

2.2.6 Environmental Protection During Dredging

(1) Description of Measure

**Table 2.2.8 Mitigation Measure No. 8:
Environmental Protection During Dredging**

| DESCRIPTION OF MEASURE | | | | | | | | | | | | | | | | | | | | | | |
|--|--|------------|---|----------------|---------------|-----------------------------------|-----------|------------------|----------------------------------|------------|-----------|--|------------|-----------|-------------------------------|-----------|--------------|---|------------|---------------------|-----------------|------------|
| <p>1. Reduce the spread of suspended sediment around the dredger and at the disposal site, by monitoring turbidity and setting trigger levels that require operations to cease if exceeded.</p> <p>2. Set up warning signs at the dredging and dumping sites to prevent vessels entering; train personnel in the environmental effects of dredging to raise awareness; carry booms and skimmers on the dredger to deal with spills of any hazardous liquids on board.</p> | | | | | | | | | | | | | | | | | | | | | | |
| <p>OBJECTIVE: Reduce water pollution from the spread of suspended solids (SS) produced by dredging and disposal, and the spread of oil from accidental fuel spillages.</p> | | | | | | | | | | | | | | | | | | | | | | |
| RATIONALE: | | | | | | | | | | | | | | | | | | | | | | |
| <p>1. Reducing the spread of suspended sediment Dredging the approach channel, dock and turning basin will remove 11.4 million m³ of sediment, half of which will be dumped offshore, 12 km from the end of the channel, at 20-35 m depth. Both operations will generate suspended sediment, which could reduce phytoplankton productivity, irritate gills of fish and cause them to avoid affected areas, and smother and kill the benthos on the seabed. Precautions such as surrounding the dredger and dumpsite with silt reduction curtains are not necessary because this is not a sensitive environment, and turbidity is naturally high, so organisms are adapted to such conditions. One area requiring special protection is in the north of La Unión Bay where extensive mangrove swamps are important nursery grounds for fish and shrimp, and where beds of filter feeding mollusks are exploited by the local community. Turbidity and SS will be monitored daily at 12 stations before dredging begins to establish background levels and the relationship between the two parameters. Turbidity will then be monitored throughout the dredging, converted to SS, and if trigger levels are reached, dredging will cease until levels return to background. Stations and trigger levels (increases above ambient) are:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;">Stations 1, 2</td> <td style="width: 40%;">: near Perico Island mollusk beds</td> <td style="width: 30%;">: 60 ltr;</td> </tr> <tr> <td>Stations 3, 4, 5</td> <td>: southern edge of mangrove area</td> <td>: 100 ltr;</td> </tr> <tr> <td>Station 6</td> <td>: north of inner channel, near north-eastern mangroves</td> <td>: 200 ltr;</td> </tr> <tr> <td>Station 7</td> <td>: 500 m from reclamation area</td> <td>: 200 ltr</td> </tr> <tr> <td>Station 8, 9</td> <td>: west of outer channel, near inshore fishing grounds</td> <td>: 200 ltr;</td> </tr> <tr> <td>Stations 10, 11, 12</td> <td>: disposal site</td> <td>: 200 ltr.</td> </tr> </table> <p>2. Other pollution control measures Warning signs will be placed at the dredging and disposal sites to prevent entry by vessels which could impede the operation and cause accidents. Workers will be trained in the environmental effects of dredging to raise awareness, and the contractor will develop an oilspill contingency plan and carry booms and skimmers to deal with any fuel spillage.</p> | | | | | Stations 1, 2 | : near Perico Island mollusk beds | : 60 ltr; | Stations 3, 4, 5 | : southern edge of mangrove area | : 100 ltr; | Station 6 | : north of inner channel, near north-eastern mangroves | : 200 ltr; | Station 7 | : 500 m from reclamation area | : 200 ltr | Station 8, 9 | : west of outer channel, near inshore fishing grounds | : 200 ltr; | Stations 10, 11, 12 | : disposal site | : 200 ltr. |
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| Station 6 | : north of inner channel, near north-eastern mangroves | : 200 ltr; | | | | | | | | | | | | | | | | | | | | |
| Station 7 | : 500 m from reclamation area | : 200 ltr | | | | | | | | | | | | | | | | | | | | |
| Station 8, 9 | : west of outer channel, near inshore fishing grounds | : 200 ltr; | | | | | | | | | | | | | | | | | | | | |
| Stations 10, 11, 12 | : disposal site | : 200 ltr. | | | | | | | | | | | | | | | | | | | | |
| MAIN ELEMENTS | | | | | | | | | | | | | | | | | | | | | | |
| | D | C | O | Responsability | | | | | | | | | | | | | | | | | | |
| 1. Contract Docs require daily turbidity monitoring: 12 sites | █ | | | Completed | | | | | | | | | | | | | | | | | | |
| 2. Contract Docs: operations cease if trigger levels reached | █ | | | Completed | | | | | | | | | | | | | | | | | | |
| 3. Contract Docs: train workers in effects of dredging | █ | | | Completed | | | | | | | | | | | | | | | | | | |
| 4. Contract Docs: oilspill contingency plan and equipment | █ | | | Completed | | | | | | | | | | | | | | | | | | |
| 5. Dredging, disposal, monitoring as specified | | █ | | Contractor | | | | | | | | | | | | | | | | | | |
| 6. Training, oilspill plan, equipment provided | | █ | | Contractor | | | | | | | | | | | | | | | | | | |
| 7. Set up signs at dredging and dump sites | █ | | | CEPA | | | | | | | | | | | | | | | | | | |

| MONITORING | | | |
|---|--|--|-----------|
| 1. Review SS results, decide when dredging should cease | | | CEPA/MARN |
| 2. Ensure operations and monitoring are as specified | | | ECW |

(2) **Approach**

1) **Dredging in the Outer Channel**

The type of dredger to be used for the operation is not specified in the Contract Documents as it is the responsibility of the Contractor to choose the most economical method(s). However it is very likely that a trailer suction dredger will be used for the outer channel and the outer part of the inner channel (near Zacatillo Island), as this is generally the most appropriate method where there are not major constraints on the operation.

The trailing suction hopper dredger suck the seabed material through the trailing pipe into the hold of the dredger (Figure 2.2.4). The vessel is not anchored, and moves slowly across the area, and the operation is controlled by GPS to ensure highly accurate positioning at both dredging and disposal sites. Excess water is normally allowed to overflow from the top or bottom of the dredger for a period after the hold fills, to allow more sediment to settle in the hold, thus maximizing the amount of material carried to the disposal site. This is the part of the operation that generates the most turbidity, as the overflow water contains high levels of suspended sediment.

The generation of plumes of suspended sediment was simulated by the SEDPLUME numerical model of Hydraulics Research Wallingford (UK). This simulated the most likely operating parameters, which are a trailing suction hopper dredger of 8,000 m³ capacity and 6 m³/sec pump rate, which would take roughly 2 hours to fill, and be allowed to overflow for 2 hours. Allowing time for traveling to and from the disposal site, a dredging cycle should last for 5-6 hours and the dredger will operate for 24 hours a day.

Figure 2.2.5 shows the suspended sediment plumes predicted for dredging in the outer channel. This shows that:

- Plumes produced by individual periods of dredging tend to remain discrete and oscillate up and down the outer channel with the tide;
- At any one time there will be two main plumes within which turbidity and suspended solids are increased, covering areas of 10 x 3-4 km and 5 x 1-2 km;
- At HW+2hours, plume become small due to reduced current velocity accelerating the particle to settle, but it will be larger at HW+4hours because

of erosion occur at the north of the Bay by increased current of ebb tide.

- At most locations within these plumes, increases in suspended solids (SS) will be 60 ltr or less;
- There will be higher levels for short periods in small areas, when increases of 200 mg/ltr above ambient could occur within 0.5 km²;
- The only time that a plume will impinge upon the coast is around high water when the smaller plume reaches the south and west of Zacatillo Island.

