1. INTRODUCTION

The Environmental Impact Assessment (EIA) which is summarized hereafter concerns the whole Port of Praia Expansion and Modernization Project but focuses on three project items which are going to be implemented as a first step:

- The Cargo Village.
- The Connecting Road.
- The Rehabilitation of the Quay n°2 Complex.

The breakwater, the extension of the quay n°1 and the reclaimed container yard will be launched separately, as a second step.

The full EIA document consists of the following sections:

- A description of the institutional and legal framework.
- A description of the local environment.
- A description of the port project.
- A comparison of the various project alternatives with regard to their environmental impacts.
- An identification and an assessment of all environmental impacts.
- A series of mitigating measures.
- A Monitoring programme.
- The Environmental Management Plan.

2. LEGAL FRAMEWORK FOR THE ENVIRONMENTAL EVALUATION

The **Basic Law of Environmental Policy n°86/IV/93** establishes the basis for environment policy development and implementation in Cape Verde, especially concerning prevention of deterioration of environmental quality. Articles 30, 31 and 32 establish the objectives and required content of **Environmental Impact Assessments (EIAs)** with respect to new projects. An EIA must aim at maintaining the balance among various natural environment components, and must include:

- An analysis of the initial local environment.
- A study on modifications resulting from the implementation of the project.
- A full inventory of foreseeable impacts, and measures to suppress, reduce and compensate the possible impacts on the natural environment.

The decree-law n°29-2006 of 6 March 2006 sets the framework for the environmental evaluation of development projects in the Republic of Cape Verde.

The **Port of Praia Expansion and Modernization Project** is subject to an **environmental impact assessment (EIA)** as per sections 9, 10, 11, 41 and 43 of Appendix I of the decree.

Section	Type of project concerned	Application to the project	Project phase
9	Road construction	Road linking the port to the cargo village and the cargo village to the city of Praia ring-road	1
10	Construction of ports and port facilities	Rehabilitation of quay n°2 area	1
		Breakwater and land reclamation on the sea (container yard)	2
11	Dredging works	Dredging the bay of Praia to extract sediment	2
43	Industrial allotments	Cargo village	1

Note: Opening of a new quarry or extension of a quarry for construction materials requires an EIA (cf. section 41, Quarrying)

3. THE PROJECT

The principal facilities at the Port of Praia were first constructed in the 80s. At that time there was no thought of handling containers, liquid petroleum gas (LPG) and cement as the primary cargo. The focus was on the handling of multi-purpose general cargo and grain, primarily wheat and corn. As tourism increased, in tandem with the continued containerization of break bulk cargo, the port began to handle more and more containers. ENAPOR responded to this demand by purchasing container handling equipment and stacking containers wherever space was available. The cabotage operations (domestic inter-island seaborne traffic) also experienced a significant growth in cargo handled and quickly used up the space allotted for the operation. To complicate the matter further, the International Ship and Port Facility Security Code (ISPS) regulations required that the port physically separates the domestic cabotage from the international cargo operations. Consequently, domestic operations could no longer borrow berth space from the international cargo area when needed.

Between year 1990 and year 2006 Praia Port traffic increased at an average yearly rate of 6 %, growing from 235,000 tons to 616,000 tons. The port traffic consists of two broad categories: the international traffic, amounting to 444,000 tons in 2006 (72 % of total, almost exclusively import) and the inter-island traffic, reaching 172,000 tons in 2006, 18 % of the total.

The Port of Praia is currently faced with the following issues:

1. Rising traffic levels within the port will cause more bottlenecks and delays.
2. Lack of container storage area will further squeeze the available quay aprons, slowing down ship unloading operations and adding to the traffic congestion.
3. Lack of container storage area will result in higher stacking of containers, resulting in an increasing amount of wasted moves, relocating containers while 'digging' to retrieve containers from lower down in the stacks. As the number of available slots dwindles, the displaced containers must be taken further away, resulting in greater time lost in the digging process. This will result in over-utilization of the reach-stackers and hence a shortage of handling equipment, exacerbating the delays.
4. Shortages of space, equipment and increasing congestion will rapidly cause a significant increase in ship time at the quay, which will in turn cause rapidly increasing ship-waiting times. If unchecked, this will soon result in increased freight rates to Praia.
5. Overall, therefore, with regard to costs:
    - Shipping costs will increase due to the longer time in port, both longer waiting times and longer times at the quay.
    - Cargo handling costs will increase due to the higher utilization, and shortage, of equipment and general congestion.
    - Transport costs will increase due to the increased congestion, slowed handling and increasing bottlenecks.

