5 Environmental Issues

5.1 Natural Environment

(1) Issues and Measures for Natural Environment

1) Biodiversity

a. Flora and Fauna

Egypt has rich natural heritage such as sand dunes, mangroves, oasis, coral reefs as well as coastal and marine resources. It also possesses many rare species. An estimated 18,000 species of flora and fauna are in the Egypt, but there are no quantified estimation of how far the biodiversity losses has gone in Egypt. Confirmed number of flora and fauna are; 132 species of mammals, 514 birds, 98 reptiles and 460 fishes in vertebrates, more than 7,000 of insects as a invertebrate and 2700 of spermatophyte. Among these, 44 animals and 2 deserticolous plants are recognized as endangered species.

Table 5.1: Flora and Fauna in Egypt

Category		No. of families	No. of species	No. of endangered species
Vertebrates	Mammals	24	132	6
	Birds	68	514	17
	Crawler	19	98	6
	Fin	101	460	14
Invertebrate	Insects	309	7,308	1
	Mullosk	106	466	
	Annelid	11	44	
	Crustacea	19	107	
	Brachyuran	22	185	
	Coelenterata	13	42	
	Echinodermata	52	253	
Plants	Spermatophyta	133	2,700	2
	Pteridophyte	12	25	
	Fungi	64	600	

Source: IUCN, *Red List*

Natural forest distribution is limited in the mountain area of the Gebel Elba, at latitude 22º ~ 22º30’ N, and tropical rainforest, mainly composed of acacias and mangrove forest, at the coastal area of the Red Sea. Protectorates of Elba, Ras Mohamed, Nabq, Abu Galum are existed in these areas.

(2) Biodiversity Degradation

1) Causes of Biodiversity Degradation

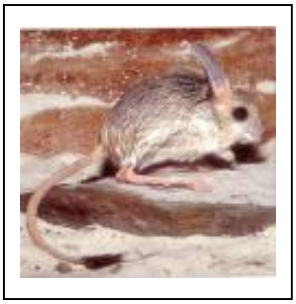
Main sources of biodiversity degradation are development of land, expansion of agricultural land, and disappearance of habitat from excessive grazing or application of agrochemicals, as well as habitats being polluted at the wetland of the Delta area, and hunting, fishing and tourism activities disturbing the natural habitat areas.

Regarding losses of habitats, habitat of mammals like African lion, raptors and bird species like geese & ducks, are in decrease with expansion of agricultural land or stockbreeding. Also animals like desert rats are threatened by development in coastal areas. Many species are adversely affected by human induced pollution, i.e. raptors like lesser kestrel (see Photo 5.4) are for soil pollution, bird species like white-tailed sea eagles and lesser flamingo, are affected for water degradation. On the other hands, mammals such as African lion and Fennec Fox, and bird species such as duck and snipe, are for game hunting, whereas various birds and sea turtles, and fish including gilthead and sandfish are in decrease for hunting for living. Human caused turmoil from tourism is threatening bird species living in coastal region.

Table 5.2: Causes of Biodiversity Degradation

Factors	Threatened Species	
Loss or degradation of habitat	Mammals	Four-toed Jerboa (Allactaga tetradactyla), Ruppell's Sand Fox etc. (Vulpes rueppelli etc.), African Lion(Panthera leo) etc.
	Birds	Saker Falcon, Grey Sea Eagle etc. (Falco cherrug、Haliaeetus albicilla etc.), Sociable Lapwing, Long-billed Curlew etc. (Vanellus gregarius、Numenius tenuirostris etc.), Lesser White-fronted Goose, White-headed Duck etc. (Anser erythropus, Oxyural leucocephala etc.)
	Reptiles	Green Turtle(Chelonia mydas)
	Fishes	Estuary Cod, Brown-marbled Grouper (Epinephelus coioides, Epinephelus fuscoguttatus)
Pollution of habitat, land pollution	Mammals	Flower's Shrew (Crocidura floweri)
	Birds	Hermit Ibis (Geronticus eremita), Black Crowned-crane (Balearica pavonina), Lesser Kestrel, Lapper-faced Vulture etc. (Falco naumanni, Torgos tracheliotus etc.) Great Bustard, Marbled Duck (Otis tarda、Marmaronetta angustirostris etc.)
Pollution of habitat, water pollution	Birds	White-headed Duck(Oxyural leucocephala), Gray sea Eagle(Haliaeetus albicilla), Lesser Flamingo(Phoenicopterus minor) etc.
Hunting for cultural, scientific or recreational demands	Mammals	African Lion(Panthera leo), Fennec Fox(Vulpes zerda)
	Birds	Lesser White-fronted Goose, Ferruginous Duck etc. (Anser erythropus, Aythya nyroca etc.), Black Crowned-crane (Balearica pavonina), Saker Falcon (Falco cherrug), Great Snipe (Gallinago media)

