

**INTER-AMERICAN DEVELOPMENT BANK**



***CHILE***

***Mejillones Port Project  
(CH-0162)***

***ENVIRONMENTAL AND SOCIAL IMPACT REPORT  
(ESIR)***

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## **LIST OF ABBREVIATIONS**

Ag	Silver
As	Arsenic
BOD-5	Five day biochemical oxygen demand
BOT	Build, operate, transfer
BPEO	Best Practicable Environmental Option
Cd	Cadmium
CPM	Complejo Portuario Mejillones S.A.
Company	Compañía Portuaria Mejillones S.A.
CONAMA	Comisión Nacional del Medio Ambiente
COREMA	Comisión Regional del Medio Ambiente
Cr	Chromium
Cu	Copper
dB(A)	A-weighted decibels (noise levels within human hearing range)
DIRECTEMAR	Dirección General del Territorio Marítimo y Marina Mercante de la Armada de Chile
DOP	Dirección de Obras Portuarias
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GDP	Gross Domestic Product
Hg	Mercury
Hs	Wave height
MOP	Ministerio de Obras Públicas
NCh	Norma Chilena
Ni	Nickel
NPSeq	Nivel de presión sonora equivalente (equivalent sound pressure)
NRS	Nivel de reducción de sondas (approximately 0.8m below sea level)
Pb	Lead
RO	Reverse Osmosis
SAG	Servicio Agricultura y Ganadero
SEIA	Sistema de Evaluación de Impacto Ambiental
TBT	Trybutyltin
TMDA	Transito Medio Diario Annual (Annual Average Daily Traffic)
TOC	Total organic carbon
Tp	Wave period
TSD	Trailer suction dredger
TSH	Trailer suction hopper
UV	Ultra violet
Zn	Zinc

## **I. INTRODUCTION**

- 1.1 Over the last decade, the Government of Chile has promoted the development of a port complex in Mejillones Bay, in Region II of Chile. In March 1997, the state-owned copper company CODELCO established the firm Complejo Portuario Mejillones (CPM) to undertake the necessary studies to develop a port complex in the city of Mejillones. The project was officially supported by the Government of Chile through Supreme Decree No. 53 which declared the project to be in the national interest. In July 1998, CPM started an international bidding process for firms interested in designing, financing, constructing and operating Terminal 1 of the port complex for a Concession period of 30 years, renewable for a period of 10 years.
- 1.2 In November 1999, a Concession was awarded to the Compañía Portuaria Mejillones S.A. ("Company"), which is owned by Inversiones y Construcciones Belfi Ltda. ('Belfi'), Inversiones Cosmos Ltda. (an affiliate of Ultraport), and Puerto de Mejillones SA (which itself is jointly owned by the two former companies). Belfi is a construction company, Ultramar is a port operating company, and Puerto de Mejillones is a company owned jointly by Belfi and Ultramar, which operates an existing port facility in Mejillones.
- 1.3 The Project involves the construction of Terminal 1, a multi-purpose, four-berth terminal to handle principally copper cathodes and also general cargo. CPM and the Company have signed a Copper Throughput Agreement to guarantee shipments of copper cathodes. Copper exports from Region II of Chile are projected to reach 2.5 million tons by the year 2010 and 10 million tons by 2050. The Project will be developed in two stages. In the first stage, a three berth multi-purpose terminal will be constructed, at a cost of US\$110 million, to open in the second half of the year 2002. In stage 2, a fourth berth will be constructed, when warranted by demand, with a total investment of US\$15 million.
- 1.4 The Company has approached the Inter-American Development Bank (IDB) for a loan to finance the first stage of the Project. The IDB is analyzing the possibility of financing the project through an A Loan not exceeding US\$20 million and B Loan not exceeding US\$40 million.

## **II. PROJECT DESCRIPTION**

### **A. Site Location**

- 2.1 The proposed port location is situated in Region II of Chile, north of Antofagasta, in the Municipality of Mejillones, specifically to the northeast of the town of Mejillones in the industrial quarter (see Figure 1). Approximately 5000 ha of land have been reserved for the phased development of the port complex in the Municipality of Mejillones Development Plan ("*Plan Regulador Comunal del Puerto y Bahía de Mejillones*"), while CPM has purchased a small portion of this land for Terminal 1.

### **B. Project Components**

- 2.2 The proposed port complex at Mejillones will be developed in two stages. Stage 1 involves the construction of a multi-purpose terminal for handling copper cathodes and general cargo (see Figure 2). In Stage 1, a marine service area will be constructed from the cliff-line seawards consisting of a three-berth wharf, pre-embarkation areas, open air storage areas, and general service areas amounting to about 6 ha, and approximately 60 ha of consisting of storage facilities,

offices, service areas, entrance, fuel storage, and road and rail accesses. The port will be equipped with wharf cranes mounted on rails, zones for loading and unloading from the railway, weighing station, offices, workshops, canteen, washrooms, and an electrical sub-station. All the services for potable water, sewerage, electricity, and telecommunications, will be installed during Stage 1.

- 2.3 The three-berth wharf will be 420m long, consisting of a nucleus of fill material protected by rock armour and horizontal platforms supported on piles. The two outer berths will be 220m long, 50m wide, and lie in water 14m deep, while the single inner berth will be 200m long, 27.5m wide, and lie in water 12m deep. The inner berth will accommodate smaller ships.
- 2.4 A 200m long breakwater will be constructed 40m off the end of the wharf to protect shipping. This structure will consist of piles and reinforced concrete panels. A sediment control structure will be built to the east of the port and will extend from the beach to about 75m offshore. The pre-embarkation and storage areas will be created alongside the three-berth wharf by land reclamation. This area will extend from the cliff base to about 300m into the sea. Provision will be made for stormwater drainage, but it will not be discharged to surface water.
- 2.5 The port will be accessed by a short length of new asphalt road 1.7km long from the existing port road and a short section of state highway B262 (about 5km) will be upgraded. Both sections will be designed for a 100km/hr vehicle speed limit. A 3km extension of the railway line from the Interacid terminal to a new rail terminal opposite the port will also be built.

#### *Construction Activities*

- 2.6 The main activities associated with the construction of the port include the following.
  - Site preparation, including site clearance, the installation of temporary sanitation facilities, the construction of warehouses, canteens, offices and all the other installations necessary for the construction of the works.
  - Delivery of raw materials (aggregate, rock armour, piling etc) and disposal of wastes (inert materials, spoil, sewage, packaging etc). Raw materials will be transported to the site from Antofagasta and surrounding areas by railway or heavy goods vehicle.
  - The dredging and disposal of the dredged material to provide sufficient draft for both the wharves to be constructed for Terminal 1.
  - Manufacture and erection of structures (wharf, breakwater, sediment control structures, underground fuel tanks, etc). The structures will be coated with special anti-corrosion paints at the workshops where they will be manufactured. The type of paint used, and manner of application, will comply with the technical and environmental requirements for this type of project.
- 2.7 The dredging scheme requires dredging the seabed to provide a draft of 14m for the outer berths and 12m for the inner berths. An estimated 850,000m<sup>3</sup> of material will be dredged from the seabed over an area of approximately 172,000 m<sup>2</sup> in order to provide sufficient draft for ships entering and leaving the proposed port. The material to be dredged consists of two clearly divided and distinct materials. The upper layer consists of fine, clean, uniform sand containing some silt and gravel sized shell fragments. From the technical reports containing the borehole data, this layer appears to be 1-5m thick. Underlying this is a layer of weakly cemented sedimentary rock known as diatomite that extends below the proposed maximum dredged depth. Diatomite is a siliceous sediment made up almost entirely of the "skeletal" remains of microscopic plants (algae) called diatoms. The grain size of the material when broken down is of a uniform fine silt. It has been estimated that some 35% of the material to be dredged (297,500 m<sup>3</sup>) is diatomite. Since the fine

sand also contains 6-20% silt fraction, the total volume of silt to be handled by dredging operations may be about 370,000m<sup>3</sup>.

- 2.8 The dredging will most likely be undertaken using a medium sized Cutter Suction Dredger, which would be capable of dredging the weak bedrock without the use of explosives about 800DWT, between 10,000 and 20,000HP, and with a 4 to 6m draft. Consideration is also being given to the need for a tug to position the dredger. However, as part of the EPC dredging contract proposals from the six international dredging companies prequalified, the companies may propose other options, as long as these options comply with the technical specifications and DIRECTEMAR (governmental agency) requirements. The Company undertook investigations to select a preferred site for the marine disposal of the dredged material, using a methodology approved by DIRECTEMAR, who will also approve the requisite authorization. The methodology used environmental and technical criteria. The final design and governmental approval for dredging method and dredged material disposal site is still pending. The diatomite dredged material would not be suitable for reuse in land reclamation due to the problem of bearing loads and risk of liquefaction during earthquakes and therefore needs to be disposed off. Reportedly, the utilization of the diatomite in the industrial process is not economically feasible due to the cost of treating the diatomite for industrial purposes as well as the cost of transport.
- 2.9 Disposal of the dredging material will be conducted depending on the location of the disposal site. The dredged material will be transported by one of two methods, (i) floating pumping line with a booster station, or (ii) by barge. In the case that the dredged material will be disposed of via a floating pumping line, it is expected that pumping line would have a diameter of 800-1000mm, and convey fine material at a rate of 2-3m/s and coarser material at 5-7m/s to avoid blockages. The end of the pumping line would be submerged, either vertically or at an angle, to a depth of 5m below the water surface. The end of the pumping line would also be relocated from time to time within the disposal area to encourage a more even dispersion of the sediment on the seabed. The floating line will be mounted on floaters and marked adequately to be visible to smaller craft.
- 2.10 In the case of the use of barges, the sediment will be pumped or placed from the dredger onto the barges with a capacity between 900-2700T, length of 80-120m and a draft between 4 and 6m. The ratio of sediment to water is variable, but may be in the order of 30-70%. To improve the efficiency of transport by barge, they are allowed to overflow, with less turbid water draining back into the sea. The dredged material will be carried to the selected disposal site and then discharged via bottom-opening gates at a depth of about 4m below the surface. The discharge will occur over a trajectory agreed with the maritime authorities and indicated in the field by buoys within the disposal zone to encourage dispersion. The number of barge journeys per day is estimated to range between 15 and 75, depending on the characteristics of the dredger used, its performance and the size of the barges.
- 2.11 The dredging activities will commence with a trial period, consisting of increasing periods of dredging over 6hrs, 12hrs, and 24hrs, in order to evaluate the impact of dredging on water quality. Once this is completed satisfactorily, the main dredging operation will commence. The dredging operations are expected to last for 3 to 6 months. Further information on the proposed dredging trials, mitigation and monitoring activities are presented in Section 5.
- 2.12 Earthworks will involve the removal of material or land reclamation to create the storage and service area by the three-berth wharf, interior and exterior roads, and storage parking areas. The total volume of cut and fill is estimated to be 155,000m<sup>3</sup> while the volume of rock armoring is estimated to be 200,000m<sup>3</sup>. These materials will be purchased from specialist companies, which will have to comply

with the relevant regulations for this type of activity. Earthworks will require the use of various plant such as compactors, loaders, lorries, etc.

- 2.13 During construction, the local water company ESSAN will provide potable water from tankers, the local electricity generator companies will supply electricity, and local companies will supply fuel for plant.

#### *Operational Activities*

- 2.14 During operation, the principal cargoes handled at the multi-purpose terminal will be copper cathodes, and secondary cargoes will be machinery, containers, cargo in pallets, refrigerated products, packaged goods and specific non-unitary goods. The port is not designed or licensed to handle bulk materials, which can give rise to dust during stockpiling and handling. The copper cathodes would be brought in by rail and stored in piles at the port for up to 10 days. Shipping transport is projected to reach about 358 ships per year. Annual cargo movements are expected to be approximately 1.75 million tons. Most of the cargo would be transported by railway, but a small proportion would be transported by trucks. Average daily truck movements are estimated to be about 190.
- 2.15 The port operation includes a maintenance program for structures initially consisting of painting and sanding to avoid corrosion, but at later stages may require the deepening, reinforcement or replacement of structures due to processes such as undermining and abrasion. A dredging program may be needed to maintain an adequate draft for shipping. Initial modeling estimates suggest that the volume of sediment to be dredged in the proposed port location may be in the order of 55,000m<sup>3</sup> every 3 years, depending on the frequency and direction of storm events. This is a relatively small volume for maintenance dredging. Port equipment and lorries will need to be maintained routinely.
- 2.16 Basic services, such as electricity and fuel, will be supplied by local companies. Electricity will be used principally for equipment, machinery, and lighting at the port. Fuel will be stored in underground fuel storage tanks and used for plant and machinery. The diesel will not be used for refueling ships. The structural design, installation and maintenance of the tanks will comply with the relevant legislation, particularly Supreme Decree No. 379/86 on the minimum security requirements for the storage and handling of liquid fuels derived from petroleum and Supreme Decree 90/96 on the storage, refining, transport and public retailing of liquid fuels derived from petroleum.
- 2.17 Water for human consumption will be abstracted from the sea and will be treated at a desalination plant at the port site. It is proposed to install a reverse osmosis plant, consisting of pre-treatment filtration using multimedia filters with automatic backwashing, filtration through 5µm cartridges, high pressure piston pump, TURBO energy recovery, reverse osmosis membrane modules, anti-encrustation injection system, a membrane washing system, central control system, and disinfection by chlorine injection. The plant will have a capacity to produce 150m<sup>3</sup>/day of treated water sufficient to supply the people who will work at the port during operation.
- 2.18 Wastewaters will be treated at a wastewater treatment works (WwTW) at the port site. The proposed WwTW plant will contain the following components: coarse screening (<30mm); pumping well; manual fine screens (10mm); primary sedimentation; biological treatment (biodiscs); secondary sedimentation; disinfection by chlorination and anaerobic digestion of the sludges. The treated wastewater will be used to irrigate green areas and the sludge will be dehydrated on drying beds and used as a soil conditioner also within the port complex or be disposed of at the waste disposal site.

- 2.19 Maximum annual estimates of waste generation during port operation are 350tons/year for non-hazardous waste, 120tons/year of explosive, inflammable, corrosive or reactive wastes and 1.2tons/year of toxic wastes. Non-hazardous solid wastes will be disposed of to a new authorized waste disposal facility within the land reserved for port development A suitable 25ha site has been identified within the port zone which would provide a 30 year design life, with scope to extend the site. Hazardous and toxic wastes would have to be disposed of to a specially licensed site.
- 2.20 The disposal of waste from ships is regulated under international conventions and controlled by the Navy. It is not permitted to change ballast waters in Chilean coastal waters. There is no provision for the handling and disposal of wastes from ships (sewage, solid waste) at the proposed port, apart from a small provision for domestic type wastes, wood used in stowage and wastes from ship maintenance amounting to an estimated 65tons/year which would be disposed of at the waste disposal site.

### **C. Project Cost, Schedule and Workforce**

- 2.21 The estimate cost for constructing Stage 1 is US\$110 million.
- 2.22 The construction of Stage 1 is tentatively planned to start during the third quarter of 2001, and is expected to finish in 20 months.
- 2.23 The average workforce employed during the construction phase is estimated to be about 450 persons, consisting of about 350 manual workers (bricklayers, carpenters etc) and 100 professional staff (foremen, surveyors, engineers etc). During peak construction periods, the labor force may rise to 500-800 persons. Manual labor will be drawn locally, from Mejillones or Antofagasta. There are no plans to build a temporary camp at the port site, as sufficient accommodations are available in Mejillones and Antofagasta. The construction company will provide dedicated bus services for staff to travel to and from Mejillones and Antofagasta, as well as canteen facilities at the construction site.
- 2.24 During the operation phase, about 150 people will be employed at the port, with three shifts to provide 24 hour operation.

### **D. Analysis of Alternatives**

#### *Port Site Selection*

- 2.25 In 1998, CPM commissioned a study to analyze the various alternatives for port design and the selection of the best location for developing a port complex in Mejillones Bay. The resulting study by Geotécnica Consultores, 1998, looked at alternatives and also prepared general proposals for land use zoning to promote sustainable development in the Municipality of Mejillones. The study focussed on two key areas, El Rincón, located between the town of Mejillones and the peninsular, and the area to the north of the industrial quarter and northeast of Mejillones. Consideration was given to differences in costs, port layout, and environmental and planning issues.
- 2.26 The El Rincón site posed a number of disadvantages. There is limited level ground for the development of port support facilities and related industry. All traffic would need to circulate around the outskirts of Mejillones, which would then become surrounded by port and industry-related development to the west and the east. There is an active faultline - Fallo Mejillones - running along the footslopes of the mountains. This site is also located close to the designated shellfish culture grounds, which would be affected by ship movements and pollution incidents,

and the ecological reserve of Punta Angamos. The main advantage of this site is that it is very sheltered from winds and waves.

