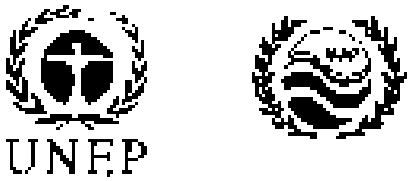
# National Action Plan

## For Reduction of Pollution of Mediterranean from Land Based Sources

## *PALESTINIAN AUTHORITY*

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# CHAPTER I

## Introduction

### 1.1 Background

The Environmental Quality Authority (EQA) has participated in the MED POL (Mediterranean Pollution) that made an assessment of land based pollution sources in 2001. EQA also have worked closely with a consultant who has been hired to calculate a baseline budget of these pollutants. The two projects were sponsored by the Mediterranean Action Plan (MAP/MED-POL). A great deal of work has been done to identify both point and non-point sources of land based pollutants. An inventory of industrial establishments was included which was based on a survey prepared by the Ministry of Environmental Affairs (MEnA1999).

The current political situation has complicated the environmental management in the occupied Palestinian territories. It induced negative impact on sectors of the environment. Marine pollution has been increased due to flow of wastewater from destroyed wastewater treatment plants (Rafah and Gaza) or by restrictions imposed by the Israeli on the movement of civil Palestinian crews to repair these plants. Proper management of solid waste could not been achieved due to inability to collect and transport to sanitary landfills. Over the past two years, the curfews and road blocks, prevented proper waste disposal leading to accumulation of huge amount which contributed to the burden of coastal and marine pollution especially.

The exact quantity of pollutants produced in the Gaza Strip that might reach the Mediterranean is not accurately measured. The Capacity of governmental institution to make serious inventories of sources of waste is very poor. Many industries are (e.g., garments) highly dependent on Israeli market. For these reasons and others, one can expect great variations in the number of industrial establishments over a short period of time and therefore, a change in the quality and quantity of the resulting pollutants.

With the close cooperation of Global Environmental Feasibility (GEF) national coordinator and other stakeholders has been developed taking into account achieving the following objectives:

1 Build on the previously developed projects sponsored by Mediterranean Action Program.
2 Build on the previous planning documents developed by EQA.
3 Identify, organize, and elaborate measures that have been developed aiming at coastal areas protection and propose the necessary financial mechanisms to carry out these measures.

### 1.2 Scope

Gaza Strip is part of the Palestinian coastal plain in Southwest Palestine, where it forms a long narrow rectangle. Its length is approximately 42 km; and its width 5.7 kilometers in the Northern section, attaining a maximum, of 12 kilometers at the Southern end. The Palestinian National Authority (PNA) has gained a political control over Gaza Strip and the West bank after Oslo agreement between Israel and the Palestinian Liberation organization. This report will only deal with the Gaza Strip coastal area currently under the control of the PNA. Figure 1 shows the location of the study area relative to Mediterranean shoreline. It also depicts the major governorate of the Gaza Strip (UNEP 2003)**.**


**Figure 1.1: Gaza Strip coastal area map (White-shaded areas are Israeli settlements), UNEP, 2003**

## 1.3 Current Settings

### 1.3.1 Demography

Gaza Strip is one of the most densely populated areas on the world with over than one million inhabitants. Socioeconomic developments in the area strongly influenced the growth and distribution of population in the Governorates. Gaza Governorates have a very young population in comparison to other countries, 50.2 % of the population is 15 years. As much as 21% of the Gaza citizens are 4 years or younger. In addition, Gaza Governorates have an average of nearly 6.5 persons per household. Moreover, they have a higher average number of children per adult household members in comparison with West Bank and East Jerusalem.

### 1.3.2 Topography

Elongated ridges and depressions, dry streambeds and shifting sand dunes, characterize Gaza topography. The ridges and depressions generally extend in a NNE- SSW direction, parallel to the coastline. They are narrow and consist primarily of 'Kurkar' sandstone. In the south, these features tend to be covered by sand dunes. Land surface elevations range from mean sea level (msl) to about 10 meters above mean sea level (msl) (MEnA 2001/UNEP). The ridges and depressions show considerable vertical relief, in some places up to 60m. Surface elevations of individual ridges range between 20m and 90m above msl. The major topographic depressions, filled with alluvial sediments, collect considerable quantities of storm-water. Flooding is common in Rafah and Gaza City during the wet season.

The parallel, Kurkar ridges have been dissected by Wadi Gaza, the largest surface water feature in Gaza. It rarely flows due to numerous water diversion and storage projects upstream in Israel. However, it has historically cut an incised valley with river terraces to the sea. There are two other wadis in Gaza: Wadi Silka near Khan Younis (a fossil river and now a dry wash) and Wadi

Halib near Beit Hanoun (a tributary of the much larger Nahal Shiqma (Israeli terminology) that drains to the sea just north of Gaza.
Gaza is essentially a foreshore plain gradually sloping westwards. The quaternary rocks are visible as Kurkar ridges go South West-North East. The ridges have an increasing height towards the east, from 20 m to 100 m above sea level. Among these ridges there are 20-40m deep depressions filled with soils. This geomorphologic shape continues to the west in to the Sinai Desert, and to North East to Magdal. Among different quaternary soil deposits, the sand dunes are of special interest. They are formed by wind (eolic), and located along the seashore. Their main distribution is in the South and the North. Sand is extensively quarried for construction purposes, e.g. for local use and export to Israel. The quarrying is an encroachment both on the landscape and the geomorphologic history of Gaza.

### 1.3.3 Coastal Geology

The text of this section is largely based on Grabowski & Poort, 1994. The Holocene and Pleistocene deposits in the Gaza terrestrial area are approximately 160 m thick and cover the underlying Pliocene sediments. These deposits consist of marine Kurkar formation, shell fragments and quartz sands cemented together, and sometimes calcareous sandstone. Due to its high porosity and permeability the marine Kurkar forms a good ground water aquifer. Most of the groundwater in the Gaza Strip is extracted from this layer. The thickness of the marine Kurkar varies between 10 m and 100 m showing a tendency to be thicker near the coast.
The continental Kurkar formation varies from friable to very hard, depending on the degree of cementation. Alluvial and wind blown sand deposits are found on top of the (Pleistocene) Kurkar formations and can locally reach a thickness of 25 m.

### 1.3.4 Coast and Seabed Characteristics

Going from sea to land, the coastal profile can be divided into the seabed, the beach, the dune face or Kurkar cliffs, and the adjacent body of the dune or cliff plateau.
The coastal profile does not only consist of sand, but locally also erosion-resistant formations of rock and Kurkar protrude, on the seabed, on the beach, and in the cliffs. The geophysical survey for the Port of Gaza demonstrated the presence of non-erodible layers at a mean distance of about 3m below the alluvial seabed. Further, a detailed bathymetric survey of the area where the Gaza Sea Port is planned revealed that between the shoreline and 10m depth, the seabed is characterized by areas of rock outcrops and linear features of sand bars (Sogreah, 1996). On the beach and near the waterline of the Gaza shoreline on many places Kurkar outcrops and rocky ridges can be seen.
These hard ridges are important coastal features in that they form natural breakwaters that tend to mitigate an eroding trend. Where those hard layers are covered only by a relatively thin layer of sand, a retreating coastal profile will gradually consist of an increasing amount of erosion-resistant surface
Defining the erodibility and composition of the steep Kurkar cliffs along the Gaza coastline is another important challenge, which will hopefully be undertaken soon. These cliffs themselves are to a certain extent are able to retard an erosive tendency. If they are attacked by waves and locally collapse, the eroded Kurkar material will feed the beach with a mixture of very fine to very coarse sediment. The fines will soon be transported to deep water, whereas the coarse particles will act as an armor layer, protecting the freshly exposed Kurkar cliff face during some time.

