand was estimated as a half the total throughput assuming the transshipment incidence of 50%.

In order to estimate Salalah's share in the market, the Study Team formulated three scenarios with different levels of Salalah's competitiveness. After combining these market shares with the total regional demand, the Study Team identified plausible scenarios involving relatively low risks (See Table 24.1.1).

Table 24.1.1 Demand Forecast of Transshipment Containers at Salalah

Term	Economic Growth	Transshipment Market in the Region (,000 TEUs)	Salalah's Competitiveness	Salalah's Share in the Market	Throughput of Salalaah (,000 TEUs)
Short Term (2005)	High	12,820	Strengthened	30 %	3,846
		12,820	Status quo	20 %	2,564
		12,820	Weakened	15 %	1,923
	Low	9,934	Strengthened	30 %	2,980
		9,934	Status quo	20 %	1,987
		9,934	Weakened	15 %	1,490
Long Term (2020)	High	30,917	Strengthened	30 %	9,275
		30,917	Status quo	20 %	6,183
		30,917	Weakened	15%	4,638
	Low	16,933	Strengthened	30 %	5,080
		16,933	Status quo	20 %	3,387
		16,933	Weakened	15 %	2,540

Note: Demand in plausible scenarios are shown with underlined figures.

Domestic cargo

The Study Team determined the catchment area of Port Salalah taking into account the geographical condition and the distribution of economic activities. Dhofar is the catchment area for bulk and general cargo, while Al Wusta is also included in the catchment area for container cargo. Two methods were employed, macro estimation and micro estimation, for the forecast of local cargo. After crosschecking, the Study Team adopted the results of the micro forecast. The macro forecast did not yield reasonable results because the economic activity in the catchment area is too small.

In 2020, Port Salalah needs to handle 0.3 million TEUs of container, 0.3 million tons of break bulk, and 1.8 million tons of bulk cargo (excluding fuel). Fuel volume will widely vary depending on whether Salalah can be a major bunkering point or not.

24.1.3 Port Master Plan

The long-term master plan is targeted to develop Port Salalah toward 2020 in line with the economic needs of the region. Since many economic factors and variables are incorporated as

the preconditions, the depth of the long-term master plan is limited to the basic directions of development. The Study Team also proposed some areas for future expansion which can not be proven viable at this time.

The master plan for 2020 proposes the expansion of the port which includes container quays, government berths, a new breakwater, bridges, and approach channels (See Table 24.1.2, Figure 14.6.1). This plan comprises two main basins with deep alongside draft which are protected from waves and sedimentation by a breakwater and groin.

The Study Team took the following steps to formulate the master plan.

- demand forecast
- evaluation of the development sites
- evaluation of the alternative layouts
- structure design and cost estimate
- modification of the port layout responding to the results of wave disturbance simulation
- capacity evaluation
- economic and financial analysis consistent with the proposed port management scheme

FIRR (Financial Internal Rate of Return) of the proposed container terminal development for SPS is over 14 % based on a financing and management scheme similar to that applied in the existing container terminal.

EIRR (Economic Internal Rate of Return) of the port development is 6.7-10.1 % and EIRR of the entire Salalah development (development of the port and port-related industries) is over 33 % (excluding the costs of the government berths and bridge). Proposed Salalah development is therefore recommendable from a viewpoint of the national economy on condition that appropriate industrial promotion measures are taken in a timely manner.

Table 24.1.2 Master Plan

Features	Dimensions and evaluation
Additional berths	18m draft container quay: 1,050m 16m draft container quay: 1,750m Passenger berth: 350m Government berth: 800m (Future expansion: 980m with 12m depth)
Additional terminal area	112ha (Additional 42 ha for future expansion)
Handling equipment	Container: 15 gantries (18 rows), 9 gantries (22 rows), 48 RTGs, 96 yard tractors Conventional: 1 grab bucket crane
Container handling capacity	6 million TEUs/year
Breakwater	2,550 m
Dredging	17,393,000 m^3 (Additional 331,000 m^2 for future expansion)
Reclamation	15,062,000 m^3 (Additional 7,271,000 m^2 for future expansion)
Total cost	310 million R.O.