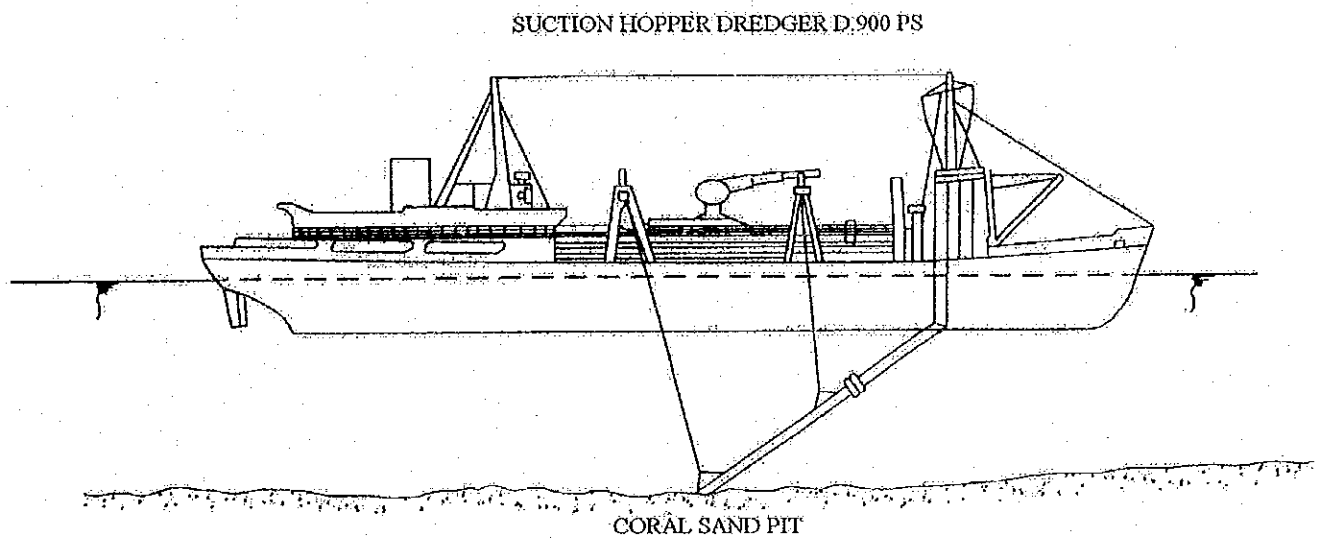


Figure 2.2.4 Trailing Suction Hopper Dredger

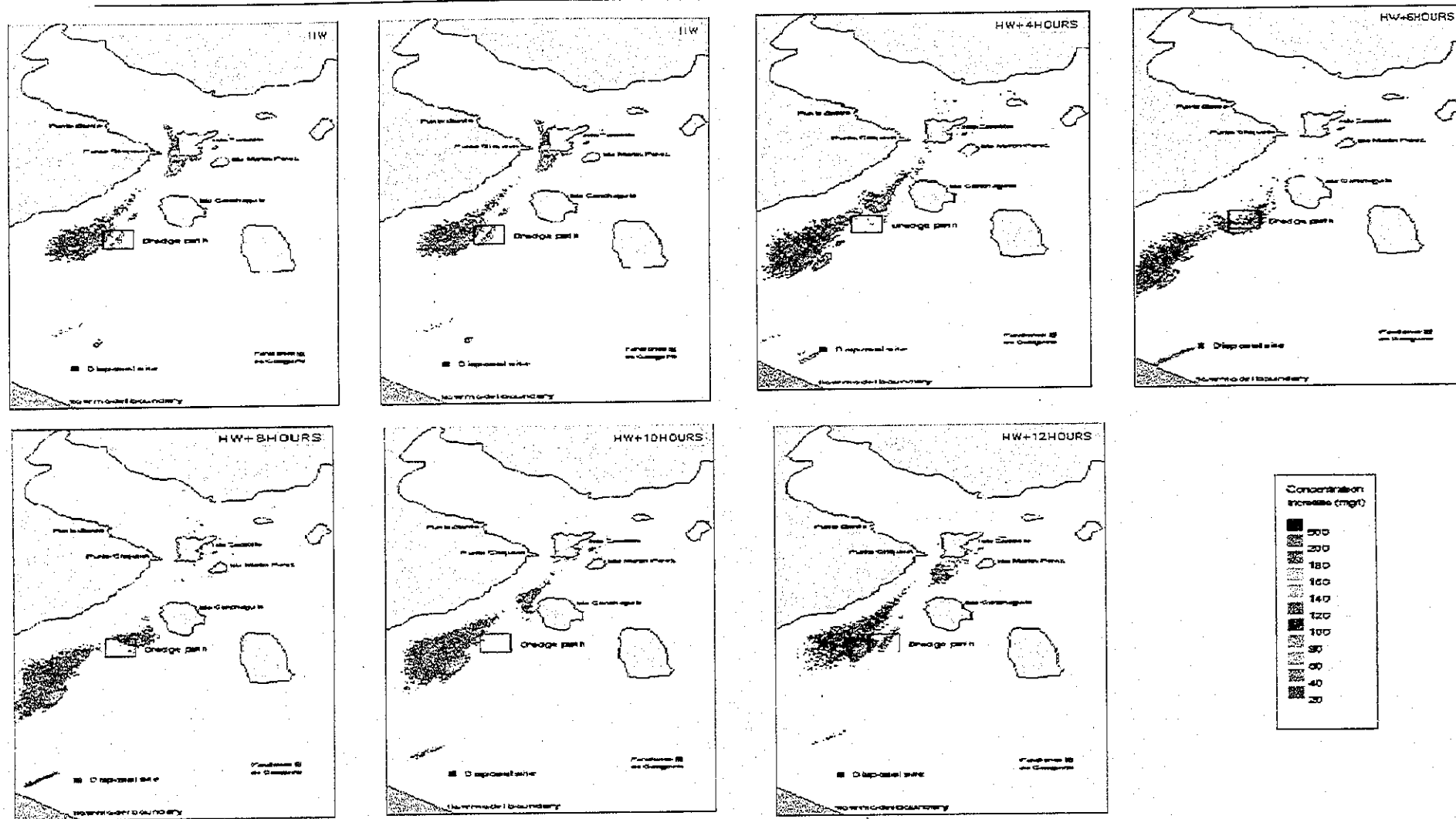


Figure 2.2.5 Numerical Modeling of Sediment Dispersion from Dredging in the Outer Channel and Disposal at The Alternative Dumpsite

These increases will be present throughout the period when the dredger is operating in the outer channel.

Dredging can cause environmental impacts from the effects of the plumes as explained in Table 2.2.8 above, and by the destruction of benthos pumped into the dredger with the material from the seabed. These impacts should not be significant in the outer channel because:

- The plumes will occur in a location of high current action where phytoplankton is constantly replenished from adjacent areas, so overall productivity should not be greatly affected by reduced light availability;
- If fish avoid turbid areas this is only temporary and results in more fish being available in unaffected areas nearby;
- Benthic organisms in a high turbidity environment are naturally tolerant of settling sediment and respond by burrowing up through the material, so smothering is generally not a major problem;
- Surveys during the design stage showed that the benthos of the outer channel comprises animals that are all found elsewhere in Fonseca Gulf and along the coast of El Salvador, so the losses will be a very small proportion of the overall populations.

2) Dredging in the inner channel

Figure 2.2.6 shows the plumes produced by dredging using the same method as above in the inner channel. This indicates that for two hours overflow:

- A single large plume will be formed, extending 10 km upstream and 5-10 km downstream, for all but a short period just after high water;
- SS increases of up to 200 mg/ltr above ambient will occur 10 km upstream from 2 hours before low water to 4 hours after, and 3-5 km downstream for 2 hours before low water;
- Much higher increases, of 500 mg/ltr above ambient will occur near Perico Island around low water.

Because of the extent and duration of these increases, further simulations were carried out, with the overflow period limited to 1 hour. These are shown in Figure 2.2.7, which indicates that under these conditions:

- The plume would be smaller in area, although it would still extend up to 10 km upstream and 3-8 km downstream through most of the tidal cycle;

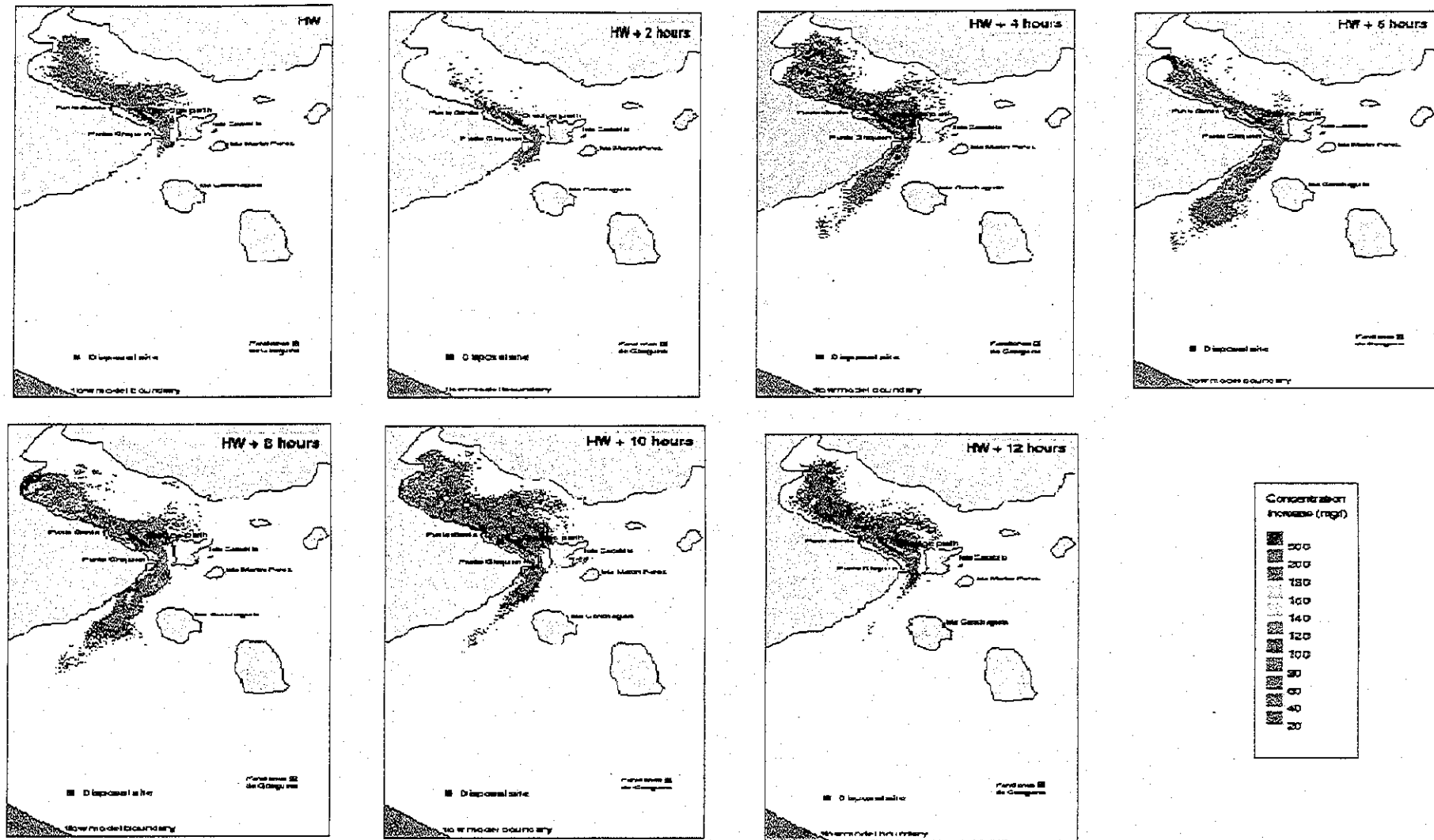


Figure 2.2.7 Numerical Modeling of Sediment Dispersion from Dredging in the Inner Channel, with a 1-hour Overflow Period

