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Netherlands Ministry of Foreign Affairs
Directorate General for International Cooperation

Palestinian National Authority
Ministry of Planning and International Cooperation
Environmental Planning Directorate

Additional Environmental Impact Statement for the Gaza Sea Port

Borrow areas

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1. INTRODUCTION

In the advisory review of the Environmental Impact Statement (EIS) for the Gaza Sea Port (April 29, 1996), the Commission for Environmental Impact Statement (the Commission) has concluded that "on a number of essential points information was not available due to delays in the execution of the design studies." One of these essential points are the borrow areas for construction materials. The commission recommended to complete the EIS at the moment all relevant information with respect to quantities and the location of borrow sites are known.

The design process of the port has reached at the end of 1996 the status of a pre-final contract design, which means that the contractor can calculate a final price for construction. The quantities of construction materials are known. The locations of these extraction areas are known only roughly.

The quantities of materials required for the construction of phase IA of the port are well known by now. It is probable, but not sure that the potential borrow areas for stones are located on the West Bank in the Hebron region. The exact locations will be determined when construction will start.

The quantities of material required for the future phases of the project are not yet known. The potential sources of the construction materials for the future phases of the project are not yet known and it is very likely that they will differ from the sources that will be used for phase 1A. It is therefor suggested not to address the issue of borrow areas for the future port extension in this EIS, but to subject the borrow areas for a future extension to an additional EIS at the time the actual extension will be realized.

This reports presents the following parts:
- quantities of materials;
- borrow areas and transport routes;
- conclusion on environmental impacts.

2. QUANTITIES OF MATERIALS

The quantities refer to the construction of the initial phase (IA) of port development. Quantities required for construction of phase IB (additional 400 m quay), IC (liquid products berth, ID (dredging to 12- MSL), IE (bulk terminal), II (container terminal and breakwater) and III (fully developed port) are not known in detail. In table 1 a summary of the quantity of materials is presented. As far as it is relevant for the EIS also the quality of the material required for the construction will be mentioned.

2.1. Concrete

Concrete is required for the following purposes:
- accropodes in the breakwater;
- cap on the breakwater;
- coping on the combi wall (sheet piles);
- concrete block pavement;
- buildings etc.

In total some 75,000 m^3 of concrete is required for the works.

2.2. Aggregates for concrete

fine aggregate

The fine aggregate for concrete will be sand. It is estimated that some 32,000 m^3 of fine aggregate is required.

coarse aggregate

The coarse aggregate for the concrete will be crushed rock. It is estimated that some 51,000 m^3 of coarse aggregate is required.

2.3. Cement

The cement (Ordinary Portland Cement) will be used for concrete, mortar, sand-cement stabilization under pavement (if required). It is estimated that some 27,500 tons of cement is required.

2.4. Reinforcement

A relative small quantity of steel for reinforcement is required. Some 400 tons will be required for the capping beam of the combi wall and the buildings. It is unknown yet whether reinforcement is required in concrete cap of the breakwater.

2.5. Water

Potable water is required for concrete and for general cleaning/washing purposes. It is expected that some 11,000 tons of water will be required for concrete mixing. For cleaning and other purposes it is a guesstimate that 2 times this quantity of water will be required, thus totally some 33,000 tons. Water required for the workforce is assumed not to increase the normal water demand in Gaza.

→ is toeslag aan effectrange. 1/3 van het gebruik.

2.6. Fill material

Fill material is required for:
- the land reclamation of the port area;
- the erosion buffer north of the port.

In total some 1,150 million m^3 of fill material is required.

2.7. Asphalt

It is not expected that asphalt will be used in the port construction.