24.1.4 Short-term Development Plan

The capacity of the present container terminal is estimated to be 2 million TEUs. According to the demand forecast, container throughput is expected to reach the capacity in 2002-2003. The demand forecast projects an increase of the throughput to 2.5-3 million TEUs in 2005. In order to meet this growth, construction works for at least two berths should start in 2001.

The Study Team prepared two alternatives for the short-term development within the scope of the master plan for 2020. One is the northward expansion (Plan A) and the other is the eastward extension (Plan B). Due to the port geometry envisaged in the master plan, Plan A includes 700m container quay while the quay length in Plan B is 1,050m. Expansion of the existing harbor entrance is also proposed to alleviate the harmful effects of long-period waves as well as to enable a two-way traffic at the entrance. The Study Team evaluated these alternatives from various aspects and concluded that Plan B was recommendable (See Table 24.1.3).

FIRR (Financial Internal Rate of Return) of the Plan B for SPS is over 14 % based on a financing and management scheme similar to that applied in the existing container terminal.

EIRR (Economic Internal Rate of Return) of Plan B is 6.7-10.0 % and EIRR of the entire Salalah development (development of the port and port-related industries) is over 35 % (excluding the costs of the government berths and bridge). Proposed Salalah development is

therefore recommendable from a viewpoint of the national economy on condition that appropriate industrial promotion measures are taken in a timely manner.

Table 24.1.3 Two Alternative Plans for the Short-term Expansion

Features	Plan A	Plan B (Recommended)
Additional berths	16m draft container quay: 700m Government berth: 800m	18m draft container quay: 1,050m Government berth: 800m
Additional terminal area	28ha	42ha
Handling equipment	Six gantry cranes (18 rows) 12 RTGs 24 yard tractors	Nine gantry cranes (22 rows) 18 RTGs 36 yard tractors
Container handling capacity	3 million TEUs/year	3.5 million TEUs/year
Breakwater	1,200m	2,550m
Dredging	13,779,000m^3	6,722,000m^3
Reclamation	3,060,000m^3	7,003,000m^3
Total Cost	118 million R.O.	164 million R.O.
EIRR	8.2-9.0% (Port development) 42.3-43.4% (Port and industrial development)	6.7-10.0% (Port development) 35.4-41.4% (Port and industrial development)
FIRR	22.2-28.3% (Terminal developer)	15.3-20.1% (Terminal developer)
Wave disturbance	Sufficient protection can not be provided	Sufficient protection will be provided
Waiting time	Long	Short
Overall evaluation	Poor	Good

Note: EIRR is calculated excluding the costs of the government berths and bridge

24.1.5 Recommendations

The results of the economic analysis indicate that the transshipment business itself will not be so beneficial to the Omani economy, while a terminal developer can make good profits. If GSO takes appropriate measures to attract private investments in the Hinterland, however, there will be a great chance to achieve the development of the regional economy with sustainable sources of employment. Economic returns will be very high if industrial development will occur taking advantage of business environments improved by Salalah's hub port status. Consequently, Port development and industrial development should be promoted in a well-coordinated manner.

The demand forecast projects an annual growth of 150-200 thousand TEUs throughout the planning period. Since it takes at least two years to complete an expansion project, Port Salalah should always have a spare capacity of not less than 300-400 thousand TEUs/year to capture

the potential growth. For that reason, the relevant authorities should take appropriate actions when the spare capacity of the terminal comes close to the minimum spare capacity.

A transshipment port is likely to experience a sudden increase in demand. An expansion project therefore needs to provide a capacity addition of at least 600-800 thousand TEU/year, or double the minimum spare capacity.

A change in the investment policy of private companies and competition between the surrounding countries will have a large impact on the outlook of the industrial development in the Hinterland. For that reason, the relevant authorities should reexamine those factors based on the latest information when they decide to undertake a port development project included in the master plan.

24.2 Industrial Development

24.2.1 Conclusion

The most prospective industry, in view of Salalah's geographically advantageous location combined with the call of international major container lines, will be redistribution businesses. The development of redistribution businesses will lead to increase in local production of these goods, if appropriate encouraging measures are taken.