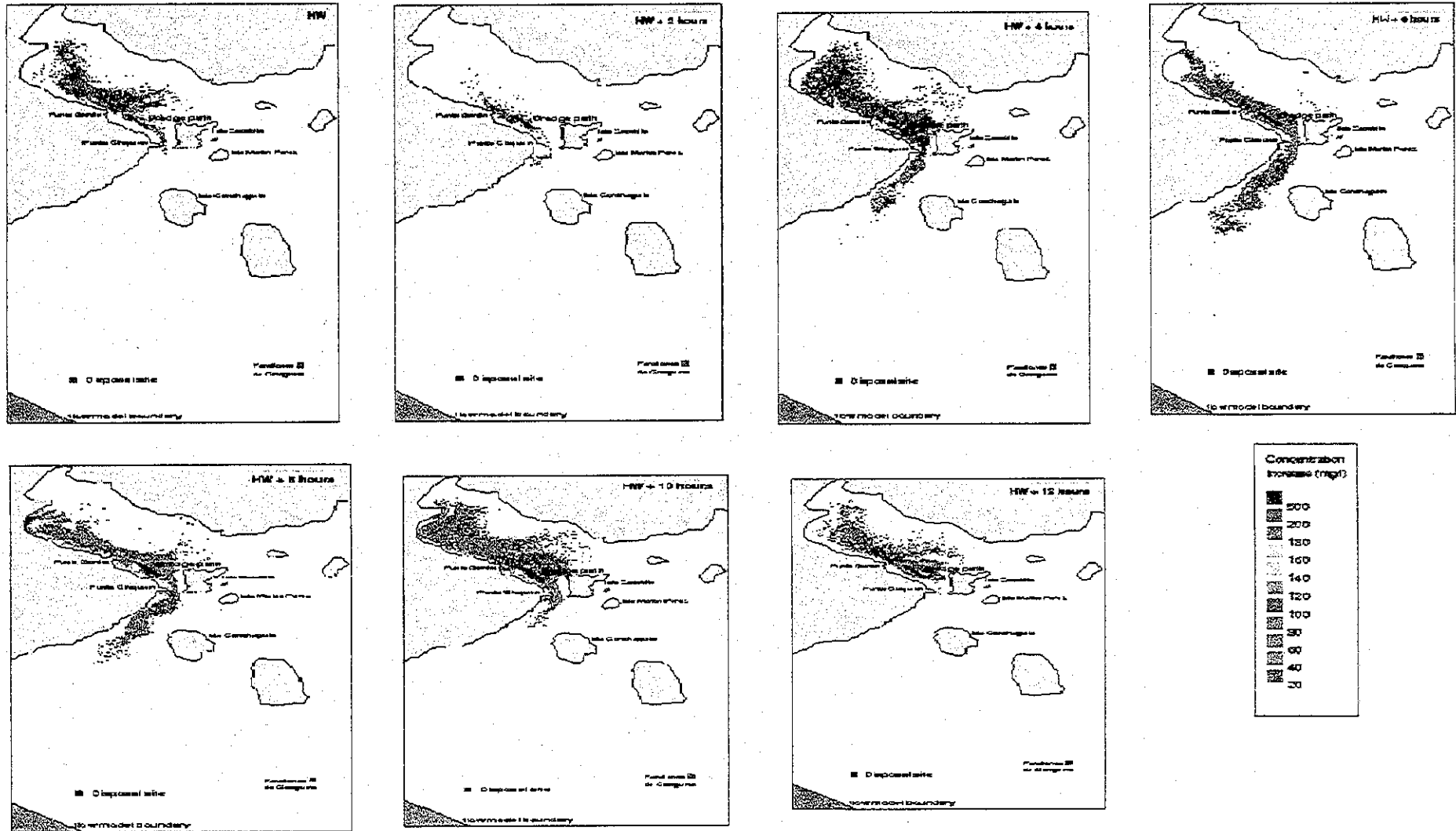


Figure 2.2.6 Numerical Modeling of Sediment Dispersion from Dredging in the Inner Channel, with a 2-hour Overflow Period

- SS increases would be lower, generally 100 mg/ltr or less, except around low water when they could again rise to 500 mg/ltr at the two ends of the plume.

These were still very high increases, and were considered likely to have significant impacts in the one part of La Unión Bay requiring special protection. This is at the head of the bay where the extensive mangrove swamps are important nursery areas for fish and shrimp, where the delicate young stages should be protected from environmental stress. There are also important populations of filter feeding mollusks in this area (between Perico and Periquito Islands), which could be damaged by excess silt in suspension, of the levels predicted by the modeling. Therefore, the overflow during the dredging operation in the inner channel will not be allowed to minimize impact.

Investigations in the design stage showed that some of the material in the channel was suitable for use in reclamation, so it was decided to use some of the material for this purpose, and to reclaim additional areas on either side of the port (shown in Figure 2.2.3) to provide new land for future port expansion and dispose of further dredged material. This would:

- Provide a beneficial use for the material;
- Reduce the spread of turbidity plumes in the inner channel;
- Release less material at the dumpsite, reducing plumes offshore.

Although it was initially proposed to reclaim a total of 89 ha (including 26.6 ha for the port), this was reduced to 62 ha to prevent excessive loss of intertidal and subtidal habitat as explained in Section 2.2.9 below.

It is likely that a cutter suction dredger will be used for this operation (Figure 2.2.8); this uses the same approach as the trailer hopper dredger, but is stationary, being anchored by legs ("spuds") drilled into the seabed. Dredged material is not retained in the hold of the vessel, but will instead be pumped directly into the banded reclamation areas through pipes. There will thus be no overflow from the vessel and no turbidity plumes around the dredger throughout the 9 months of this operation. Section 2.2.9 below shows that plumes from the overflow of water from the reclamation areas will be much less significant than those from a hopper dredger.

Because of the reduction in size of the reclaimed area it will be necessary to dispose of material from the outer 25% of the inner channel (near Zacatillo Island) at the dumpsite. It is likely that a trailer suction vessel will be used here, so during the three months of this operation, plumes similar to those in Figure 2.2.6 will be formed.

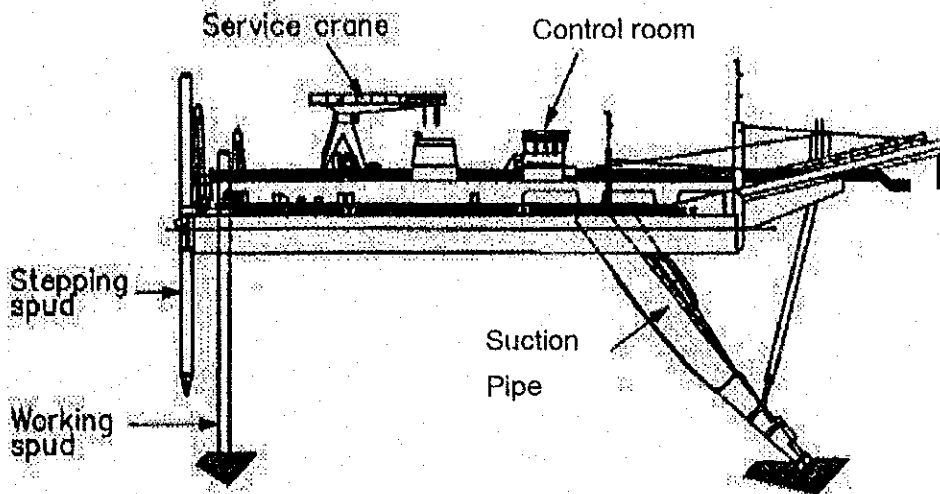


Figure 2.2.8 Cutter Suction Dredger

3) Offshore Disposal

Figure 2.2.5 shows the turbidity plumes produced by disposing of material from the outer channel and outer 25% of the inner channel at the dumpsite. This indicates that:

- After dumping, a small plume of increased suspended sediment is formed, extending 1-2 km south-west of the disposal site;
- SS increases of up to 200 mg/ltr could occur, but only in a very small area for a short period, after which levels fall to 60 mg/ltr or less above background;
- The plume is carried a few km north-westward towards the coast, and it disperses within a few hours, well before release of the next load.

The increases in silt in the water or settling on the sea bed are unlikely to cause significant impacts.

4) Change in the Mitigation Measure

Mitigation Measure No. 8 as stated in the Environmental Permit required:

- An environmental study of the disposal area;
- Anti-turbidity curtains employed around the dredger and at the disposal site to prevent the spread of sediment;
- Training of workers to raise awareness of the environmental impacts of dredging;
- Installation of warning signs in the disposal area to prevent entry by vessels;
- Booms and skimmers to be available on the dredger to deal with spillage of

any hazardous materials carried on board.

These conditions were all considered acceptable, except the use of turbidity curtains to limit the spread of sediment around the dredger and at the disposal site. This was considered:

- Inappropriate, given that such measures are normally used to protect highly sensitive, clear waters, supporting rich growths of coral, which is not the case in La Unión Bay where the water is highly turbid and where there is no hard coral;
- Unfeasible for dredging because turbidity curtains are anchored in the water whereas the dredger moves across large areas pumping continuously;
- Impracticable at the dumpsite where wave and current action operating on the fine-meshed curtains would make them impossible to anchor securely and retain in a vertical alignment, allowing turbid water to pass both over and under the curtains.