### 1.3.5 Seawater Quality

The level of coastal and marine pollution varies from one place to another depending on the nature and intensity of development activities, the size of the human population, the state and type of industry and agriculture located on the shoreline. Pollutants enter the sea water via different modes of transport including direct outfalls, atmospheric deposition, and runoff pollution. Point sources are sources that emit pollutants at designated location such as a stack and pipeline outfall. They are easy to be identified but they account for small fraction of the land-based pollution sources affecting coastal and marine environments. Non-point sources are dispersed in nature and hard to identify. Examples of non point source include urban storm water run-off and overflow discharges, as well as runoff from streets and agricultural lands.

The seawater in the Gaza Strip is polluted to a large extent by sewage, sediments, nutrients, pesticides, litter and marine debris, and toxic wastes. The lack of concern during years of occupation has left the coastal area in a bad and neglected state and consequently led to the deterioration of seawater quality.

Few studies have been conducted to examine the sea water quality in Gaza Strip. These studies had focused mainly on the microbiological quality of sea water near sewers outfall. The data collected indicates a large microbiological contamination of seawater above the international accepted limits especially in locations near sewage outfalls. Data also show that pollution levels (Faecal Coliform) have decreased since 1999, when Gaza city wastewater treatment plant was refurbished.

## 1.4 Methodology

The Palestinian National Authority has participated in the MED POL program and has conducted two studies related to the Mediterranean pollution. First, the "Assessment of Land based Pollution Sources in 2001" sponsored by the Mediterranean Action Plan (MAP/MED-POL) has been developed to identify both point and non-point sources of land based pollutants. Second, the Baseline Budget has been developed to preparation a comprehensive inventory of the existing industry in each administrative region in the coastal zone according to annex I of LBS protocol.

The national action plan will be developed by the following steps:

1. Review of the previous planning documents such as Palestinian Environmental Strategy, National Environmental Action Plan, Baseline Budget, and Assessment of Land based Pollution Sources in 2001.
2. Conduct interviews of representative stakeholders.
3. Gathering stakeholders in general workshops.
4. Synthesis of the information to get the final document.

## CHAPTER II

## Institutional Framework

The responsibility for environmental management is shared by several authorities, ministries and municipalities as well as by the private sector in the Palestinian territories. An example is the required cooperation between EQA and the Palestinian Water Authority (PWA) in the fields of groundwater and surface water quality protection, setting groundwater and wastewater quality standards, increasing public awareness in the water sector, training EQA and PWA staff in the field of water quality protection, undertaking EIA for water projects and setting regulations for the reuse of treated wastewater.

The objective of this section is present the national integrated (Government-local community) institutional framework that is capable to effectively respond to environmental pollution incidents in the coastal and marine environment and to manage associated activities and training programs to support the proposed National Action Plan.

### 2.1 Institutional framework for environmental protection

Until May 1995, all environmental responsibilities in the Occupied Palestinian Territories were held by the Israeli Administration. They were administered through the Environmental Health Department under the Israeli Ministry of Health and limited mainly to inspections. Following the establishment in 1993 of the Israeli Ministry of Environment, the Department of the Environmental Officer was established in the Civil Administration, which carries out projects in the fields of solid waste and liquid waste treatment, and pest control. Municipalities were the provider of some environmental services such as solid waste collection and this continues to be the case until 1996 when a specialized body was established to handle these issues.

#### 2.1.1 Environmental Quality Authority (EQA)

In October 1994, an Environmental Planning Directorate (EPD) was established in the Ministry of Planning and International Cooperation (MOPIC) to handle the environmental protection matters in terms of planning, management and implementation. In December 1996, a Palestinian Environmental Authority (PEA) was established and the EPD mandate and responsibilities were transferred to it. In December 1998, a Minister of State for Environmental Affairs was appointed by a presidential Decree No. 2. Following this Decree No. 2, a Palestinian Ministry of Environmental Affairs was established. As a result of administrative reforms, Presidential

Decree No. 6 in June 2002 established the Environmental Quality Authority as the successor body to the Ministry of Environmental Affairs.

The Environmental Quality Authority has its own budget and is responsible to the Cabinet of Ministers. All the functions, responsibilities and authorities of the former ministry were transferred to the Environmental Quality Authority including all property and employees. Although there continues to be no overall written mandate for the Environmental Quality Authority, its primary responsibilities are clearly set out in the Palestinian Environmental Strategy and the Palestinian Environmental Law.

Two levels of coordination and cooperation are required for cross-cutting environmental issues: (a) coordination among Palestinian environment-related institutions, municipalities, NGOs and the private sector; and (b) coordination between Palestinians and those donors supporting environmental activities in the Occupied Palestinian Territories.

### 2.1.2 Stakeholders

In addition to the Environmental Quality Authority, many other ministries and authorities, as well as one international organization, have environment-related tasks. Among those specifically identified in the environmental strategy are:

• Ministry of Planning and International Co-operation and the Higher Planning Council, which are responsible for land use and planning, and hence development of emergency natural resources protection plans and regional development plans;

• Ministry of Local Government, which deals with solid waste management and is therefore involved in the operation and financing of solid waste collection and disposal.

Municipalities and village councils focus on collection, transport and disposal of municipal wastes. The United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA), on the other hand, is responsible for these services in the refugee camps;

• Ministry of Health, which, via its Department of Environmental Health, is involved in the control and management of medical waste. It is also involved in management of water and food quality, wastewater and solid waste, pest control, etc;

• Ministry of Industry, which is concerned with hazardous waste and industrial pollution control and management, environmental standards, natural resources and industrial safety and zoning;

• Ministry of Agriculture, which is responsible for environmental management in the use of agro-chemicals and protection of nature and biodiversity;

• Ministry of Tourism and Antiquities, which focuses on protection and management of the cultural heritage tourism sites;

• Ministry of the Interior, which is involved in environmental law enforcement;

• Ministry of Transport, which is concerned with environmental aspects of traffic and infrastructure.

The Ministry of Education also has a specific role through environmental education and awareness building. In addition there are several authorities with environment-related mandates and functions. These include the Palestinian Water Authority, and the Palestinian Energy Authority. There are also numerous environment-related NGOs in the Occupied Palestinian Territories, many of which have played an important role in contributing information and experience to the preparation and review of laws and decision-making processes. Capacity-building for NGOs will assist in making these functions still more effective in future, particularly with regard to supporting and facilitating the work of public bodies.

### 2.2 Marine and Coastal Environment Protection Task Forces

The following proposed institutional set up was developed recently through a participatory approach of all stakeholders within the activity of Gaza Marine & Coastal Action Plan Project funded by LIFE Third Countries. During the project period the following activities in the field of institutional development have been performed:

- Three Environmental Protection Task-Forces,
- Draft Environmental Action Plans (for three environmental areas),
- Coastal and Marine Environmental Protection Committee,
- Legal framework for C&M Environment Protection.

The task forces were established to develop protection plans for the selected themes: sand exploitation, coastal erosion and marine pollution. The environmental protection task-force on marine pollution has been composed from the members presented in Table 2.1. These task forces are responsible to plan the necessary protective measures of the marine environment at the technical level. They will report their findings/plans to the Coastal and Marine Environmental Protection Committee (C&MEPC) as shall be detailed in the next section. The objectives of the task force for coastal and marine environmental protection are as follows:

1. Identifying and prioritizing the protective measures needed to be taken and to determine the division of mandate between the institutions and agencies that will implement them.
2. Jointly analyzing the environmental situation (with regard to sand exploitation, Coastal erosion and marine pollution respectively).

3. Identifying and prioritizing a combination of physical, administrative and enforcement measures to protect and improve the coastal and marine environment.
4. Assisting EQA to monitor the impact of the environmental protection projects.
5. Anticipating and selecting the socio-economic developments that have been affecting the coastal and marine environment, and proposing some recommended interventions.