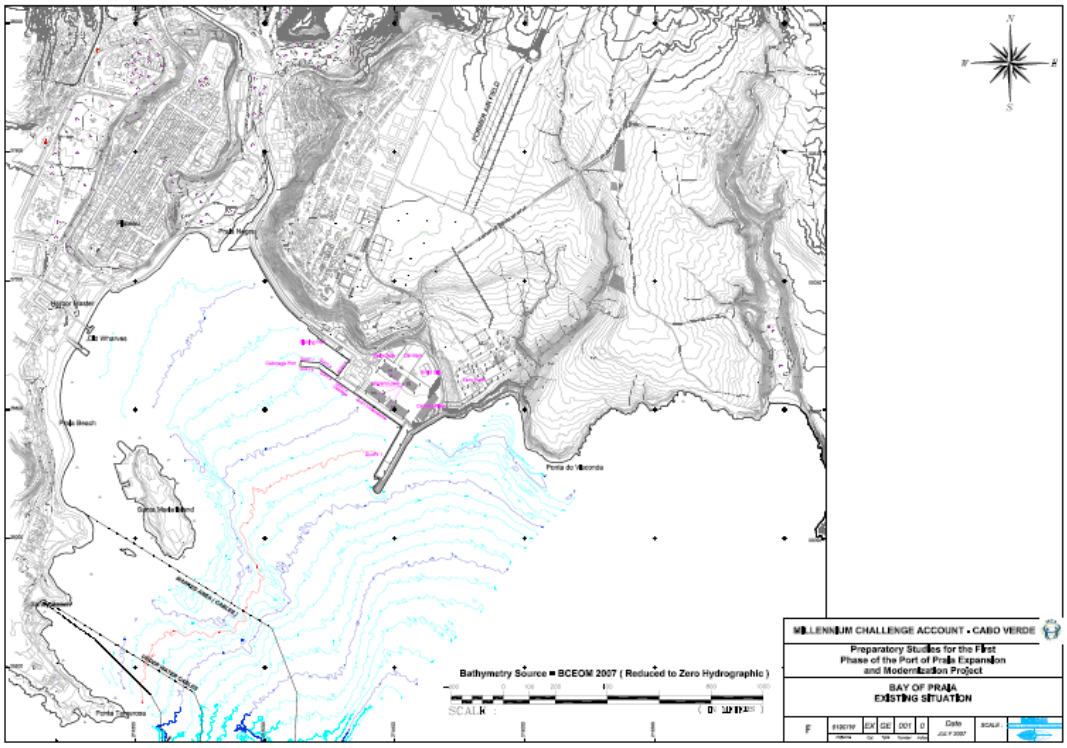
The Government of Cape Verde, acting through the **Millennium Challenge Account – Cabo Verde** (MCA-CV) and using the proceeds of a grant from the **U.S. Government Millennium Challenge Corporation** (MCC), intends to undertake a project to upgrade

the facilities and operating systems at the Port of Praia to be able to handle forecasted cargo growth efficiently and economically through the year 2025. The project aims at:

- Guaranteeing greater productivity in the terminal.
- Bringing the Port into compliance with International Maritime Organization (IMO) environmental and security requirements and standards.
- Lowering overall cargo distribution costs in Cape Verde.

The project is located in the southeast corner of the island of Santiago, next to the city of Praia. Activities will primarily concern the existing port territory as well as the land to be occupied by the cargo village (near the former airport), the route of the road to be built to connect the existing port facility with the cargo village (the so-called 'connecting road'), and the proposed breakwater.

The area selected for installing the road to connect the existing port and the cargo village will pass through a break in the cliffs that border on the sea in this part of the island of Santiago. All additional land to be occupied by this port project is owned by ENAPOR, the city of Praia or the State (marine territory part). Although further land use and zoning issues concerning the new areas to be annexed to the port may need to be further clarified, the main extended area, the site of the cargo village, is in an industrial zone.



The MCC *Pre-feasibility Study for Improvements* defined a two-phased development program to be implemented over five years. This EIA concerns the first phase, consisting of the following:

- Construction of a **cargo village** on the plateau above the port to house an inland

container depot (ICD), container freight stations (CFS) for stripping and stuffing operations, a Customs Impoundment Area (CIA) and a business park for housing the port operator, the Customs and shipping agents' offices.

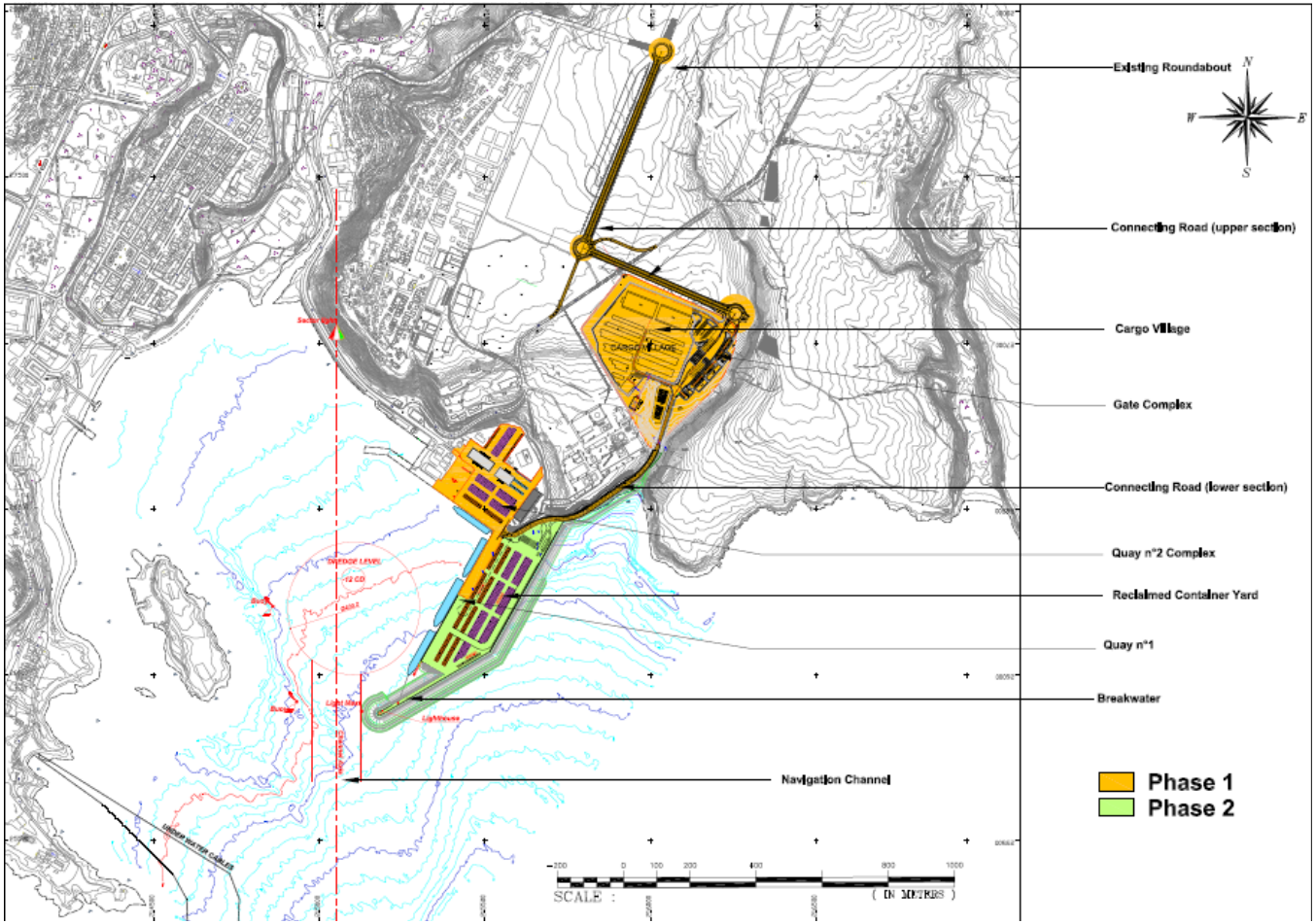
- Construction of a new **port road** from the port to the cargo village and from the cargo village to the Praia ringroad.
- At **quay n° 2**, removal of old quayside warehouses, repairs to the quay apron and fenders, and re-pavement of the back-up yard.