The industries prospective for local production in Salalah will be:

1) Development of food industries based on imported grain and oil crops
2) Development of quick response and high quality garment industry targeting EU markets
3) Promotion of industries to meet the import demand in the markets in Southeastern Asia
4) Tourism development with link to that of Dubai
5) Development of fish processing industry targeting European markets

The major impacts expected from the development in view of national economy, or Dhofar economy will be:

1) Contribution to increase in GDP
2) Earning or saving of foreign exchange
3) Job creation

The contribution to GDP increase is expected to be 700 million R.O. in 2010, and 1,100 million R.O. in 2020 in the case of Projection Scenario (1). The increase accounts for 1.5 and 2.4 times of estimated GRDP in Salalah in 1998 respectively. The major source of increase will be trade and distribution related industries (or total of commerce, redistribution, and transportation & communication), which accounts for almost 60% of total increase. Next largest contribution comes from "other sector", which represents the infrastructure and public service sectors including electricity, construction, finance, and public administration, accounting for 34% of total in 2010, and 32% in 2020.

The contribution to job creation is also conspicuous. It will create an additional job for 21,650 persons in 2010, and 27,800 persons in 2020 (Scenario 1), compared to 52,700 persons of estimated workers in Salalah in 1995[1]. The largest contribution is expected from "other sectors", followed by the trade and distribution sector and manufacturing sector.

The contribution to foreign exchange earning will be 150million R.O. in 2010 and 250million R.O. in 2020. The largest contributing sector is the trade related sector, accounting for 62% of total in 2010, and 53% in 2020. It is followed by the manufacturing sector with contribution

[1] Source: Phase 5 Final Structure Plan, Revision of Salalah Structure Plan.

33% in 2010, and 41% in 2020. However, the foreign exchange earning/ saving will not be significant, when comparing the earning with remittance to overseas as profit and expatriates' salary and wages.

Thus, the industrial development in the Hinterland area of Salalah Port is prospective.

24.2.2 Recommendations

(1) Develop the hinterland area with the development concept, as follows:

Development of the hinterland area as the regional center of redistribution businesses, taking advantage of its geographic location, and among others, the advantage of the area as the hinterland of international trunk line port of container, where the network of feeder lines are also developed so that the Salalah Port has easy access to the countries in the region.

Development of the regional redistribution center, which was networked and further enhanced by the linkages with other zones, which are specially designed for trade, production and distribution, including Mazuyunah Free Trade Zone, Salalah Airport, Raysute Industrial Estate, and JAFZ and other Free Zones in the peripheral countries.

Development of area as a center encouraging local production, with promotion of the local production for establishing the basis of sustainable growth of economy in Salalah, taking advantage, not only of, the development of the area as the redistribution center of the region, but also of:

1) Natural resources available in Salalah and peripheral areas
2) Industrial experiences in Oman
3) Port of international container lines accessible to the world-wide potential markets

(2) Promote the investment and operation of redistribution center with the following:

1) Provision of favorable investment conditions and business environment sufficient to attract the investment, both for local and foreign investors. These will be materialized basically through (1) establishment of free zone, and (2) continuous development of the existing industrial estate.
2) Provision of special conditions for formulating the linked operation in handling cargoes particularly among Salalah Port Free Zone, Raysute Industrial Estate, Mazuyunah Free Trade Zone, Salalah Airport, and Free Zones in the neighboring countries particularly JAFZ,
3) Encourage local and foreign investors to launch the local production

24.3 Administrative Aspects

24.3.1 Port Management Scheme

(1) General

(Nationwide port development plan)
For efficient port development, a nationwide port development plan should be made. In order to make this plan, DGPMA needs to obtain relevant data in a timely manner, but the present data collecting system is time-consuming and does not include sufficient items. Therefore, the present statistic collecting system must be improved. In addition, to make the plan smoothly, an efficient coordination system, involving various port related organizations, should be introduced. To that end, one option is to hold a national port development meeting.

(Establishment of Port Committee of Salalah)
It is necessary to establish a "Port Committee" to coordinate benefits of relevant port related organizations and promote the port development from the viewpoint of regional development. This committee should include not only the government and SPS but also representatives of the port users and the region. Main functions should be as follows.