With MARN approval therefore this measure was amended to omit the use of silt curtains and to limit the spread of turbidity by monitoring and the establishment of trigger levels instead.

5) Reducing the Spread of Suspended Sediment

Because La Unión Bay is not a highly sensitive environment, trigger levels with respect to suspended solids in the water were set by considering:

- The levels of SS predicted by the numerical modeling;
- The SS increases that naturally tolerant organisms would be expected to withstand;
- The two sensitive areas at the deep part of the bay where special protection is needed.

The aim was to select trigger levels that would not impose excessive constraints on the dredging and disposal given that this is not a sensitive environment, but which would protect a high proportion of the marine and estuarine organisms from unnecessary harm. Water quality surveys (see Appendix) recorded a SS in the channel of 170-210 mg/ltr without significant difference in wet and dry seasons. For the disposal site and the majority of the dredged area, limits of 200 mg/ltr above ambient were proposed. The modeling indicated that increases above this level would only occur in small areas for limited periods, so with reasonable precautions it should be possible to maintain all increases below this value. 200 mg/ltr represents an increase of 45% above the maximum ambient level, which most organisms adapted to high turbidity, should be able to

withstand.

For the sensitive area at the deep part of the bay a level of 100 mg/ltr was proposed to protect the juvenile stages of fish and shrimp, with a level of 60 mg/ltr near Perico Island to protect the more sensitive filter-feeding mollusks, which are deprived of food if sediment is ingested, and which have to do increased metabolic work to eject the silt particles.

Twelve monitoring stations were proposed, at the locations shown in Figure 2.2.9 and Table 2.2.9 (which also shows the trigger levels). A two stage Contingency Plan was developed to respond to the trigger levels, as follows:

Stage 1a: Stations 3-12: if a trigger level is exceeded at any station, dredging and disposal will cease, and will only resume when the background level is re-established;

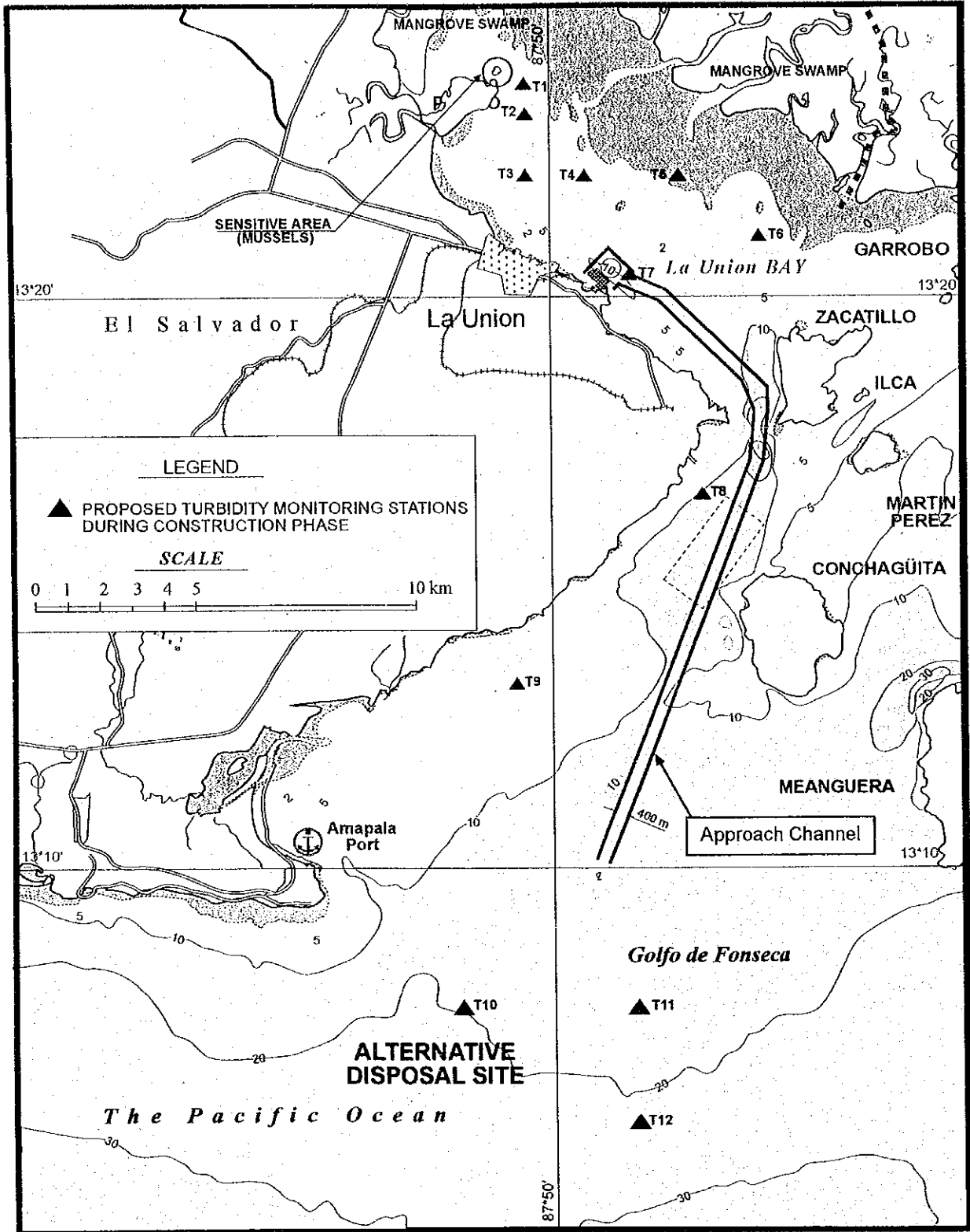


Figure 2.2.9 Turbidity Monitoring Stations

- Stage 1b: Stations 1-2: if a trigger level is exceeded, and the same level has also been exceeded at Stations 3, 4 and 5, dredging will cease, and will only resume when the background level is re-established;
- Stage 2: Repeated exceeding of trigger levels at any station, or at different stations over successive days, requires an examination of the causes and a review of the dredging method to determine whether more substantial remedial action is necessary.

Table 2.2.9 Turbidity Monitoring Stations and Trigger levels

| Station Number | Grid Reference (Mercator Projection) | | Trigger level (SS, above ambient) |
|----------------|--------------------------------------|--------------|-----------------------------------|
| | North | East | |
| T1 | 1480000 | 409000 | **60 ltr |
| T2 | 1479000 | 409000 | **60 ltr |
| T3 | 1477000 | 408000 | 100 ltr |
| T4 | 1477000 | 411000 | 100 ltr |
| T5 | 1477000 | 414000 | 100 ltr |
| T6 | 1475000 | 416000 | 200 ltr |
| T7 | 500 m from overflow weir | | 200 ltr |
| T8 | 1467000 | 414000 | 200 ltr |
| T9 | 1460000 | 408000 | 200 ltr |
| T10 | *13° 5' 45" | *87° 48' 24" | 200 ltr |
| T11 | *13° 5' 45" | *87° 51' 36" | 200 ltr |
| T12 | *13° 2' 57" | *87° 51' 36" | 200 ltr |

* To be converted to Mercator Projection

** Trigger levels at T1 and T2 apply if SS at T3, T4 and T5 are also 60 ltr or more above ambient

Dredging and disposal produces suspended sediment, but this can only be measured in the laboratory following vacuum filtration of a water sample, so there is a delay in obtaining the data. Turbidity can be measured instantaneously using a hand held meter, but measurements are based on the scattering of light, which is done by all particles in the water (including plankton, decaying organic matter, etc), not just suspended sediment. However a standard relationship between the two parameters can be deduced allowing immediate access to SS levels from turbidity readings. It was proposed therefore to require the Contractor to measure turbidity and SS at all stations every day for at least a month before dredging begins, to determine background levels and the relationship between the parameters. Turbidity would then be measured at all stations every 24 hours throughout the dredging period, and the data supplied to CEPA, who would decide when the contingency plan of ceasing dredging should be applied.

These measures were discussed in detail with the Technical Committee and with

MARN and the recommendations were approved. They were therefore included in the Specification prescribing the dredging operation.

6) Other Pollution Control Measures

The remaining actions required by this Mitigation Measure, as described above, were accepted without amendment. CEPA will liaise with the National Coastguard and Police Service, and will locate appropriate warning buoys, lights and signs in the vicinity of the dredging and disposal sites to warn vessels to avoid the area. The Specification requires the dredging contractor to train all personnel in the environmental impacts of dredging, and to prepare a contingency plan to contain and remove any oil or other material spilled from the dredger, which will also need to be equipped with the necessary equipment (booms and skimmers).

(3) Action Taken - Design Stage

1) Reducing the Spread of Suspended Sediment

The Specification prescribing the dredging operation includes a requirement for the Contractor to:

- Monitor turbidity every day for at least a month before the dredging begins, 50 cm below the surface at the 12 stations shown in Figure 2.2.9 and Table 2.2.9;
- Take a water sample from 50 cm below the surface at each station and send to an accredited laboratory for analysis of Suspended Sediment (SS);
- From the data collected, calculate the overall relationship between turbidity and SS, and the background (average) value of SS at each station;
- Monitor turbidity every day throughout the dredging and disposal operation, 50 cm below the surface at the 12 stations;
- Submit the results of the turbidity monitoring to CEPA every week, and immediately if any trigger value is exceeded;
- Cease dredging immediately if instructed to do so by CEPA, and do not re-start until instructed.