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table 1

Estimated quantities of materials for construction of the port

	Quantity	Unit	fill material m3	stones m3	200kg/m3 steel ton	370 kg/m3 cement ton	1150 kg/m3 course aggreg. m3 (17kN/m3)	150 kg/m3 water m3	680 kg/m3 fine aggreg. m3 (16kN/m3)
DREDGING AND RECLAMATION									
nautical dredging	847,000	m3	847,000						
imported fill	260,000	m3	260,000						
cliff excavation	44,250	m3	44,250						
CAUSEWAY SLOPE PROTECTIONS									
1–1000 kg	33,560	m3		33,560					
1–200 kg	4,109	m3		4,109					
200–1000 kg	12,030	m3		12,030					
1–3 T	15,805	m3		15,805					
3–6 T	6,875	m3		6,875					
6–9 T	11,200	m3		11,200					
geotextile	36,790	m2							
BREAKWATER									
concrete cap	9,212	m3				3,408	6,232	1,382	3,915
1–1000 kg	231,717	m3		231,717					
1–200 kg	5,846	m3		5,846					
1–200 beddinglayer	32,498	m3		32,498					
200–1000 kg	46,802	m3		46,802					
1–3 T	48,335	m3		48,335					
3–6 T	6,132	m3		6,132					
6–9 T	22,498	m3		22,498					
accropode 12 m3	5,271	m3				1,950	3,566	791	2,240
accropode 9 m3	32,985	m3				12,204	22,313	4,948	14,019
accropode 4 m3	14,000	m3				5,160	9,471	2,100	5,950
geotextile	66,556	m2							
GROYNE									
1–3 T	7,567	m3		7,567					
200–1000 kg	7,169	m3		7,169					
1–200 kg	7,634	m3		7,634					
BEACH PROTECTION									
1–3 T	2,000	m3		2,000					
COMBI–WALL									
steel incl. anchorage	3,868	T							
cap beam	1,028	m3			206	380	695	154	437
geotextile	3,120	m2							
BOLLARDS									
lo–lo berht+roro berth 50T	20	ea							
small craft harbour (25T)	8	ea							
FENDERS									
ro–ro (timber)		ea							
lo–lo berth + roro berth (rubber)	28	ea							
small craft harbour (timber)	30	ea							
DOLPHINS	2	ea							
SMALL CRAFT LANDING	1	ea							
RESCUE LADDRERS	4	ea							
SHEETWALL SMALL CRAFT HARBOUR									
steel excl. anchorage	265	T							
cap beam	30	m3			6	11	20	5	13
1–1000 kg	160	m3		160					
REVETMENT SMALL CRAFT HARBOUR									
1–3 T	3,920	m3		3,920					
1–1000 kg	1,440	m3		1,440					
200–1000 kg	3,523	m3		3,523					
geotextile	5,380	m2							
retaining wall	104	m3			21	38	70	16	44
GROYNE SMALL CRAFT HARBOUR									
1–1000 kg	320	m3		320					
1–3 T	500	m3		500					
PAVEMENT concrete blocks									
causeway + onshore	103,366	m2				3,825	6,992	1,550	4,393
DRAINAGE SYSTEM	1	ea							
FENCING	1,000	m							
barrier	2	ea							
gates	12	m							
BUILDINGS									
gatehouse, weighbridge, etc.	1	ea			200	370	1,150	150	680
total quantities			1,151,250 m3	511,640 m3	432 ton	27,368 ton	50,510 m3	11,095 m3	31,691 m3

← unit is EA

Concrete blocks and sand–cement stabilisation

pavement	103,366 m2
concrete for blocks (10 cm)	10,337 m3
sand for paving (5cm)	5,168 m3 (included in fill)
sand–cement stabilisation (30 cm)	31,010 m3 (included in fill)

2.8. Stones

Stone suitable for the use in marine conditions are required for:

- the breakwater;
- the groyne;
- the beach/slope protection;
- the revetment for the small craft harbour;
- the scour protection in front of the sheet pile combi wall.

In total some 511,000 m^3 of stones is required. The required quality of stone is of importance as not every quarry will be capable to deliver this quality and has been set by the designers at (in general terms):

- specific gravity at least 2,600 N/mm^2;
- compressive strength at least 60 N/mm^2;
- soundness less than 18%; → moet dit niet meer dan zijn
- abrasion less than 25%.

Foo zoals het mt.

3. BORROW AREAS AND TRANSPORT ROUTES

The materials mentioned in chapter 2 have to be transported to the location of port construction. Some materials are available in the Gaza Strip, or will be produced on location, other materials have to be transported from areas in the region to the port. The Netzarim road, located in the port area is open to the traffic and may be used for the supply of materials from the hinterland. The use of this road has the relative advantage that materials does not have to be transported through densely populated areas of Gaza City.

3.1. Concrete

Despite concrete can be purchased from local batchplants in the Gaza Strip, it has been decided that a batchplant to produce concrete with armour units precasting on or near the the port site will be economical and will ensure quality requirements and safeguard continuous production of armour units.

Supply routes on to the port site are not suitable for large pours as concrete-mix trucks will have to pass through Gaza City and are subject to delay in traffic. A concrete plant on the port site has the advantage that sufficient quantities of sand, aggregate and cement could be delivered to the concrete yard during night hours. So the concrete will be produced in a special batching plant that will be erected near the port. Its exact location is not known until now. Transport of the concrete to the site will be by means of truck mixers.