-approval of port development plan
-supervision of port activities and giving advice
-coordination among port management body, port users, and local government

GSO has a plan to establish a similar committee called the "Port Planning and Regulator Committee"("PPRC"). Once it is established, it is recommended that its functions be expanded to include those envisaged in the "Port Committee" described above. For this purpose, PPRC should include local government members as representatives of the region.

(Port Management Body)
The sole management body is assumed to be SPS because it is generally agreed that a single body can manage port activities more efficiently.

(Vocational Training)
To promote Omanisation, vocational training is essential. GSO should support vocational training of SPS including establishment of a new training school.

(2) Container Terminal

(Increase of Container Cargo Throughput)
It is urgently necessary to increase the cargo volume in order to use the facility efficiently and improve the financial situation of SPS.

(Attracting Third Shipping Companies)

To attract other shipping companies than Maersk-Sealand, SPS must foster an image of neutrality which means that any shipping companies will be treated equally in any services. The following measures deserve consideration.

1)To advertise its neutral management policy to the shipping world

2)To change the composition of shareholders (to achieve more diversity)

3)To appoint a neutral committee, for example PPRC, to guide and supervise SPS

(Container Terminal Operation for Import/Export Cargo)

This container terminal was developed and designed as a transshipment port. When the volume of import and export cargo from/to its hinterland, including FTZ, increases, the operation policy and system should be reviewed to accommodate these cargoes.

(Container Berth Development Scheme)

Based on the privatization policy, BOT scheme, which was also employed for the existing container berths, is recommended. The government should provide infrastructure and retain ownership since the port is a public asset.

(Container Terminal Utilization)

For efficient utilization of berths, "Open use" system should be adopted as a basic scheme. But the berth allocation system should be flexible and 'Prioritized use' system also should be adopted if it will attract shipping companies.

(Container Terminal Operator)

From the viewpoint of efficient use of port facilities and equipment, a single operator system (by SPS) is considered preferable, but a third company operation should also be considered if it is necessary to attract a new shipping company.

(Basic Management Scheme)

GSO provides infrastructure while SPS provides superstructure. Terminal management and operation is conducted by SPS. Basic berth allocation is "Open use" system, but a third company participation and adoption of other berth allocation systems are possible. Port Salalah needs flexibility in its operation system.

(3) Conventional Terminal

(Conventional Terminal Development)

Conventional terminals are generally difficult to make profitable. Therefore, to support regional development GSO should develop necessary infrastructure and set reasonable concession conditions which will allow SPS to set low port charges.

(Improvement of Conventional Terminal)

The cargo handling efficiency is not satisfactory to port users. Some facilities have become deteriorated and require immediate rehabilitation, while some cargo handling equipment is becoming superannuated. The efficiency must be improved with rehabilitation work.

(Enhancement of user-friendliness)

SPS and port users including shippers form the "Port Users Meeting" to exchange their opinions and requests. It would be a good idea for a government representative to attend the "Port Users Meeting" in order to coordinate between SPS and the port users from a neutral position. In addition, Port Salalah should provide higher productivity than Port Sultan Qaboos and attractive port charges, which are less than Port Sultan Qaboos to be competitive with other ports, especially Port Sultan Qaboos.

24.3.2 Marketing Strategy

(Port Sales)

To conduct effective port sales, the following measures are recommended.

1)To improve the web site of Port Salalah

2)To prepare several brochures appropriate for each target audience

3)To make a promotion video and to keep historical film records of the port development

4)To dispatch Port Salalah Sales Missions formed by SPS and the government regularly to the cities and regions which are strategically important to Port Salalah

5)To set up offices in South Asia and East or South Africa, which comprise the main feeder network area in addition to the office in Dubai

(Port Tariffs)

Port Salalah offers a very low volume discount rate of container handling compared with Singapore Port. From the viewpoint of a common user port, standard tariffs should be reduced while the volume discount rate should be increases from the present level.

(Network of Shipping Lines)

Based on the main prospective market areas of hinterland development, to increase trunk lines and to expand the feeder network, especially from/to East Africa and Indian Sub-Continent, are the main targets.

(User Friendly management)

It is recommended that SPS forms a advisory council with shipping companies calling Salalah for direct communication with shipping companies.

(Introducing Modernized Facilities)

Salalah port must take advantage of its new port status. Salalah boasts the most modern facilities and this fact should be used to attract new shipping companies.