**Table 2.1 Members of Marine Environment Task Force**

| **Memeber** | **Role in the task force** |
|---|---|
| Palestinian Water Authority | Chair |
| Environmental Quality Authority | Secretariat |
| Gaza Municipality | Member |
| Civil Defence | Member |
| Fishery association | Member |
| Ministry of Public Works | Member |
| Palestinian Coastal Police (PCP) | Member |
| Ministry of Transport | Member |
| Ministry of Agriculture | Member |
| Ministry of Industry | Member |
| Ministry of Local Government | Member |

### 2.3 Coastal & Marine Environmental Protection Committee (C&MEPC)

To address the increasing stress on the marine environment, the Ministry of Environmental Affairs had established the Coastal and Marine Environmental Protection Committee (C&MEPC) during the execution of a project funded by the life third countries program. The Committee members have been appointed after the 2nd regional workshop that was held in August 2000 as explained in Table 2.2. During the project, MEnA has prepared a presidential decree, which needs to be approved by the Chairman of the Palestinian National Authority. The overall objective of the committee is to protect and improve the coastal and marine environment of Gaza. The actions to achieve this overall objective are:

1. to advise the cabinet regarding timely and adequate coastal and marine environmental protection measures,
2. to get a feed back from EQA and the other task forces regarding the proposed and the ongoing activities in coastal and marine protection, and
3. to entitle and to take part on an equal footing in any system of research and regulation for the conservation of the living resources, and coastal and marine protection.

**Table 2.2 Membership of the Committee**

| Name | Post |
|---|---|

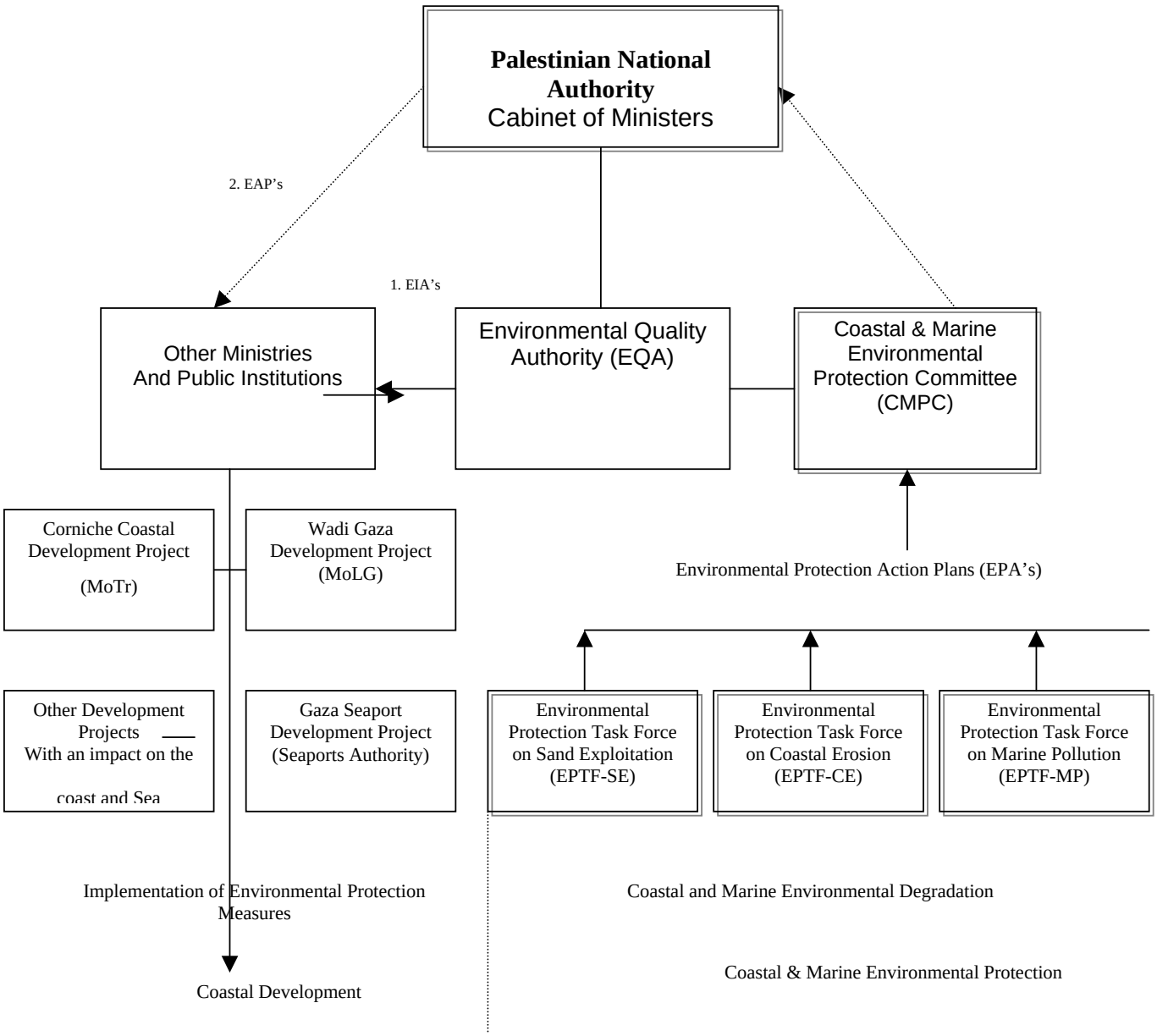
| | |
|---|---|
| Environmental Quality Authority | Chair |
| Ministry for Local Government | Vice-chair |
| Ministry of Planning and International Co-operation | Member |
| Ministry of Finance | Member |
| Ministry of Agriculture | Member |
| Ministry of Public Works | Member |
| Gaza Municipality | Member |
| Seaports Authority | Member |
| Sand Directorate; General Security | Member |
| Palestinian Water Authority | Member |
| Palestinian Coastal Police | Member |

The institutional framework for the Coastal and Marine Environmental Protection Committee is given in Figure (2.1). The task forces recommended protection measures that may minimize the threat to the marine and coastal environment in Gaza. Moreover, for developmental activities, an Environmental Impact Assessment (EIA) unit has been established at EQA. Adequate protection measures defined by EQA would be a condition to granting environmental approval.

The Coastal and Marine Environmental Protection Committee has been assigned with the following roles and responsibilities:

- to monitor the environmental status of the coastal zone and marine waters, and to keep the information on the Gaza Coastal and Marine Environmental Management up-to-date. This information System (GAMIS) will be kept at EQA,
- to initiate studies and research to gain a better insight of the trends and alternative solutions to emerging coastal and marine environmental problems,
- to prepare strategies and polices to protect and to improve the coastal and marine environment, which will be submitted to the Cabinet for approval,
- to recommend any administrative measures or additional legislation which will improve the protection of the coastal and marine environment,
- to co-ordinate, monitor (and enforce) the implementation of appropriate coastal and marine environmental protection measures by the stakeholder organizations concerned,
- to initiate specific environmental protection programs or projects and secure funding for implementation, and
- to generate public awareness and to stimulate community participation on the issue of coastal and marine environment protection.

*Figure 2.1: Institutional Framework for Coastal & Marine Environmental Protection*




## 2.4 Legal Framework for Coastal and Marine Environmental Protection

In addition to the institutional arrangements, legal bases for protecting, improving and developing the environment in the coastal zone and the marine waters are required. As an elaboration of the approved Environmental Law, further legislation has been formulated to better cater for the coastal and marine environment. Currently, the roles and responsibilities of EQA with regard to marine environment, as described in the Environmental Law of October 1999, are reflected here below:

1. Set standards for the quality of sea water (article 31).

2. Specify the environmental conditions for coastal or off-shore construction (article 33).
3. Set rules and regulations for the preservation and control of the marine environment, and prevention of pollution caused by economic activity at land or in the sea (article. 35).
4. Set rules and regulations for the pollution prevention caused by dumping (article. 36)
5. Set rules and regulations for the pollution prevention generated by ships (article. 37)

The other articles in the Environmental Law: chapter on Marine Environment state:

1. It is forbidden to cause sea pollution (article 32).
2. It is forbidden to affect the natural track of the beach, unless environmentally approved (article34).
3. All entities, including ships, are forbidden to discharge oil or other pollutants (article. 38).
4. All companies authorized to undertake digging or exploration, production, manufacturing or exploitation of oil or other marine resources shall abide by the environmental conditions (article39).
5. Article 35 states that EQA's mandate and responsibility to set rules and regulations for the prevention of pollution caused by economic activity at land or in the sea, preservation and control of the marine environment, provision of the legal bases to take the initiative to devise environmental protection action plans. It should be stipulated that in this context EQA is creating the Coastal and Marine Environmental Protection Committee.