- 2.27 The preferred site corresponds to the sector to the north of the industrial quarter, which benefits from multiple advantages. There are excellent natural conditions, including the large area of land available (the coastal plain around the Bay is about 23km long and 16km wide in this location), deep water close to shore reaching 20m depth at only 600m from the coastline, low wave climate, little tidal influence, and moderate winds. The extensive coastline in this area (approximately 12 km) allows further development north of the existing industrial quarter of Mejillones and the integration of the existing port terminals with the new port. Development to the north, would also reduce the impacts on the residential areas of Mejillones and permit residential growth to the south and east of the town away from industrial areas.

#### *Dredging*

- 2.28 The Company undertook investigations to select a preferred site for the marine disposal of the dredged material. The methodology for the site investigations was approved by DIRECTEMAR, who will also approve the requisite authorization. The methodology selected for disposing of the dredged material would depend partly on the location of the disposal site. The potential disposal sites were selected on the basis of four key criteria:
- no biological rare or commercially important species to be found within the Zone and that the habitat is not biologically unique;
  - the area is not used by third parties i.e. no commercial interests within the zone;
  - the site is to be a low energy environment (e.g. currents <0.01 m/sec) where the risk of resuspension is low, and with low dispersion and high dilution; and
  - seabed slope must be greater than 2 percent.
- 2.29 Two potential disposal zones (See Figure 3) were evaluated on environmental, operational and economic grounds. Zone A lies at a nearshore location to the north of the proposed port, while Zone B is located on the western side of the southern Bay off Punta Angamos. The disposal sites under investigation lie in waters 80-100m deep where the low velocity near-bed currents would minimize resuspension of the sediment once deposited. If Zone A is selected as the preferred disposal site, then the dredged material will be transported to this location by one of two methods, (i) floating pumping line with a booster station, or (ii) by barge. If Zone B is selected, the dredged material will be transported by barge.

### **III. INSTITUTIONAL AND LEGAL FRAMEWORK**

#### **A. Institutional Framework**

##### *Industrial Sector (Ports)*

- 3.1 Ministry of Public Works (Ministerio de Obras Públicas - MOP), Office of Port Works (Dirección de Obras Portuarias -DOP). Article 19, of the law governing the MOP (Decree with Legal Force No. 850, 1997) establishes the functions of the DOP. These include the supervision, inspection and approval of studies, projects, construction, improvements and extensions of all port, maritime, river or lake engineering works, and dredging operations in ports and navigation channels which are required by the Administration of the State and undertaken by themselves or private parties. In this Project, the DOP is responsible for approving the detailed port design, dredging, and navigation channels.

- 3.2 Ministry of National Defence, Marine Subsecretary, General Office of Maritime Waters and Merchant Navy of the Chilean Navy (Ministerio de Defensa Nacional, Subsecretaría de Marina, Dirección General del Territorio Marítimo y Marina Mercante de la Armada de Chile - DIRECTEMAR). The law on maritime concessions (Decree with Legal Force No. 340, 1960, and its implementing regulation Supreme Decree No. 660, 1988) establishes the role of this Ministry and Subsecretary. The Ministry is responsible for the control, inspection and supervision of the whole coastline and territorial waters of Chile, including rivers navigable by ships greater than 100 tons. The Ministry has the exclusive power to allow any form of the coast, beaches, rocky shores, seabed and sectors of coastal waters for private use. Among the activities undertaken by DIRECTEMAR are the enforcement of international conventions and national legislation concerned with shipping, environmental monitoring in Chilean waters, and the control of discharges to the marine environment. With respect to the proposed Project, DIRECTEMAR is responsible for approving the environmental monitoring plans affecting the marine environment and the proposed dredging operations.

#### *Urban Planning*

- 3.3 Office of Municipal Works (La Dirección de Obras Municipales de la Municipalidad). New developments have to comply with the land uses that have been authorized in the corresponding land use plan, which in this case would be defined by the 'Plan Regulador del Puerto y Bahía de Mejillones'. If a given sector is not included within the urban limits, it is necessary to request a change to the land use plan in accordance with the requirements of Law No. 458, 1975, General Law on Urbanisation and Construction.

#### *Environment*

- 3.4 The National Environment Commission (Comisión Nacional del Medio Ambiente - CONAMA) was created by Law No. 19,300 on the General Provisions on the Environment. CONAMA is the state institution charged with the mission to promote the environmental sustainability of development and co-ordinate actions to implement environmental policies and strategies promulgated by government. CONAMA has a decentralized structure, with a national office in Santiago and an office in each of the regions (Comisiones Regionales del Medio Ambiente - COREMA).
- 3.5 The responsibilities of CONAMA include the administration of the Environmental Impact Assessment System ("Sistema de Evaluación de Impacto Ambiental" - SEIA). The Sponsor of a project submits an EIA to the COREMA or CONAMA as appropriate. CONAMA organizes a technical review of the EIA, involving the relevant state bodies identified above, and prepares a Technical Report that summarizes the views of the Technical Committee. The Technical Report is presented to the COREMA, and all the representatives on the COREMA have a single vote on whether or not to approve the EIA. If the project is approved COREMA issues a Resolution (Resolución de Calificación Ambiental) that summarises, amongst other things, the scheme, the proposed mitigation, monitoring and compensation plans, and any further stipulations required by the appropriate authorities. This system adopts the approach of the 'unique window' (ventanilla única) in which, if the environmental resolution emitted by CONAMA or COREMA is favorable, no state organization can then refuse the technical authorizations on environmental grounds.

#### *Health and Safety*

- 3.6 According to the Sanitation Code Law No. 725 and Supreme Decree No. 263/86 Regulation on the sanitation at ports, airports and national frontiers, the institution directly responsible for matters on occupational health and industrial security is the Regional Office for the Health Service, Department of Environmental Health. This organization is responsible, among other things, for approving plans for potable water treatment works, wastewater treatment works and waste disposal facilities.

## **B. Legal Framework**

### *Environment*

- 3.7 Article 19, No. 8 of the Constitution of the Republic of Chile of 1980, confirms the right of citizens to live in an environment free from contamination and the duty of the State to ensure that this right is not affected. The principal piece of legislation on the environment is Law No. 19,300 on the General Provisions on the Environment ("*Ley sobre Bases Generales del Medio Ambiente*"), which was published in the Official Journal on 9 March 1994. This law includes the introduction of environmental management tools, one of which is the EIA process, responsibility for environmental damages, and the creation of CONAMA and COREMA. The provisions of this law are being enacted through a series of enabling regulations, such as the Regulation on the Environmental Impact Assessment System, published in the Official Journal on 3 April 1997.
- 3.8 Article 8 of Law No. 19,300 states that projects or activities listed in Article 10 can only be constructed or extended after successful completion of the EIA process as set out in this law and its Regulations and administered by CONAMA or COREMA. Article 10, paragraph (f), lists 'ports, navigation channels, shipyards and marine terminals'. Article 11 sets out the conditions under which the projects identified in Article 10 require an EIA. Further articles describe the EIA process, and Paragraph 3 describes the Public Consultation process, which is to be organized by CONAMA.
- 3.9 Table 3.1 identifies all the sectoral environmental permits applicable to the project while Table 3.2 lists the relevant environmental regulations. Table 3.3 presents the international treaties, which have been ratified by Chile and are applicable to this project.

### *Health and Safety*

- 3.10 The main legislation on occupational health and industrial security that affect the project are:
- Law No. 16,744 on accidents at work and professional illnesses and its regulations.
  - Supreme Decree No. 745, Regulation on minimum sanitation and environmental conditions in the work place. This regulation establishes the minimum sanitation and environmental conditions that have to be achieved in the work place, without prejudicing specific regulations covering those installations that require special conditions. It covers the provision of temporary sanitation services during construction and permanent provision during operation; restrictions on discharges to sewer; it prohibits discharges to the environment without prior treatment; covers good working order of machinery, installations, tools and equipment to avoid harm to individuals; protection of all moving parts; and the supply of adequate personal protection equipment to the workforce free of charge.
  - Decree with Legal Force No. 725, Sanitation Code. This regulation sets out general conditions in the work place with reference to health. Article 91 covers the authorization for the construction, modification or extension of any public or private works destined for the removal, treatment or final disposal of industrial or mining wastes. Article 92 covers the authorization for the removal of sewage, while Article 95 requires the preparation of a

Sanitation Report on the effects which could occur in the environment prior to the granting of the final certificate from the Municipality.

- Supreme Decree No. 263/86, Regulation on sanitation at ports, airports, and national frontiers. The objective of this regulation is to establish the minimum sanitation conditions that have to be adopted in ports, airports and frontier posts. Ports have to provide potable drinking water, food suitable for human consumption and an adequate sanitary system for the removal and disposal of wastes, sewage, rubbish and any substances dangerous to health.

- 3.11 Under Chilean legislation, companies have to belong to employers liability insurers (*Mutuales de Seguridad*). Companies pay an annual tariff to the insurer, the level of which reflects the health and safety record of the company. The insurer covers medical and other expenses in the case of accidents at work. The insurer undertakes health and safety surveys of the works premises and they advise their members on issues such as need for improvements or health and safety training.

### **C. Project Compliance**

- 3.12 In 1998, CPM commissioned a study to analyze the various alternatives for port design and the selection of the best location for developing a port complex in Mejillones Bay (see Section II.D for details). In addition, the study assessed the compatibility of the port project with the existing land use plan the (Plan Regulador del Puerto y Bahía de Mejillones) for the Municipality of Mejillones.

- 3.13 The Municipality of Mejillones has recently revised its land use plan in 2000. The plan adopts the concept for the development of a port complex. The Plan includes:

- allowance for residential expansion to the immediate south and south west of Mejillones;
- allocation of extensive areas for port and industrial development around the south east and eastern coast of the bay;
- reservation of land to the south and south west of Mejillones for semi-industrial and mixed uses;
- a strip of land allocated for tourism development along the south west coast of the bay between the town and the peninsula;
- designation of a special area of Hornitos, Punta Itata and Chacaya for tourism development, including residential areas and tourism-support facilities, but not specifically including any areas designated for their ecological value; and
- designation of an area of special restriction at Punta Angamos (Peninsula de Mejillones) which will include an ecological protection zone (Zone ER1) where permanent development will not be permitted.

- 3.14 The Project Environmental Impact Assessment (EIA) was prepared by a multi-disciplinary team from Dames and Moore and was presented to the COREMA Region II on 23 July 1998. The public consultation process was initiated on the date of publication of the last notice in the newspaper on 13 August 1998 and continued for 60 working days until 28 October 1998 (see Section 7 for more details). A copy of the EIA was placed with the Municipality for public inspection and COREMA organized a Public Audience in the Municipality of Mejillones on 9 and 10 October 1998. Following two requests for additional information by the authorities, which were presented by CPM on 3 December 1998 and 29 January 1999, COREMA Region II published Resolution No. 031 on 17 March 1999. The Resolution approved the Project and confirmed compliance with all the applicable legal requirements and environmental standards. On 26 April 1999, CPM requested clarifications and some changes to the Resolution. CONAMA responded to these requests in Resolution No. 072/99 of 9 July 1999.

- 3.15 Table 3.4 summarizes the environmental authorization and permits required for the project under current legislation, the obligations arising from the EIA and the two resolutions and the current degree of compliance with achieving these authorization and permits.
- 3.16 In accordance with the stipulations of Resolution No. 031 from COREMA Region II, the Project has to comply with a series of conditions during the various phases (pre-construction, construction, and operation). These conditions correspond fundamentally to the delivery of technical progress and the results of monitoring programs as set out in Section 6 of this report. The Sponsor of the project, CPM, is responsible before the authorities for compliance with the obligations contained in the Resolution. The Company, as Concessionaire for Terminal 1 in virtue of the BOT contract, is obliged to comply with those obligations in the Resolution relating to the construction and operation of Terminal 1. The Company, in its turn, requires the construction company Belfi SA and the port operator Ultramar Ltda also to comply with those obligations relevant to their own activities.
- 3.17 In January 2000, the Company presented a Dredging Work Plan (Plan de Trabajo Previo Para Informe Técnico de la Actividad de Dragado) to DIRECTEMAR setting out their proposed methodology for undertaking a study to develop the dredging proposals, including disposal of the dredged material. DIRECTEMAR's requirements for environmental monitoring with regards the disposal of the dredged materials at sea is based on Annex III of the Convention on the Dumping of Wastes at Sea (The London Dumping Convention) 1972 (as amended). The Work Plan was accepted by DIRECTEMAR in January 2000.

#### **IV. ENVIRONMENTAL AND SOCIAL CONDITIONS**

##### **A. Environmental Conditions**

- 4.1 In Region II of Chile, the coastline trends generally N-S, with a narrow coastal plain backed by the N-S trending Cordillera de la Costa. The Mejillones Peninsula is an outlier of the Cordillera which forms an area of high land along the coast between Antofagasta and Mejillones, with N-S trending hills rising to 774m above sea level. A low lying, coastal plain, some 30-40m above sea level separates the Peninsula from the main Cordillera to the east. This plain, known as the Pampa de Mejillones, is about 23 km long, reaches 16 km wide and slopes at a very moderate one degree slope. Around the coast of the bay, the plain ends in an abrupt cliff about 20m high, which descends to a narrow beach. The seabed dips strongly, reaching 10m depth within 200-500m offshore and 100m depth 3-5km offshore.
- 4.2 Mejillones Bay is sheltered from the dominant southwesterly winds by the high land of the Mejillones Peninsula, but is open to the northerly and northwesterly winds. The deep water allows shipping access to close inshore, and the wide level Pampa provides large areas for potential development.

##### *Climate, Weather and Air Quality*

- 4.3 The coastal belt of Region II of Chile lies within a desert climate, moderated by the influence of the sea. Mean annual rainfall is about 3mm. Storms are very infrequent and sporadic. Temperatures are tempered by the influence of the sea, as the cool waters of the Humboldt current have a cooling effect on air temperature. Mean monthly temperatures for the meteorological station in Antofagasta range from about 13.5°C in June to 21°C in January. The mean monthly

maximum and minimum temperatures vary by 9-10°C, while the daily variation in temperature does not exceed 15°C.

- 4.4 Wind rose data for the meteorological station in Antofagasta show that the predominant wind direction is from the southwest, with a secondary peak from the north and northeast. Local diurnal wind patterns are strongly influenced by topography and solar radiation, resulting in land-sea and mountain-valley breezes. During the day, local winds are onshore and up-valley, while the reverse occurs at night. Data from the EDELNOR meteorological station in Mejillones for 1996-97 show that the main wind directions were from the south (38.54%), followed by the north (18.11%), and southwest (14.37%). 90% of wind velocities were 13 knots or below and no winds exceeded 29 knots.
- 4.5 Limited air quality data is available for Mejillones as a consequence of an air quality monitoring program associated with the EDELNOR power station. An air quality monitoring station is located within the railway grounds in the center of Mejillones. These data correspond to a four month monitoring period for the parameters SO<sub>2</sub> and NO<sub>2</sub>, and an 11 month monitoring period for particulate matter <10µm (PM-10) in 1996/97. The available air quality data do not exceed Chilean air quality standards for any of the parameters.

#### *Geology, Geomorphology and Soils*

- 4.6 There are three principal geological formations in the study area, namely the Portada Formation, the Mejillones Formation and recent fluvial and alluvial sediments. The Portada Formation consists of a sequence of Neogene marine, fossil-rich sedimentary rocks that outcrop to the south of the Pampa de Mejillones. The Mejillones Formation corresponds to a sequence of Pleistocene to Holocene marine sedimentary rocks consisting of sandstones, *limolitas*, and *coquinas* that outcrop in the central-northern part of the Mejillones plain. This formation includes a layer of Diatomite: a siliceous sediment made up more or less entirely of the skeletal remains of microscopic plants called diatoms. The recent, unconsolidated sediments consist of sands, silts, remnants of shells, and rounded to sub-rounded gravels deposited by marine and fluvial processes. The stratigraphy of these formations is horizontal to sub-horizontal, indicating deposition in a tranquil environment and minimal subsequent deformation processes.
- 4.7 The structural geology of the region is strongly influenced by numerous normal faults. The most developed fault in the region is the Falla Atacama or Falla Salar del Carmen that extends over 1000 km and controls the eastern border of the Cordillera de la Costa. This fault trends northeast to southwest, and at its closest proximity lies approximately 33km to the south west of the proposed port. The Falla Mejillones runs along the eastern border of the Mejillones peninsula just west of the town of Mejillones. The Falla Cerro Moreno trends north-south along the eastern border of the Pampa de Mejillones and coastal range, approaching to about 8km from the proposed port. No significant faults have been observed in the Pampa de Mejillones or the Project site.
- 4.8 The high level of seismic activity along the Chilean-Peruvian trough, which is controlled by subduction of the Nazca Plate, causes a large number of tremors generated at superficial, moderate and deep depths, which could directly affect the activities of the Port through earthquakes and tsunamis. In the last 130 years, there have been at least 11 earthquakes registering more than 8.0 on the Richter scale along the Chilean coastline. These events included earthquakes in Arica in 1868 (8.5) and Iquique in 1877 (9.0). Both events generated tsunamis that caused substantial damages along the Chilean coast and in other countries. A smaller earthquake occurred in Antofagasta on July 30, 1995 (8.0) that caused substantial damage to the port.