(Increase of Base Cargo)

Because a strong local cargo base would raise the status of Port Salalah, SPS should make efforts to develop its hinterland and to increase base cargo.

24.3.3 Interaction between the Port and the Region

(Coordination between the Port and the FTZ Development)

A coordination system between the Port and the FTZ development should be established. Main function is to coordinate the development timing of the Port and the hinterland including FTZ. SPS, the port management body, will be appointed as the project manager of phase I of FTZ. Until the establishment of the FTZ Authority, PEIE is responsible for legal matters. Therefore the coordination committee of the Port and FTZ should be organized with SPS, PEIE, and MOTH as core members. Main functions are to coordinate the development timing of the Port and the hinterland including FTZ and to promote investment in the hinterland.

For the coordination of port development among SPS, GSO and port users (private sector), GSO already has a plan to establish PPRC. Therefore PPRC should expand its members and function to deal with the coordination of the Port and FTZ.

24.4 Environmental Aspects

(1) Conclusion

For evaluating the adverse effect of the Future Plan by this Master Plan Study, the Initial Environmental Examination (I.E.E.) was carried out based on the checklist of adverse effect of the guidelines set by JICA on the following five (5) factors as selected for the assessment of impact:

1) Current and Water Pollution
2) Coastal Erosion
3) Mangrove Aqua Culture
4) Landscape and Land Use
5) Car Traffic

As the results of the assessment of the above factors, a significant impact to the environment was not recognized by the long-term development plan in and after the year 2020.

Only a slight and limited adverse effect was recognized at the simulation modeling results on the current and water pollution and the coastal erosion. These are related to the extension of offshore breakwater that causes a kind of shelter effect on its backside and also deflect the wave energy propagation toward the shoreline.

The existence facilities of Port as well as its hinterland have already given some significant visual impact in some extent to its surroundings, especially the area of western part of Salalah that is closest residence and tourist facilities area to the new Port development and the Industry.

Therefore, future expansion based on the existing Port facility toward west boundary of Salalah City that goes along the coast northward may give further much impact to its surroundings where currently existing issue on landscape has been recognized otherwise an appropriate measure would take to mitigate.

To minimize the expected impact described above, the mitigation on the landscape and the land use was proposed for Salalah Port and its Hinterland development.

That is the only one factor expecting much impact to its surroundings by the future plan as long as it is expected by the Study at the Master Plan.

(2) Recommendations

1) Implementation on Environmental Impact Assessment

Based on the checklist of adverse effect of the guidelines set by JICA, Initial Environmental Examination (I.E.E.) was carried out in the Study to evaluate environmental impacts; and such a depth as of the I.E.E. is appropriate for a master plan for in and after the target year of 2020.

Since this Study is Master Plan Study, the exact and/or detailed construction method with equipment to be used only known likely one not known yet exactly; therefore, such details and the mitigation relevant to the construction with engineering study is unable to be evaluated in this stage of the Study.

Environmental impact assessment needs to be done at a later stage within the scope of Feasibility Study (F/S) or Detailed Designing (D/D).

2) Implementation on Environmental Monitoring Program

At present, the environmental related data describing present Port area as well as its hinterland are none to scarce mostly. Therefore, continuous monitoring of the environment needs to start before the master plan is implemented to assess the impacts of the development.

3) Establishment on Coordination Mechanism for Development

The proposed Salalah development encompasses port development as well as related hinterland development, and thus involves various ministries of MOTH, MCI, MRME, MWR and also private entities like SPS, R.I.E., and others involved in the development will also increase.

Consequently, an appropriate coordination mechanism should be established including the government and the private sector to solve the environmental issue as well as developing the area concerned properly in the view of the environmental management for the future development toward the target year 2020 of this Master Plan.

Implementation Organization, Duration, and Flowchart of the Study

1. JICA Study Team

The Study Team was made up of experts as listed below.