# CHAPTER III

## Sectorial Plans

### 3.1 Wastewater Management

The lack of sufficient wastewater treatment facilities makes wastewater the main source of pollution of the coastal zone of Gaza Strip. There are more than 20 individual sewage drains, ending either on the beach or a short distance away in the surf zone. High percentage of the wastewater that is generated in Gaza city is currently discharged without treatment into the sea (50,000 cubic meter per day). Only about 40% of the sewage generated in the Gaza Strip is properly treated. The percentage of population served by sewerage systems is 60%. The insufficient number of sewage treatment plants in operation, combined with poor operating conditions of available treatment plants, and the present disposal practices are likely to have an adverse effect on the quality of seawater.

### 3.1.1 Wastewater Pollution Load

The lack of proper wastewater treatment facilities leads to the discharge of untreated or partially treated sewage directly to the seashore and indirectly through Wadi Gaza from the middle camps (Nuseirat, Bureij, Maghazi) and finally reaches the sea. This results in the poisoning of water and soil and consequent major health risks for swimmers and marine life. Many discharge points are registered along the shoreline in the Gaza Strip. The major points can be summarized as follows:

- Discharged point of raw wastewater from El-Sheikh Radwan.
- About 15 discharge points of raw sewage at the Beach Camp.
- The emergency overflow south of Palestine hotel in Gaza City.
- Discharge point at the seashore in El-Sheikh Egleen.
- The major discharging point of treated effluent of Gaza wastewater treatment plant.
- Discharging pond of raw sewage at the western end of Wadi Gaza accumulated from the middle Camps.
- Discharge point at seashore in Deir El-Balah City.
- Discharge point at Rafah City.

Tables 3.1, 3.2, and 3.3 show the load of pollutant discharges from different areas of the Gaza Strip to the sea.

*Table (3.1): Pollutant Discharges from Wastewater to the Sea, 2000/2001*

| Location | Flow to the Sea $M^3/d$ | BOD5 (mg/l) | COD (mg/l) | Total P (mg/l) | Total N (mg/l) |
|---|---|---|---|---|---|
| Gaza WWTP Effluent | 32000 | 33.3 | 98 | 5.4 | 50 |
| Rafah WWTP Effluent | 4200 | 269.3 | 652.2 | 4.5 | 93.1 |

| | | | | | |
|---|---|---|---|---|---|
| Deir El-Balah and other Outfalls (Estimated No.) | 3000 | 589 | 1165 | 5 | 100 |
| Pollutants Load from Gaza WWTP (ton/y) | | 389.94 | 1,147.58 | 63.23 | 585.50 |
| Pollutant Load From Rafah WWTP (ton/y) | | 414.72 | 1,004.39 | 6.93 | 143.37 |
| Pollutant Load From Deir El-Balah and other Outfalls (ton/y) | | 644.96 | 1275.68 | 5.48 | 109.50 |
| TOTAL pollutants load from wastewater (ton/y) | | 1449.62 | 3427.65 | 75.64 | 838.37 |

(source: MED POL2001)

*Table (3.2): Pollutant Discharges from Wadi Gaza to the Sea, 2000/2001*

| Parameter | Average Conc. (mg/l) | Pollutant Load (ton/y) |
|---|---|---|
| BOD5 | 130.00 | 214.50 |
| COD | 251.67 | 415.25 |
| Total P | 1.12 | 1.84 |
| Total N | 30.78 | 50.79 |

(source: MED POL2001)

*Table (3.3): TOTAL Pollutant Discharges to Coastal Area*

| # | Variable | Unit | Load |
|---|---|---|---|
| 1 | Biochemical Oxygen Demand (BOD5) | 1000t $O_2$/y | 1.66 |
| 2 | Chemical Oxygen Demand (COD) | 1000t $O_2$/y | 3.84 |
| 4 | Total Phosphorus | t P/y | 77.48 |
| 5 | Total Nitrogen | 1000t N/y | 0.89 |

(source: MED POL2001)

### 3.1.2 Wastewater Management Objective

The Palestinian Environmental Strategy (PES), which has a time span extending from the year 2000 till 2010, has given the highest priority among it is environmental themes to *"setting up an effective wastewater management system in Palestine"*.

Three main wastewater management targets were set by the PES for the Gaza Strip:

1. Aiming at full coverage of connection to households to the sewer collection system.
2. Establishing the required wastewater treatment facilities that can capacitate the existing and the estimated production of wastewater in Gaza Strip.

3. Setting the proper wastewater influent and effluent standards for discharging wastewater to: the direct land, the sea and the reuse for irrigation.

### 3.2 Coastal Activities

Tourism and recreation have significant impact on the coastal and marine environment. With so much pressure to cater for large number of people in relatively small areas, the competition for space in beaches and coastal areas is great. Meanwhile, developing coastal areas for tourism and recreation involves many of the processes associated with developing the coast line for industry such as ports and marinas or other facilities. A coastal resort needs access to the sea that will increase the demands on the local environment and thus increasing pollution.

A large number of small-scale structures, scattered along the entire coastline of the Gaza Strip, has been constructed. These include groins, fences, concrete and wooden beach cabins, concrete stairs on cliff slopes, beach watchtowers, sea walls …etc. Off shore structures have been constructed very close to and even right on the active part of the shore, thereby constraining the range of free space needed for the natural Mediterranean coastline dynamics. Waste dumps have been placed on the beach in a haphazard and unplanned way, and without regard to their negative effects on wave action, seawater circulation, sediment transport patterns, or landscape amenity.

There are twenty five registered restaurants built directly on the beach area, and 2 recreational facilities which occupy a large area on the coast contribute to the pollution of the coastal and marine area due to the lack of public services like sewerage facilities or proper solid waste collection. It is estimated that these facilities discharge about 13,000 $M^3$/day of wastewater to the Mediterranean Sea environment. This is in addition to two tons of litter and solid waste that being generated in the open recreational areas on the beach and being dumped directly on the beach and may find its way to the sea by the same facilities.

The impacts of the tourist industry on coastal and marine resources result from all the sub-sectors of the industry, primarily the construction and operation of facilities. The sources that directly attributable to tourism activities can be categorized as construction and operational. Construction includes land filling, dredging, and building on the shoreline and on steep slopes, drainage, sand mining and inappropriate design. Operational includes sewage and solid waste disposal, boat maintenance, beach maintenance and/or restoration and maintenance facilities.

Recreational activities are a third major source of impact of the industry. These are often linked with major facilities such as hotels or restaurants. They may also be undertaken without the availability of fixed operational bases. The recreational activities are mostly related to the local population that is always considered primarily responsible for the pollution of the recreational areas due to the lack of facilities and infrastructure.

### 3.3 Agricultural Pollutants

#### 3.3.1 Background

Gaza Strip is largely dependent on the agriculture production for many years. Agrochemicals are increasingly used in Gaza Strip to improve crop yields and to increase the land productivity. In the Gaza Strip, more than 125 different pesticides are currently used to protect the main crop products from pests and fungi. Moreover insecticides and rodenticides are also used in towns and cities to control household insects and pests. Nitrogen and phosphorus, potassium fertilizers are used in large quantities in most of agricultural settings in Gaza Strip.