Effect factor	Extinct and threatened species	
Hunting for food	Reptiles	Green Turtle (Chelonia mydas)
	Birds	Hermit Ibis (Geronticus eremita), Yellow-breasted Bunting (Emberiza aureola), White-eyed Gull (Larus leucophthalmus) etc.
	Fishes	Giant Wrasse (Cheilinus undulates), Dusky Grouper, Brown-marbled Grouper (Epinephelus marginatus、Epinephelus fuscoguttatus) etc.
Human caused disturbance: tourism or recreation	Birds	Ferruginous Duck (Aythya nyroca), Grey sea Eagle (Haliaeetus albicilla), Audouin's Gull, White-eyed Gull (Larus audouinii, Larus leucophthalmus) etc.



Four-toed Jerboa
(Allactaga tetradactyla)
(Quoted from www.zoofachgeschaeft-nehils.de)

Fennec Fox
(Vulpes zerda)
(Quoted from www.bvet.admin.ch)

Grey sea Eagle
(Haliaeetus albicilla)
(Quoted from www.ppp.agencjaekoserwis.pl)

Photo 5.1: Some of Threatened Species

2) Status of Secondary Nature (Rural and Urban Areas)

Most agricultural areas that are maintained by human activities, or so-called Secondary Nature, are spread across Nile Valley and Nile Deltas. Almost all indigenous habitats and its species in those areas have long been replaced by valuable agricultural land. Thus, species suited for man-induced habitat – i.e. raptors include hawks, falconine, and barn owl, and bird like heron are inhabited there. Likewise, areas irrigated by groundwater in Northern Sinai and Oasis in Western Desert has similar environment where rare bird species like oxeye and Sinai woodpecker can be seen.

There are species whose habitat relies solely on the environmental condition of secondary nature, and threatened by disappearing habitat from development of social infrastructures, contamination of farmland, and hunting activities.

Due to loss and/or contamination of habitat, mammals like shrew, snipes and plovers, geese, and raptors are in decline.

Glimpse of Agricultural Landscape

Photo 5.2: Holm of River Nile (Cairo)

Rich farmland and waterfront environment can be seen in Cairo, indicating habitats for various wild species exist very close to urban area.

Photo 5.3 Farm and Canal (Saqqara)

Most of canal in agricultural areas is natural bank. Cattle and donkey seems play an important role in farming, and habitat is not likely shrinking by changing farming practices like introducing machineries instead of cattle and donkeys. It should be noted, however, that a large quantity of waste was observed in the canals near villages.

Keelies which sit on top of food chain were observed frequently not only in agricultural area but in urban suburb. Furthermore, Greater Pied Kingfisher and heron that catch and eat fish were also commonly seen in agricultural area. Agricultural area holds diverse biota in general.

Table 5.3: Threatened Species Living in the Secondary Environment

Habitat in Secondary Nature	Threatened Species	
Cultivated area	Mammals	Flower's Shrew, Egyptian Pygmy Shrew (Crcidura floweri, Crocidura religiosa)
	Birds	Sociable Lapwing, Long-bikked Curlew (Vanellus greganus, Numenius tenuirostris), Lesser White-fronted Goose etc. (Anser erythropus, Branta ruficollis etc.), Lesser Kestrel, Greater Spotted Eagle etc. (Falco naumanni, Aquila clanga etc.), Yellow-breasted Bunting (Emberiza aureola) etc.
Pasture area	Birds	Lesser White-fronted Goose, Red-breasted Goose, Great Bustard etc. (Anser erythropus、Branta ruficollis, Otis tarda etc.), Greater Spotted Eagle, Imperial Eagle etc. (Aquila clanga, Aquila heliaca etc.), Corn Crake (Crex crex) etc.
Farmer's backyard	Mammals	Pleasant Gerbil (Gerbillus amoenus)
Artificial waterfront	Birds	Whte-headed Duck, Ferruginous Duck etc. (Oxyural leucocephala、Aythya nyroca etc.), Long-bikked Curlew (Numenius tenuirostris), Baser Reed-waebler (Acrocephalus griseldis) etc.
Urban area	Birds	Lesser Kestrel (Falco naumanni)

Lesser Kestrel
(Falco naumanni)
(Quoted from
www.ittiofauna.org)

Sociable Lapwing
(Vanellus greganus)
(Quoted from www.oiseaux.net)

Photo 5.4 Bird Species Living in Secondary Environment

3) Nature Protectorates

Law 102 of 1983 was enacted as a basis of protective zone network, and EEAA has a responsibility of observing the execution of the law.