Name	Area of responsibilities
Mr. Hidehiko KURODA	Team Leader/Port Policy
Mr. Mitsuhiko OKADA	Port Planning/Investment Planning
Mr. Tomoo AMANO	Regional Development
Mr. Yoshihisa TATENO	Demand Forecast for Container Transshipment
Mr. Makoto SAWAI	Demand Forecast for Domestic Cargo
Mr. Takahiko KISHIMOTO	Port Management/Port Marketing
Mr. Yoshinobu SHAKUTO	Financial Analysis
Mr. Tetsuo INOOKA	Industrial Development
Mr. Minoru UMEOKA	Industrial Infrastructure Planning
Mr. Mitsuo SATO	Economic Analysis
Mr. Teruo KAWANISHI	Engineering Design/ Implementation Planning/Cost Estimate
Mr. Takeaki HOSHINO	Natural Conditions
Mr. Hiroshi IKENAGA	Environmental Consideration
Mr. Shane REID	Coordination

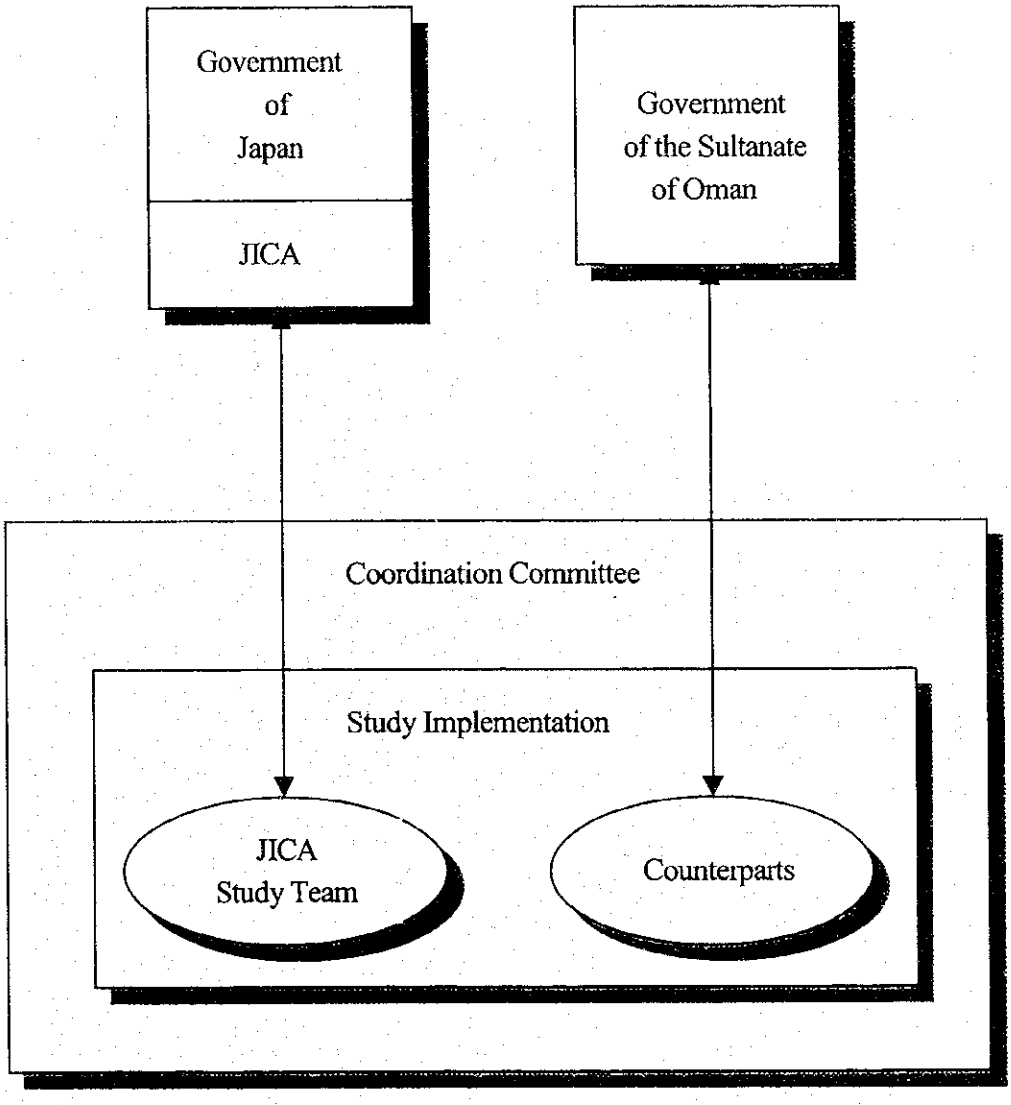
2. Counterpart and Coordination Committee