2) Other Pollution Control Measures

The Specification prescribing the dredging operation also requires the Contractor to:

- Provide training to all personnel involved in the dredging operation to raise awareness of the environmental impacts of dredging and sediment disposal;
- Prepare a contingency plan for the containment and treatment of any fuel or

oil spilled from the dredger, and equip the dredger with booms, skimmers and other necessary pollution prevention equipment;

- Implement the contingency plan to treat any pollutants spilled into the water, and inform CEPA of any such incidents immediately;

(4) Action Required – Construction Phase

1) Reducing the Spread of Suspended Sediment

CEPA will:

- Review the results of the turbidity monitoring carried out by the dredging contractor, and discuss with MARN to ensure that monitoring is implemented as specified in the Contract Documents;
- Inform MARN of any values that exceed trigger levels and decide with MARN when the contingency plan of suspending dredging should be applied;
- Advise the dredging contractor immediately if the operation is to be suspended, and subsequently when work can re-start.

2) Other Pollution Control Measures

CEPA will:

- Liaise with the National Coastguard, the Civil National Police, the El Salvador Navy and any other relevant maritime authority, and will organize the installation of appropriate buoys, lights and signs warning vessels to avoid the dumpsite and dredging area.

2.2.7 Sanitary Infrastructure for Construction Workers

(1) Description of Measure

**Table 2.2.10 Mitigation Measure No. 9:
Sanitary Infrastructure for Construction Workers**

| DESCRIPTION OF MEASURE | | | | |
|--|---|---|---|----------------|
| Install and maintain adequate toilet, washing and safety facilities for the construction site workers. | | | | |
| OBJECTIVE: Maintain worker health and safety and prevent sewage contamination of soil and water. | | | | |
| RATIONALE: Construction will involve an estimated 400 workers, who will be provided with adequate toilets, washing facilities, first aid kits, eyebaths and safety showers. Waste will be treated to El Salvador standards by a portable plant or septic tanks. | | | | |
| MAIN ELEMENTS | | | | |
| | D | C | O | Responsibility |
| 1. Contract Docs: provide sanitary facilities | | | | Completed |
| 2. Contract Docs: treat waste to El Salvador standard | | | | Completed |
| 3. Install/maintain toilets, washrooms, treat waste | | | | Contractor |
| MONITORING | | | | |
| 1. Coliform bacteria in water around site | | | | Contractor |
| 2. Provision, usage of facilities, treatment of waste | | | | ECW |

(2) Approach

The number of workers required for the construction operation will vary depending on the stage of the process, but there could be up to 400 persons on site for substantial periods of time. It is important that facilities for workers are adequate to protect their health, and to prevent the environmental pollution associated with sites where toilet facilities are inadequate. First aid kits and safety showers will also be required. A clause has been included in the Contract Documents requiring the Contractor to provide these facilities, and to ensure that they are used, and that the contents are disposed of appropriately, according to El Salvador discharge standards.

(3) Action Taken - Design Stage

Contract Documents require the Contractor to:

- Provide portable toilets and washing facilities sufficient for the number of workers on site at all times, and ensure that waste is treated or disposed of according to El Salvador discharge standards, direct discharge to the bay will not be permitted;
- Provide First Aid kits, a small medical clinic, safety showers and such other safety facilities as are appropriate to the level of hazard presented by the activities and materials used on site;

2.2.8 Project Promotion

(1) Description of Measure

**Table 2.2.11 Mitigation Measure No. 12:
Project Promotion**

| DESCRIPTION OF MEASURE | | | | |
|--|---|---|---|----------------|
| Conduct a publicity campaign, via information boards and public meetings, to inform the La Unión population about the project and gain public support. | | | | |
| OBJECTIVE: Prevent social unrest and protest regarding the port development, the increases in the transient population and other issues. | | | | |
| RATIONALE: When the new port is functioning there will be an increase in the population of La Unión due to an influx of workers from the port, and from visiting ships and vehicles. In meetings held during the consultation process for the EIA study, La Unión residents were concerned regarding the impact of the transient population on the social fabric of the city. CEPA are conducting a campaign to inform the public about the economic and social benefits of the port and the environmental protection measures, to allay public concerns and generate widespread public support. This involves public meetings (of which several have been held already), and information boards. | | | | |
| MAIN ELEMENTS | | | | |
| | D | C | O | Responsibility |
| 1. Erect billboards at the site and in La Unión City | | | | CEPA |
| 2. Hold 4 more meetings to promote the project | | | | CEPA |
| MONITORING | | | | |
| No monitoring required | | | | |

(2) Approach

As required by the El Salvador law on Environmental Impact Assessment (Capítulo IV: Sistema de Evaluación Ambiental), a public consultation process was held during the EIA study. Amongst the issues raised by the La Unión public was concern regarding the impact on the town of the expansion in population, which will result from workers from ships, trucks and other vehicles visiting the port, and workers engaged in stevedoring (cargo handling) and other port activities. Some of these will be transient visitors, who will visit the city for only a few hours or days, and people were worried that this could have a negative effect on La Unión City and society.

Given the present condition of La Unión City and the low income bracket of many of the inhabitants, it is likely that the benefits of the port in terms of stimulating the local economy and improving the income of its citizens, will greatly outweigh any negative aspects. The EIA report considered that such concerns could be overcome if the general public were better informed about the project, and recommended the erection of two billboards (3 x 9 m, one on site and one on the outskirts of the city), upon which information on the project should be placed and regularly updated. It also recommended that regular meetings be held with the local community at least eight (8) times over the four-year design/construction period, again to raise their awareness, and to enable any justified concerns to be identified and dealt with. CEPA have already

held four (4) of such meetings, and plan to continue with this program throughout the design and construction stages, and to take action to address any reasonable concerns expressed. CEPA will also erect and maintain the recommended billboards.

(3) Action Taken – Design Stage

CEPA have:

- Held four consultation meetings with the local community of La Unión City.

(4) Action Required – Design Stage

CEPA will:

- Liaise with La Unión Municipality to obtain approval for the erection of two 3 x 9 m billboards, one at the project site and one outside the city, which shall both be maintained in good condition;
- Continue the ongoing program of public campaign with the La Unión public, holding one more meeting.

(5) Action Required – Construction Phase

- Hold three (3) further public campaign meetings with the La Unión public, consider the justification of any issues raised and take action to address any reasonable concerns.

2.2.9 Disposal of Dredged Material to Onshore Dumping Areas

(1) Description of Measure

**Table 2.2.12 Mitigation Measure No 16:
Disposal of Dredged Material to Onshore
Dumping Areas**

| DESCRIPTION OF MEASURE | | | | |
|---|---|---|---|----------------|
| Limit the use of dredged material to reclaim new land near the port, to prevent the unnecessary loss of intertidal/nearshore habitat. Dispose of excess material offshore instead. | | | | |
| OBJECTIVE: Conserve important intertidal and subtidal habitat. | | | | |
| RATIONALE: The proposal to use dredgings to reclaim land around the area to be reclaimed for this phase of the port development was originally proposed to avoid environmental damage from offshore dumping. Surveys and mathematical modeling during the design stage showed that offshore dumping will not have significant impacts and that the fauna at the dumpsite is in no need of special protection. The reclamation will be limited to 35 ha, and will not, at this stage, include the planned 27 ha south of Punta Gorda. | | | | |
| MAIN ELEMENTS | | | | |
| | D | C | O | Responsibility |
| 1. Contract Docs: reclaim 24 and 11 ha NW and SE of port | | | | Completed |
| 2. Contract Docs: use dredgings for reclamation | | | | Completed |
| 3. Contract Docs: monitor turbidity 500 m from overflow | | | | Completed |
| 4. Inner channel dredging, reclamation disposal as specified | | | | Contractor |
| MONITORING | | | | |
| 1. Dredging, reclamation, disposal, monitoring as specified | | | | ECW |

(2) Approach

1) Impacts of Increased Reclamation

As explained in Section 2.1.2 above, investigations during the design stage indicated that some of the dredged material from the inner channel was suitable for use in reclamation, so it was decided to use dredgings for this purpose because less terrestrial material was available from the borrow site which had been reduced in size. MARN also expressed concern regarding the impacts of offshore dumping, so to reduce the amount released offshore it was decided to reclaim additional areas around the port (Figure 2.2.3) to provide land for future port expansion, using dredgings from the inner channel.

However when the results of the sediment dispersion modeling (Figure 2.2.5) and the environmental survey of the offshore disposal site (see Appendix) became available, it was found that:

- Offshore disposal will produce only small plumes of suspended sediment, extending 1-2 km southwest, within which increases are 60 ltr above ambient or less in all but a very small area;
- The plume disperses in the water within a few hours, well before the next load arrives;
- The dumpsite is a species-poor environment, supporting a fauna of worms and shrimps in low densities, all species being found widely throughout Fonseca Gulf and elsewhere along the coast.

Increased dumping at the offshore site would not have significant impacts because:

- Increases in turbidity will affect only a small area, so any decreases in phytoplankton productivity from reduced light penetration will be minor in terms of the overall area and energy flow in the bay;
- The levels of turbidity would be unlikely to cause significant avoidance by fish, and even if this did occur it would be only temporary and would result in more fish being available in adjacent areas;
- The organisms on the sea bed are naturally adapted to high levels of turbidity and should be able to tolerate the increases in sediment settling out from the water column.

Currently the reclamation of onshore dumping areas considers 24 ha on the north-western side and 11 ha on the south-eastern side (Zones A and B on Figure 2.2.2

2) Impacts of Overflow from the Reclaimed Areas

As explained in Section 2.2.6 above, although the use of dredgings for reclamation avoids the generation of turbidity plumes around the dredger because material is pumped direct into the designated area, turbidity plumes are still produced in the channel, by the overflow of water from the settlement lagoons.