Various physical activities will take place during development of this project: demolition, excavation, ground leveling, landfill, construction of buildings and dock facilities, road construction.

Large amounts of materials from local quarries will be required. Furthermore, quarried materials will have to be brought to the construction site. The most viable method of transport is by truck. The three closest and most suitable quarries investigated by the Consultant are very close to the Praia ringroad, which has been opened at the end of year 2007.

Fill material, either selected (clearly defined by diameter or by weight) or non-selected (any material out of a quarry except fine material), must be used for various filling purposes such as behind quay walls, underneath roads and pavements, for storage areas and as core for breakwaters. All of this will normally come out of a quarry, if not provided by mass balancing of different diameter or weight materials at the spot or by using dredged material out of the bay.

Water and electricity are currently supplied to the port by ELECTRA, the state-owned electricity generation and distribution company. This supply is expected to be sufficient during the period of construction and operation of the new facilities. However, the cargo village will have its own water tower. Similarly, provision must be made for sewage removal from the cargo village. Water is a scarce resource on the island of Santiago. Nevertheless, the impacts of construction and operation of the new facilities on the regional water supply are expected to be minimal.


Existing Roundabout
N
W
E
S
Connecting Road (upper section)
Cargo Village
Gate Complex
Connecting Road (lower section)
Quay n°2 Complex
Reclaimed Container Yard
Quay n°1
Breakwater
Navigation Channel
Phase 1
Phase 2
SCALE :
(IN METERS)

4. DESCRIPTION OF THE LOCAL ENVIRONMENT

4.1. CLIMATE

The climatic characteristics of the Cape Verdean Archipelago are controlled by the following air masses:

- Subsiding modified tropical maritime air circulating on the eastern side of the Azores anticyclone and known as the NE Trade Winds.
- Tropical continental air transported in the circulation of the North African anticyclone, which reaches the archipelago blowing from NE to E and which is called the Harmattan.
- Unstable tropical maritime air coming from the Saint Helena anticyclone which, when it reaches the equator when circulating beside the African continent, is defected to the right by the Coriolis effect and comes towards Africa from the SW. This wind, due to its features, is called the South Atlantic Monsoon or the SW Monsoo.

Modified cold maritime polar air, the presence of which is normally caused by deep depressions between the island of Madeira and the Iberian Peninsula and which, when it affects the archipelago, is know as “Invernada” (“winter wind”).

The Archipelago is dominated by the NE Trade Winds which blow strongest from November to April. From May to October the winds are lighter, usually also coming from the NE, but coming sometimes from the SE and S, and, to a lesser extent, from the SW, accompanied by thunderstorms and rain with strong winds, or blowing weakly from the SE or S or SW for a few days or for just a few hours at any time. During this period it is frequent to have “Kalemas” (wave swells) from the SSW to the SSE, mainly in the southern Leeward Islands.

4.2. MARINE ENVIRONMENT

Tides	Praia tides has a semi-diurnal character marked by the occurrence of relatively low ranges (0.5 to 1.5 m).
Waves	The different sea conditions possible off the port of Praia are the following: ▪ The South Atlantic swell (SSE to SSW sector) which reaches Praia after a long propagation distance. It becomes the predominant condition during the summer (May-October). ▪ The trade wind sea (ENE sector) which is generated between Western Africa and Cape Verde, with relatively short periods, becomes predominant during the winter (November-April), when trade winds prevail. ▪ The North Atlantic swells (NW or WNW sectors off Praia) which

reach Praia after diffraction and refraction around the island of Santiago.

The operational statistics were consequently determined for each directional sector.