- 4.9 There is no historical information on the effect of tsunamis in Mejillones. Geotecnia Consultores (1998) present a simulation of the 1877 tsunami in Mejillones Bay and a Preliminary Flooding Map (the map does not extend to the proposed port area). The simulation of the tsunami generated waves 10m high in the center of the bay travelling southwards at an average velocity of 4.5 m/s after 35 minutes. The tsunami reached 16m high on the southern coastline of the bay, but the marked cliff line along much of the bay limited the area of flooding and the flooded area corresponds to the location of Mejillones itself.
- 4.10 The soils are coarse sand, with calcareous remains in the top 20cms of the profile. The soils are poorly developed, resulting from the weathering of a marine terrace on which aeolean processes have played a fundamental role. There is no organic material in the soil. Under the Use Capability Classification system, these soils are characterized by strong limits on agriculture due to the type of soil and the climate. Site investigation at the proposed port location shows that a layer of fine sands and gravels between 1-5m deep overlies Diatomite rock. The Diatomite has a platy laminar structure, with bands of cemented and fractured rock of varying hardness. Particle size analysis of the Diatomite places shows the dominance of the silt fraction. The saturated bulk density of the Diatomite is about 1.4 T/m<sup>3</sup> and the specific particle density varies between 2.21 and 2.64.
- 4.11 Site investigations in the Project area during January 1992 identified the ground water table at depths of approximately 22 meters below ground surface. No information is available on groundwater quality, although given the proximity to the sea, the lack of surface water, and absence of groundwater abstraction, one may infer that it is likely to be saline.

### *Oceanography*

#### Tides and Waves

- 4.12 Water levels for different tidal states are summarized below.

<b>Tides</b>	<b>Height NRS<sup>1</sup> (m)</b>
Mean height at low tide	0.17
Mean height	0.80
Spring tides	1.29
Equinoctial spring tides	1.64

<sup>1</sup> NRS - Nivel de reducción de sondas

- 4.13 There are three sources of data for deep-water waves with between 6 and >100 years of records. From this data, Geotécnica Consultores conclude that some 95% of waves in deep waters are between 0.5-3.5m high and only 2% exceed 4m in height. Extreme wave heights tend to occur with waves from the southwest, with a maximum wave height recorded of 6.8m and a period (Tp) of 9.9. GSOWM modeling results derive to similar extreme wave heights.
- 4.14 Wave heights and periods in Mejillones Bay were modeled using REF/DIF, which took account decreasing wave height with depth, refraction, diffraction, and dissipation of energy. Waves from the south, southwest and west are greatly attenuated due to the layout and bathymetry of the bay, while those from the north and northwest suffer less loss in height and energy. In the proposed port area, the extreme wave heights will come from the north and northwest as the bay is open in these directions and sheltered from the southwesterly waves. The expected extreme wave heights coming from the north will oscillate around 2m.

#### Currents

- 4.15 There are three current streams that converge in the Project area, in addition to local wind-generated currents - a tropical stream from the north, an Antarctic stream from the south and a third deep equatorial current that gives rise to upwellings. The tidal influence on current directions and velocities is considered to be very low. Direct current readings showed relative homogeneity both vertically and horizontally, with dominant current directions towards the SW independent of the state of the tide and wind patterns. This reflected the low influence of tide-induced currents and the low to moderate local winds during the study. Drogue tracking studies showed a predominance of near-surface current movements to the SW, with a maximum velocity of 10cm/s. Littoral currents monitored over 5 days in March 1998 indicated current velocities between 3-12cm/s with displacement to the NE or SW. Rhodamine dye tracing experiments showed a general dispersion towards the SE and the coast, probably reflecting the combined effects of winds and currents on the field days.
- 4.16 There is believed to be a cyclic variation in the current patterns generated by these three streams with a period of the order of a few days. The cycle is controlled by the deep, upwelling current. When the upwelling current is active in the area there is shown to be an overall flow of warmer waters into Mejillones Bay from the north; when the upwelling subsides, a circulatory pattern develops in the Bay as the colder current from the north flows south past Mejillones and meets the current flowing north past Punta Angamos. The result is a large gyre occupying the southern end of Mejillones Bay, with an area of reduced velocity in its center that is favorable for sedimentation.

*Sediment Transport, Beach Erosion and the Evolution of Coastal Morphology*

- 4.17 Sediment transport and coastal processes were studied in the area of the proposed port. From visual observations they considered that wave action on the beaches was essentially perpendicular as waves refracted around Punta Angamos creating a crenulate shaped bay. Wave action was considered to be uniform and low energy. The coastline in the proposed port area appeared to be stable, while some erosion of the cliff line further south indicated net erosion and transportation around the bay.
- 4.18 Estimates of sediment transport were made using the COSMOS modeling software. The results suggested a slow net redistribution of sediment from the extreme south of the bay towards the center and slow net redistribution of sand from south to north in the northern part of the bay. Sediment transport rates towards the SE into the port area was estimated at a relatively modest 4000-5000m<sup>3</sup>/yr assuming waves from the 320° direction. For a single three-day storm from the direction 322° with wave heights of 2m and periods of 22s, sediment transport was estimated to be 30,000m<sup>3</sup>. Such a storm would have a return period of 2-5 years.

*Water Quality - Mejillones Bay*

- 4.19 There is a wide variability in the physical and chemical characteristics of the water within Mejillones Bay due to the interaction and mixing of at least three waterbodies: the surficial subtropical waters; the subantarctic waters; and subsuperficial equatorial waters. The surficial subtropical waters possess salinities greater than 35.0psu and temperatures above 17°C. The subantarctic waters are characterized by low salinity (34.2-34.8psu) and temperatures in the range 13 to 18°C. The subsurface equatorial waters are usually found at depths between 200 and 400m, rising to the surface during 'upwelling' events. These waters are cold, with temperatures less than 15°C, salinities between 34.8 and 35.1psu, and are typically very poor in dissolved oxygen (<1ml/l). Offshore from Punta Angamos there is a semi-permanent upwelling of subsuperficial

equatorial waters characterised by cold temperatures, high nutrient concentrations and low oxygen levels. This plume of water frequently enters Mejillones Bay.

- 4.20 The waters in the Bay are also subject to a high interannual variability due to alternating cycles of ENOS (El Niño Southern Oscillation) with a warm phase (El Niño) and a cold phase (La Niña). During El Niño periods, seawater temperatures rise by 2-4°C and dissolved oxygen levels are higher. During La Niña events the subantarctic waters tend to dominate in the Bay.
- 4.21 Water stratification occurs within the Bay, particularly during the summer months, due to the strong temperature gradient in the upper 20m. This condition acts as a density barrier, preventing the vertical transport of more oxygenated waters, and promotes anoxic conditions of the water profile below about 30m. In winter, the physical characteristics of the water column were more homogenous. Stratification was weak, given the uniform temperatures in the water column. Temperatures and salinity levels were lower than those reported for the summer conditions, indicating a relaxation of the processes of radiation and evaporation.
- 4.22 Collected water quality data indicate that there are significant seasonal variations in certain water quality parameters (temperature, dissolved oxygen, BOD5, suspended solids, and nutrients), which are attributed to natural changes in weather and water circulation patterns. There is limited evidence of anthropogenic sources of pollution, although there are a number of existing outfalls from industries including two thermoelectric power stations and several fishmeal factories along the southern shore of the Bay. Suspended solids values are higher for the summer campaign (generally between 20-40mg/l) than the winter one (10-15mg/l). This may reflect seasonal variations in plankton levels or the effect of wind or wave-induced currents on resuspension of sediments during the monitoring program. Concentrations of total and dissolved heavy metals mercury, arsenic, lead, silver, and zinc were generally below the level of detection. Cadmium and copper concentrations exceeded detection levels, reaching a maximum of 0.07mg/l for total cadmium and 0.089mg/l for total copper. These values may reflect natural background levels rather than pollution.

#### *Quality of Marine Sediments - Mejillones Bay*

- 4.23 Sediment data was collected as part of the Project for samples taken in waters between 25-40m deep off the proposed port location. These sediments consisted of fine sands and gravels, with finer sediments found in deeper waters. Concentrations of total hydrocarbons and dissolved heavy metals (Hg, As, Pb, Cd, Cu, Zn) in the sediment samples were below detection limits. However, there were notable levels of total heavy metals, particularly for samples taken in the winter monitoring campaign, for arsenic (16.5-21.3mg/kg), copper (11.5-30.5mg/kg), and zinc (22.6-28.5mg/kg). The presence of these metals could reflect natural ambient levels or the impact of mining in the area over the last 100 years.

#### *Intertidal and Subtidal Benthos - Mejillones*

- 4.24 In both summer and winter, low species diversity and abundance were detected in intertidal areas (14 species in the summer compared to 10 in winter), which were dominated by crustaceans *Exirolana braziliensis* and *Emerita analoga* and the polychaetes (burrowing worms) Gliceridae. . This reduction was attributed to seasonal changes in the ambient environment such as decreased water temperatures. Greater species diversity was found in the subtidal zone compared with the intertidal area (59 taxa identified) and seasonal changes were also noted. The dominant species were the molluscs *Mitrella unifasciata*, *Crucibulum quiriquinaei*, and *Nassarius* sp. Sixteen species of benthic macroalgae were identified. The high diversity of this group is typical of an

extremely sheltered environment. Statistical data analysis indicates that the subtidal environment is relatively undisturbed with a medium diversity and uniform distribution of species density and biomass. No protected or endangered species were observed.

- 4.25 Mejillones Bay is known for its shellfisheries found in subtidal waters. At the beginning of the 1980s a strong commercial interest developed in the exploitation of the scallops *Ostión del Norte* *Argopecten purpuratus*. Mejillones, together with another bay to the north, together supplied 82% of Chile's output in 1984. These banks were over-exploited and production fell rapidly, such that in 1986 it was necessary for the government to decree a closed season (DS No. 146) on this resource, which is still in force. About this time, commercial farming of this species commenced, encouraged by the strong international demand for the scallops. The red seaweed, which is found in association with the scallops, is also farmed using the same apparatus for the cultivation of the scallops and is sold to Japan.
- 4.26 The Company contracted for a study of the shellfish stock along the southeast coast of Mejillones Bay between the industrial quarter and Punta Chacayo in June-August 1999. This study was one of the requirements of the COREMA Resolution on the EIA for the proposed port. *A. purpuratus* was found in waters 8-24m deep, over an area of about 255ha. Densities of *A. purpuratus* varied between 32-33 individuals/m<sup>2</sup> within the main scallop bank and about 1 individual/m<sup>2</sup> around the periphery. The total size of the stock was estimated to be 18.2 million individuals with a mean density of 7.14 individuals/m<sup>2</sup>. The relatively low numbers of *A. purpuratus* above the legal size for fishing indicated continued over-exploitation of this resource. The study attributed the increase in stock during the 1990s to warmer waters in 1997/98 due to El Niño. Avendaño estimated that over the whole scallop bank there were some 3.7 million units in the size range 30mm to 70mm, which is suitable for translocation, and about 0.85 million units in the area of the port and surrounding buffer zone of 33.5 ha. In August 2000, a resurvey of 7 of the original 203 monitoring stations, found that the densities of scallops had fallen appreciably from 12.7 and 72.8 individual/m<sup>2</sup> a year ago to between 0.57 and 5.7 individuals/m<sup>2</sup>. This decrease was attributed to illegal fishing, natural mortality, and lack of recruitment possibly due to a pollution event from one of the fishmeal factories, which occurred in February 1999. As part of the IDB Environmental and Social Due-Diligence, underwater observations confirmed a density of about 1 individual/m<sup>2</sup>.
- 4.27 The study also found other commercially valuable species in the study area, consisting of Jaiva *Cancer setosus*, Cholga *Aulacomya ater*, locates *Thais chocolata* and pulpo *Octopus mimus*, while Macha *Mesoderma donacium* and Langostinos *Pleuroncodes monodon* were absent. The loss of Macha could be due to El Niño events.
- 4.28 Heavy metal concentrations (Cu, Pb, Zn, Ag) were analyzed in the soft tissue of *A. purpuratus*, *Aulacomya ater*, *Ermita analoga*, and *Thais chocolata*, and it was determined that heavy metals are not present in significant quantities. Higher concentrations were reported during the winter. This increase in the concentration of heavy metals during the winter may be attributed to an increase in currents and reduced temperatures that decrease the solubility of heavy metals.

#### *Marine Ecology - Mejillones Bay*

- 4.29 Mejillones Bay contains rich coastal and marine flora and fauna. However, the fauna is believed to be concentrated in the oxygenated zone above 30m depth. In the deeper water, the marine fauna is scarce and composed principally of polychaetes (burrowing worms) that are able to tolerate anoxic conditions. The water column has an extremely high abundance of phytoplankton for oceanic

waters. Given the high level of nutrients from the upwelling, the phytoplankton provides abundant food for the zooplankton and juvenile fish, molluscs and crustacea.

- 4.30 Plankton studies indicate that Mejillones Bay South is an area of local importance for the recruitment of fish of commercial importance such as Anchovy and Sardine. The abundance of fish eggs in the water column varies annually and are found principally in the Bay in wintertime. Anchovy are a major regional resource and the eggs are found within the Bay between July and December, being most abundant in August. However, it is believed that Anchovy spawning takes place outside the Bay and the eggs and larvae are brought in on the currents. The local fishery resource Pejerrey and Motecillo are thought to spawn within the Bay at this time. Commercial extraction of marine fauna within the Bay tends to occur above 20m depth. Mejillones Bay also has commercial shellfish and algae (*Gracillaria sp.*) projects, with seven existing aquaculture concessions (current licences are under consideration).

#### *Marine Environment of the Port Location*

- 4.31 The physico-chemical parameters of the sediments found in the footprint of the proposed Project port were analyzed. The sediment texture indicated a heterogeneous substrate, varying between very coarse and very fine sands associated with moderately to poorly sorted fractions. Dissolved heavy metals in the sediments were below detection levels, while concentrations of total mercury was not detected, and cadmium and lead were only found at 2 and 1 stations respectively. Of the total heavy metals analyzed, silver is found in the highest concentrations (40-46mg/kg). Total and volatile hydrocarbons and polycyclic aromatic hydrocarbons were not detected.
- 4.32 In general, the water quality data are typical for relatively unpolluted waters affected by upwellings from deep waters. The water quality data did show high levels of fats and greases (up to 85mg/l) found in shallow waters probably due to the discharges from the fishmeal factories. Fats and greases may interfere with the biological processes thus prejudicing water quality, and plant and animal life. The low counts of total fecal coliforms indicated that there is no significant impact from sewage discharge. Nutrient concentrations correspond to those found in areas of coastal upwellings, ammonia was not detected, nitrites are less than 0.025mg/l, nitrates less than 0.46mg/l, and phosphorous less than 0.2mg/l. The concentration of suspended solids (20-40mg/l) was also deemed to be normal for the time of year and coastal environment. The concentrations of total and dissolved heavy metals were below the levels of detection, except for copper and cadmium (total Cu about 0.17mg/l and total Cd about 0.03mg/l).
- 4.33 As mentioned, the Ostión bank is situated between the Interacid plant to the southwest (the proposed port site is just north of this location) and Quebrada Pejerreyes to the northeast. The bank was estimated to contain 16,222,000 individuals within the proposed area for port development. However, due to clandestine fishing activities, the density of the Ostión is now thought to be significantly lower. In November 2000, a mitigation procedure was implemented to translocate examples of the Ostión from the proposed port site to a Management Area at Puerto Bello on the western side of the Bay. Other biological communities include molluscs (*Mitrella unifasciata*), crustacea and polychaetes. Analysis of the biomass and abundance of the subtidal communities indicate an undisturbed environment at all survey stations but one. The diversity of the benthic flora was typical of sheltered bays where the macroalgal group generates a low component of biomass and total density in the subtidal environments.