Ministry of Transport and Housing served as a counterpart agency of the Study Team. A coordination committee was organized by officials of the agencies concerned (See Figure 1). Participants of the committee are listed below:

<u>Ministry of Transport and Housing (Counterpart Agency)</u>	
Mr. Jamal T. Aziz	Director General of Ports and Maritime affairs
Mr. Hiroshi Sasajima	Advisor to H.E. The Minister
Mr. Khalid Mirza	Director of Sohar Port
Mr. Hassan Al-Mugaini	Director of Port Affairs
Mr. Issa Al-Barmani	Civil Engineer
Mr. Hassan Bakheet Ajham Fadal	Acting Manager, Port Raysut
<u>Ministry of Commerce and Industry</u>	
Ms. Manal Mohamed Al-Abdwani	Director General of Planning and Follow-up
Mr. A. Moneim Khalifa	Advisor
Mr. Faisal Elamir	Technical Advisor

Mr. Saoud Nasser Al-Khusaibi	Director of Industrial Planning
Ministry of Regional Municipalities and Environment	
Mr. Salim Abdullah Al-Jufaili	Director of EIA
Mr. Mohammed Bin Abdullah Al Muharrami	Deputy Director General for Environmental Affairs
Mr. Salim F. Abdoon	Directorate General of Environmental Affairs
Mr. Ahmed Abdullah Mahroos	Directorate General of Environmental Affairs
Mr. Nabil Habib Ali Awatiya	
Ministry of Finance	
Mr. Mohamed Al Harthy	Director General
Ministry of National Economy	
Mr. Khalifa Said Salim Al-Abri	Director General of Economy
Ms. Khorila Al-Zakwani	Economic Researcher
Mr. Najhaa Ali Al-Farsi	Economic Researcher
The Omani Center for Investment Promotion & Export Development	
Ms. Malak Ahmed Al-Shaibani	Acting Director General of Investment Promotion
Mr. Douglas Aitkenhead	Special Advisor
Public Establishment for Industrial Estates	
Mr. Ahmed Aldheeb	Managing Director
Mr. M. Bahwan	IE for MD of PEIE
Mr. Hamad Salim Al-Harthy	Director of Rusayl Industrial Estate
Mr. Said bin Ali Salim Al Mashani	Director, Raysut Industrial Estate
Mr. Musallam Mohammed Al-Shahri	Civil Engineer, Raysut Industrial Estate
Mr. Qais Mubarak Bahawan Al-Muakhaini	
Ministry of Agriculture & Fisheries	
Mr. Zayed M Al-Muharrami	Director of Projects
Ministry of Foreign Affairs	
Mr. Mabrook Al-Hinai	First-Secretary
Salalah Port Services Co	
Mr. Jack Helton	Chief Executive Officer
Mr. Bill Burns	Marketing Manager
Mr. Yuvral Narayan	Chief Financial Officer
Maersk Sealand	
Mr. V. I. Mathew	General Manager
Han Padron Assdociates	
Mr. John H. Rosser	Associate and Regional Manager
Mr. David C. Ames	Chief Engineer

Figure 1 Organization Chart



3. Ministry of Foreign Affairs and JICA

The Study Team was supported by the officials of the Japanese Government and JICA as listed below.

Ministry of Foreign Affairs

Japanese Embassy in Oman	H.E. Mr. Zenji KAMINAGA, Ambassador
	Mr. Eiji SHIMAMURA, Second Secretary

JICA

First Development Study Division, Social Development Study Department

	Mr. Takao KAIBARA, Director
	Ms. Rie HONDA, Deputy Director
	Mr. Takayuki OYAMA

4. Field Survey

First Stage	December 9, 1999 to February 27, 2000
Second Stage	June 1, 2000 to Jun 14, 2000
Third Stage	September 14, 2000 to September 28, 2000

5. Flowchart

The Study was carried out according to the flowchart shown in Figure2.

Figure 2 Flowchart of the Study