Hydrographic, Geophysical and Geotechnical Surveys

Hydrographic, geophysical and geotechnical surveys were carried out between April and June 2007 and involve a bathymetric survey of Praia Bay, a side scan sonar survey covering the whole of Praia Bay, a marine seismic reflection survey also covering the whole of Praia Bay and land seismic refraction surveys along the main beach of the bay. Additional surveys were performed in September and October 2007 along the tracks of the future marine structures.

Three layers are identified below the seabed:

- First superficial layer corresponds to sands and silts as a result of the desegregation and alteration of the sea rock and deposition of alluvial material provided by fresh waters.
- Second layer was interpreted as weathered and highly altered rock that corresponds to the top level of the Ancient Complex.
- Third layer corresponds to the sound rocks of the Ancient Complex.

Sediment Dynamic

Most of the coastline of the southern half of Santiago Island can be considered as a group of independent sedimentary coastal cells in which the seasonal exchanges of each beach predominate over the longitudinal sedimentary transfers in their organization and morphological variability. These cells are essentially fed locally from the torrential flows of the stream and rivers which flow into them, plus sporadic contributions from localized landslips from the coastal slopes. Praia Bay is sheltered from the prevailing wave motions for two main reasons : it is located on the south coast, and it is deeply indented, with more than 1 200 m of latitude separating the top of the bay from the line of Temerosa and Bicuda points which limit the bay to the west and east.

The Bicuda promontory in particular gives protection to the bay against all seas coming from north to east. This bay is, however, open to the south and is thus exposed to the “Kalema” waves, and it also receives some diffracted energy from eastern waves.

The sedimentation inside the bay is predominantly of terrestrial origin, with contribution from seas coming from the south and southeast with some fine grained sand and “ground shells”, especially in the deeper, outer part of the bay. The tidal currents are extremely weak in the bay. The only significant source of sediment in Praia Bay is the Trindade river that discharges in summer time at the Praia Negra site. During the rest of the year no water flows in that river bed.

The water-depth differences that appear from comparisons between bathymetric charts are mainly due to differences in mapping methodologies, at least in rather deep waters, say between 5 m and 15 m depths. Water depths in the vicinity of the two old wharves have been decreasing for several decades, and

	this can be trusted, as current depths at the head of these structures do not allow any barges to berth. It is also clear that beaches located in the northwestern part of the bay are continuously rising. It is thus credible that there is a real siltation phenomenon in the shallow north-western part of the bay.
Geochimicals in Sediment	Analyses in sediments show the main following results : ▪ Total organic matter and Nitrogen contents in the sediments are moderate whereas contents in total Phosphorus is relatively high. ▪ Sediments are free from contamination by Hydrocarbons (HPAs), Polychlorobiphenyls (CBs) and inorganic trace elements as cadmium, mercury, nickel and lead. ▪ Sediments are not contaminated by MBT, DBT and TBT. ▪ Sediments show significative concentrations in Chromium and Copper.
Benthic Communities in Soft Sediments	Overall, the macrofaunal assemblies of Praia bay are as roughly expected, namely in view of the present sediment types. Sandy and gravel bottoms are usually more diverse than muddy bottoms, the former being the former dominated by crustaceans and the latter by marine worms. The results show that muddy bottoms are less diverse than sandy ones.
Fish Biodiversity	The habitat structure and complexity are similar to station 6 and both the total number of species and the mean species abundance are similar between these two stations. The results of a qualitative sensus suggest that areas in close vicinity to the harbor are still well-preserved regarding fish species diversity and abundance. The lower species richness outside the breakwaters is probably the result of the present habitats being less complex, and not a consequence of their closer proximity to the harbor.
Water Quality	Four sampling campaigns were made on 2 May 2007, 30 July 2007, 30 September 2007 and 23 October 2007. In terms of bacteriological water quality, considering that the sampling area in the vicinity of a port in a semi-closed bay bordering a mid size city, we found a relatively good situation. At most stations bacterial abundance was negligible or very low, even in September, during the rainy season. The nitrate plus nitrite values were very low. However, phosphate values (PO_4) were pretty high. A possible explanation is an anthropogenic source of phosphate upstream the bay.
Archeology	Beginning in 1498, the captains of European ships (Portuguese, Dutch, English, and Danish) took advantage of the northeast trade winds to sail toward Brazil or along the African coast en route to the Cape of Good Hope. However, the ten islands of the Cape

	Verde Archipelago, lying 600 km off the west coast of Africa, posed a lethal hazard. Ships often ran aground on the shallow offshore reefs. Archival research indicates the presence of more than 300 shipwrecks in Cape Verdean waters. Underwater archaeological investigations performed in the bay of Praia, combined with side scan sonar reveal only one valuable shipwreck, the Urania, lying just south of the Santa Maria islet. Five smaller ships are lying in the northern part of the bay, all recent (5 to 15 years).
Socio economics in relation with marine activities	▪ **Port activities** Between 1990 and 2006, Praia Port traffic increased at an average yearly rate of 6 %, growing from 235,000 t to 616,000 t. The port traffic consists of two broad categories: international traffic, amounting to 444,000 t in 2006 (72 % of total, almost exclusively imports) and inter-island traffic, reaching 172,000 t in 2006, 18 % of the total. ▪ **Fishing activities** The fishing port, situated near the commercial port, is a port of discharge for coastal and commercial fishermen. Some fishing boats are attached to this port, but the majority comes from Boa Vista or Maio. In and around the Bay of Praia, there is a small informal fishing industry comprising several communities of fishermen, many of whom are not registered as maritime professionals. Three fishing communities, Achada, Brazil and Tirachapeu, work in the bay. They probably comprise about 100 more or less occasional fishermen. These coastal fishermen pull their boats out of the sea onto Praia beach. Several fishing sectors are exploited depending on the species sought after and the techniques employed. ▪ **Leisure activities** The beaches of Praia, and in particular the beach furthest to the west, are used by the local inhabitants for bathing and seaside leisure activities. The Praia Grande breach is also used for bathing and beach games in spite of the unhealthy sanitary conditions.