More than 900 metric tons of formulated pesticides and 28,157 tons of chemical fertilizers are used annually in Gaza Strip. Several dangerous agricultural pesticides that are internationally banned are allowed to enter the Gaza Strip and still widely used. Since there is no monitoring on the chemical composition of the pesticides containers, sale of expired and impure pesticides is widely evidenced between the farmers.

### 3.3.2 Means of transport

Pesticides reach the coastal and marine environment via rivers, atmospheric transport and runoff during heavy rain seasons. The main point source is Wadi Gaza, which is considered the only surface water in the Gaza Strip. The Wadi carries water only for about ten days a year. It crosses heavy agricultural areas in Both Israel and Gaza Strip, and during heavy rainfall and flooding seasons, it carries all the agricultural chemical pesticides and fertilizers residues and discharges them into the sea. Pesticides runoff is usually greater when heavy rain follows soon after pesticide application. Runoff can also occur if pesticide is applied to a saturated soil, resulting from heavy rainfall and over-irrigation.

### 3.3.3 Effect on the marine Environment

Pesticides are highly toxic and tend to accumulate in the coastal and marine biota, making pesticide contamination a serious concern. Although small fraction of pesticide used would be transported to the marine environment. The negative effects of pesticides in the marine and coastal environments include changes in reef community structure, such as the decrease in live coral cover and the increase in algae and sponges, and the damage of sea-grass beds and other aquatic vegetation from herbicides. Marine organisms may be affected either directly, as the pesticide moves through the food chain and accumulate in the biota, or by loss or alteration of their habitat. Pesticides may kill fish in areas of poor water circulation.

Agriculturally used Fertilizers are major source of nutrients reaching the coastal zone. The main nutrients are nitrogen and phosphorus compounds, which are considered the major cause of eutrophication. It causes algal blooms, changes in the aquatic community structure, decreased biological diversity, and fish kills and oxygen depletion events. The presence of nutrients in the water column enhances the growth of plants. In some cases it may cause algae to overgrow the corals or sea-grass that were previously present. Habitat degradation will lead to a decrease in fisheries production and loss of recreational and tourism potential.

## 3.4 Industrial Pollution

The improper industrial Palestinian practices may impose a real threat to the environment in the future. The main polluting industries include the textile dyeing, jeans washing factories, car washing workshops, electroplating, painting, foaming industries, etc. Most of the factories in Gaza Strip discharge their wastewater without proper treatment or even without any treatment to the municipal sewerage system. Furthermore, the solid waste, which may include hazardous waste, is badly managed and is dumped without separation in the municipal landfills or open dump sites. Also the gaseous emissions from some industries are not monitored, and no treatment is used which endanger the public health of the workers and the people living at close proximity to these industries.

### 3.4.1 Profile of the Industrial Activities in Gaza Strip

The industrial establishments in Gaza strip are characterized by their small number of employees. For example, 85% of industrial establishments have less than 8 workers and 97% are less than 20 workers. Most of the industrial activities are related to clothing, metal, wood products and construction sectors. The growth of the industrial production has, to a large

extent, taken place in the existing establishments. Many of these industries are sub-contracting to Israeli industries (EPD, 1996). There are few industrial zones, but most of the industries are scattered in the residential areas causing nuisance and inconvenience to people. Investment in industry was low and fluctuating around 10% of the GDP till the year 1996. After that, the contribution of the industrial sector to the GDP showed significant increase till the beginning of El-Aqsa Intifada.

### 3.4.2 Industrial Wastewater

Most of the wastewater generated from industries in Gaza Strip is similar to domestic wastewater. Industries in Gaza Strip are small-scale industries and several industries such as garment manufacturing, plastic, paper manufacturing, print shops, glass, wood, leather, asphalt, gas stations and refrigeration don't use water as a raw material in the production process, but only for domestic purposes. These industries constitute with about 60% of the total number of the industrial establishments in Gaza Strip. Table (3.4) gives the wastewater estimation of the main polluting industries in Gaza Governorates.

Table 3.4: Annual Wastewater Production of Selected Main Polluting Industries

| Type of industry | Wastewater quantity (CM/year) |
|---|---|
| Textile dyeing | 30,000 |
| Jeans washing | 55,000 |
| Car washing | 22,500 |
| Photo Processing | 54 |
| Electroplating | 2,500 |

(Source: MEnA, 1999)

Lab analysis of the wastewater of some industries in Gaza Strip shows that it contains some heavy metals with concentrations exceeding the permissible limits. In addition, it has a high COD/BOD ratio which indicates that these contaminants are hardly biodegradable. A recent study for selected polluting industries in Gaza demonstrates that the effluent is almost free of heavy metals Table (3.5). In addition to the industries in Table 3.5, there are three paint factories located in Gaza Strip. Big quantities of toxic and hazardous materials are used by these industries without proper storage. Although these industries produce low quantities of wastewater, but it is highly contaminated and discharged to the municipal sewer system without any treatment.

**Table 3.5: Wastewater Effluent Characteristics of Selected Industries**

| Industry | Parameter | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | COD (mg/l) | TDS (mg/l) | TSS (mg/l) | pH | Al (μ/l) | Fe (mg/l) | Cu (mg/l) | Zn (mg/l) |
| Draft Palestinian Standards | 2000 | 2500 | 500 | 6-9 | 10 | 50 | 2 | 5 |
| Textile dyeing | 1042 | 4586 | 375 | 7.5 | - | 0.27 | 0.05 | 0.62 |
| Jeans | 2290 | 1180 | 6711 | 7.4 | - | 0.4 | - | 0.55 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| washing | | | | | | | | |
| Car washing | 700 | 1510 | 1142 | 7.7 | - | 0.50 | 0.11 | 0.08 |
| Photo processing | 4250 | 31300 | 86 | 9.5 | 234 | 1160 | 0.08 | 1.82 |
| Electro-plating | 630 | 2400 | 86 | 9.5 | 220 | 0.60 | 9.20 | 20.8 |

(Source:Safi, 1999)

Most of the industrial wastewater is discharged without treatment to the sewer system and ends up at the wastewater treatment plants and then to the shoreline. Although the quantities of the industrial wastewater compared with the inflow to these treatment plants are considerably low and the dilution factor is very high, its accumulation impact on the seawater quality and marine life may be of concern. The information about the industrial wastewater quality and its impact on the sea is rather little or unavailable.

### 3.4.3 Industrial Solid Waste

Data on the industrial solid waste quantities and composition is limited. Generally, there is no separation of the hazardous waste. It is collected with other waste and dumped in the municipal landfills or in the open areas. Recently, the Ministry of Industry carried out a field survey of the industries in Gaza Strip, but the data has not been analyzed yet. According to this survey, more than 15,526 tons/year of solid waste is generated from the industries in the Gaza Strip. At the Gaza Industrial Estate (GIE), there is special agreement with the municipality of Gaza to collect the solid and hazardous waste from the individual industries and to transfer it to Gaza landfill. Special arrangement will be developed for collection, transportation of the hazardous waste and disposal in the hazardous waste cell at Gaza landfill. Table (3.6) gives the main polluting industries and the type of solid waste and hazardous waste with its quantities where available are given.