#### *Marine Environment in the Proposed Disposal Zones*

- 4.34 In Zone A, Site 1 (60-80m deep), the seabed sediments consist of fine sands associated with well sorted fractions suggesting a more hydrodynamically stable environment in comparison to the

proposed dredging location close to the shore. The currents in the area at both the surface and depth showed a clear predominance to the southwest, reflecting a clockwise circulation pattern in the southeast part of the Bay. Maximum velocities monitored were in the order of 20cm/s at the surface and 12-13cm/s at depth, while at the surface current velocities ranged between 5.1 and 9 cm/s for 43% of the time and at depth between 1.1 and 5 cm/s for 40.5% of occasions.

- 4.35 Thermal stratification of the water column indicated that the three waterbodies described in earlier sections were present. The salinity was uniform although, there was marked deoxygenation with depth falling from about 4ml/l at the surface to 0.14ml/l at 80m. The level of turbidity was low, as were concentrations of suspended solids (34 to 37mg/l). Ammonia concentrations were below limits of detection. Nitrites were higher than expected for coastal waters (up to 0.008mg/l), which probably reflect the local upwellings and correspond to the low oxygen and high nutrient loading. Nitrates were normal for areas with upwellings (0.25 to 1.27mg/l). Concentrations of total and dissolved cadmium and copper exceed normal values for oceanic waters (total concentrations of Cd about 0.03 mg/l and of Cu about 0.1mg/l) although all other heavy metals investigated were below detection limits. The elevated levels may be due to high natural background levels.
- 4.36 The biological analyses indicated an undisturbed area with relatively low diversity and species richness. The dominant species was the detritivore snail *Nassarius gayi*.
- 4.37 At Zone A Site 2 (80-100m deep) the seabed sediments consist of very fine sands with moderately sorted fractions. The currents in the area at both the surface and depth showed a clear predominance to the southwest, reflecting the clockwise circulation pattern in the southern part of the Bay. Maximum velocities monitored were in the order of 12cm/s at the surface and about 6cm/s at depth. Surface currents varied between 5.1 and 9 cm/s for almost 60% of the record, and at depth current velocities varied between 1.1 and 5 cm/s for 89% of the record.
- 4.38 The temperature profile in the water column showed the same thermal stratification at 12m and 50m depth as at Site 1. The concentration of dissolved oxygen was low at depth falling to about 1.0 mg/l. Turbidity and concentrations of suspended solids (about 7 to 33mg/l) were low and significantly lower than Site 1, possibly reflecting greater distance from the shore. Ammonia concentrations were low, less than 0.097mg/l. There are high levels of nitrites (0.042 to 0.758mg/l), as expected in areas of high nutrient loading and low oxygen. Nitrates were within levels associated with upwellings and peaked at intermediate depths (13-15mg/l) possibly reflecting the effects of water stratification. Levels of phosphorous (0.7 to 3.21mg/l) were also normal. The concentrations of total and dissolved mercury, arsenic, lead, chromium and zinc in the seawater were below detection limits. Copper and cadmium levels were again high (total Cu about 0.1mg/l and total Cd about 0.02mg/l).
- 4.39 The flora and fauna of the benthos were found to have low diversity and species richness with the fauna being dominated by the bivalve *Nuculana cuneata*. The data indicate an undisturbed environment.
- 4.40 At Zone B (160-180m) the seabed sediments consist of fine sands with moderately sorted fractions indicating a hydrodynamically stable environment. The currents in the area were predominantly to the west, followed by the southwest and north at the surface, while at depth currents were predominantly to the southwest. Maximum velocities at the surface were about 16cm/s in the northerly direction, while some 64% of current velocities were in the range 5.1-9cm/s. At depth maximum current velocities were about 9cm/s in the southwesterly direction, and 55.4% of current velocities were in the range 1.1-5 cms. The water quality results show very similar results to those in Zone A.

- 4.41 The most abundant benthic species were the tube dwelling polychaetes Megalonidae and Spionidae. Amphipods and the Nereidae worms were also frequent and abundant. Again, there was low diversity and species richness. The site was identified as being disturbed.

#### *Sea Mammals and Reptiles*

- 4.42 Based upon the EIA, 8 species of sea mammals (mustelids, otarids and cetaceans) have been observed in the study area. While these species may feed in the bay, it is not known whether they breed in the area. A pair of Green Turtles *Chelonia mydas* is resident within the study area, although it is not known whether this is a breeding pair. The turtles reportedly arrived in the bay following the construction and operation of power stations in the bay, attracted by the warmer waters. These turtles are a protected species. SERNAPESCA and the Maritime Government have taken some steps to protect this species and a non-statutory protection area has been declared in the vicinity of the outfalls where all types of activities are prohibited.

#### *Terrestrial Flora and Fauna*

- 4.43 There is no vegetation in the immediate area of the Project, although introduced species have been planted in urban and industrial zones. The only one plant species was observed in the desert, *Nolana crassulifolia*, but is not listed as endangered.
- 4.44 Based on the literature, 50 species of birds have been observed in the area excluding a number of species typically found in urban areas. Of these, 19 species are classified as migratory, a significant proportion of which arrive in the summer from the northern hemisphere. Twelve of the 50 species of birds identified are listed in the Red Book for Terrestrial Vertebrates. Two species, Gaviota garuma *Larus modestus* and Gaviotín chico *Sterna lorata*, are found in the three types of environment - sea, coastal fringe and coastal desert - while the remaining species occupy either one or two of these environments.
- 4.45 The *Sterna lorata* is considered to be one of the species facing most problems of conservation in Chile. This species is listed as being 'In Danger' of extinction at both the national and regional level in Chile, and is protected by the Hunting Law No. 19,473 and its Regulation. Very little information is known about *S. lorata*. The bird is endemic to the coastal plains of Ecuador, Peru and Chile, extending as far south as Antofagasta in Region II of Chile. The total population is estimated by some at about 5000 individuals, while others put the population in Peru at 5000 pairs. There is consensus that the numbers of *S. lorata* in Chile are low. There are thought to be three colonies in the Mejillones area, one along the south east coast of Mejillones Bay from about 5km from the town up to Punta Chacaya, and probably at La Rinconada and Hornitos.
- 4.46 The colony at Mejillones Bay was first surveyed between September and December 1996. It was estimated that there were 40-50 pairs breeding in a broad area along the coast, and from the top of the sea cliff to up to 1km inland. Breeding is believed to be asynchronous but may peak in November. It is not clear whether the species is resident or migratory, and if the latter, the destination of the species between January and August. The surveys were repeated in January 2000 and July 2000 as part of the baseline surveys for the present Project. In January, no terns were observed in the area, while in July, two individuals were observed feeding in the bay about 20m from the coast. These two recent surveys occurred at the tail end and beginning of the breeding season, and as such do not reflect the activity of the colony.

- 4.47 During January 2000 survey, the presence of 14 bird species were noted, including *Phalacrocorax bougainvillii* (c100 individuals) and *Larus modestus* (c3000 individuals) which are listed as 'Vulnerable' (Chilean Red Book) and about 400 individuals of *Sterna elegans*, a migratory species from the northern hemisphere. In July 2000, 15 species were observed, including the two individuals of *S. lorata*, several species which nest in Antarctica and migrate northwards in winter, as well as *P. bougainvillii* (c6000 individuals) and *L. modestus* (c2000 individuals). Most of the migrants from the northern hemisphere had disappeared.

#### **B. Socioeconomic Conditions**

- 4.48 Mejillones is a small town located on the southern shore of the Bay. The town is laid out on a grid street pattern, extending about 2km along the coast and up to 1km inland. Land use within the town is predominantly residential, with a number of small scale services including the town hall, a school, hospital, fire station, a church, a theatre, several small hotels and restaurants. Open ground and recreational facilities include a stadium to the south of the town, two plazas, a small open air stage, and a promenade along the beach in front of the town. A large railway compound borders the western side of Mejillones, although the railway spur into the compound was closed several decades ago. To the west, between Mejillones and the Peninsula the land is undeveloped. Shellfish culture beds are located offshore, to the north east of the town, and there is a small pier for fishing boats.
- 4.49 To the east side of Mejillones, the land use along the coast is given over to large scale industry. There are three fishmeal factories, which have been established for about 50 years. Further along the coast are the Enaex explosives factory, Corpesca, CPM's sulphuric acid storage tanks, Endesa (electricity supply company), Gas Atacama power station with intake works and outfall, Edelnor jetty and handling facility for petcoke, the Edelnor power station (mixed fuel) with intake works and outfall, and the Interacid jetty and handling facility. These industries give rise to environmental emissions that cause localized nuisances and pollution. The fishmeal factories cause a noticeable odor on the edge of town, and discharge effluent into the bay. In February 1999, one discharge incident resulted in a widespread fish/shellfish kill in the bay. The two power stations abstract and return cooling water to the bay. The return water would be several degrees higher than ambient and contain chlorine.

#### *Landscape and Tourism*

- 4.50 The Project study area lies in a coastal desert landscape, where settlement is concentrated in the town, and the surrounding rural areas are dominated by the open, large scale geomorphological units of the mountains, desert plain and bay.
- 4.51 At present, the Municipality of Mejillones boasts 68km of beaches. The main tourist destinations are reported to be the beaches in front of and to the west of Mejillones and Punta Chacaya to the north. Mejillones Bay is readily accessible via Route No. 1 from the south and north, and traffic levels increase appreciably in summer months. Another popular leisure activity is driving across the desert flats on the Pampa de Mejillones. Tourists are reported to come from Mejillones and Antofagasta. In the immediate area of the Project, there are no tourism activities.

#### *Noise*

- 4.52 The Project area is located outside the urban limits of the Mejillones, where there are no nearby buildings or dwellings that would be considered noise-sensitive. Noise levels were monitored at eight locations for periods of less than 1 hour in the industrial sector to the east of Mejillones on

10 and 11 April 1997. The results indicated that the ambient noise level (measured as equivalent sound pressure - NPSeq) varied between 46.2 y 65.5 dB(A). Although the top range of these values is high, they do not exceed the maximum permissible level established by Supreme Decree No. 286/84 for industrial zones of 70 dB(A). The maximum NPS measured varied between 54.1 and 83.1 dB(A), for the locations and periods monitored. The maximum instantaneous values of about 80 dB(A) were attributed to the passage of heavy goods vehicles, buses, and other traffic, close to the noise meter.

#### *Demographic Characteristics*

- 4.53 According to the last national Census (1992), the population of Antofagasta, Region II, was 410,724 (3.1% of the national total), with a density of 3.3 persons/km<sup>2</sup>. Some 55.6% of the population live in the Municipality of Antofagasta, while only about 1.5% of the regional population lived in the Municipality of Mejillones (6,315 inhabitants). The population of Mejillones has continued to grow during the last decade, and is currently estimated to be between 9,000 and 10,000. According to the last Census, almost 57% of the population in Mejillones was male compared to 43% female, reflecting the influx of temporary labour and the predominance of the industrial and fishing economic sectors. The age structure of the Municipality of Mejillones is more or less equal between the young population (47.7%) and adults (47.8%). Given the difficult climatic conditions in the Chilean desert, only 2.7% of the population of Region II live in rural areas. In the Municipality of Mejillones, the rural population is slightly higher at 11.7%, although this figure is well below the national average of 16%. The 'rural' population is based in the Caleta Los Hornitos area.

#### *Economic Activities*

- 4.54 Historically, Mejillones depended upon employment provided through mining (originally guano and saltpetre, and then metals such as copper), fishing, and in the last 50 years fishmeal manufacture. The railway provided employment and access to Antofagasta and the mines. Recent years have seen major changes in the economic and social life in Mejillones. The railway connection and yard in Mejillones was closed several decades ago, and the fishing industry has become depressed in the last decade. However, in the last 6-7 years, Mejillones has experienced substantial industrial development starting with the construction and operation of the Interacid facility and the power stations. The new industries have brought improvements in infrastructure (more secure energy and water supplies), increased costs and rapid urban growth. During the construction of these works, some 2500 workers came from outside the region. This caused social problems in the town, but not, according to the mayor, on the same scale as occurred during previous decades with the development of mines.
- 4.55 According to recent figures, Region II supplies between 6 and 10% of the Gross Domestic Product (ranking the region in fourth place in terms of economic importance), with a marked contribution from the primary sector. At the local level, mining contributes 59.6% of the total regional GDP, such that Region II, with 2.8% of the country's labour force generates 24% of national exports, and more than 50% of Chile's copper production. The forecasts indicate that Region II could reach the production of 2.8 million tons of metallic copper in the year 2010, and in the order of 3.5 million tons in 2015. The fishing sector is the second most important exporter of the region, where the principal product is fishmeal. Other economic sectors of regional interest are industry (6.3% of regional GDP) and tourism. At present, the tourist industry is very limited, but the extensive beaches around the bay are a potential resource for future development.

- 4.56 In Mejillones, the economically active population was about 2,435 persons concentrated mainly in the industrial manufacturing, fishing and mining sectors which together account for 19.2% of the work force. Reportedly, there are 20-25 fishing artisanal boats in the bay with 2-3 persons per boat. Each fishing boat collects 5000 mussels/boat/day, which results in 40-50 kg of meat. This is sold at 2000 – 2500 peso/kilo. During the summer, there are several bans on the extraction of other commercial species, such as the abalone. According to figures from the last census, the unemployment rate in Region II was 10.1% compared to 7.1% in the Municipality of Mejillones. According to figures from 1995, 70% of the population of the Municipality of Mejillones were considered to be 'in poverty', of which 31.6% were considered to be destitute.

#### *Archaeology*

- 4.57 Existing background information on the archaeology of the study area (Register of Archaeological Sites undertaken by the Environmental Technical Unit of the Ministry of Public Works) indicate that there are no registered archaeological sites within the area of influence of the project. A Spanish galleon sunk off the coast of Mejillones, to the north of the development area of the megaport. According to local fishermen, little remains of the vessel.

#### *Physical and Social Infrastructure*

- 4.58 In the Municipality of Mejillones, there are three educational establishments, two in Mejillones and one elementary rural school in Michilla, which are attended by 1,481 schoolchildren. These schools provide primary and limited secondary education (up to 8th grade). There is a hospital, which provides basic services in general medicine, maternity and gynaecology, and a dental service. Staff include two doctors, a matron, a nurse, paramedics and drivers. Accident and emergency patients are brought to the hospital in the first instance, and transported to Antofagasta by ambulance if further treatment is necessary.
- 4.59 Given the scarcity of water in the region, potable water is obtained from mountain streams, treated, and conveyed by pipeline over large distances to towns and villages. The exploitation of water resources is reported to be close to capacity. The high distribution losses and high demand (especially in summer), contribute to shortages and cuts in service. Furthermore, potable water is relatively expensive. The Mejillones water supply is conveyed from the treatment works in Antofagasta and in Mejillones. The coverage of potable water is about 100%.
- 4.60 Sewerage connections reached about 90% in the mid-1990s. Wastewater is collected and conveyed to a preliminary treatment works where the wastewater is screened before being discharged into the bay via a 300m long sea outfall. Domestic solid waste is disposed of at a Municipal waste disposal site, which is presently not authorized under existing legislation.
- 4.61 Electricity is supplied by the Sistema Interconectado del Norte Grande (SING), formed by a collaboration between EDELNOR and CODELCO. Most of the electricity generated serves the mines inland. In Mejillones the coverage of electricity supply is about 100%.

#### *Transport Infrastructure*

- 4.62 Mejillones is accessed by a dual lane highway from the south (B-272) and the east (B-262) off Route 1, the Antofagasta-Tocopilla inter-urban highway. Heavy trucks are not permitted to enter Mejillones and access the industrial area via a road off the B-272 without passing through the town center. Present traffic flow is relatively as listed below.

	Route 1	B-272 (south access to Mejillones)	B-262 (eastern access to Mejillones)
Total	2123	842	97
Heavy Goods Vehicles	467	152	15
Buses	191	84	6
Light Vehicles	1465	606	74

- 4.63 The Antofagasta-Mejillones railway line approaches Mejillones from the south and divides, with a short siding into the railway yard to the west, and a longer spur to the Interacid terminal on the eastern side of town.
- 4.64 Antofagasta is the main port of the region. It supports 7 terminals, Codelco Chile, Caleta Coloso, Esso, Sitios Nos. 1, 2 and 3, and Shell Chile. Antofagasta is an old well-established port, but it suffers from a number of problems. Some of the structures are old and need refurbishment, particularly following the earthquake in 1995. There are difficulties in manoeuvring vessels within the port area, and during high seas ships need to leave the harbour as they can break anchor. The port is surrounded by urban development, so that traffic movements by road and rail to the port cause noise, congestion, and other traffic-related impacts. The Empresa Portuaria Antofagasta, which operates the state-owned Terminals, has recently drafted a Port Master Plan for the future development of the port. This plan reportedly takes account of the decrease in shipping from c450 to 300-350 ships per year resulting from the transfer of traffic to Mejillones; assumes the cessation of exports of ore concentrate which largely come from Bolivia; and envisages the release of port-owned land for redevelopment. These changes would lead to improvements in Antofagasta (stimulate commercial activity through redevelopment, reduced transit through the town to the port, less congestion, cleaner cargo, reduced fugitive dust). There would also be limited adverse socio-economic impacts through the loss of jobs.