4.3. LAND ENVIRONMENT

Geology	The geology of Santiago is relatively complex and the rocks found there are essentially volcanic in nature; however, there are also terrestrial and marine sediments which occupy relatively extensive areas, although the volume of these sediments is small in comparison with that of the lavas.
Vegetation	Achada Grande, like all the “plateaus” south of the island, is on the dry level of altitude on the classification of agro ecological chart and Santiago Island’s vegetation. With a rainfall level of less than

	500 mm per year on humid years, ground herbs of annual cycle, bushes and trees with great adaptation to dryness are the dominant vegetation. Concerning Achada Grande above the cliff, the untamed cattle breeding since the beginning of the occupation towards the end of the 1960's caused a violent diminishing on the vegetal covering due to overgrazing. Wind erosion combined with rain concentrated on the wet season transformed it into a field of stones. For the past few years Achada Grande has been pushed by the urban subsidence, especially warehouses and other equipment related to harbor activity. This area is characterized by degraded vegetation cover with dominance of herbaceous tufts, adding up to 21 species, including those with specific localization such as small shrubs and trees, honey mesquite (*Prosopis juliflora*) and rooster tree (*Calatropis procera*). These vegetal species are not included in Cape Verde's preservation norms. It's important to point out that only one species, *Sarcostemma daltinii*, on the top of the cliff, is on the endangered species list.
Avifauna	Concerning avifauna, the existence of 14 native bird species was confirmed in Cape Verde, corresponding to 34% of the archipelago's native bird species. Two of them are on the red list: *Phaeton aethereus* (red-billed tropicbird) classified as an endangered species, and *Pandion haliaetus* considered a rare species.
Population	The most exposed populations in the study area are houses located on access roads, houses and offices near the industrial areas.
Air Quality	During the on sites visits in the proposed area for the project implementation the following air pollutants sources were identified: • Maritime ship traffic (small, medium and large tonnage vessels). • Cement unloading from the ships in the port. • Heavy and light road traffic in and around the port access. • Natural dispersion of dust caused by the wind in Achada Grande plateau. • Combustion gases emitted by the power station (Electra) located near the Port which operates with gas-oil. • Air traffic in the vicinity of the port with the emission of N_2O (from the Jet Fuel) and other combustion gases. Ship traffic due to normal port activity, associated with intense circulation of vehicles and handling machines, originates emissions of particulate matter and combustion gases. Pollutants emissions are aggravated due to the relative old fleet of light and heavy road

	vehicles that circulate near the harbor. The main pollutants identified are the Carbon Monoxide, Sulphur dioxide, Nitrogen oxide, Particulate matter and volatile organic Compounds. Even with the observed sources of air pollution, the air quality in the Port of Praia area should be considered as satisfactory. In fact the frequent occurrence of strong winds contributes for an intense and significant dispersion of air pollutants in the direction of the sea.
Noise	In the vicinity of the study area various possibly sensitive receptors were identified. The receptors are composed essentially of human population living in houses located throughout the area of site access roads, and next to airport, as well as houses and offices near the industrial area and houses next to power station along the beach. Ecological sensitive receptors include land and marine ecosystems located within the study area. From the land we should emphasize the different species of birds that lives in the cliffs and in the plateau area of Achada Grande.
Socio-Economics	The 2000 census indicated that Cape Verde had a population of 435,000 persons. An estimated 55 % lived in urban areas, primarily in the principal cities of Praia and Mindelo. The island of Santiago was the most populated island with 54% of the country's resident population. The population growth rate was 2.4 % per year and 68% of the population were under 30 years old. The unemployment rate currently hovers around 22%. In 2002 the per capita GDP was US$ 1,420 and the human development index (HDI), a measure of life expectancy, income, and education, increased from .578 to .670 between 1990 and 2002. According to the 2000 census, the city of Praia had, in that year, a population of about 95,000 inhabitants.

5. PROJECT ALTERNATIVES

5.1. CARGO VILLAGE

Once substantially leveled in accordance with the recommended scheme, the Cargo Village area may be developed to provide the maximum amount of space for container operations. Leveling the entire area would be very difficult and costly due to the presence, in particular, of a deep ravine or canyon in the southern corner. Alternative 2 is to use the area partly for container operations, principally to provide space for the CFS operations and empty container storage, and partly as a Logistic Zone. A third option would consist in building the Cargo Village on a flatter area, closer to the southern end of the former airfield.

In order to implement Alternative 2 a smaller amount of ground leveling works would have to be planned (150,000 m^3 of earthworks, instead of 400,000 m3 with the recommended option). The Logistic Zone would provide space for companies to set up logistics, warehousing, and similar functions to provide added-value services. Under this option, a reduced area of container stacking would be available to the port. Under this option, the port would have to make use of a reduced area, which barely responds to the port's needs. It would not be long before the port again finds itself short of space, by which time the remaining area would probably have been taken up by logistics companies. In view of the expected continued rise in annual cargo traffic, particularly containers, this option is not recommended.

Besides, with the recommended layout, the excavated material can be reused as fill for the connecting road and for the marine structures, therefore minimizing the amounts to be trucked from quarries.