To date, 21 areas have been designated as protectorates, close to approximately 8% of the total landmass of Egypt. Egypt also intends to increase this ratio to 15% by 2017 by adding 19 new

protectorates. Those nature protectorates are playing an important role in protecting Egypt's distinctive natural environment, including gulf coastal areas and wetlands.

Table 5.4: Natural Protectorates

Name	Type	Area (km^2)	Year of decree	Objective	Feature
Ras Mohamed	Marine environment protection	480	1983	Protection on marine and land animals	Grassland beach, mangrove, marine animals, and stopover for migrating birds
Zaranik	Internationally important wetland	250	1985	Protection of migrating birds	Bird species including flamingo, pelican, and snipe.
Omayed	Biosphere protection	758	1981	Conservation, sustainable development and support	Coastal dune, saline and fresh water swamp area and animals/ plants.
Ahrash	Eco-system protection	8	1985	Protection of biodiversity in Mediterranean coast line	Forest of acacia, camphorwood and so on.
Elba	Natural protection, natural park	35,600	1985	Protection of unique habitat and biodiversity	Red sea mangrove, coral reef, saline lake, dugong etc.
Saluga and Ghazal	Nature protection	0.5	1986	Protection of precious bird species	Vast expanse of Shrub zone, habitat of migrating birds and resident birds
St. Catherine	Natural park	5,750	1996	Biodiversity protection	Upland ecosystem, ibex, striped hyena etc.
Ashtum El Gamil	Nature conservation	180	1988	Protection of migrating birds	Important wintering spot of birds
Lake Qarun	Internationally important wetland	230	1983	Protection of marine and land animals	Water birds and fishes
Wadi El Rayan	Protective zone	1,759	1989	Protection of unique ecosystem and geological/ cultural resources	Marine fossil, serows, sand fox, and bird species, etc.
Wadi Al Allaqi	Nature protection, biosphere preservation	30,000	1989/ 1993	Protection of genetic diversity of flora and fauna	Yearly and perennial plants, mammals, birds, invertebrate animals
Wadi El Assuti	Protective zone, valley	35	1989	Protection of genetic resources of desert	Deer, goats, bighorn, ostrich, some reptiles, and medical plants etc.
El Hassana Dome	Protective zone, desert	1	1989	Protection of geographical ruins	Precious plants in northern Egypt
Petrified Forest	Protective zone, desert	7	1989	Protection of geographical ruins	Fossil forest, acacia forest, scrub forest etc.
Sannur Cave	Protective zone	12	1992	Protection of geographical ruins	Vast cave result from alabaster
Nabq	Protective	600	1992	Protection of coral	134 species of plants,

Name	Type	Area (km^2)	Year of decree	Objective	Feature
	zone, coastal area			reef and mangrove	heronry, breeding area of osprey etc.
Abu Galum	Wildlife resource	500	1992	Protection of coral reef and mangrove	Mammals such as fox and ibex, lizards, snakes etc.
Taba	Protective zone, water springs	3,590	1998	Protection of rare animals and plants	Rare animals/plants, mammals, birds, 480 species of rate plants and ancient monuments of nomad
Lake Burullus	Protective zone, lake	460	1998	Protection of biodiversity in lake Al Manzara	135 species of land and marine plats, migrating birds etc.
Nile Islands	Protective zone, the Nile river basin	55	1998	Nature protection of 144 small islands in River Nile	16 governorates are involved.
Wadi Digla	Protective zone, valley	60	1999	Protection of unique nature of Digla valley	Valley plants, migratory birds, etc.