*Table 3.6: Main Producers of Industrial Solid Waste in Gaza Strip*

| Industry | Location | Types & Quantities of Normal Solid Waste | Types of Hazardous Waste |
|---|---|---|---|
| Ready mixed concrete Industry | All over Gaza Strip | Domestic waste | Empty barrels of chemicals |
| Marble cutting | All over Gaza Strip | Waste marble (4000m3/year) | |
| Foaming | Jabalia | Garbage, cartoon, plastic. | Empty barrels of chemicals |

| | | | |
|---|---|---|---|
| | | | chemicals |
| Tile Industry | Gaza, Khan Younis, Beit Hanoun | Garbage, cartoon, plastic. | Sediments |
| Electroplating | Gaza, Jabalia | Garbage, cartoon, plastic. | Packaging materials of chemicals, sediments of coating tanks (small quantity) |
| Stone washing | Gaza, Jabalia, Beit Hanoun | Packaging materials of chemicals, cartoon, plastic, wasted fabric | Sediments (50 CM /year), empty barrels of some chemicals |
| Food industry | All over Gaza Strip | Bagging materials (cartoon, plastic, etc.) | |
| Textile Industry | Beit Hanoun | Packaging materials of chemicals, cartoon, plastic, wasted fabric, garbage | empty barrels of some chemicals |
| Paints Industry | Gaza | Packaging materials (cartoon, plastic, etc.), garbage | Empty containers of chemicals |
| Fodder Industry | Gaza, Deir El-Balah | Packaging materials (cartoon, plastic, etc.) | |

(Source: MEnA 1999)

At present small quantities of the industrial solid waste is randomly dumped near the shoreline due to the improvement in the solid waste management in Gaza Strip in the last few years. The direct pollution of industrial solid waste is not significant and is limited to the contaminated runoff with such solid waste that reaches the MS in the wet season. There is no information about the quantity and the impact of these contaminants on the Mediterranean Sea.

### 3.4.4 Industrial Air Pollution

Industry is one of the main sources of air pollution in the Gaza strip, although most of the available industries are of small and medium size.

Air pollution produced by traffic is estimated at about more than 50% of the total air pollution emissions in the Gaza Strip. Limited data is available on the gaseous emissions from the different industries due to absence of any stack emissions monitoring equipment in Gaza Strip and West Bank. Table (3.7) shows the main air polluting industries, their location and the type of pollutants produced.

**Table 3.7: Main Air Polluting Industries in the Gaza Strip**

| Type of Source | Location | Types of Air Contaminants |
|---|---|---|
| Wastewater Treatment Plant | Beit Hanoun, Gaza, Rafah | Dust, $H_2S$, $NH_3$, $CH_4$ |
| Concrete Industry | All over Gaza Strip | Dust |
| Gas Station | All over Gaza Strip | Hydrocarbons |
| Bakeries( that use oil fuel) | All over Gaza Strip | CO, $CO_2$, $SO_2$ , $NO_x$ |
| Batteries | Gaza, Khan Younis | Pb |
| Asphalt Mixing Industry | (Jabalia, Gaza) | Dust, CO, $CO_2$, $SiO_2$ , Hydrocarbons |
| Tiles Industry | Gaza, Khan Younis, Beit Hanoun | Dust, Hydrocarbons |
| Textile Industry | Beit Hanoun | Dust, CO, $CO_2$, $SO_2$ |
| Paints Industry | Gaza | Hydrocarbons |
| Fodder Industry | Gaza, Deir El-Balah | Dust, $NH_3$, CO, $CO_2$, $SO_2$ |

*(Source: MEnA 2000)*

Regular monitoring of air quality is conducted each month in two locations in Gaza Industrial Estate. In table (3.8), a sample of the monitoring results is given. Most of the time the gases concentrations are within the standards.

**Table 3.8: Air Quality at Gaza Industrial Estate**

| Gas | Location 1 | | | Location 2 | | |
|---|---|---|---|---|---|---|
| | Minimum | Maximum | 24-hours Average | Minimum | Maximum | 24-hours average |
| | ($g/m^3$) | | | ($g/m^3$) | | |
| SPM | 77 | 574 | 250 | | | |
| CO | 0.0 | 1530 | 203 | 0.0 | 1225 | 50 |
| $SO_2$ | 0.0 | 140 | 5.7 | 0.0 | 72 | 69 |
| $H_2S$ | 0.0 | 14 | 7.5 | 0.0 | 7.5 | 3 |
| $NO_2$ | 0.0 | 9 | | 0.0 | 10 | |

(source: MED POL2001)

The prevailing wind direction in Gaza Strip throughout the year is the Northwest in the daytime and Northeast during the night. Most of the air contaminants are transported by wind to the eastern part of Gaza Strip away from the coastal area. Actually there is no actual information about the quantity and the impact of these contaminants on the Mediterranean Sea, but the expected impact is small.

### 3.5 Solid Waste

Solid waste in Gaza consists mainly of household waste, building debris, agricultural waste, industrial waste (workshops), medical waste, and car workshops. SW generation rates varies between 0.35 kg to 1.0 Kg per capita. The total SW generated in Gaza Governorates varies between 500 to 550 tons per day in the cities and village councils. In the refugee camps from 200 to 220 tons per day .

It is estimated that more than 65% of the household solid waste consists of organic material, while sand is the second major component (23%). This implies that the density of the household solid waste ranges between 250 to 600 kg/$m^3$.

#### 3.5.1 Composition of solid wastes in Gaza Strip

**Table 3.9 Composition of solid wastes**

| Composition | % by Wet Weight |
|---|---|
| Organic materials | 67.0 |
| Paper | 1.5 |
| Metal | 1.5 |
| Glass | 1.5 |
| Cloth | 1.5 |
| Plastic | 2.0 |
| Sand | 23.0 |

(Source: MEnA 2000)

#### 3.5.2 Proportion of Total Waste Generated by Different Sources in Gaza City

**Table 3.10 Proportion of Total Waste Generated by different sources in Gaza City**

| Source | Percentage |
|---|---|
| households generate around | 49% of the waste |
| shops and markets contribute | 8% |
| butchers, restaurants, hotels | 4% |
| offices, banks, institutions | 4% |
| army, police camps | 4% |
| schools and universities | 2% |
| hospitals, clinics, pharmacies | 2% |
| construction sector | 10% |
| other industries | 10% |
| Litter, sand and crash cleaning | 7% |

(Source: MEnA 1999)

### 3.5.3 Mode of Pollution

The potential recreational activities on the beach of Gaza City including swimming, surfing, picnics and sports are potentially jeopardized with the quality of sea -water. This in turn will affect the tourism activities in the area due to major health risks for swimmers and marine life.

In absence of control, the beach was used as a dumpsite for municipal solid waste and construction debris. Garbage is thrown off randomly from the urbanized areas near the beach and from users. Also, industrial waste was dumped in the area.

Another sources of pollution on the beach of Gaza are: lack of containers, lack of toilets, and absence of litter bins on the beach.

One of the biggest problems regarding beach pollution in Gaza is the problem of construction debris that the harbor authority used for a long time to dump in the sea to build the body of the fisherman's harbor. This practice actually brought a huge amount of the debris to the sea. Therefore, it was a solution to get red of the debris, without carefully studying its environmental impacts to the marine life.

Another dangerous phenomenon that takes place from time to time is the illegal disposal of some hazardous chemicals to the sea by the Israeli. For many times many barrels of hazardous chemicals have been caught near to the sea. The lab analysis of these chemicals proves that they have very negative impacts on marine life .

### 3.5.4 Toxic & Hazardous Waste Effect on Marine Life

Toxic pollutants are organic and inorganic compounds; either synthesized or chemically transformed natural substances. When accidentally released into the marine environment, they can have severe adverse effects on marine ecosystems. Many compounds are very persistent in the aquatic environment, bio-accumulate in marine organisms, and are highly toxic to humans via the consumption of seafood. The sources of toxic pollutants are primary industrial point sources, such as petroleum industry (oil refineries and petrochemical plants), chemical industries (organic and inorganic), wood/pulp plants, pesticide production and formulation, metal and electroplating industries, … etc.

Toxic substances also enter the marine environment from non-point sources via rivers and streams and through the atmosphere.

Toxic substances are generally released as a result of manufacturing operations, effluent discharges, and accidental spills.

The wastes generated may contain heavy metals, carcinogenic hydrocarbons, dioxins, different types of pesticides, noxious organic and inorganic substances, … etc.