5.2. CONNECTING ROAD

The upper part of the connecting road, between the existing "airport roundabout" and the cargo village, shall strictly follow the path governed by the Praia Development Plan (PDM). In this area the terrain is flat and gently sloped. Almost no earthwork will be required.

The lower part of the road, between the cargo village and the port, must follow the toe marine cliff. Two layouts were compared: the first one was sticking to the cliff toe and therefore minimizing the earth fills and the impact on the seabed, whereas the second one was standing further from the cliff. The latter was recommended, as it reduces the risk of block falls from the cliff onto the road, and also because it reduces the road impact on birds nesting in the cliff front.

In terms of structures the Consultant considered either a dam or a pile-founded structure. The dam solution, consisting in building the road on top of an earth-fill, was recommended as its cost is lower and because it can be implemented much faster. This dam solution will require a protection of the fill by concrete armoring blocks.

5.3. QUARRIES

Three quarries were investigated by the Consultant in the vicinity of Praia: the ITP quarry in Sao Francisco, the Polinertes quarry and the CVC quarry, north of Praia, close to the Assomada road. Under the authorization procedures for operating the

three quarries, the impacts and mitigation measures are identified in the documents approved by – or produced by – the DGA. Quarry material can be taken from one or all three of these quarries. Other quarries on Santiago Island were discarded by the Consultant either as their material is not appropriate, or because they are located too far away from the construction site.

6. IMPACTS OF THE PROJECT ON THE ENVIRONMENT, PROTECTION AND MITIGATION MEASURES

The MCC Environmental Guidelines require that proposed projects must be developed such that they "are not likely to cause significant environmental, health or safety hazard."

6.1. MATERIALS

Quarries

There must be satisfying assurance that the production of quarry material to be used for port construction does not result in any significant negative environmental impacts. Possession by the selected quarries of a valid operating license, based on an EIA approved by the Competent Authority (DGA) must be a condition of the contract with the future beneficiary construction Company. Furthermore, given the considerable volume of materials required (up to 2 million m^3) and the period during which this supply must be guaranteed (over 2 years), two special conditions are to be added to the materials supply contracts:

1. The quarries must have, from the start of the project, a permanent quarrying authorization delivered by DGA. The non-renewal of a temporary authorization valid for one year could compromise the continuity of supply of the project site.
2. The operator(s) must present a landscape and ecological rehabilitation plan, along with financial guarantees for its accomplishment, validated by the DGA. Such a plan alone provides the assurance that the indirect impacts of the project on the environment due to the supply of quarry materials, will be under control. Although it cannot be formally requested, the partial rehabilitation, depending on the cases, of quarry sites at the end of the project would be desirable.

Movement of Materials

Movement of materials required for this project is likely to cause extra traffic :

- On the public roads, mainly supplies of materials from quarries (aggregate for construction materials, fill materials and natural rock fill).
- Near the site, storing excess cut, building the road, transporting rock fill and concrete armor units, rehabilitating quay n°2, building the cargo village.

The main route taken will be the Praia-Assomada road which serves the three potential quarries, followed by the ringroad via

the airport to the last roundabout situated on the Achada Grande Plateau. Due to construction constraints, works on the future port access road will be fast-tracked from the base of the quay n°1 breakwater. That presupposes transporting the materials by the main port service road along the waterfront.

Road transport will be accomplished either entirely or in part using Heavy Goods Vehicles (HGVs). However potential impacts from transport will include increased congestion, noise and vibration, reduced access and safety, increased pollutant emissions from truck, exhausts, and inordinate road wear and tear (because of the large size and weight of the trucks), especially on minor roads that constitute the truck route. Poor driving habits by the truck drivers could result in considerable stress if not risk to pedestrians and other vehicles in communities through which the truck route will pass. Access by pedestrians and local vehicles may also be restricted due to the increased truck traffic. Dust, grit and mud may be spilled from the trucks or carried by truck tires and chassis.

Excavation and Storage of Materials

A total of 400,000 m^3 shall be excavated at the cargo village area, out of which 100,000 m^3 shall be reused as fill for the connecting road (lower part). Out of the remaining 300,000 m^3:

- 50,000 m^3 may not be directly reused for the works because the material may be too fine or too loose. However, it will be laid on slopes before planting operations.
- The remaining 250,000 m^3 are supposed to be used for the marine structures (extension of quay 1, breakwater and new marine yard) and may have to be temporarily stockpiled, in case immediate reuse is not possible. In that case the area for temporary stockpiling will be the one which appears on the map next page, at a distance of 1.6 km from the Cargo Village, along existing roads.

The potential impacts of this storage will be as follows:

- Impact on water flow: storage must not constitute an obstacle to the flow of water which, if heavy rainfall occurs.
- Disappearance of local vegetation and the disappearance of fauna, especially bird life.
- A minimal impact on the landscape due to a fairly low storage height, but the site may lose its natural beauty and character.


Existing
Roads
Cargo Village
Area
Achada Grande
de Traz
Temporary
Stockpiling Site
(7 hectares)

6.2. QUAYSIDE DEMOLITION AND QUAY REPAIR

Quayside Demolition

The project plans to demolish two old warehouse buildings situated in front of and running parallel to Quay N° 2. Each building is about 80 m long x 25 m wide x 8 m high. The hangars have stone walls, concrete and steel beams and roofs covered with asbestos-cement panels.