This was again simulated by SEDPLUME, assuming in this case the use of an 8,000 HP cutter suction dredger, with a low rate of retention of fine material in the lagoon (to simulate worst-case conditions). The results are shown in Figure 2.2.10, which indicates that:

- Plumes are confined to the vicinity of the site for much of the high water-ebb tide period;
- Plumes are larger on the flood tide, extending up to 6 km down the channel at low water and 6 km up the channel between low water and the following four hours;
- During this time increases in SS are 100 ltr above ambient or less in all but the immediate vicinity of the site, where increases of 500 ltr could occur.

This shows that a further benefit of disposing of dredged material by using it to reclaim land around the port is that this produces smaller plumes of suspended sediment than those generated around a trailer suction dredger collecting material for disposal offshore.

As explained in Section 2.2.6 above, the spread of this sediment will be limited by monitoring turbidity at station T7, 500 m from the overflow weir, where SS must be maintained below a trigger level of 200 ltr above ambient (see Table 2.2.9). If this is exceeded the reclamation will have to cease until SS falls to the background level, and repeated failures may require the implementation of further sediment reduction measures such as the construction of additional bunds inside the reclamation areas to prolong retention and settling time, or the use of silt curtains outside the overflow weir as shown in Figure 2.2.3.

This Mitigation Measure was not specified in the EIA report or the Environmental Permit, but was developed during the design stage to reduce the negative impacts of the additional reclamation around the port site. The

requirement to limit reclamation to 24 and 11 ha on the north-western and south-eastern sides of the port, to avoid the area south of Punta Gorda, and to measure turbidity 500 m from the overflow weir, have been included in the Specification for the dredging operation. CEPA will include 6 ha of mangroves in their planting described in Section 2.2.1 above, to compensate for the 3 ha lost when Zone A is reclaimed.

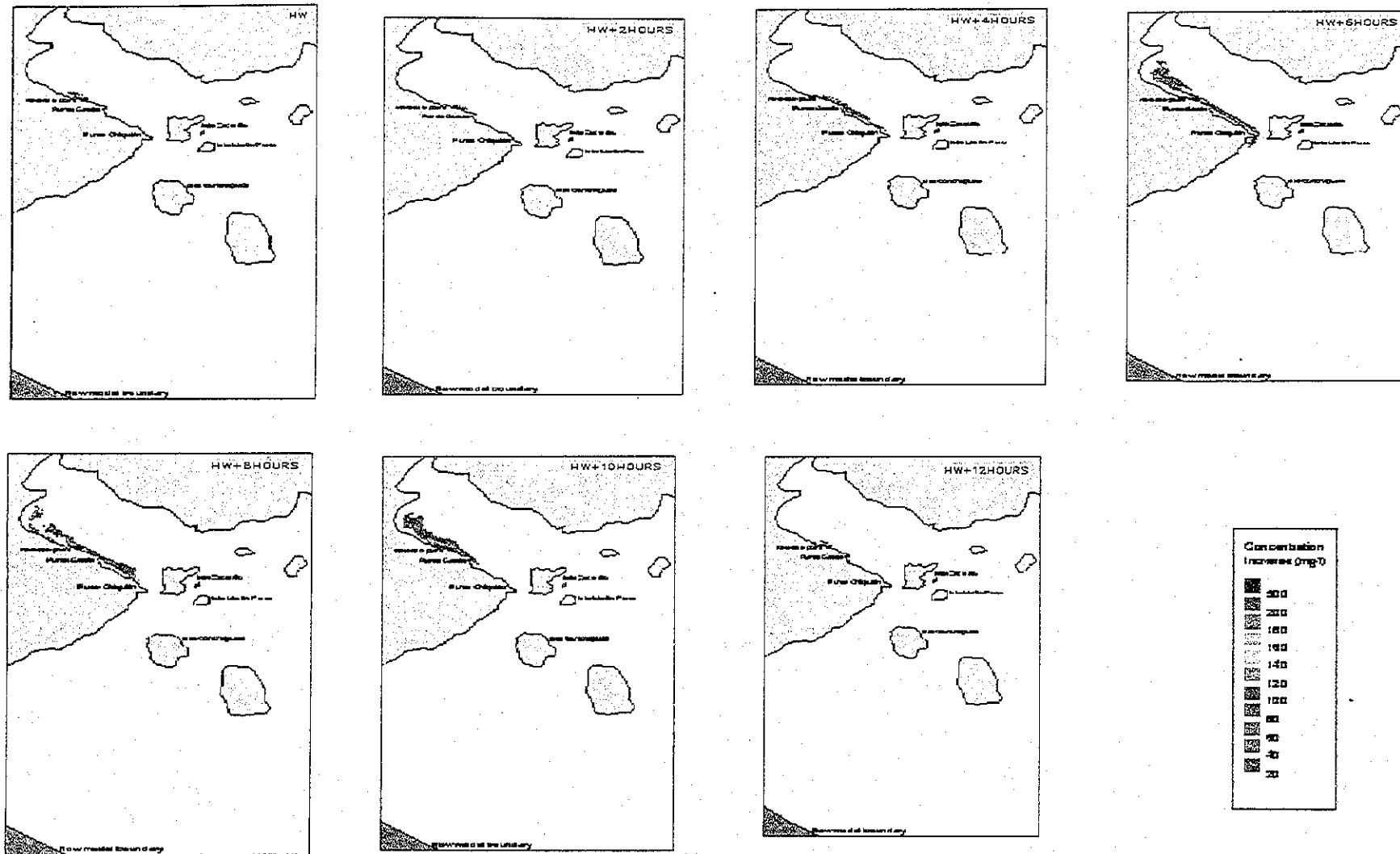


Figure 2.2.10 Numerical Modeling of Sediment Dispersion from Overflow of Water from the Reclamation Site

(3) Action Taken - Design Stage

The Design Drawings of the reclamation specify areas of 27 ha for the port site and 24 and 11 ha for additional land on the north-western and south-eastern sides only.

The Specification prescribing the dredging operation includes a requirement for the Contractor to:

- Monitor turbidity as described in Section 2.2.6 above, which includes Station T7 500m from the overflow weir from the reclamation area;
- Submit the results of the turbidity monitoring to CEPA every week, and immediately if any trigger value (shown in Table 2.2.9) is exceeded;
- Cease dredging immediately if instructed to do so by CEPA, and do not re-start until instructed.

(4) Action Required - Design Stage

CEPA will:

- Liase with MARN and La Unión Municipality to identify an intertidal area of 6 ha suitable for planting of mangroves;
- Seek assistance from MARN in developing a Specification for the re-planting of mangroves. This should specify species, the number of each to be provided, planting locations, densities and patterns, and maintenance requirements.

2.2.10 Re-settlement of Inhabitants of the Borrow Area

(1) Description of Measure

**Table 2.2.13 Environmental Permit Condition No. 12:
Re-settlement of Inhabitants of the Borrow Area**

| DESCRIPTION OF MEASURE | | | | |
|---|---|---|---|----------------|
| Amicable re-settlement of people previously living in the borrow area to suitable alternative houses | | | | |
| OBJECTIVE: Relocate the former inhabitants of the borrow area voluntarily, allowing port construction to commence without obstruction or danger. | | | | |
| RATIONALE: There were 60 families living at the site to be used as the borrow area, inhabiting self-built shacks and houses, mostly along La Gaviota Street. The families were provided with funds and assistance to enable them to build new accommodation at the village of Hacienda El Choro near Conchagua, and the relocation was completed in December 2001. | | | | |
| MAIN ELEMENTS | | | | |
| | D | C | O | Responsibility |
| 1. Families relocated in December 2001 | █ | | | Completed |
| MONITORING | | | | |
| 1. Confirm satisfaction with new accommodation | | | | CEPA |

(2) Approach

The 60 families formerly inhabiting the borrow site were relocated to their new houses in Hacienda El Choro (Figure 2.2.11) in December 2001. The relocation was organized by CEPA and assistance with the relocation and construction of new houses was provided by army personnel from La Unión infantry division. CEPA will conduct a poll of residents to ensure that they are satisfied with their new accommodation, and will take action to address any reasonable complaints.

(3) Action Taken – Design Stage

- CEPA organized the amicable relocation of the residents in December 2001.

(4) Action Required – Design Stage

CEPA will:

- Conduct an opinion poll of residents to determine the degree of satisfaction with their new accommodation;
- Take action to remedy any reasonable complaints.