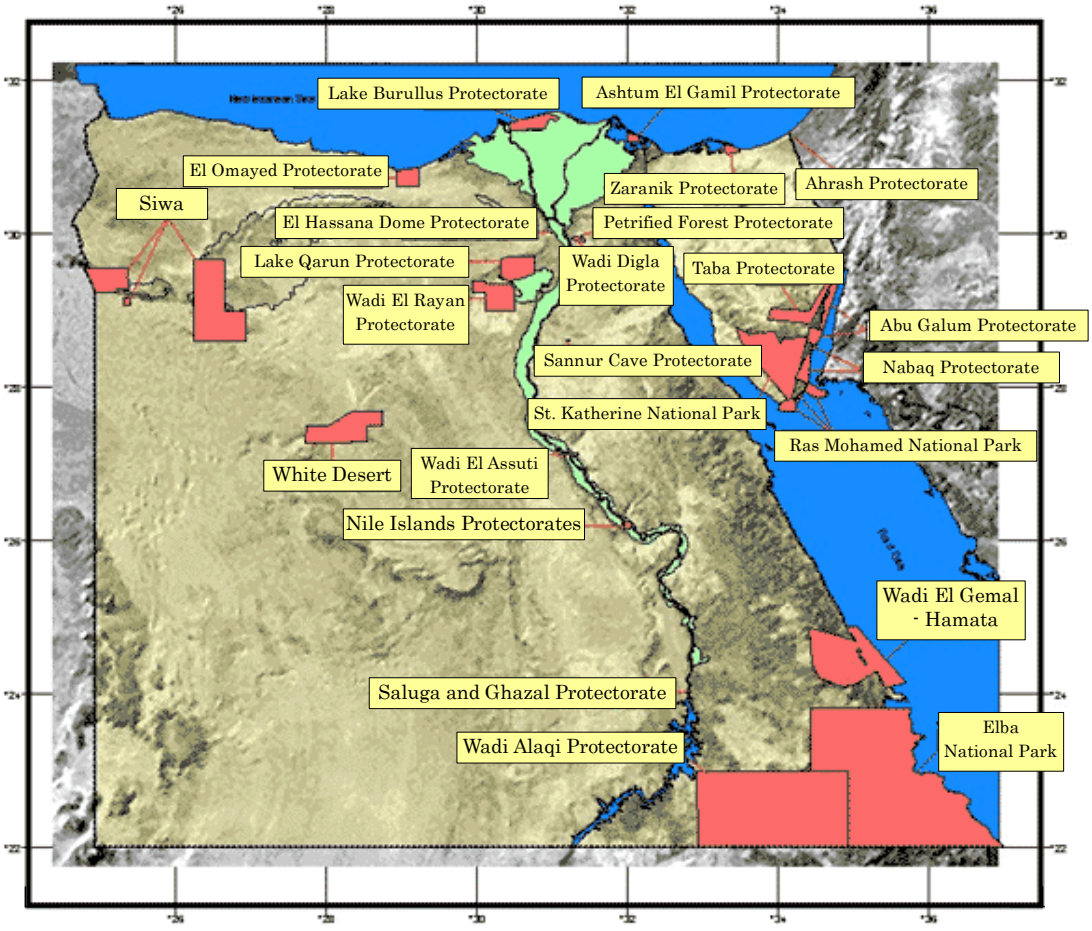


Figure 5.1: Map of Nature Protectorates

4) International Conventions

Egypt is a signatory on numerous international accords concerning biodiversity preservation, such as Convention on Biological Diversity (CBD), Ramsar Convention, and Washington Convention. Lake Bardawi and Lake Burullusl are registered in Ramsar Convention.

Table 5.5: International Conventions Regarding Biodiversity

Conventions	Concluded city	Concluded year
Convention Relative to the preservation of Fauna and Flora in their natural state	London	1933
Agreement for the Establishment of a General Fisheries Council for the Mediterranean	Rome	1951
International Plant Protection Convention	Rome	1953
International Convention for the Prevention of Pollution of the Sea by Oil	London	1963
Phyto-sanitary Convention for Africa	Kinshasa	1968
African Convention on the Conservation of Nature and Natural Resources	Algeria	1968
Convention for the Protection of the Mediterranean Sea Against Pollution	Barcelona	1976
Convention on International Trade in Endangered Species of Wild Fauna and Flora	Washington	1978
International Convention for Regulation of Whaling	Washington	1981
Convention on the Conservation of Migratory Species of Wild Animals	Bonn	1979
United Nations Convention on the Law of the Sea	Montego Bay, Jamaica	1982
Protocol Concerning Mediterranean Specially Protected Areas	Geneva	1983
Convention on Wetlands of International Importance especially as Waterfowl habitat	Ramsar, Iran	1971
Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment	Jeddah	1990
Convention on Biological Diversity	Rio de Janeiro	1992
Agreement for the Establishment of the Near East Plant Protection Organization	Rabat Morocco	1993
International Tropical Timber Agreement	Geneva	1994
Protocol Concerning Specially Protected Area and Biological Diversity in the Mediterranean	Barcelona	1995

5) Foreign Assistance

EEAA has been thrusting various projects for biodiversity conservation with support from international aid institutions. Projects aiming for improving management at protectorates and the capacity building regarding biodiversity conservation are currently undertaken.