## V. ENVIRONMENTAL AND SOCIAL IMPACTS

### A. Construction

#### *Impacts of Dredging on Water Quality and Marine Ecology*

- 5.1 During the construction of the first stage of Terminal 1, about 850,000m<sup>3</sup> of material will be excavated from the seabed in order to provide the draft required for ships. This activity will result in a permanent change in the sediments and marine habitat in the port area, and a temporary change in water quality due to the suspension, dispersion and deposition of sediments during the dredging activity. The potential impacts of the dredging activities include the permanent loss of habitat for the flora and fauna including some species of commercial interest such as the scallop, Ostión del Norte, *Argopecten purpuratus* and the change in physico-chemical characteristics of the water column as a result of the dredge plumes.
- 5.2 The dredged area, at about 0.6km width represents a loss of about 5% of the habitat for the *A. purpuratus* bank (assumed to be 12km long). The area of the Ostión bank affected may be greater, depending on the circulation of the plume and the sensitivity of this species to increased turbidity.
- 5.3 During dredging, the proposed works will give rise to a sediment plume around the cutter head due to physical agitation of the sea bed; behind the cutter head as not all the material is sucked up the pipe; leaks from joints along the floating pumping line; from overspill from the hopper (if this is used); and at the disposal site. The sediment plumes would be carried with the currents and

gradually disappear as particles settled out of the water column. It is expected that the sediment plume will be less than 3km long by 500m wide and will be present within the surface layer of the thermally stratified water (2-10m). Settlement should occur below 10m although the behavior of the material through the water column would be affected by stratification, particularly if the material is very light. This problem is more likely to occur in summer months. The direction of the plume will depend on the currents, which are predominantly to the southwest, which will carry the plume along the coast towards Mejillones.

- 5.4 The dredging works and disposal are likely to be continuous over a period of about 3 months. The effects on the marine environment would occur for the same period or for some months longer if stratification in the water column impedes sedimentation. This will result in the change of the physico-chemical characteristics of the water column. The impact of the sediment on benthos will depend on the rate of deposition and the nature of the bottom sediments and benthic organisms. In 80m of water, there would be no organisms dependent on photosynthesis, but there may be filter and detritus feeders. If the bottom sediments are fine (and the available information suggests fining of sediments into the bay), the depositing sediment may not lead to significant changes in sediment composition, and the material would be recolonised. The low bottom current velocities would significantly reduced the risk of resuspension of the sediment. High concentrations of suspended sediments would affect photosynthesis in phytoplankton, and cause abrasion and damage to ictioplankton, especially fish eggs. Filter feeders such as the scallops (*A. purpuratus*) and Cholga (*A. ater*) can withstand some temporary increases in turbidity but tolerance limits are not known. Tolerance levels will vary between species, and according to the nature of the sediment (fine sediment causes more problems for filter feeders). Mobile organisms such as fish and crabs can take avoiding action and thus will not be affected.
- 5.5 The final disposal of the dredged material at sea would result in the creation of sediment plumes covering an area of approximately 200 ha and extending 3 to 4km from the discharge point. The sediment plume from the Zone A disposal site could affect the nearshore environment and the water in-take works for the two thermal power stations in the Bay. The sediment plume from the Zone B disposal site should be transported out of the Bay. Reportedly, there is no significant difference on the impacts between the two disposal zones. Other impacts include temporary modification of the physico-chemical quality of water in the bay, minor modification of the chemical characteristics of the sediment in Zones A and B and the permanent modification of the seabed topography. Smothering of the biota is not thought to be significant given the anoxic nature of the sediment. The areas will rapidly be recolonised.
- 5.6 Mejillones Bay is considered to be biologically very productive due to the upwelling of high nutrient waters. Consequently, the ability to recover from potentially adverse activities should be high. However, in recent years there has been a strong anthropogenic influence including the proposed port development. The Project dredging study concludes that there are no high adverse impacts and measures have been offered to mitigate against low to medium adversity impacts

#### *Impacts of Land-based Works on *Sterna lorata**

- 5.7 Construction activities, such as the construction of the berths, installation of the coastal defences, earthworks, the transportation and disposal of inert material, and the construction of access roads, will impact upon wildlife populations, particularly the *Sterna lorata* colony, through loss of habitat and disturbance. The proposed location for Terminal 1 lies within the southern extent of the presumed breeding grounds of *S. lorata*. Dredging may also impact upon the colony by disturbing feeding patterns. At present there is little information on the size and location of the

breeding colony of *S. lorata* in Mejillones and it is not clear whether very colony is active in this area.

#### *Air Pollution*

- 5.8 Earthworks such as the removal of material for cut and fill, internal and external roads, storage and parking areas, will generate dust and larger particles in suspension, especially given the dry nature of the ground and aggregates used in construction. Air quality will also be affected by emissions from vehicles and plant during construction. The maximum emission of fugitive particulate matter is estimated to be 96 kg/day, assuming that all construction activities occur simultaneously, although this estimate does not take account of dispersion of the prevailing wind and the proportion of the fine fraction (<10µm diameter) which is injurious to health. The surrounding land uses (desert and industrial sector) are not particularly sensitive to dust.

#### *Construction Noise*

- 5.9 Noise levels during the construction stage were estimated to be 66.6 dB(A) at the boundary of the construction site, assuming plant generated noise levels in the order of 85dB(A) about 250m from the site boundary. Noise levels would continue to attenuate with distance, and would approach background levels of 45-65 dB(A) within 500-1000m. Daytime construction noise should not cause a nuisance to workers in the industrial quarter or residents in Mejillones, which is some 7km away. At night-time, ambient levels fall appreciably, in rural areas typically to 35-40 dB(A), so noisy night-time activities could pose a potential nuisance in Mejillones.
- 5.10 Noise levels from dredgers vary with the type of dredger and operation, and can have a significant impact on ambient noise levels, especially at night. The preferred plant for this project, cutter suction dredgers, tend to make a relatively quiet, monotonous noise from diesel engines. Furthermore, as the proposed port location is approximately 7km from the nearest settlement at Mejillones, noise attenuation with distance is likely to be sufficient to avoid a noise nuisance.

#### *Quarries and Borrow Pits*

- 5.11 Construction of the wharf will require an estimated total of 155,000m<sup>3</sup> of cut and fill material, and a similar volume of other construction materials (aggregates, rock armouring, piling etc) which will be supplied from local sources. The nearest existing sand and gravel quarries are located within 5-6 km of the port. The main issues will be health and safety rather than environmental. There may be potential environmental impacts at rock quarries such as landscape and visual impact.

#### *Liquid and Solid Wastes*

- 5.12 During construction, various consumables will be used such as paints, oils, greases, solvents, chemical compounds and fuels in the workshops and work areas, which could generate impacts in the marine environment and on land due to accidental spills or inadequate handling.
- 5.13 Domestic waste will be generated from the canteen, offices, and washrooms. There will also be construction wastes such as wood, plastics, packaging, and waste oils and greases from maintenance activities. The organic wastes would be biodegradable, but others are non-perishable, and a small quantity may be classified as hazardous wastes (e.g. paints, solvents or used oils).

#### *Construction Traffic*

- 5.14 Most environmental impacts would be associated with movement of trucks delivering materials to the port site, resulting in increased congestion, risk of accidents, severance and air emissions. On Route 1, an increase of traffic flow by 240 trucks represents about an 11% increase on the mean daily traffic flow. The percentage increase for the B-262 is much greater, but only because the existing traffic flow is so low. The provision of daily transport for workers would help to reduce the number of vehicles entering and leaving the construction site at peak hours.

#### *Landscape Quality*

- 5.15 The construction of the port will lead to visual impact even though it is located in an existing industrial area. The port would have a negative impact on the landscape quality, although the magnitude of the impact is not considered to be significant.
- 5.16 The development of the port could affect tourism potential along the coast in Region II. The construction of the proposed port would not directly affect existing tourism developments in the area such as at Punta Chacaya. Furthermore, at the proposed port site there is no existing infrastructure or services which would encourage tourism, and the site is part of an existing industrial area which would also detract from the tourism potential of the immediate study area. Notwithstanding the above, the development of a megaport and supporting industries could have impact on the landscape, and may impact future tourism developments in Mejillones and around Punta Chacaya in the long term.

#### *Socioeconomic Impacts*

- 5.17 The activities associated with construction, such as the transport of primary materials and the contraction of the workforce, would modify the economic base of Mejillones. These activities would affect the socio-economic environment and the quality of life of the inhabitants, with an increased demand for services, housing, transport, health, security and employment.
- 5.18 Some moderate influx of construction workers in Mejillones during the construction period will occur and may impact local social infrastructure.
- 5.19 Construction and subsequent operation of the port will result in a loss of fishing grounds to the local artisanal fishing industry. While it is illegal to catch the *A. purpuratus*, there are other commercial resources in the area (crab, mussels etc). Furthermore, the loss of fishing grounds at the proposed port and the approach channels are relatively small in area, in the context of the cumulative losses in fishing grounds due to the recent development of the power stations and other port facilities in Mejillones Bay.

### **B. Operation**

#### *Impact of Dredging and Maintenance Works on Water Quality and Marine Ecology*

- 5.20 Maintenance dredging in the port will be required to maintain sufficient draft for ships in the harbor. Initial estimates of maintenance dredging are in the order of 55,000m<sup>3</sup> every 3 years, depending on the frequency and effect of storms on sediment transport. This is a low figure and indicates that maintenance dredging requirements will be substantially less than the initial capital works. Furthermore, the material will tend to be fine sand, which would cause less environmental damage than the diatomite due to faster settlement rates. The sediment plume resulting from this activity would be expected to be much smaller. There may also be scope for reuse of the sediment

on land. This activity will affect water quality and marine life, but to a much lesser degree compared to the capital dredging works.

- 5.21 The maintenance of structures (painting, sanding etc) to avoid corrosion, undermining, and abrasion will potentially introduce contaminants to coastal waters and generate residues such as leftover anti-fouling and anti-corrosive paints, contaminated sands, and empty paint and solvent containers. Certain anti-fouling chemicals, such as tributyltin (TBTs), are widely banned and should not be used.
- 5.22 Over the long term the operation of the port will result in environmental pollution due to accidental leakages from ships, spills of cargo, drainage from the port area (possibly containing oils, greases, fuels, trace metals from hydrocarbons, silts etc), litter etc. Greater potential for environmental pollution would occur if the port were to provide facilities for the repair and maintenance of ships (heavy metals, hydrocarbons, greases etc).

#### *Solid and Liquid Wastes from Shipping*

- 5.23 During the operation phase, discharges to sea from ships in port may occur from a variety of operational and other activities, such as cleaning, accidental spills, disposal of particulates, wastes from accidental fires etc, and inadequate handling of industrial liquid and solid wastes.

#### *Air Pollution*

- 5.24 Air emissions from vessels occur mainly on entering and leaving the port, when marine diesel engines, which are designed primarily to provide constant power, have to provide variable power outputs while maneuvering. If the vessel is in port for some time, the propulsion engines will be shut down, and the ship's electricity requirements will be met from generators using lighter fuels. However, during start-up and warm up, the propulsion engines will emit visible plumes from incomplete burning of diesel fuels. During port operations, 1-2 ships may be expected to be entering or leaving the port each day. The good air quality at present, land-sea breezes and distance of the port and Mejillones, indicate that the emissions from ships would not raise local air quality above Chilean standards.
- 5.25 At present the port is not designed or authorized to accept bulk cargo, including ore concentrate. If the port were to seek authorization for handling this type of material, they would need to review the potential impacts of dust pollution and health implications from the transport, stockpiling and loading of this material onto ships.

#### *Noise*

- 5.26 Port operation 24 hours a day will give rise to noise levels, which would be noticeably higher at night due to the fall in ambient noise levels. Levels of operational noise are estimated to be 56.5 dB(A). This is well within the Chilean environmental standard for noise levels in industrial areas of 70 dB(A) and similar to existing ambient noise levels measured in the industrial quarter. Operational noise levels are not expected to cause a significant nuisance away from the port.

#### *Management and Disposal of Solid and Liquid Wastes*

- 5.27 The water treatment works and the wastewater treatment works will generate liquid effluent and sludge. Domestic and commercial solid waste will also be generated during the operation of the port.

- 5.28 Leaks from underground fuel storage tanks may occur, affecting groundwater and coastal waters due to seepage. Fumes and accidental spills may occur during the fuelling of plant and equipment, and the refueling of the tanks.

*Operational Traffic*

- 5.29 The project will increase railway traffic due to the movement of goods by land. The construction of, and improvements to, the existing railway infrastructure will generate indirect environmental and social impacts. Increased rail traffic would help to minimize operational road traffic, and attendant environmental impacts, but could lead to increases in accidents at railway crossings.
- 5.30 The new port would be serviced by an estimated 190 truck movements per day. Given the low traffic flows at present, the addition of another 190 trucks is unlikely to affect the capacity of the roads. However, an increase in traffic may impact the community and environment long before the traffic flows on the road reach capacity. The Project Road Impact Study compares traffic flows on various roads with and without the project for the year of opening and then every 5 years up to 20 years, assuming a low traffic growth scenario. In the first years, traffic demand on roads is low and the level of service on the roads is good lying in classes A and B. Towards the end of the study period demand is higher, and the level of service is predominantly classed as B and C, with some sections classed as D and E. Most problems are associated with short sections of road in mountainous areas near Antofagasta, Tocopilla and Chuquicamata.

*Indirect Impacts on Antofagasta*

- 5.31 The opening of Mejillones Port will remove some of the shipping and associated commerce from Antofagasta. The Antofagasta Port Authority has considered this issue in their Port Master Plan. It is expected that there will be job losses at the Port, which would be partially offset by redevelopment of the port and relocation of some dockers to Mejillones. Further indirect benefits may be expected from the decrease in traffic to and from the port, through the relief of congestion and traffic-related impacts such as noise, air emissions, and accidents.

**C. Positive Impacts of the Project**

- 5.32 It is envisaged that the construction staff will be recruited mainly from Mejillones and Antofagasta and the Company considers that there is sufficient provision in both towns to accommodate the additional temporary labor. Assuming 40% of the population of 10,000 are of working age, and a 7% unemployment rate, this gives some 280 people out of work. Given that the construction company Belfi may be seeking to employ 350 unskilled workers, the people and local economy of Mejillones could benefit substantially over the 20 month construction period. Drawing on the local population for employment would also help to negate the adverse social impacts that occur when a large temporary, non-resident workforce is brought into an area.
- 5.33 The proposed port development in Region II is oriented to the increased efficiency of the present transport system, strengthening simultaneously the physical international integration and commercial exchange between the countries of the Pacific basin. Once in operation, the proposed scheme has the potential to bring further socio-economic benefits to Mejillones. This could occur directly, through the provision of manual labor and increased local taxes (based on the number of employees at the port) for the Municipality, and indirectly through stimulus to the local economy and demand for improved services (health, education, domestic waste disposal, roads etc).

## **VI. ENVIRONMENTAL, SOCIAL, HEALTH AND SAFETY MANAGEMENT**

### **A. Environmental and Social Mitigation Measures**

- 6.1 The EIA identified a series of mitigation, restoration and compensation measures which would be implemented to avoid, offset or reduce the adverse impacts of the construction and operation of the port. The EIA also set out proposals for environmental monitoring prior to and during construction, and in the operation phase to determine the nature of residual impacts on the environment. These proposals were reviewed, modified and approved by COREMA II and CONAMA during the evaluation of the EIA, and are set out in the Resolutions emitted by these two organizations. In addition, and at the request of the IDB, the Company has developed an Environmental and Social Management Plan (ESMP) for the construction activities which consolidated the various prevention and mitigation environmental and social measures identified in the several environmental reports (EIA, Traffic Study, Dredging Work Plan, etc). The ESMP includes the associated monitoring programs and the personnel responsible for its implementation. Monitoring and mitigation measures specifically related to dredging will be included into the ESMP, as soon as the works are awarded. The ESMP will be revised by the Bank to confirm that the project includes complete and adequate measures to control and mitigate environmental and social impacts, including the impacts on the artisanal fishermen. Overall responsibility for compliance with these obligations lies with CPM, who will pass on responsibility for compliance to the Company under the Concession Contract.