3.2. Aggregates for concrete

fine aggregate

Sand is available in abundance from various sources in Gaza. These are existing sources in the middle, the southern and the eastern part of the Gaza Strip, in general some 4-5 km from the shore, amongst others along Wadi Gaza. As the EIB requires a separate tender procedure for the supply of sand, it is unknown yet where the exact borrow areas for the sand will be. The borrow method will be open pit excavation and possible sieving at the borrow site. Transport will be by means of truck over the existing roads.

coarse aggregate

The course aggregate in the form of crushed rock will be imported from Israel or the West Bank through Erez. Borrow areas will be from existing quarries, no new quarries will be opened. In an area of some 100 km^2 near Hebron there are some 80-100 existing quarries that deliver rock of the required quality. From 10 to 15 of these quarries stone will be taken for port construction. As the EIB also requires a separate tender procedure for the supply of crushed rock, it is unknown yet where the exact borrow area or areas will be. Several potential borrow areas have been visited by Witteveen+Bos, the location of these quarries are indicated on figure 6.4 of the EIS. A first indication of environmental impacts has been made in the EIS (Witteveen+Bos and Team Palestine, 1996).

The borrow method will be by means of sawing and hydraulic pressure in the West Bank and by means of explosives in Israel. The rock will be crushed and sorted in a stone crusher on the borrow site.

Transport is by truck with transshipment from Israeli to Palestinian trucks at the border. This is an existing procedure in other construction projects in the Gaza Strip at this moment.

3.3. Cement

Cement will be imported from the usual sources in Israel. Transport will take place in bulk trucks or in bags on ordinary trucks. Supply is subject to conditions at the checkpoints. Early and timely arrangements with the suppliers can safeguard the supply to a fair extent.

3.4. Reinforcement
Reinforcement will be needed for coping of the quay structure. The minimum quality of reinforcement is available in the Gaza Strip. Ordinary steel bars and high yield steel bars are supplied through specialized firms. A survey at other projects under construction in the Gaza Strip revealed that both steel and specialized cutting and bending subcontractors are sufficiently available in the Gaza Strip or Israel. Transport will be on ordinary trucks.

3.5. Water
Water is a scarce natural resource in the Gaza Strip. Its supply is made from a variety of wells and systems. A well will be made during construction. Purification needs to be done.

The quality of water from wells ranging in depths from 10 to 40 m is generally poor and only suitable for compaction and maybe cooling. The quality of water coming from wells ranging in depths from 40 to 80 m is generally suitable for domestic purposes and also for concrete, although tests are required. Beyond 80 m in depth, one can in most cases find water suitable for drinking purposes

3.6. Fill material
The fill material will be derived from several sources:
- 44,250 m^3 from excavation of the cliff;
- 260,000 m^3 from external borrow areas (see borrow areas for fine aggregates);
- 847,000 m^3 from nautical dredging works.

3.7. Asphalt
In case asphalt will be used for pavement purposes the bitumen have to be imported from Israel. The construction works on the Rafah airport has shown that the import procedure of asphalt is no problem.

3.8. Stones
Although the delivery of the stones still have to be tendered by the contractor, it is very probable that the stones will be derived from one or more quarries in the neighbourhood of Hebron. In an area of approximately 100 km^2 there are 60 to 80 quarries. It may be assumed that for port construction 10 to 15 quarries will be used. Hydraulic and mechanical (by sowing) methods of borrowing will be used. Transport will take place through checkpoint-Erez and in the neighbourhood of the port by the Port Road (the recently re-opened Netzarim Road).

3.9. Transport
Transport of the majority of the material for the construction of the port will be by means of truck. To get an impression of the traffic intensity which will be generated the following estimates can be made. In total some 870,000 m^3 of material (sand, stones, aggregates and cement) have to be transported from its source to the port site. This material is expected to be transported by truck. Assume an average truck size of 15 m^3 then in total some 58,000 truck loads are required, or some 116,000 vehicle movements. Assume a construction period (actual construction) of 12 months, then this implies some 390 movements a day on average. With a rush factor of 1.5 this means some 580 movements a day or some 1.0 movement per minute.

3.10. Storage
The storage of the material for as far as required will be in the area near the batching plant.

4. CONCLUSION

Even in phase IA construction of Gaza Sea Port requires big quantities of materials. One of the materials, rock has to be borrowed from quarries. As said before, at this very moment (January 1997) the exact borrow areas are unknown. At the time construction will start the delivery of stones, fine and coarse aggregates and sand will be subjected to a tender procedures. Though the use of local sources (Gaza Strip 2.d West B2.k)is probable, it is possible that the construction materials will be obtained from other areas in the world.

In any case no new quarries will be opened for the supply of materials for Gaza Sea Port. If the quarries of the West Bank will be used, only hydraulic and mechanical methods of extraction will be applied. In chapter 6.4 of the EIS (Witteveen+Bos and Team Palestine, 1996) two quarries in the Hebron and the Bir Zeit have been compared.

It is recommended to supervise the borrowing process very carefully when the sites are known and borrowing starts. Opening of new quarries should not be permitted, just like the use of dynamite at the quarries. At the beginning of the production process a transport route should be determined, which will cause the least hindrance for the population. In the neighbourhood of the port the recently re-opened Netzarim Road should be used. The use of the assigned transport corridor from the borrow area(s) to Gaza Sea Port should be controlled very strictly.

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