The following demolition techniques shall be used:

- The buildings will be demolished using mechanical diggers equipped with hydraulic rock breakers (HRB) and grabs and hydraulic shears for metal and concrete.
- The large metal parts, beams, spacers, steel reinforcing bars will be cut up on the spot and stacked under tarpaulins and stored for collection and/or recycling.
- The asbestos-cement roof panels will be carefully dismantled, wrapped, placed in a container and shipped towards a suitable treatment center in Western Europe.
- The other elements (wires and electrical cabinets, ducts, doors and door frames, glass panes etc.) will undergo selective sorting.
- Any polluting and hazardous objects that might still be stored in these hangars will be collected and sorted.

The environmental impacts will be limited if the following precautions are taken:

- Selective deconstruction to separate the essential of the non-inert materials before the buildings are demolished. The contractor will audit the building to be demolished in order to identify the potentially recyclable materials and help develop recycling.
- Sorting, or rather non-mixing, implies organizing the worksite, informing and training the personnel. It requires having several skips on the site at the same time: skips reserved for given types of inert waste that can be recycled, and a skip for inert waste that cannot be recycled.

Removal of the present covering in the backup yard will also be undertaken. This consists of dressed basalt paving stones using a track digger. The paving stones will be stocked temporarily, then used to repair the paving of local roads. The main environmental impacts are expected to concern the transport of materials brought to the port (aggregates and gravel-sand mixtures, new paving stones) or taken away from it (old basalt paving stones, material from old underlying capping layer): noise and dust on the transport route, hindrance to traffic and port operations during work.

Quay Repair

Diving inspections revealed that additional works will be needed along the lower part of the Quay N° 2 bulkhead such as filling gaps underneath the quay toe by the use of cement bags and rehabilitating the scour protection.

The work could cause limited impacts on the marine environment. This work takes place within the confines of the port, the waters of which are already disturbed by the various port operations (propellers re-suspending sediment, waste from the ships, pollution when unloading goods, and loose bulk products in particular). Following are the possible environmental impacts:

- The laying of scour protection at the base of the quay will temporarily cause fine sediment to be re-suspended, but this will be limited to the vicinity of the quay. Firstly the quantity of materials will be small, and secondly the protection will comprise medium and large sized blocks that are not loaded with fine particles.
- The repair of the quay will necessitate the demolition of certain sections of the quay facing in order to prepare their repair. The large pieces of concrete from such demolition works will be broken into small pieces and reused in the road fill.
- The repair of the quay beam edge will require the pouring of concrete. Spatters of concrete could fall into the harbor.
- If underwater work is carried out to repair certain submerged parts of the quay, precautions shall be taken to prevent pollution by the concrete or materials used.

6.3. CONNECTING ROAD

Construction

The road connecting the Cargo Village to the city road network will be built on the plateau and requires only a small amount of fill representing about 10,000 m^3. The road works will be integrated in the construction of the cargo village. The expected disturbances (movement of vehicles and machines, noise, vibration and dust) will therefore be global.

The construction of the road connecting the Cargo Village to the port will require that earthmoving machines avoid dropping materials on the thalweg slopes in order to preserve their hydraulic transparency. The embankments will have to be stabilized as rapidly as possible with local vegetation, such as Aloe Vera.

The environmental impacts on the section of the road that passes over what is currently sea will depend on the construction techniques used. The road platform will be built using the progressive construction technique. From the port and the cargo village, the quarry materials and/or those from the leveling of the cargo village will be brought by lorry then dumped at the foot of

	the cliff to constitute the body of the road platform. The proposed way of reducing this risk is to first build the breakwater to provide protection against the swell, then to fill the volume between the breakwater and the foot of the cliff with aggregate materials. This solution will limit to a large extent the washing out of fine particulate materials and production of suspended particulate matter that temporarily increases the turbidity of the seawater. The large blocks used for the construction of the external breakwater will induce very little or even no suspended particulate matter. The following measures shall also be adopted: either, prior washing of the quarry materials the most heavily loaded with fine particles, or establishing precise specifications for these materials in order to limit losses of materials and the generation of turbid plumes. The area of the marine floor covered by the road foundation represents some 20,000m². Over this surface area the hard substratum populations will be irreversibly destroyed. The geological appraisal of the cliff below which the road passes pointed to the risk of falling rock from the cliff. Protective measures such as fitting a net to protect against falling rocks, a drainage system at the top of the cliff, consolidation of the limestone layer, and filling in the cavities in the cliff are recommended. If such work is necessary to ensure the safety of traffic below the cliff, it also leads to an irreversible change of the biotope for the birds that frequent it, and notably the species that nest and reproduce there. The impact of the work itself, but above all the structural modifications made to the cliff, will result in the desertion of the recorded species. To reduce this impact the following measures are recommended: ▪ To the extent possible, the natural state of the cliff should be maintained, possibly removing any boulders that risk falling before commencing the road construction work. ▪ The road should be moved away from the foot of the cliff with a sufficient margin to prevent boulders from falling onto the road platform. ▪ Periodic appraisals of the cliff (before, during and after the road construction work) should be performed.
Operation **Road Drainage**	Concerning road drainage, it is planned to collect storm water in a lateral ditch situated at the foot of the cliff, and then evacuate it to the sea via transverse pipes situated at low points. Due to the shortage of space at the low point in the road, no settling basin is planned for pre-treating storm water in the event of heavy rainfall. The port operator should:

	▪ Use this ditch to contain accidental pollution in dry weather (spillage from a truck, large leak from a gasoil reservoir). The two outlets would then be closed and the polluted effluent would be pumped up and evacuated to a treatment site. ▪ Implement periodic cleaning of the road to avoid the pavement being washed in heavy rain and carrying away concentrated pollution which would then find its way into the sea. The heavy vehicle traffic will cause chronic pollution: accumulation on the road surface of residues of unburned hydrocarbons, oil, particles from the wear of tires and brakes. To prevent these residues from being washed out and running into and polluting the sea, the pavement (2 to 3 times a year during the dry period) periodically cleaned using a motorized brush. Cleaning water would be drained into the ditch (with the outfall valves closed). The ditch would serve as a settling area. The sludge would be cleaned and evacuated before the rainy season.
Disturbance of Avifauna by Traffic	The movement of heavy vehicles on the road (up to 100 vehicles/hour) will produce noise, vibration and exhaust gas discharges into the atmosphere by day and night. The road lighting will constitute and an additional nuisance factor at night-time It is probable that birds, and nesting birds in particular, will desert the cliff for equivalent coastal sites that are not disturbed by human activities. The most seriously threatened species in this respect are *Phaeton aethereus* (red-billed tropicbird) classified as an endangered species, and *Pandion haliaetus* (Osprey) considered a rare species. These two birds are on the red list.

7. MINIMIZATION AND COMPENSATION MEASURES

All the measures intended to eliminate or reduce the environmentally damaging effects of the project during the general works and the various construction works are included in an **Environmental Management Plan (EMP)** included in the EIA**.** Particular measures relative to the three main construction components (quay n° 2, cargo village and access road) are detailed.

7.1. REMOVING OLD QUAYSIDE WAREHOUSES, REPAIRING QUAY N°2 AND REPAVING THE BACK-UP YARD

Removing old quayside warehouses	The environmental impacts will be limited according to the following precautions : ▪ **Selective deconstruction** to separate the essential of the non-inert materials before the building is demolished. The prime contractor will audit the building to be demolished in order to identify the potentially recyclable materials and help develop recycling. ▪ **Sorting,** or rather non-mixing, implies organizing the worksite, informing and training the personnel. It requires having several skips on the site at the same time: skips reserved for given types of inert waste that can be recycled, and a skip for inert waste that cannot be recycled.
Repaving the back-up yard	▪ Removal of the capping layer. ▪ Reuse of the old paving stones. ▪ Construction of an impervious retention area in case of accidental pollution leaking from a container.

7.2. CARGO VILLAGE

- Retention basin downstream of the cargo village to prevent chronic and accidental pollution of water.
- System for collecting and treating the solid waste.
- Reducing the effects of illumination on fauna.
- High environmental quality for landscaping.

7.3. ACCESS ROAD

Reducing Measures	▪ Reduction of impact of material filling on the marine environment and life (reduction of water turbidity). ▪ Measures to reduce the impacts of consolidation of the cliff on the avian fauna. ▪ Measures to reduce the impact of road traffic on the hydraulics and water quality. ▪ Measures taken to limit the effects of lighting on the avian fauna. ▪ Measures to reduce the visual impact of the riprap of the road fill.
Compensatory Measures	▪ **Measures relative to avifauna** Standard protection measures will not guarantee that individuals of the affected species *Phaeton aethereus* (red-billed tropicbird) classified as an endangered species. The best compensating (mitigating) measure would be to ensure protection of habitat near the area of the connecting road. The implementation of this protection measure requires several phases: ▪ Identification of numbers of nesting sites on the cliffs East of the port. ▪ Identification of nesting periods. ▪ As far as possible, minimization of disturbance by the works during the above nesting periods. ▪ Development of a plan of actions to protect the species on this site, comprising physical measures (control of human frequentation, protection of nests), a species monitoring programme and an educational programme, to open the site to the public to observe the birds, under certain conditions. ▪ **Measures relative to marine environment** As was emphasized earlier, the area of the marine floor covered by the road foundation represents some 20,000 m². The immersed part of the external shell of the breakwater would partly, but only partly, compensate for the loss of these habitats. A global compensatory measure must therefore be sought to compensate for this loss of biodiversity, for example by setting up artificial reefs that could be exploited by the coastal fishermen, in agreement with the stakeholders concerned (the port operator, the scientific community, local coastal fishermen's socio-professional organizations and Government Authorities).

8. MONITORING PROGRAMME

8.1. DURING THE WORKS IN PROGRESS

The **proposed environmental monitoring of the site** will have the objective of monitoring application of the **Environmental Management Plan** during the works.

The project owner will appoint an **environment / health / safety coordinator** who will be responsible in particular for the verification of good conducting of the site work by the designated contractors. This coordinator will ensure:

- Compliance with the instructions relative to the environment and the life space that the companies must respect.
- Verification of the implementation of mitigating measures during the work site in collaboration with the public works contractors.
- The contacts between the owner and the associations, the public and the socioprofessional groups, to resolve complaints and conflicts induced by the nuisance and bother caused by the different site works. An operational cell will be functional throughout the construction works.
- The organization and implementation of monitoring during the site works and the subsequent operation of the structures.

The **environmental inspection supervisor** will have the following missions:

- Intervene on the ground to ensure that the rules described in the Environmental Management Plan are applied. He can carry out specific inspection measures (taking water samples, making point measurements of the noise level, prepare a photographic record, etc.).
- Organize periodic meetings with the contractor to make a detailed assessment of the problems posed in the preceding period and find solutions in anticipation of new impacts.
- At the end of the mission, assess the actions conducted in the field and judge the effectiveness of the measures and methods used on the site to prevent the temporary impacts of the site. He can propose a methodological framework applicable to similar sites (experience feedback).

8.2. AFTER COMPLETION OF THE WORKS

The **proposed monitoring during the operational phase** consists in performing measurements and analyses in accordance with a predetermined programme to monitor the environmental impacts of the extensions to the Port of Praia facilities and structures.

Encl. Five Project Posters