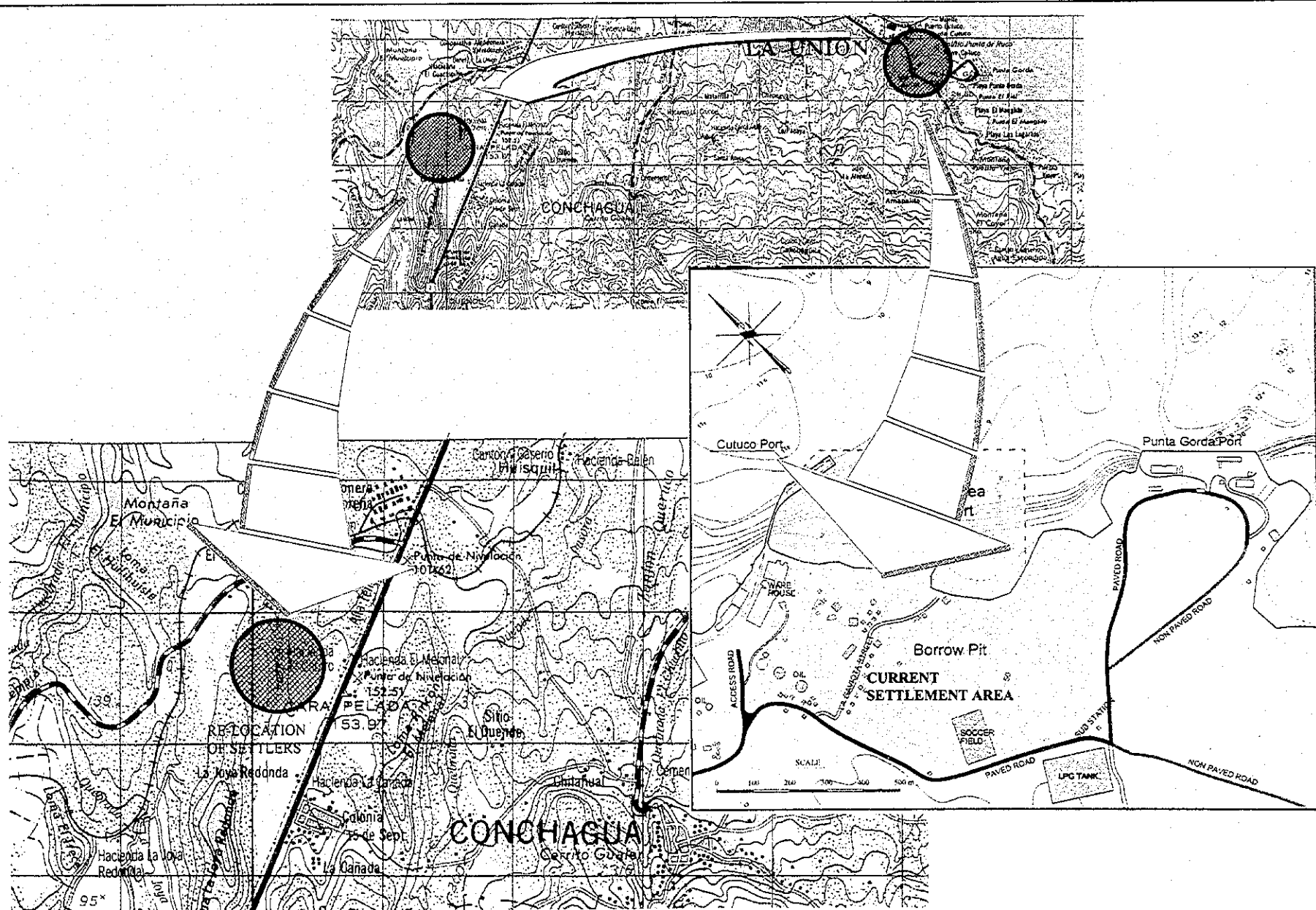


Figure 2.2.11 Relocation of the Former Inhabitants of the Borrow Site

2.2.11 Completion of La Unión Bypass

(1) Description of Measure

**Table 2.2.14 Environmental Permit Condition No. 13:
Completion of La Unión Bypass**

| DESCRIPTION OF MEASURE | | | | |
|--|---|---|---|----------------|
| Construction traffic will use part of La Unión Bypass before the road is completed. | | | | |
| OBJECTIVE: Prevent heavy machinery and equipment passing through the narrow streets of La Unión City, causing noise and air pollution, and disrupting traffic. | | | | |
| RATIONALE: The streets of La Unión City are narrow and congested, heavily used by pedestrians, and unsuitable for heavy vehicles. A new bypass is planned to support the port, running outside the south of the city, linking Punta Gorda in the east with the Pan American highway in the west. The road will not be completed before port construction begins, but the Ministry of Public Works (MOP) have agreed that construction-related traffic can use part of the route before the road is built, avoiding the need to pass through the city. | | | | |
| MAIN ELEMENTS | | | | |
| | D | C | O | Responsibility |
| 1. Contract Documents specify transport route | | | | Completed |
| 2. Agree mechanism for port traffic to use bypass | | | | CEPA |
| 3. Construction traffic using bypass route | | | | Contractor |
| MONITORING | | | | |
| 1. No monitoring necessary | | | | |

(2) Approach

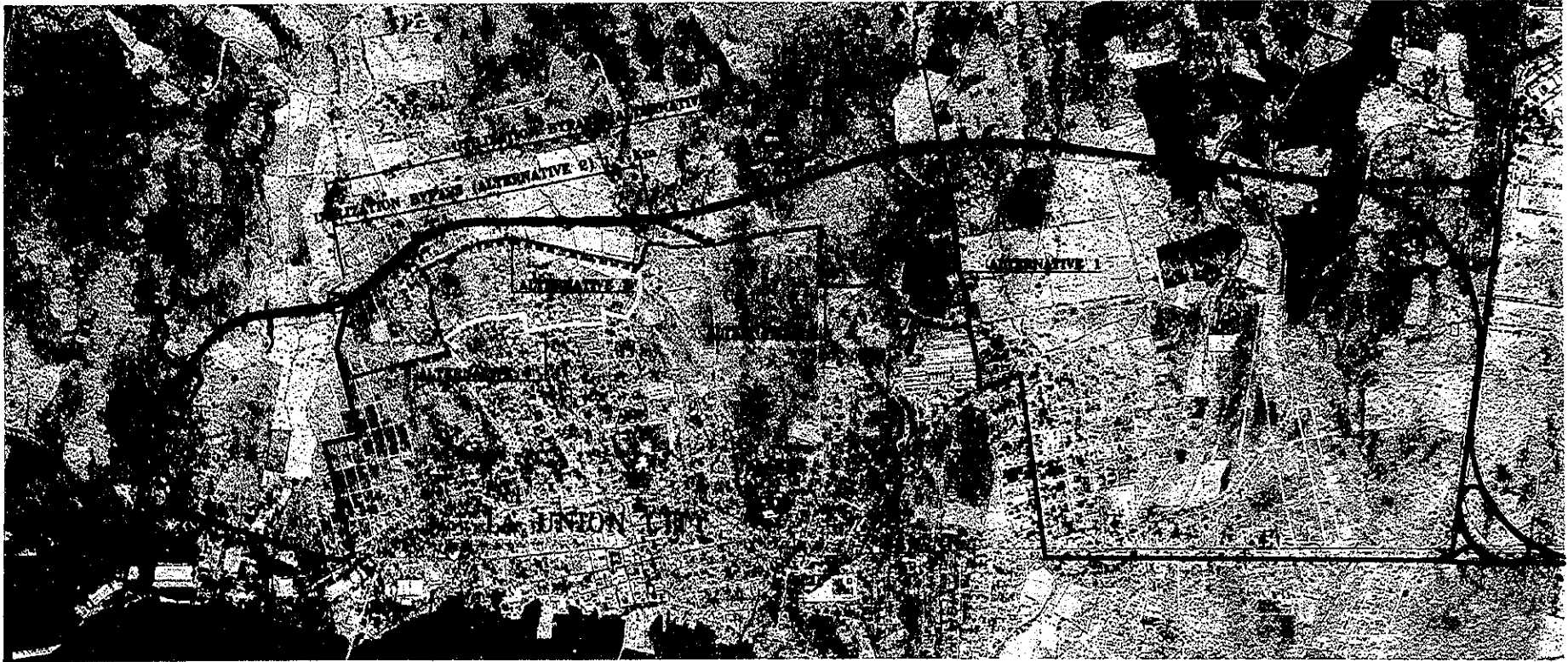
1) Change in the Permit Condition

This Environmental Permit condition states that port construction should not begin until the bypass is completed, and from discussion with MARN it was learned that this was to prevent construction traffic having to pass through the streets of La Unión City, which are unsuitable for heavy vehicles. Such traffic could include:

- Trucks transporting many loads of large rocks for the revetments, together with crushed stone and sand;
- Numerous other lorries bringing various types of construction materials;
- Several types of heavy machinery such as bulldozers, mobile cranes, pay-loaders, etc.

Discussions with the Ministry of Public Works (MOP) indicated that the bypass project is being implemented as a design and construction contract, with construction expected to commence around the later half of 2002, for completion around 18 months after commencement. As port construction should commence in the second quarter of 2003, strict implementation of this condition could seriously delay the project.

CEPA therefore discussed alternatives with MOP, who agreed that construction traffic could use part of the bypass route (Figure 2.2.12) before road construction has been completed, thus avoiding the city, and MARN agreed to the request to amend this condition accordingly. CEPA will finalize the details of the arrangement with MOP during the design stage.



----- NEW ROAD

----- NEW ROAD

Figure 2.2.12 Alternative Routes of La Union Bypass

(3) Action Taken - Design Stage

- Contract Documents specify that no construction traffic should pass through the streets of La Unión City;
- Contract documents specify the route to be used along the bypass.

(4) Action Required - Design Stage

CEPA will:

- Liaise with MOP to agree the detail of the arrangement for port construction traffic to use the route of the bypass road.

2.2.12 Control Development of Improvised Canteens

(1) Description of Measure

**Table 2.2.15 Environmental Permit Condition No. 15:
Control Development of Improvised Canteens**

| DESCRIPTION OF MEASURE | | | | |
|--|---|---|---|--------------------|
| Prevent the development of food stalls and other premises outside the port | | | | |
| OBJECTIVE: Maintain a modern, clean appearance around the port site and prevent the accumulation of refuse. | | | | |
| RATIONALE: The workforce engaged on a construction site and those employed in the subsequent new development represent a potential source of income for the local community, which frequently results in the establishment of improvised canteens and other stalls selling provisions near the site. These are unplanned and unauthorized, and are thus not provided with basic services such as electricity, water and waste collection, so they can easily become unsightly, generating waste which is not properly contained and removed. This will be prevented to maintain the modern, clean appearance of the port, and to avoid the health hazards associated with discarded uncollected piles of garbage. This will require legal measures, the provision of adequate canteens within the port, and the provision of a suitable site with proper facilities nearby, where vendors can be licensed to establish canteens and other premises. | | | | |
| MAIN ELEMENTS | | | | |
| | D | C | O | Responsibility |
| 1. Contract Does: provide canteens at construction site | | | | Completed |
| 2. Pass laws making stalls illegal outside site | | | | CEPA/La Unión City |
| 3. Police remove any illegal premises | | | | CEPA/La Unión City |
| 4. Provide suitable site nearby, license vendors | | | | CEPA/La Unión City |
| MONITORING | | | | |
| 1. Report any premises outside port to police | | | | ECW, PEU |

(2) Approach

The workforce employed on a construction site represents a potential source of income for the local community, and as a result, stalls selling food and other provisions normally proliferate outside construction sites. These premises then frequently remain in place after construction has been completed, providing the same kind of service to employees of the new facility. The premises are unplanned and unauthorized, and not provided with facilities such as water, electricity and a waste collection service, so rubbish accumulates and they often become unsightly and can be a risk to human health.