#### ***Construction***

##### ***Impacts of dredging on water quality and marine ecology***

- 6.2 Dredging and associated activities will be regulated by the approved Dredging Work Plan. The Plan covers (a) a description of the dredging proposals, (b) water quality, sediment and benthos characterisation in the area to be dredged, (c) collection of background information on the disposal areas, and (d) baseline studies of the disposal areas covering current and dispersion studies, wind studies, water quality variations with depth, benthos and sediments. There will be a strong emphasis on safety, to avoid accidents during the whole dredging operation, which will embrace the contractors, consultants, the local community and third parties.
- 6.3 The Company will subcontract the dredging works through international competition to a suitably qualified dredging company. Six firms have already been qualified, and the construction company, Belfi, has been in discussions with them. The prequalified dredging companies will be invited to bid for the works, taking account of the specifications required by the Company, Belfi and DIRECTEMAR. Within these constraints the dredging company can set out their preferred *modus operandi*. At present, the preferred dredging approach would be to employ a cutter suction dredger (see Section II for details). The plant required to transport and dispose of the dredged material would partly depend on the location of the disposal site, which can be either Zone the A or Zone be as identified in the Dredging Plan.
- 6.4 The Company attaches great importance to the security arrangements under which the dredging operations will be developed, including the initial dredging trials, the main dredging and disposal operations, the monitoring programs, and the implementation of mitigation measures and corrective actions. A trial dredging is planned in order to study the behavior of the sediments in the water, particularly the evolution and circulation of a sediment plume during dredging. This will involve dredging during increasingly long periods, separated by downtime and marine observations.

- 6.5 During the dredging operations it is proposed to restrict the size of the sediment plume to approximately 150ha in the dredging area and 200ha in the dredging disposal zone, and maintain a distance of approximately 1km between the sediment plume and sensitive areas. The plume is defined as the location in which suspended sediment concentrations are above 400mg/l. When the concentration of suspended solids at the monitoring locations exceeds 400mg/l during dredging operations, mitigation measures or corrective actions will be instigated, which may consist of one or more of the following:
- restricting the operation rates of dredging;
  - restricting water overflow from barges;
  - restricting the use of the Automatic Light Mixture Overboard (ALMOB);
  - employment of silt curtains to prevent excessive dispersion of the plume towards sensitive areas; and
  - restricting dredging activities in the light of winds and currents.
- 6.6 Similarly, when the concentration of suspended solids at monitoring locations exceeds 400mg/l during disposal operations, one or more of the following mitigation measures will be implemented:
- temporary suspension of disposal should the dispersion plume reach within 1km of one of the designated protection areas;
  - restricting rates of discharge;
  - restricting dredging activities in response to winds and currents; and
  - discharge below 5m.
- 6.7 To mitigate the impacts on the benthos, the area to be dredged will be restricted to that indicated in the design specifications. The impacts on the commercially sensitive species Ostión del Norte (*Argopecten purpuratus*) is being further mitigated by relocating the Ostiones found in the port area to a new site at Puerto Bello on the west side of the Bay. This program was undertaken in early November 2000 by the local fishing union under the supervision of Dr. Avendaño and completed in December 2000.

*Impacts of land-based works on Sterna lorata*

- 6.8 To mitigate the impact on the decrease in population of wild fauna, particularly the colony of *S. lorata*, the following measures will be undertaken:
- reduce as far as possible the fragmentation of the sea, coastal fringe, and coastal desert habitats, by placing the works as close as possible to the existing industrial quarter;
  - restrict earthworks to the volumes and areas stipulated in the specifications via contractual arrangements with the construction companies;
  - identify specific routes and locations for the transport and disposal of inert material;
  - minimize the area affected by the construction of access roads; reduce the general disturbance generated by the transportation of primary materials;
  - select a temporary location within the port site for the handling and disposal of solid waste;
  - avoid the entry of domestic animals into the area; and
  - define in conjunction with the authorities an exclusion area within the coastal desert habitat to protect the nesting bird colony.
- 6.9 The selection of the exclusion area has to be agreed with SAG and the Municipality. The protection area should be sufficiently large to protect sites for nesting, feeding, courtship, and other activities. Moreover, a buffer zone needs to be established around the protected site. After 10 years, CPM has to evaluate the measure, and consider extending the protection program.

#### *Air pollution*

- 6.10 Dust suppression will be undertaken by spraying construction sites and access roads as required using untreated seawater water.

#### *Quarries and borrow pits*

- 6.11 Aggregate and rock armour will be purchased from specialized companies that comply with the appropriate Chilean legislation. There are existing sand and gravel quarries near the proposed port location, but rock may have to be obtained from locations further away. Sand, gravel or another type of granular material will be used as infill underwater in the creation of the platform by Terminal 1 to avoid the development of a sediment plume.

#### *Management and disposal of solid waste*

- 6.12 The construction and operation of the port complex will involve the risk of liquid emissions, the generation of excess solid wastes, the handling of contaminating substances etc. A program is being prepared, both for the construction and operation phases, as part of the detailed Contingency Plans that CPM has to submit to the relevant authorities 90 days prior to the start of construction. In accordance with the requirements placed upon port operators, CPM will comply with the requirement to advise the maritime government in the region immediately of discharges to the sea of any toxic or dangerous substances. The maritime authority will direct the contingency plans, which are based on the requirements stipulated by the International Maritime Dangerous Goods Code (IMDG).
- 6.13 The storage of fuels (diesel, petrol) will comply with all the technical and structural specifications such as the design of the installation within the port precincts (Supreme Decree No. 379/85 which controls the Regulation on Minimum Security Requirements for the Storage and Handling of Liquid Fuels Derived from Petroleum, and the Official Chilean Standards NCh387. Of55, NCh389. Of74, and NCh2190. Of93). When the stock of waste oils reaches a given level, they will be sold or transferred to companies authorized in the treatment and disposal of such residues.
- 6.14 The type of paint used and its application will comply with the technical and environmental requirements for this type of project. The rubbish or solid wastes will be reused or disposed of at authorized waste disposal sites. As the Municipal waste disposal site is not authorized, CPM has been required to develop its own waste disposal site on the land reserved for port development. Engineering and environmental studies are in preparation. Chemical baths will be provided for the workforce during construction to avoid contamination by sewage.

#### *Landscape Quality*

- 6.15 The measures proposed to mitigate the impact on the landscape and tourism potential are based on improvements to the landscape and appearance of the site. These measures include the choice of harmonious colors for painting the installations and the creation of green areas within the port precincts following appropriate landscape design and the planting of at least 40% native species.

#### *Socio-economic Impacts*

- 6.16 The Company is considering primary auxiliary installations, dining services, and others to cater for the most immediate needs of the workforce and to reduce the pressure for the provision of this

type of service on the community. Recruitment of workforce from Mejillones would help to boost the local economy through employment and reduce the anti-social impacts caused by introducing large numbers of temporary workers. Further investigations and the subsequent assessment will be conducted by the Company to identify likely social impacts on local fishermen as a result of loss of fishing grounds, likelihood of spills, interference with established routes, etc. Social mitigation and compensation measures will be defined both for construction and operation of the port.

- 6.17 Traffic-related impacts in Mejillones itself would be controlled by directing all traffic approaching and leaving the port to use the access onto the Route 1, thereby avoiding circulation in the town center. Given the under-capacity of Route 1 and absence of properties, even a large increase in heavy goods vehicles would be unlikely to cause congestion or community severance problems. More problematic would be the impacts on communities and local traffic circulation in Mejillones and Antofagasta. These impacts should be minimal in Mejillones, as trucks can access the construction site without entering the town.

#### *Demarcation of the Spanish Galleon*

- 6.18 Due to the proximity of the Spanish Galleon to the coastline (less than 100m) and the shallow water in the area (less than 8m), the Galleon would not be affected by shipping to and from the proposed port. Nevertheless, it is proposed to demarcate the site with four buoys and provide the necessary instructions to those with responsibilities for activities during the construction and operational phases of the port, in order to avoid any damage to the remains of the Galleon.

### **Operation**

#### *Impact of dredging and maintenance works on water quality and marine ecology*

- 6.19 The dredging activities associated with the maintenance of the port will be undertaken, with due consideration to the mitigation measures applied during the construction phase, including the disposal of the dredged material. The volume of maintenance dredging is expected to be relatively small, in the order of 55,000 m<sup>3</sup> every 3 years, depending on the frequency and effect of large storms on sediment transport in the bay.

#### *Solid and liquid waste from shipping*

- 6.20 The disposal of waste from shipping is covered by international conventions such as the MARPOL Convention (International Convention for the Prevention of Pollution from Ships, 1973/78) as well as national legislation. The enforcement of MARPOL is undertaken by DIRECTEMAR, except with regards to the disposal of wastes at reception facilities in ports, in which case responsibilities lie with three separate organizations Customs, Health, and SAG. These authorities prohibit the disposal of solid and liquid wastes on land under national legislation. Consequently, mitigation measures concerning the handling of wastes from ships are considered to lie outside of the control of the Company. It is illegal to exchange ballast water within Chilean coastal waters. The Company will comply with wastewater collection and treatment facilities in accordance with Annex IV of MARPOL when this international treaty comes into force. It is being recommended that wastewater facilities take into account future expansion to accept waste water from ships (i.e inlet works should be designed to allow additional pipelines, extra land for expansion of treatment packages, etc).

#### *Management and disposal of solid and liquid wastes*

- 6.21 A new solid waste facility will be constructed within the land reserved for port development with a 30-year design life. This facility will accept inert and non-hazardous wastes only. Wastes will be placed in excavated hollows and covered daily with aggregate. Hazardous wastes will be disposed of separately in accordance with national legislation.
- 6.22 The liquid wastes generated in the canteens, toilets, and offices will be conveyed to a wastewater treatment works. The wastes will undergo coarse and fine screening, primary sedimentation, biological treatment, secondary sedimentation, disinfection by chlorination and anaerobic digestion of the sludge. The treated liquid effluent will be used to irrigate green areas within the port, in compliance with the current legislation. The treated sludge will be dehydrated on drying beds and used as a soil conditioner also within the port complex or be disposed of at the waste disposal site. The construction of a water treatment plant within the port precincts would avoid pressure on the water supply services in Mejillones.

#### *Operational Traffic*

- 6.23 At present the Ministry of Public Works is constructing a direct access to the port precinct from the B-262 (northern access to Mejillones) in order to facilitate road access and avoid possible traffic problems in Mejillones. Traffic-related impacts will also be greatly reduced by transporting most of the copper cathodes via rail from the mines to the port.
- 6.24 Embarkation and disembarkation activities will be halted by the authorities when appropriate in order to avoid accidents due to strong winds or tides in the port. Shipping transport is projected to reach about 358 ships per year, representing approximately one ship daily. Due to its location on the eastern side of the Mejillones bay, port marine activities will not interfere with the routes of local fishermen. Ships approaching and leaving the port will follow specific and authorized routes to avoid any interference with the activities in the rest of the Mejillones Bay. The Port Authority will regulate the overall marine operations.

#### *Landscape quality*

- 6.25 Pedestrian access will be provided to the beach to the north east of the port complex in accordance with the Municipality of Mejillones local plan.

#### *Indirect impacts on Antofagasta*

- 6.26 No particular mitigation measures have been considered for the indirect impacts on Antofagasta. It should be noted that the Port Authorities in Antofagasta are making plans to address the reduction in shipping expected in the town following the opening of the new port in Mejillones. Similarly, no compensation measures have been presented for the loss of fishing grounds.

### **B. Environmental and Social Monitoring Programs**

- 6.27 The Monitoring Program for the Project involves the sub-components outlined in the EIA and in the Dredging Work Plan. The EIA defines all monitoring activities associated with the port works while the Dredging Work Plan defines monitoring related to dredging and disposal activities. A water quality, sediments and intertidal and subtidal communities baseline survey was undertaken in the year 2000 in order to supplement the studies undertaken for the EIA. Further baseline of the Ostión del Norte was obtained during the relocation campaign at the end of 2000. The methodologies and programs for any outstanding monitoring programs required under Resolutions 031/99 and 072/99

(i.e. WWT operation, *S. lorata*) will be defined by CONAMA. The monitoring programs require the preparation of reports summarizing the information. These reports are reviewed internally by the Company, and are also reviewed by the relevant environmental authorities.

### *Dredging*

- 6.28 Monitoring will be undertaken during the capital dredging operations (including the trial period, the main dredging program and the disposal of the dredged material) and continue for one month after completion. During the first month of monitoring, samples will be collected every two days, after which the frequency will be reduced to weekly monitoring. The monitoring program may be adjusted in the light of the results obtained during the trial dredging period.
- 6.29 Water samples will be collected at 7 stations located around the Bay. These locations have been chosen to afford protection to sensitive locations. Three Grade 1 stations have been designated at the most sensitive sites:
- to the south east of the proposed port (the most likely direction of the sediment plume);
  - off the coast by the in-take works for the thermal electric power stations; and
  - to the north east of a quadrant protecting the shellfish culture area in Mejillones.
- Four Grade 2 stations have been designated located at the following points:
- the southwest quadrant of the Zone A disposal site;
  - the southeast quadrant of the Zone B disposal site;
  - off Punta Angamos to the north of the relocation site for the Ostión;
  - off the north west quadrant defining the protection area for the shellfish cultivation west of Mejillones.
- 6.30 At the Grade 1 stations the following parameters will be analyzed: material in suspension, unicellular organisms, phytoplankton biomass as chlorophyll A, water transparency and water temperature. At Grade 2 stations, material in suspension and water transparency will be monitored. Wind speed and direction will also be monitored from a land-based field station. Samples will be taken from the water surface, and through the profile. Standard analytical methods will be applied. The field monitoring, laboratory analysis and data interpretation will be undertaken by appropriately qualified and experienced professionals. The results will be verified every two days and plotted on graphs against time to show trends or sharp changes in values. A bathymetric survey will be undertaken in the selected disposal zone pre and post dredging.
- 6.31 If the suspended sediment concentrations exceed 400mg/l, this will trigger corrective actions to reduce the impact of the plume. The value of 400mg/l was chosen on the basis that during phytoplankton blooms suspended material concentrations of this order start to affect light penetration in the water column.
- 6.32 Two sets of reports will be prepared and submitted to the maritime authorities for review, consisting of (i) biweekly reports of the consolidated results and every four weeks a consolidated account of the results to date, and (ii) a final report containing the details of the methodology and procedures used, the results obtained, an evaluation of the results in relation to the objectives of the monitoring plan, the parameters, and bibliographic information.

### *Water Quality*

- 6.33 With regards to the port works, water samples are to be collected from six sampling stations at three depths. Of the six stations, five are located in the area of influence of the port, while the sixth site is a 'control' site away from the port. In January 2000, the location of the six sites was

agreed with the national maritime authority in accordance with the requirements of the EIA Resolution. The parameters to be measured are: temperature, salinity, dissolved oxygen, pH, transparency, BOD5, suspended solids, nutrients (ammonia, nitrate, nitrite, and phosphorous), total hydrocarbons, total coliforms and fecal coliforms, total organic carbon (TOC), detergents, residual free chlorine, and heavy metals (Hg, As, Pb, Cd, Cu, Ag, Zn). During construction, water quality monitoring will be undertaken every two months, while during the port operation the frequency will be reduced to every four months during the first five years and then to once a year for the remainder of the port operation. The same methodology will be adopted during all stages.

- 6.34 Within the program for the translocation of the scallop *A. purpuratus*, a baseline survey of the potential receptor sites was undertaken in April-June 2000. The physico-chemical parameters monitored were: temperature, salinity, dissolved oxygen, pH, particulate organic matter, particulate organic carbon, feopigments, and chlorophyll-a. A single campaign was undertaken at each of the three proposed receptor sites that were selected with the participation of SERNAPESCA. Following the translocation of the scallop, a monitoring program in the receptor site is proposed, although at present the nature of this program depends on the environmental authorities.

#### *Sediments*

- 6.35 The monitoring program for sediments for the port works involves the collection of seabed samples from the same locations and with the same frequency as the water quality monitoring program. The following parameters will be measured: particle size distribution, total hydrocarbons, and polycyclic aromatic hydrocarbons (PAH), organic matter (as TOC), and heavy metals (Hg, As, Pb, Cd, Cu, and Zn). The baseline survey was undertaken in March and August 2000.
- 6.36 For the dredging works, the baseline survey requires the granulometric characterisation at 30 sampling stations within the area to be dredged, plus the chemical characterisation of five of those samples (total hydrocarbons, polycyclic aromatic hydrocarbons, total organic carbon, and heavy metals - Hg, As, Pb, Cd, Cu, Cr, Zn). A single baseline survey will be undertaken. The monitoring program during construction (dredging) will depend on the maritime authority.