The extent of industrial toxic substances released into the environment depends on the location of the sites and the measures that companies are taking to reduce their waste flow. The potential effects of toxic substances in the marine and coastal environments include the destruction of fish and other wildlife leading to a loss of biodiversity, and a decrease in the productivity of mangrove, seagrass and coral reef ecosystems, negative economic impacts related to tourism and recreation, and human health risks through contaminated food.

The impact of oil pollution on the ecology of coastal and marine ecosystems and the species that inhabit them is particularly destructive following massive oil spills caused by maritime accidents. Corals do not die from oil remaining on the surface of the water. However, gas exchange between the water and the atmosphere is decreased, with the possible result of oxygen depletion in enclosed bays where surface wave action is minimal. Coral death results

from smothering when submerged oil directly adheres to coral surface, and oil slicks affect sea birds and other marine animals. In addition, tar accumulation on beaches reduces tourism potential of coastal areas.

### 3.5.5 Institutional Set up for Solid & Hazardous Waste Management

Apart from the refugee camps, where the services are largely provided by UNRWA, the collection and disposal of solid & hazardous waste is the responsibility of local government (municipalities and village councils).

The organizational structures of municipalities show considerable variations among themselves in the numbers of departments and the responsibilities of each. Solid & hazardous waste management in municipalities is managed by either a health department (usually headed by a veterinarian) or an engineering department.

Ministry of Local Government (MoLG) is assigned responsibility for the local government system and has been actively engaged in defining the structure of local government, the institutional arrangements and the key organizations at the various levels. It also defines the role and functions at these levels. The Municipalities and the village councils are responsible for providing the public with solid waste services.

In the middle area of the Gaza Strip (south of Wadi Gaza, excluding Rafah) a Solid Waste Management Council has been established. It serves eleven communities; the heads of these communities are all members of the Council and participate in decision-making. Each municipality has a voting right according to the size of its community. The mission of the Council is to provide secondary collection from communal storage points and to dispose of this waste in an acceptable way. In addition, the Council has conducted a public awareness campaign to foster community participation. The recycling of decomposed waste is being considered.

EQA's role in managing solid & hazardous waste has been clearly stated in the Environmental Law particularly sections 7 - 13. EQA has the responsibility in cooperation with the concerned ministries and institutions to formulate a national plan for SWHA management including manners and designation of disposal sites. Furthermore, EQA in cooperation with other stakeholders is responsible for setting up the standards for solid and hazardous waste disposal sites. Moreover, EQA is responsible for monitoring the disposal sites and enforcing the relevant regulations.

The NGOs work directly with people to improve their awareness about the proper practices of solid waste and its impact on the environment and public health. Most of the big solid waste projects include a public awareness campaigns component.

### 3.5.6 Achievements, Ongoing and Proposed Activities

The achievements, ongoing activities and proposed actions are summarized in Table 3.11.

**Table 3.11 Achievements, ongoing and future work in the solid waste management**

| No. | Achievements | Ongoing Activities | Proposed activities |
|---|---|---|---|
| 1. | Cleanup Campaigns<br>. | Environmental regulations and bylaws of solid waste are under preparation. | |

| | | | |
|---|---|---|---|
| 2. | The Environmental law has been formulated and approved. | | Monitoring program for the control of the illegal disposal of hazardous waste on the beach |
| 3. | Monitoring and enforcement plan for the beach of Gaza has been prepared and partially implemented. | | Persuade the municipality to find an area for dumping construction material |
| 4. | | | Develop and implement a Management System for used oil. |
| 5. | Limiting the amount of toxic substances entering the coastal and marine ecosystems | | -Promoting the importance of the work of health educators |
| 6. | | | -Co-ordination with other organisations to take joint action and exchange experience |

(source: MED POL2001)

The improper handling of solid waste in Palestine is a major cause of deterioration of water quality, land degradation, air pollution, pollution of the Gaza shoreline and the coastal marine environment and aesthetic distortion of the visual environment. The negative impact on water quality is not as serious as the one caused by infiltration of wastewater. On the other hand, the risks from leachate from non-sanitary hazardous waste dumps should not be underestimated. Also public health risks related to direct exposure to hazardous or infectious waste are serious.

These negative impacts are expected to be addressed by the solid waste management which, according to this PES, is only topped by wastewater management and water resources management.

# CHAPTER IV

## Priority Actions

### 4.1 Prioritization

In the previous chapters the environmental issues affecting the sea pollution have been discussed one by one. The main causes of the problems have been mentioned and Mediterranean load has been identified. In this chapter of NAP, prioritization of issues affecting Mediterranean pollution will be performed following the same steps used to prioritize the environmental themes in the Palestinian environmental strategy (PES). This plan aims to resolve the urgent environmental problems that have negative impact on the marine environment in a consistent and effective manner. The time span of this environmental strategy is about ten years. The environmental target with regard to the Shoreline and Marine Pollution is:

> **"To reverse and prevent pollution, or risks for pollution of the shoreline and the coastal marine environment, in order to protect the marine ecosystems and public health and to enable a sustainable economic, recreational and tourist development of the area."**

The environmental indicator that will be used to measure to what extent the target has been reached is the actual concentrations of various substances in the seawater. In additional, it is recommended to investigate the assimilative capacity of the coastal sea with regard to maximum emission loads of wastewater. The actual loads can then also be used to 'measure' to what extent the environmental target has been reached.

In order to start tackling the most urgent environmental problems, the urgency itself has to be determined first. The urgency of the environmental issues has been determined through the use of evaluation criteria. They were specified by the PES as follows:

- **Public health impacts,** meaning the (potential) impact an environmental theme has on the public health situation;
- **Ecological impacts**, meaning the impact on the living (non-human) environment;
- **Economic impacts**, meaning the impact on economic productivity and income, including low income groups
- **Cultural and social well-being impacts**, meaning the impact on other aspects of the quality of life;
- **Risk and uncertainties**, meaning the risks that an environmental theme might become much more urgent in the near future, or the uncertainty that a certain environmental theme is not yet well understood and might be more serious than currently assumed.
- **Irreversibility**, meaning the irreversibility of the negative environmental impacts that are associated with the different environmental themes. Or, in other words, the possibilities to mitigate or overcome the negative environmental impacts within a reasonable period

## 4.2 Strategy Elements

The PES contains eleven different strategy elements. The five largest and most urgent elements are: wastewater management; water resources management; solid waste management, agricultural and irrigation management and industrial pollution control. The strategy elements that have direct impact on marine environment are shown in Table 4.1. The first three of these elements are the most urgent ones and the reminder ones are equally important using the prioritization criteria listed in article 4.1 above. Each of these five elements contributes to solving one or more of the environmental themes that are mentioned above. The following table provides an overview.

**Table 4.1 Strategy elements affecting marine pollution**

| No | Strategy Elements |
|---|---|
| 1 | Wastewater Management |
| 2 | Solid Waste Management |
| 3 | Industrial Pollution Control |
| 4 | Agricultural and Irrigation Management |
| 5 | Land use Planning |
| 6 | Public Information and Awareness |
| 7 | Monitoring, Database Management and Studies |

(Source: MEnA 2000)

## 4.3 Priority Actions

In the following sections the main required actions that are needed to address the issues presented in Table 4.1 and have direct impact on marine and coastal areas pollution.

### Wastewater Management

1. Wastewater Collection and Treatment
2. Wastewater Standards and Enforcement
3. Wastewater Cost Recovery

### Solid Waste Management

1. Setting up a non-hazardous domestic and industrial waste collection and transport system, enabling 100% collection coverage.
2. Construction of sanitary landfills for all non-hazardous waste streams that are effective in terms of transportation distances and operational management.
3. Other disposal methods such as separation and composting of organic waste, incineration, separation and recycling of certain waste streams are not considered feasible for the short term.
4. Prevention of open air burning of solid waste, both at the source as on the landfills.
5. Setting up an effective solid waste management system with the municipalities that enables full operation of the solid waste management system.
6. Setting up a separate system for collection and disposal of hazardous industrial waste, small domestic house hold waste and infectious hospital waste.
7. Development of a cost recovery system and institutional management system for the solid waste sector.