To prevent such an occurrence around La Unión Port and to maintain the appearance of the site both during construction and operation, five actions will be taken as follows:

- Contract Documents require the Contractor to provide clean inexpensive canteen facilities for the construction site workforce;
- The issue of improvised canteens will be discussed with La Unión Municipality to ensure that laws are in place making it illegal to erect and maintain stalls and any other premises in the vicinity of the site;
- Action will be requested by La Unión Police Force to remove immediately any such stalls that develop;
- A request will be made for La Unión Municipality to provide a suitable area near the port with an adequate structure, running water and electricity, and with a proper waste management service, where persons from the local community could be licensed to provide canteen services and other facilities;
- CEPA will also provide suitable canteen facilities within the port during the operational phase.

(3) Action Taken - Design Stage

- Contract Documents require the Contractor to provide inexpensive canteen facilities on site throughout the construction period for use by workers.

(4) Action Required - Design Stage

CEPA will:

- Liase with La Unión Municipality to ensure that bylaws are passed forbidding the illegal erection of stalls and other premises in the vicinity of the port site, to ensure the enforcement of the leg-lams
- Request the Municipality to organize a permit system to enable the orderly development of canteens and other stalls near construction site.

(5) Action Required – Operational Phase

CEPA will:

- Appoint a catering company from the La Unión area to provide catering facilities for the new port, including both a restaurant and inexpensive canteen.

2.2.13 Worker Safety and Wildlife Conservation

(1) Description of Measure

**Table 2.2.16 Environmental Permit Condition No. 16:
Worker Safety and Wildlife Conservation**

| DESCRIPTION OF MEASURE | | | | |
|--|---|---|---|----------------|
| Provide medication for treatment of snake bites, and train workers in how to avoid and treat snake bites, and how to deal with any wildlife found on site. | | | | |
| OBJECTIVE: Protect workers from snake bites, protect wildlife from damage by workers. | | | | |
| RATIONALE: The borrow area and parts of the Cutuco Port are vegetated, and inhabited by a variety of wildlife including venomous snakes. Although wildlife will be captured and relocated before construction begins, it is likely that some will remain, and others may enter the site from outside. Measures to protect both workers and wildlife will therefore be taken. Antiserum will be provided on site and workers will be trained in avoiding and treating snakebites, and conserving any wildlife found on site. | | | | |
| MAIN ELEMENTS | | | | |
| | D | C | O | Responsibility |
| 1. Contract Docs: train workers, provide antiserum | | | | Completed |
| 2. Training and medical care during construction | | | | Contractor |
| 3. Training and medical care during port operations | | | | CEPA |
| 4. Include wildlife conservation measures in EMS | | | | PEU |
| MONITORING | | | | |
| 1. Training and antiserum provided | | | | ECW |

(2) Approach

Although the noise, and visual and physical disturbance that occurs at the start of the borrow operation should cause most un-captured animals to leave the site, it is possible that some may be encountered by workers during this period. Most of the surface of the completed port will be concrete, asphalt or block and therefore inhospitable to wildlife, but because the surrounding area will remain vegetated, wildlife will enter the site from time to time, as transient visitors. Because the fauna of the area includes venomous snakes, it will be important to raise the awareness of workers to the dangers presented by snakes, to provide training in the treatment of bites, and to retain antiserum on site to deal with any emergencies. This is a risk during both the construction and operational phases, so training will be given to both sets of workers.

There is also a danger of wildlife (snakes, but many other species also) being harmed by workers, either deliberately or accidentally. Again awareness will be raised through training, on the ecological, aesthetic and even economic value of wildlife and the strong reasons for their conservation, and of steps that need to be taken to protect animals if they are encountered on the site. MARN will be contacted to provide the necessary training, and to assist the Port Environmental Unit in developing procedures for the safe treatment of wildlife, for inclusion in the port Environmental Management System (see Section 2.3.5 below).

(3) Action Taken - Design Stage

Contract Documents require the Contractor to:

- Provide training to all site workers by qualified medical persons, in the avoidance and treatment of snake bites. This could be done during the safety control meeting which will be held every month;

- Maintain on site a supply of suitable anti-serum throughout the construction period.

(4) Action Required - Design Stage

CEPA will:

- Request MARN to provide training to site workers early in the construction period in the value of wildlife, and appropriate action to take if animals are encountered on site.

(5) Action Required - Operational Phase

CEPA will:

- Provide training to all port workers at least once per year by qualified medical persons, in the avoidance and treatment of snake bites;
- Arrange for MARN to provide training to all port workers once per year in the value of wildlife, and appropriate action to take if animals are encountered on site;
- Instruct the Port Environmental Unit to prepare procedures for inclusion in the Port EMS specifying action to take if wildlife is encountered on site;
- Arrange for MARN to assist the Environmental Unit in preparing the wildlife conservation procedures;
- Engage a suitably qualified medical person to work full time at the port Medical Center, and provide all necessary equipment and medicines, including antiserum for the treatment of snakebites.

2.2.14 Comply with Relevant Laws

(1) Description of Measure

**Table 2.2.17 Environmental Permit Condition No. 18:
Comply with Relevant Laws**

| DESCRIPTION OF MEASURE | | | | |
|--|---|---|---|----------------|
| The port and its activities must comply with relevant laws throughout all stages. | | | | |
| OBJECTIVE: Ensure that port design and all construction and operation activities comply with all relevant national laws. | | | | |
| RATIONALE: The construction process and the operating port involve many activities which could be hazardous if equipment, machinery and operations are not designed and implemented to the strictest standards and specifications, and if laws are not upheld. A port is also a place where illegal activities could occur, including handling prohibited goods. Designs have been prepared following established national, and where relevant, international standards, and the Port Contractor will be required to operate in compliance with all national laws. As the project proponent and the legal authority for the operating port, CEPA will also ensure that all applicable laws are upheld by port operators and users at all times. | | | | |
| MAIN ELEMENTS | | | | |
| | D | C | O | Responsibility |
| 1. Port designs comply with standards and laws | | | | Completed |
| 2. Contract Docs: Contractor to comply with laws | | | | Completed |
| 3. Port built according to standards and laws | | | | Contractor |
| 4. Port Manual checked for legal compliance | | | | CEPA |
| 5. Port Manual and procedures comply with laws | | | | CEPA |
| 6. CEPA enforce compliance with procedures, law | | | | CEPA/Port Mgr |
| MONITORING | | | | |
| 1. Construction carried out according to contract | | | | Consultant |
| 2. Port operations according to POM | | | | CEPA/Port Mgr |

(2) Approach

1) Port Design

Engineering designs are developed by reference to standards and criteria set down in design manuals, which have been used over many years to produce designs of quality and safety, that comply with relevant laws. For the present port El Salvador standards were used as the primary source, and where these were not applicable or unavailable, international standards were used, specifically those of the Japanese and USA Design Manuals. This, plus quality checks carried out as part of routine engineering procedure, have ensured that the designs comply with the relevant laws.

2) Construction Process

As far as the construction process is concerned, the Contract Documents require the Contractor to obtain information on the appropriate laws and to ensure that all activities are in compliance. The construction process will be supervised by a civil engineering Consultant, who will engage local consultants familiar with the legislative environment of El Salvador, to ensure that any illegal or non-compliant practices are recognized and corrected.

3) Port Operations

As explained in Section 2.3.1 below, all of the activities within the port will be prescribed by procedures contained in a Port Operations Manual. CEPA will ensure that their Legal Department review all procedures in the draft and final

versions of the manual to ensure that the approaches specified are in compliance with all appropriate laws. Adherence to the procedures will then be monitored by the Port Management Team, and they will report transgressions to CEPA, who will have the ability to apply appropriate sanctions.

Ports normally house officials from the government customs and immigration departments who operate to detect illegal cargoes or immigrants. Officers from the Dirección General de Aduana (Customs) and Dirección General de Migración (Immigration) will thus be provided with offices in the port from where they will implement their activities. These will include routine checking of baggage and passports at the multi-purpose terminal, plus targeted searches of specific vessels, vehicles and containers.

(3) Action Taken - Design Stage

- Port designs have been prepared by reference to El Salvador design manuals as the primary source of applicable standards, criteria and specifications. Where these were not available or not appropriate, Japanese or American standards were used;
- Quality checks were carried out on all drawings, documents, calculations and other aspects related to both basic and detailed designs;
- Contract Documents require the Port Contractor to be conversant with all relevant El Salvadorean law and to ensure that site practices are in full compliance at all times.

(4) Action Required – Construction Phase

CEPA will:

- Liaise with the Ministerio de Hacienda (Finance Ministry) and Ministerio del Interior (Interior Ministry) to ensure that they provide Customs and Immigration Officers respectively at the commencement of the port operations.

(5) Action Required – Operational Phase

CEPA will:

- Ensure that both draft and final versions of the Port Operations Manual are reviewed by the CEPA Legal Department to ensure that all practices are in compliance with the relevant laws;
- Make the Port Manager responsible for monitoring the implementation of the Operational Procedures and reporting transgressions to CEPA;
- Take action in cases where procedures are not adhered to.