#### *Intertidal Biological Communities*

- 6.37 For the port works, the monitoring programs for the baseline survey, and the construction and operation phases, will follow the same methodology based on six transects across the intertidal zone with monitoring stations every 5 or 10m. The parameters to be measured are: abundance, (number of individuals/m<sup>2</sup>), wet biomass, ABC curves, diversity, similarity curves, uniformity and species richness, classification and ordination of monitoring stations, and cover. It will also be necessary to analyse the heavy metal content (Cu, Pb, Ag, y Zn) in the flesh of a number of organisms.
- 6.38 The baseline survey involves two monitoring programs (summer and winter) before the start of construction. The summer campaign was undertaken in March 2000 and the winter campaign in August 2000. During the construction phase, the sampling frequency will be every four months, and during the operational phases, the sampling frequency will be six-monthly during the first five years, falling to once a year during the life of the port. The location of the six transects required under the EIA resolution was agreed with the national maritime authority in January 2000.

#### *Subtidal Biological Communities*

- 6.39 The baseline, construction and operation monitoring programs for the subtidal biological communities for the port works will follow the same frequencies and parameters as the intertidal community monitoring program. The sampling sites will correspond to the six stations for sediment quality. The sediments from the soft substrata will be collected by scuba divers using a corer 15cms in diameter and 15cms long, and analyzed for infauna and chemical quality. The heavy metal content of the flesh of a sample of fauna will also be analyzed.
- 6.40 The baseline surveys for the areas to be dredged and the disposal sites involve the measurement of abundance, species richness, diversity, similarity, cluster analysis of sampling stations, simple and multiple regression, biomass and ABC curves. In the dredging area, the same five stations selected for the sediment characterization will be studied for subtidal benthos. At the disposal sites, the sampling sites will correspond to the locations of the water quality monitoring stations. A single monitoring campaign will be undertaken. The monitoring programs for both the construction and operation phases for the dredging and disposal areas will depend on approval by the maritime authority.
- 6.41 The study of the donor site for the scallop *A. purpuratus* involved an evaluation of the shellfish stock, including the demographic structure of the scallops and the updating of a list of benthic species of economic importance. To undertake this study, an initial exercise was undertaken to determine the distribution area of the scallop using 40 transects perpendicular to the coast and 300m apart. Once the area had been delimited, a pilot sampling study was undertaken to define the sampling grid, using 14 transects perpendicular to the coast and 900m apart, with stations every 4m. Subsequently, the minimum number of sampling stations was calculated to estimate the abundance of the resource, which was called the Definitive Sample. This was undertaken on a regular grid of samples, along transects 300m apart. In each of the sampling stations the density and size structure of other species of economic importance were also recorded, namely Cholga, Langostino and Macha. Finally, the exploration and evaluation of the shellfish resource over an area between the Interacid facility to the southwest and Punta Chacaya to the northeast along 12km of coastline and up to the 25m depth contour was undertaken. A single monitoring campaign was completed in August 1999.
- 6.42 A baseline survey was undertaken in the potential receptor areas for the scallops to determine the presence of scallops and characteristics of the subtidal substrate such as algae, and polychaetes. Three stations were studied at the Sector de Hornitos, the Sector de Chacaya and the Sector de Puerto Bello. The field work was undertaken between April and June 2000.
- 6.43 The number of scallops at the donor site was re-evaluated in August 2000, just before the translocation program to verify the numbers of units to be translocated. The translocation program was undertaken in the first half of November 2000, with a short monitoring program between 29 November and 6 December to evaluate the success of the translocation exercise.

#### *Sterna lorata*

- 6.44 A monitoring program of the *S. lorata* colony in Mejillones is being undertaken by appropriately qualified ornithologists. For the baseline survey, two monitoring campaigns (summer and winter) were undertaken in January and July of 2000. The area monitored included the known colony on the Pampa de Mejillones, and the two possible colony sites at Hornitos and La Rinconada. The methodology involved visits by foot along transects in the Mejillones coastal desert, and inspections by vehicle in the other two locations. The parameters studied during the field observations were: the area of the colony; the areas of greatest intensity of use within the area

occupied by the colony; the numbers of individuals and pairs; mobility and migration; the extent of areas of social interaction, feeding, and nesting; seasonality and duration of reproduction; survival of the eggs and birds; and adverse factors affecting the colony.

- 6.45 From January 2001, the monitoring program will consist of six campaigns a year, over three years, following the same methodology. During the operation phase, the monitoring program will continue for five years, with four campaigns a year. The monitoring program may only be modified in the light of the results obtained and comments from the relevant authorities.

*Water Resources (Potable Water Treatment Plant and Wastewater Treatment Plant)*

- 6.46 Water for human consumption will be monitored monthly. The parameters to be monitored are given in the Chilean Standard on Potable Water Quality (NCh 409/84). The effluent from the wastewater treatment plant will be used to irrigate green areas within the port and will be monitored monthly.
- 6.47 The Antofagasta Health Service undertakes an independent monitoring program to check that the supply of water for human consumption and treated wastewater comply with the Chilean standards.

**C. Health and Safety**

- 6.48 All works will be undertaken under the strictest health and safety standards, especially those required under Law No. 16,744, on Accidents at Work and Professional Diseases and its implementing regulations. In particular, this law obliges companies:
- to have a Department of Risk Prevention;
  - to collect statistics on accidents and professional diseases;
  - to have internal regulations on Health and Security approved by the Health Service;
  - to inform all workers about potential risks;
  - to set up and finance Hygiene and Safety committees in workplaces with more than 25 workers; and
  - to establish basic sanitation and environmental conditions in workplaces.
- 6.49 The Company will develop a Health and Security Plan based on risk prevention procedures. The Health and Safety will include:
- the assignment of responsibilities to General Management, the Technical Sub-Division, the Head of the Department of Risk Prevention, the Area Head, Supervisors and Trainers, the Hygiene and Security Committee, Head of Stores, and Workforce;
  - risk prevention activities, including training, preventative measures, corrective measures, and security meetings;
  - program of risk prevention documentation; and
  - internal regulations on Order, Hygiene and Security.
- 6.50 All members of the Concessionaire will be required to comply with the Health and Safety Plan. The construction company Belfi, and the port operator, Ultramar have their own internal arrangements for health and safety. Belfi's general management includes a Department for Risk Prevention and Environmental Evaluation as well as site specific offices for Risk Prevention and Environmental Evaluation at construction sites. A Plan is prepared for each construction project, which contains procedures for dealing with specific situations, particularly those associated with risk, for example the transport and storage of fuel, piling operations, handling of sands contaminated with paints, fire contingency plan, accidental spills of substances or products into the sea and demobilization

of construction sites. Belfi provides medical facilities at construction sites consisting of a doctor, nurse, and ambulance. New employees are provided with a copy of the company's Regulation for Internal Arrangements - Hygiene and Safety (Reglamento Interno de Orden, Higiene y Seguridad) and have to countersign to demonstrate that they have read the contents. The contents of this booklet is divided into three sections:

- Part 1 - Regulations on Internal Arrangements (e.g. conditions of employment, contractual information, working hours, remuneration, termination of employment, claims, sanctions and fines, claims procedures in case of dismissal etc);
- Part 2 - Regulations on Hygiene and Security (e.g. general conditions, obligations of employees, prohibited activities, obligations of the supervisors, sanctions and fines, legal procedures related to Law No. 16,744 and Supreme Decree 101 of 1968, and the workings of the workers' Hygiene and Security Committee); and
- Part 3 - Principal Risks in the Workplace and Prevention Measures (covers typical accidents for different types of construction projects and ways of controlling them).

- 6.51 Ultraport has a Department of Prevention of Risks and Training. Ultraport has its own manual on risk prevention, which covers the areas of leadership and administration, training for the workforce, analysis of tasks and safe working procedures, investigation of accidents, personnel protection, 'right to know' the risks facing the workforce, preparation for contingencies, promotion of security, medical examinations for staff and program evaluation. Ultraport also has procedures for dealing with specific port operation activities, including mobilization of empty containers, transfer of containers, handling of mineral carbon, contingency plan for oil spills from ships, contingency plan for fires and contingency plan in the case of accidents involving personnel.
- 6.52 Belfi and Ultraport belong to *Mutuales de Seguridad* as required under Chilean legislation. The *Mutuales de Seguridad* undertake inspections of work places and advise their member companies on improvements in facilities, practices, and training. Tariffs paid to the *Mutuales* are influenced by the number of accidents at work that occur throughout the year. Health and safety indices available for 1999 for Ultraport lie well below the sector benchmark figures.

#### **D. Contingency Plan and Procedures**

- 6.53 In accordance with Resolution No. 031/99, the Company has to prepare Contingency Plans for the construction and operation phases of the proposed port. The plans have to contain information on the equipment, training and procedures to be followed in the case of spillages of oil and other dangerous substances from the port and ships, and on the prevention and management of fires. The Contingency Plans have to be submitted to CONAMA Region II and the local Maritime Authority 90 days prior to the start of construction. The Contingency Plans will also be passed onto DIRSOMAR (Dirección de Seguridad y Operaciones Marítimas) for approval.
- 6.54 Guidelines for the development of an oil spill contingency plan are presented in the Dredging Plan that cover the following procedures:
- notification of an incident to the Company and its staff, including a template for notifying the relevant authorities of the incident,
  - evaluation of the nature of the incident based on the information available and the potential environmental risks, followed by procedures to inform third parties,
  - determination of the actions to be taken, such as observations of the spill, containment or dispersion activities, and clean up tasks,
  - clean up operations,
  - communications, and
  - finalization of the clean up activities.

The guidelines also provide advice on the selection of techniques for controlling the oil spill, depending on the size and location of the spill.

- 6.55 The Contingency Plans, which are in preparation, will define:
- the functions of staff within the organization: Technical Subdivision, Head of the Department of Risk Prevention, Supervisor, wardens, and general workforce;
  - logistical aspects, including maps indicating evacuation routes and safe areas during construction and operation, and a map of water supply for fire control;
  - alarms and communications to staff; and
  - specific hazards and procedures to handle them during construction and operation: natural hazards (earthquakes and tsunamis), fires, and oil spills.

#### **E. Environmental, Health and Safety Management**

- 6.56 The overall responsibility for complying with Chilean environmental and health and safety legislation and the requirements of the environmental Resolutions from COREMA Region II and CONAMA National lies with the CPM. Under the Concession Contract, the Concessionaire will be responsible to CPM for implementing the relevant conditions set out in the Resolutions, and complying with national legislation. The Concessionaire is committed to meeting the costs of the mitigation and monitoring programs required under the Resolutions.
- 6.57 The Company will instigate close supervision of the works during the dredging operation. DIRECTEMAR will be responsible for ensuring compliance with the Dredging Plan. Previous mitigation and monitoring activities were implemented by the Company and some aspects were subcontracted to third parties. Where studies are subcontracted to third parties, the Company seeks suitably qualified consultants and scientists. For example, the program for the translocation of the Ostiones and water quality baseline studies were carried out by experts from the University of Antofagasta, the monitoring program for the bird *S. lorata* was undertaken by an expert ornithologist who had studied the colony some years earlier, and the original EIA (commissioned by CPM) and the Environmental Management Plan were prepared by environmental consultants with extensive knowledge of the area. The Company reviews all the environmental mitigation and monitoring studies, prior to forwarding the reports to the project sponsor CPM for review. All the mitigation and monitoring studies required by Resolutions 031/99 and 072/99 are also subject to review by the relevant environmental authorities as prescribed in the Resolutions. CONAMA is responsible for ensuring that reports on monitoring studies are circulated to the appropriate authorities for review and approval.
- 6.58 The Company will be structured into three main divisions: Administration, Commercial and the Technical Division. Responsibility for the management of environmental, health and safety issues will lie in the Technical Division of the Company. This office(s) will direct the overall environmental management for the project. An Environmental and Social Management Plan has been prepared, which will be maintained and updated during the construction and operation of Terminal 1 of the Port Complex.
- 6.59 The objectives of the Environmental and Social Management Plan are:
- to comply with all the environmental conditions contained in the EIA and its addenda.
  - to comply with all the requirements of the Resolution No. 31/99 of COREMA Region II of 17 March 1999 and Resolution No 072/99 of CONAMA of 9 July 1999.
  - to comply with the environmental obligations contracted between the Company and the Inter-American Development Bank.

- to ensure compliance with Chilean environmental legislation during construction and operation of the port.
- 6.60 The Environmental Management Plan includes: a revisions sheet; a contents page; introduction; organization of the Environmental Management Plan; objectives; a description of the project; organograms; applicable legislation and permits; plans for obtaining new permits and authorizations; monitoring plans; mitigation plans; contingency plans; master plan for environmental training; a plan for hygiene and security; and a communications plan. The General Management of the Company will have to approve the Environmental Management Plan and any future modification. The Coordinator for the Department of Environment and Prevention of Risks at the Company will be responsible for coordinating the implementation of the Environmental Management Plan both at the level of the Company and for each of its subcontractors.
- 6.61 During the construction phase, the Management of the construction firm Belfi will be responsible for ensuring compliance with the Environmental and Social Management Plan, while during the operational phase, the Technical Sub-Manager of Ultraport will be responsible for ensuring compliance with the plan.

## **VII. PUBLIC CONSULTATION**

- 7.1 CPM has undertaken public consultation and citizen participation activities in different stages of the project, consisting of multiple activities prior to the preparation of the EIA, during its development, and following the presentation of the EIA to CONAMA Region II. During the preparation of the EIA, the following specific voluntary actions by CPM were taken:
- May 1998: Meeting, in the offices of COREMA Region II, with CPM and consultants in charge of undertaking the EIA with various regional authorities (Mining, Health, Public Works, Tourism, National Assets and Environment) in order to define the EIA scope of work and key Project issues.
  - May 1998: Meeting, in the offices of the Municipality of Mejillones, with CPM and the consultants undertaking the EIA with representatives of the Mejillones community, the artisanal fishermen's association, shellfishery, divers, local authorities and academics in order to understand potential concerns of local residents in relation to the Project.
- 7.2 Law No. 19,300 on the General Provisions on the Environment establishes a series of measures to ensure public participation from the community in the EIA evaluation system. Following the presentation of the EIA to the regional environmental authorities on 23 July 1998, a number of activities were undertaken to meet the requirements for public consultation including:
- 13 August 1998: Publication of a summary of the EIA in the Official Journal of the Republic of Chile and the newspaper El Mercurio in Antofagasta, informing of the start of the public participation process required under Law No. 19,300.
  - 13 August to 28 October 1998: (60 working days public consultation period required by Law). During this period copies of the EIA were made available to the public in the Municipality of Mejillones, at the Intendencia of Region II, and at the offices of COREMA Region II. Observations on the EIA were received.
  - 9 and 10 October 1998: A public meeting was held in Mejillones, organized by the COREMA Region II, to present and analyze the EIA. The meeting included representatives of CONAMA, the Sponsor of the project, CPM, and a consultant from the firm that prepared the EIA. Representatives of the regional and local authorities, academics, local citizen organizations, and private individuals participated in this meeting.

- 17 March 1999: COREMA Region II published their Resolution that approved the Project, and the Resolution included the responses to all the questions and observations.
- 7.3 Key issues raised during the public meeting in Mejillones on 9 and 10 October 1999, included:
- the monitoring program, including who reviews the program and what it consists of, as well as the ability of independent organizations to verify the results;
  - how fisherman or other organizations can assist in the translocation of the scallops, in order to preserve the resource and provide work for a depressed sector;
  - amount of sediment to be dredged, whether mitigation measures/monitoring program address only the scallops or also other marine life;
  - how CPM will transfer the responsibility of implementing the monitoring programs to the concessionaire;
  - concern that although the project will bring socio-economic benefits and impacts, some issues, such as health have been marginalized;
  - mitigation measures for the Gaviotín chico; and
  - concern over plans for water supply and sewage treatment given desalinization plants at EDELNOR and Interacid do not function well.
- 7.4 The Company again made the Project EIA available to the local public in Mejillones, at the request of the IDB, in August 2000.

## **VIII. RECOMMENDATIONS**

- 8.1 The Bank (IDB) will require as part of the Loan Agreement that the Company (CIEN/CTM) and all portions of the Project shall, at all times during the life of the Loan Agreement, comply with each of the following:
- (a) All applicable environmental, health and safety Chilean regulatory requirements, including all environmental, health and safety requirements of the Project contracts, and any subsequent modifications, and all requirements associated with any environmental, health and safety related permits, authorizations, or licenses that apply to the Project or the Company.
  - (b) All aspects and components of the various Project-related environmental, health and safety plans/documents.
  - (c) Applicable aspects of the World Bank General Environmental Guidelines (World Bank Pollution Prevention and Abatement Handbook, 1998), including ambient noise levels and waste water discharge limits.
  - (d) Applicable aspects of the International Finance Corporation General Health and Safety Guideline (1998).
  - (e) Consult with IDB before approving or implementing any and all substantive changes to the Project or its timetable which could potentially have negative environmental, social, or health and safety effects.
  - (f) Send written notice of any and all noncompliance with any environmental requirement of the Loan Agreement and any significant environmental, social, or health and safety accident, impact, event or environmental claim.
  - (g) Ensure that all companies contracted for construction or operation activities comply with the applicable environmental and social requirements of the Loan Agreement.