**Agricultural Waste Management**

1. Establishment of wastewater treatment standards in relation to allowed reuse by the irrigation sector.
2. Minimization of irrigation water use by detailed analyses of seasonal demands.
3. Setting up a pesticide, herbicides and fertilizer management system for the agricultural sector, including regulations for quantities and types of these materials under certain conditions regarding soil type, water use, crop types, etc. This will also include the establishment of regulations regarding storage and disposal of surplus quantities. It might also include the promotion of biological pest management techniques.
4. Reclaiming of abandoned farm lands has to be encouraged. This might be achieved by stimulating neighboring farmers to take over the land, or through economic incentive measures that stimulate farmers to stay or return to their lands.
5. Many of the proposed measures here have rural economic consequences that cannot be paid by the agricultural sector only. A cost recovery system that meets the above mentioned requirement has, therefore, to be developed.
6. Many of the measures that are proposed here need to be supported by information campaigns directly focused on the agricultural community.

**Industrial Pollution Control**

1. Setting industrial air emissions and wastewater standards, in particular for the chemical industry, tanning industry, textile dyeing industry, foaming industry, electroplating and metal industry, the olive oil mills, the quarrying and stone cutting and charcoal industries. The wastewater standards should include pre-treatment requirements and standards for discharge into the sewer system, as well as full-treatment requirements for direct discharge.
2. Regulations regarding the use of burning fuels, including prohibition or limitation of used oil or other 'dirty' sources of energy.
3. Setting regulations for industrial solid and hazardous waste management, including prevention of uncontrolled dumping of waste and waste burning.
4. Setting regulations for industrial zones, including the establishment of common environmental protection measures, facilities and regulations for traffic and noise emissions.
5. Setting up a monitoring and enforcement system that supports the previous measures.
6. Promotion of relocating polluting industries by moving them away from residential areas to industrial zones.

**Land Use Planning**

1. In the regional development plans, different areas have been defined, representing different levels of sensitivity to certain environmental themes. Examples are groundwater infiltration zones; zones with valuable and fertile soils; natural habitat zones for (endangered) species. The socio-economic activities have to be planned and enforced according to these environmental values. Special emphasis has to be given to the: (1) establishment of groundwater protection zoning in Palestine; (2) allocation of industrial zones.
2. Land use planning should aim at avoiding land use conflicts or competing demands of water and natural resources. In those areas where these conflicts have been noticed, such as the coastal zone of Gaza, proper land allocation and enforcement measures have

to be prepared. Relocation of industrial areas in the abandoned agricultural areas in the eastern part of Gaza might be part of this.
3. Sufficient capacities for infrastructure, transport, public services, facilities and sanitation have to be included in land development plans, in order to prevent negative environmental impacts.
4. Environmental protection and pollution control aspects have to be incorporated in an early stage (such as clustering industries in an industrial estate), in order to maximize the environmental benefits from these investments.

**Public Information and Awareness**

1. Wastewater practices;
2. Collection of solid and hazardous waste;
3. Prevention of waste littering and burning;
4. Information regarding exposure risks from open hazardous waste dumps;
5. Public awareness campaigns focused specifically on the agricultural pollution;
7. Public awareness with focus on the industrial sector.

**Monitoring, Database Management and Studies**

1. Wastewater emission monitoring and database system at major industrial sites and wastewater treatment plants. Special focus to be given to measuring wastewater discharges into the sea.
2. Development of a solid waste and hazardous waste data base, including quantities and types of waste being generated, collected and disposed of.
3. Development of a fertilizer and pesticide application monitoring and database system.
4. Setting up an ambient air quality, dust and emission monitoring and data base system, with special focus on industrial emissions, dense urban centers, stone quarries and transboundary emissions, and setting up a regular car emission measuring system.
5. Conducting studies on the marine coastal environment and biodiversity problems, including fishery.

**Environmental Standards and Guidelines**

1. Appropriate standards for wastewater treatment plant influents and effluents; industrial effluents and seawater.
2. Definition standards for solid hazardous waste and infectious waste.
3. Air emission standards for various emission sources and ambient air quality standards.
4. Development of standards for the application of fertilizers and pesticides.
5. Development of standards and regulations for the protection of nature areas and important ecosystems.

# CHAPTER V

## Implementation Aspects

### 5.1 Policy Instruments

Priority actions have been proposed and elaborated for various strategy elements. The plan has a time span ten years and will be implemented by various authorities, ministries and municipalities under the leadership of EQA. To implement this plan, decisions have to be made on which management principles and policy instruments to apply. Considerations that have to be taken into account are:

1. Regulatory instruments require precise definition of target groups. They have to be feasible and practical, both technically and financially.
2. Economic instruments are effective in situations where target groups are sensitive for financial penalties or incentives. The combination of the two proves to be most effective, for instance, where farmers receive financial incentives when certain obligations are met, and meanwhile are punished through financial penalties when their obligations are not met. An essential condition is that the environmental obligations are well measurable, so as to avoid differences of opinion whether they are met or not, and that the economic situation allows paying penalties if needed.
3. Defining property rights can be a valuable tool to establish responsibilities that stimulate a better environmental care.
4. Information and education aspects contribute to awareness and improve environmental behavior of the people.
5. Public investment is an option to improve the environment including investments in public works. This requires considerable higher investments than the previous policy instruments. Important aspects of public investment are procurement procedures that enable finding the best available techniques and methods for the project against economic prices.
6. The Environmental Impact Assessment (EIA) is a valuable tool in minimizing the environmental impacts of large public and private investments.

### 5.2 Institutional Capacity Building

The implementation of environmental plans and measures requires that the infrastructure is taken fully into account. Special attention has to be given to: (1) realistic and clear division of tasks and responsibilities among the involved authorities, ministries and municipalities; (2) ensuring that knowledge and manpower will be available to prepare and implement the measures. Institutional development and capacity building measures might therefore be necessary prior to the implementation of the environmental measures. It will be the responsibility of EQA to monitor the impacts of the measures on the environment.

### 5.3 Role of non governmental sector

A lot of environmental improvements and actions can be achieved through public awareness and participation, particularly through NGO's. Today NGO's participation in the environmental efforts has great advancement. Strengthening NGO's and promoting their activities in fighting environmental degradation is a must for the success of any environmental efforts. NGO's are very instrumental in enlisting public support and promoting public

awareness. Without such awareness much of the environmental efforts and projects will not meet their objectives. Universities can be involved in research.

### 5.4 Role of Key Stakeholders

The key stakeholders, who have been identified in the early phase of this planning process, have to remain involved in the implementation of this actions and proposed measures. In this respect the following actions will be undertaken:

- An annual high level meeting will be organized to discuss the progress in the implementation of NAP.
- Compilation of a report describing the condition of the environment and the progress in the implementation of NAP, based on selected environmental indicators.

### 5.5 Role of Local Authorities

Local authorities, including regional councils, municipalities, and UNRWA in refugee's camps play an important role in the implementation of NAP and related measures. It is important that during detailed planning of the proposed environmental measures, the roles of all parties of the administrative system are analyzed sufficiently, so as to increase the effectiveness and sustainability of these measures. These roles might relate to various aspects of the implementation, such as construction, operation, monitoring, enforcement, and financial management.

### 5.6 Role of the Public and the Private Sectors

Involvement of the public and private sectors in the implementation of NAP is very important. When the proposed measures have an impact on these sectors, or certain target groups within the society, early communication, explanation of the measures and the direct consequences have to be communicated. During the detailed design of the measures there might also be a role for the public to participate in final formulation of the measures. The EIA procedures that have been adopted by EQA constitute an example of a framework that enables the involvement of the public and the private sectors.

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