- (h) Implement ongoing information disclosure and consultation activities related to environmental, social, and health and safety aspects of the project.
  - (i) Implement an environmental, health and safety management system that is consistent with ISO 14001 and BS 8800 (for environment and health and safety, respectively), for the construction and the operation phases.
- 8.2 Prior to the date of Financial Closure, the Company must:
  - (a) Present the final Dredging Management Plan, in form and substance acceptable to the IDB,
  - (b) Present complementary information on the artisanal fishermen, including fishing practices, trends in activities and marine resources, land ownership, related infrastructure and equipment.
  - (c) Present a proposed preliminary approach to properly dispose of hazardous wastes that will be generated during Project operations.
- 8.3 Prior to First Disbursement of the Loan, the Company shall present, in form and substance acceptable to the IDB, the:
  - (a) Environmental and Social Management Plan for the construction phase,
  - (b) Health and Safety Management Plan for the construction phase, and
  - (c) Contingency Plan and Spill Prevention and Counter Control Plan for the construction phase.
- 8.4 Prior to the initiation of operations and Technical Completion, the Company shall submit, in form and substance acceptable to the IDB, the:
  - (a) Environmental and Social Management Plan for the operational phase,
  - (b) Health and Safety Management Plan for the operational phase,
  - (c) Contingency Plan and Spill Prevention and CounterControl Plan for the operational phase, and
  - (d) Environmental, Health and Safety Management System for the operational phase.
- 8.5 Prior to each disbursement, the Company must certify compliance with all environmental, social, and health and safety requirements in the Loan Agreement.
- 8.6 During the life of the Loan Agreement, the Company must prepare and submit an Environmental and Social Compliance Report, in form, content and frequency as determined by the IDB.
- 8.7 The Bank will monitor the project's environmental, social, and health and safety aspects via internal Bank supervision actions (e.g., site visits, review of documentation, etc.) and will contract an external independent environmental consultant to assist the Bank in supervision/monitoring of the Project. In addition, the Bank will have the right, as part of the Loan Agreement, to contract for the performance of an independent environmental, health, and safety audit, if needed.

**TABLE 3.1**  
Environmental permissions applicable to the project

<b>ARTÍCULO DEL REGLAMENTO<sup>(1)</sup></b>	<b>MATERIA DEL PERMISO</b>	<b>TEXTO LEGAL DE REFERENCIA</b>
67	Vertimiento en aguas sometidas a jurisdicción nacional o en alta mar.	Art. 108 y 109 del DS 1/92, del Ministerio de Defensa.
70	Instalación y operación de un terminal marítimo.	Art. 117 del DS 1/92, del Ministerio de Defensa.
88	Producción y/o distribución de agua potable. Recolección y/o disposición de aguas servidas.	D.F.L N° 382/88. Ley General de Servicios Sanitarios.
91	Construcción, modificación y ampliación de obras públicas o privadas destinadas a la evacuación, tratamiento o disposición final de residuos industriales o mineros.	Art. 71, letra b) del DFL 725/67, Código Sanitario.
92	Construcción, modificación o ampliación de obra pública o particular, destinada a la evacuación, tratamiento y disposición final de desagües y aguas servidas de cualquier naturaleza.	Art. 71, letra b) del DFL 725/67 Código Sanitario.
95	Instalación, ampliación o traslado de industrias.	Art. 83 del DFL 725/67, Código Sanitario.

(1) Reglamento del Sistema de Evaluación de Impacto Ambiental, publicado en el Diario Oficial de la República de Chile el 3 de Abril de 1997.

**TABLE 3.2**  
**Normativa de Carácter Ambiental Relacionada con el Proyecto**

<b>TEXTO LEGAL DE REFERENCIA</b>	<b>MATERIA</b>
Decreto con Fuerza de Ley N°725, de 1968.	Fija texto del Código Sanitario.
Decreto con Fuerza de Ley N°1.	Determina materias que requieren autorización sanitaria expresa.
Decreto Supremo N°236, de 1969.	Reglamento general de alcantarillados particulares.
Decreto Supremo N°745.	Reglamento sobre condiciones sanitarias y ambientales mínimas en los lugares de trabajo.
Decreto Supremo N°544, de 1941.	Reglamento de higiene y seguridad industriales.
Decreto Ley N°2.222.	Ley de Navegación.
Decreto Supremo N°1, de 1992.	Reglamento para el control de la contaminación acuática.
Resolución N°1.215, de 1978.	Fija normas sanitarias mínimas destinadas a controlar la contaminación atmosférica.
Decreto Supremo N°144, de 1961.	Regula emisiones desde instalaciones industriales y comerciales.
Norma Chilena Oficial NCh 387. Of 55.	Medidas de seguridad en el empleo y manejo de materiales inflamables.
Norma Chilena Oficial NCh 389. Of 74.	Sustancias peligrosas, almacenamiento de sólidos, líquidos y gases inflamables. Medidas Generales de Seguridad.
Norma Chilena Oficial NCh 2190. Of 93.	Sustancias peligrosas, marcas para información de riesgos.
Decreto Supremo N°379, de 1985.	Reglamento sobre requisitos mínimos de seguridad para el almacenamiento y Manipulación de combustibles líquidos derivados del petróleo, destinados a consumos propios.
Decreto Supremo N°146, de 1998.	Norma sobre niveles máximos de ruidos molestos generados por fuentes fijas.

**TABLE 3.3**  
**International Conventions Ratified by Chile in Relation to the Shipping and Port Activity**

CONVENTION	TEXTO LEGAL QUE LO APRUEBA
Convenio internacional para prevenir la contaminación de las aguas del mar por Hidrocarburos, 1954. (OILPOL/54) y sus enmiendas posteriores.	Decreto Ley N°1.807 del 26 de Octubre de 1977.
Convenio sobre prevención de la contaminación del mar por vertimiento de desechos y otras materias, 1972. (LC/72).	Decreto Ley N°1.809 del 26 de Mayo de 1997.
Convenio internacional sobre responsabilidad civil por daños causados por contaminación de las aguas del mar por hidrocarburos, con su Anexo, 1969. (CLC/69).	Decreto Supremo N°475 del 8 de Octubre de 1977.
Acuerdo sobre cooperación regional para el combate contra la contaminación del Pacífico Sudeste por hidrocarburos y otras sustancias nocivas en casos de emergencia. Lima, 1981.	Decreto Supremo N°425 del 11 de agosto de 1986.
Protocolo para la protección del Pacífico Sudeste contra la contaminación proveniente de fuentes terrestres y sus Anexos. Quito, 1986.	Decreto Supremo N°295 del 7 de Abril de 1986.
Protocolo complementario al acuerdo sobre la cooperación regional para el combate contra la contaminación del Pacífico Sudeste por hidrocarburos y otras sustancias nocivas en casos de emergencia.	Ratificado el 20 de febrero de 1987.
Protocolo para la conservación y administración de las áreas marinas y costeras protegidas del Pacífico Sudeste.	Ratificado el 10 de Noviembre de 1993.
Convenio para la protección del medio ambiente marino y zona costera del pacífico Sudeste.	Decreto Supremo N°296 del 14 de Junio de 1986.
Convenio internacional para prevenir la contaminación por los buques, 1973, y su protocolo de 1978. MARPOL 73/78.	
Convenio Internacional sobre el control de los movimientos transfronterizos de desechos peligrosos de 1989. BASILEA/89.	
Protocolo para la protección del pacífico Sudeste contra la contaminación radioactiva. Comisión permanente del pacífico Sur.	Ratificado el 30 de Abril de 1992.

**TABLE 3.4**  
**Environmental Conditions from Resolution No. 31/99 and state of compliance**

COMPONENT	EIA	CONDITION	COMPLIANCE AT 16/10/2000
<b>CONSTRUCTION PHASE</b>			
POTABLE AND WASTE WATER	DP	Potable Water: to be purchased from ESSAN and delivered by lorry to the site.	Not applicable at present.
	MM	Wastewaters: Use chemical baths.	Not applicable at present.
INDUSTRIAL LIQUID RESIDUES (RIL) AND THE AQUATIC ENVIRONMENT	MM	RIL: Avoid discharge of RILs of whatever nature to the marine environment.	Not applicable at present.
	MP	Seawater quality with depth: 25 parameters, at 6 stations and 3 depths. Summer and winter baseline survey. During construction monitor every 2 months. During operation, monitor every 4 months for first 5 years, and annually thereafter.	Location of stations agreed with DIRECTEMAR. The summer baseline survey (Vásquez et al, 2000a) was submitted to COREMA and have responded to their observations. The winter baseline survey has been completed (Vásquez et al, 2000b). The report will be submitted this week.
	MP	Sediment Quality: 12 parameters, at the same 6 stations chosen for seawater quality. Summer and winter baseline monitoring. During construction monitor every 2 months. During operation, monitor every 4 months for first 5 years, and annually thereafter.	As for Seawater Quality with Depth.
	MP	Intertidal Communities: 6 transects. Summer and winter baseline survey. Include species of economic importances (Ostión, Cholga, Macha, Langostinos) and heavy metal analysis of soft tissue. During construction monitor every 4 months.	Agreed the location of the transects with DIRECTEMAR. Delivered the summer baseline survey to COREMA (Vásquez, et al 2000a) and have responded to observations. Undertook the field work for the winter baseline survey. Report to be submitted this week. Species of economic interest covered in the study for the translocation of scallops (Ostiones).
	MP	Subtidal communities in soft sediments: quadrats at 6 sediment stations. Summer and winter baseline survey, including species of economic importance (Ostión, Cholga, Macha, Langostinos) and heavy metal analysis of soft tissue.	As above for Intertidal Communities.

COMPONENT	EIA	CONDITION	COMPLIANCE AT 16/10/2000
	MM	Translocate the scallops Ostión del Norte present in the dredging area: (a) Presentation of a Conservation Plan to COREMA. (b) Evaluation of the existing stock. (c) Proposal for the translocation methodology and site selection. (d) Proposal for a monitoring programme of the relocated scallops.	a), b), c) delivered to COREMA (Avendaño et al 2000a and b). OK c), have responded to observations from COREMA
	MM	Demarcation of the Spanish Galleon using small buoys.	To be undertaken by Belfi, prior to starting the construction works.
	EL	Delivery of the Technical Report on Dredging to DIRECTEMAR.	Agreed the Terms of Reference with DIRECTEMAR. Completed the field studies. The final report depends on the identification of the discharge sites and will be submitted in January 2001.
	EL	Sectoral permissions pending: a) Art. 66: Disposal of harmful or dangerous materials to sea. b) Art. 67: Spills to the sea or on the high seas. c) Art. 70: Install and operate a maritime terminal. d) Art. 71: Discharge to sea, materials or harmful substances.	a), b) and d) do not apply. Once the basic engineering is approved, will seek permission for c) from DIRECTEMAR.
AIR	MM	Dampening of roads and work areas.	Not applicable at present.
SOLID WASTE	MM	Solid residues or construction waste: will be reused as fill or disposed of at an authorised waste disposal site.	IASA identified a suitable site for a waste disposal facility. A Declaration of Environmental Impacts (DIA) is being prepared for the proposed waste disposal site.
	MM	Demarcation of the area for the disposal of inert materials.	Handling in conjunction with RIS.
TRANSPORT Y ROADS	EL	Transport Impact Study for 5, 10, 15, and 20 year horizons.	Progress Report was revised by MS and César Barrera. Final Report is being reviewed by CPM and the Company (FEJ Ingeniería Ltda).
	EL	Specification for road and railway signage.	Forms part of EIV being prepared by F. Fresard.
	MM	Minimisation of the area affected by trucks.	Not applicable to date.
	MM	Identifying and signing access and transport routes.	Not applicable to date.
	MM	Preparing pedestrian access to the coastal fringe to the NE of the bay.	Not applicable to date.
LANDSCAPE	MM	Painting buildings in specific colours.	Not applicable to date.
	MM	Creation of green areas with specific species.	Not applicable to date.
BIRDS	CM	Together with COREMA, delimit, sign and organise the protection area for the Gaviotín chico ( <i>Sterna lorata</i> ) colony.	

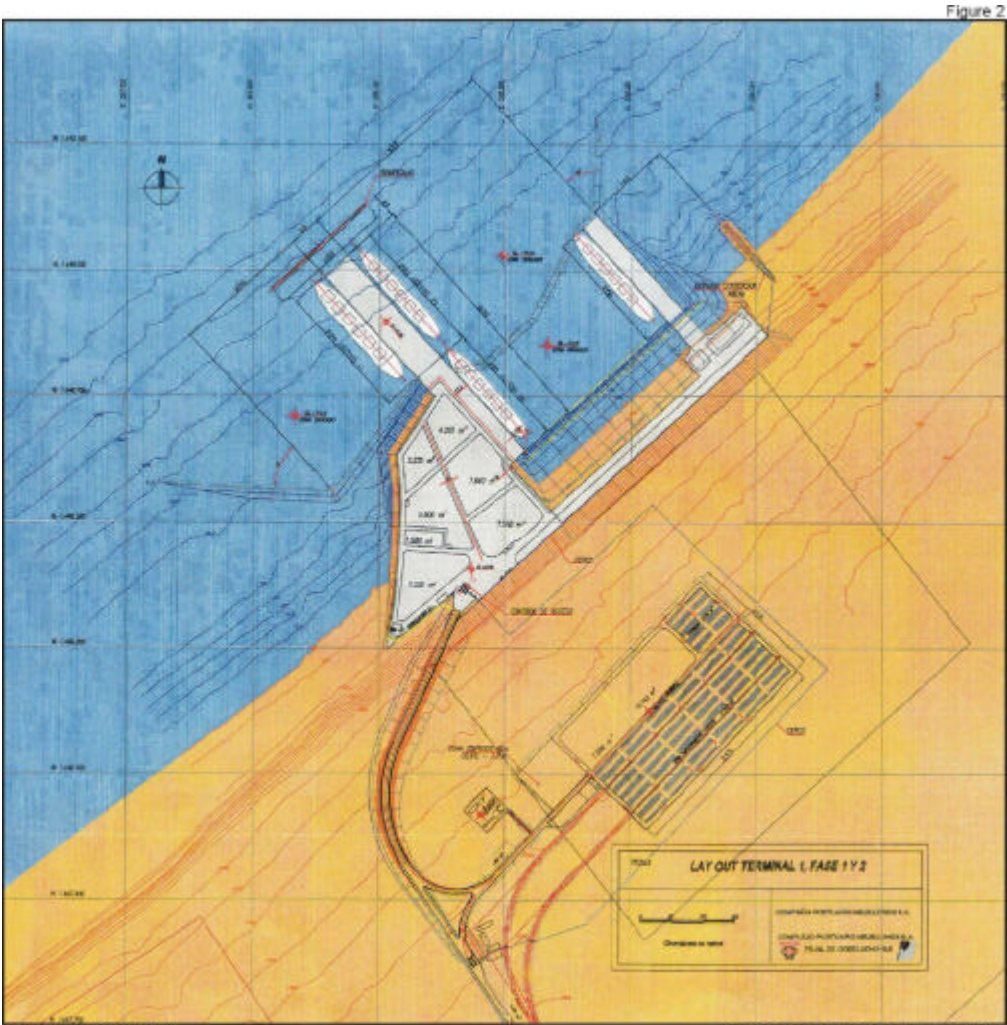
COMPONENT	EIA	CONDITION	COMPLIANCE AT 16/10/2000
	MP	Monitoring the Gaviotín chico. Summer and winter baseline survey. 6 campaigns a year during 3 year construction period starting in January 2001. 4 campaigns a year during first 5 years of operation.	Submitted the summer baseline report. Submitted the winter baseline report. (Vilina 2000 a and b).
	MM	Protection Plan dependent upon the results of the baseline survey.	Not applicable to date.
VARIOUS	CM	Present Contingency Plan 90 days before the start of construction.	Forms part of the Environmental Management Plan which has been prepared by Jaime Illanes. It needs to be revised further, hoping for an acceptable version for the end of October.
	CM	Install equipment to combat fires by the start of construction.	Not applicable to date.

DP: Description of the Project / MM: Mitigation Measure / MP: Monitoring Plan / EL: Environmental Legislation / CM: Contingency Measures

Figure 1  
Proposed Port Location



Figure 2  
Port Layout



PROPOSED PORT LAYOUT  
(from [www.mejllones.cl](http://www.mejllones.cl))

Figure 3  
Proposed Disposal Sites