Table 5.6: Projects by International Aid Institutions

International Aid Institutions	Projects	Periods
GEF/UNDP	Conservation of Wetlands of Coastal area in the Mediterranean Region	1999-2004
EU	Gulf of Aqaba Protectorate Development project	1995-2002
EU	St. Catherine National Park project	1995-2002
EU/SFD	Capacity building in South Sinai protectorate	1998-2005

International Aid Institutions	Projects	Periods
Government of Italy	Wadi El-Rayan protectorate development project	1998-2001
USAID/GEF	Development program of Red sea area	1998-2001
GEF/UNDP	Developing medical plants adapted to arid ecological systems	2000-2005
UNESCO/FAO/UNEP GEF/World Bank	Sustained management of the lake Nasser	1998-2003
UNESCO/UNEP/CBD GEF/UNDP	Capacity building on conservation and sustainable use of Egyptian biodiversity	1998-1999
UNESCO/FAO Japan aid programme GEF	Establishment of national germplasm bank(s) (natural history museum & captive breeding center)	1998-2003

(3) Desertification and Forest Conservation

1) Current Status of Desertification

Desertification is exacerbating in Egypt mainly from deterioration of irrigated farmland by using low quality water and of farmland utilizing rainwater in northern coastal area in north Sinai, and overgrazing in north costal area.

Desertification can be seen in areas with expanding urban areas, farmland exceeding its ecological capacity and applied excess pesticides, short fallow periods, and population increase, as well as vulnerable ecosystem and its weather, and surface condition – i.e. sand which would speed up the desertification.

United Nations Convention to Combat Desertification (UNCCD) is established in 1994 in which Egypt is a signatory.

In UNCCD, Egypt developed National Action Plan (NAP) for measures against desertification. In NAP, Egypt, from its characteristics of agri-ecosystem, is divided into four divisions – Northern coastal areas, Nile Valley, Oasis and Southern desert, and inland desert.

Aerial photos, satellite images, and GIS database are needed for promoting analysis on study for mechanism of desertification in connection with different land use.

2) Current Status of Afforestation

The government of Egypt is aggressively undertaking greening of environment and implemented in many cities and governorates. It is estimated that Egypt has 2,500 ha of planted forests, which were planted by public and private sector as a windbreak forest to prevent soil erosion and protect waterways and farmland as well as protection against desertification.

Afforestation plays following roles:

- Afforestation contributes to increase crop harvests as a windbreak forest in cultivated

areas.

- Producing economically valuable timbers for furniture by reusing treated water.
- Other than timber, planted trees are used for api- and seri-cultures, raw materials of glue, fodder for sheep and goat, packing materials and fuel.
- Prevent soil contamination by sewage.
- Provide job opportunities for local population.
- Afforestation contributes to preserve ecosystem and biodiversity by providing habitat for wild animals.

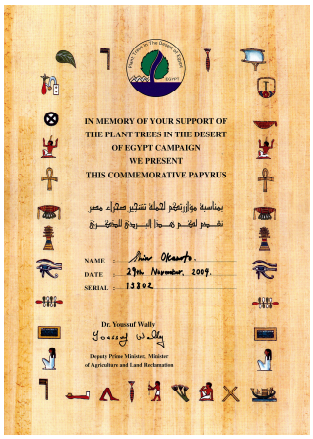


Figure 5.2: Commemorative Papyrus for Participating the Plant Trees in the Desert of Egypt Campaign

'Plant Trees in Desert' campaign is promoted as part of Egypt-Japan friendship effort, in which tourists/visitors can plant 'his/her' tree. The planted tree are given serial numbers, and the person who planted could come back and see the growth of 'his/her' tree in the later years.

3) Organization Involved in Afforestation

The projects are implemented by MALR (playing a central role), line ministries, and universities. These implementing bodies establish tree-planting policy, supply the seeds, introduce new species, carry out actual planting, and disseminate related technologies. Forestry in Egypt is taught in University of Alexisandria Forestry Department where there are programs for collection and analysis of seeds, planting of windbreak, stabilization of sand dune, and utilization of timbers. As for forest study, MALR, University of Alexisandria forestry and agricultural departments, Desert Development Center (DDC), Agricultural Research Center (ARC) are all involved in windbreak for stabilizing sand dunes, farming system in desert, strengthening of seed production, development of multi-purpose trees, and forest technologies.

Example of Afforestation Site

Photo 5.5: Recently Planted Trees (Japanese Friendship Forest)

Pines, eucalyptus, and Cupressus are planted. The trees are planted in 3-meter intervals with drop-irrigation.

Photo 5.6: Cultivation for Supplemental Planting

Nursery trees are grown in shaded area.

Photo 5.7: Growth of Planted Trees

Left: 6 – 7 years old eucalyptus. Already appears as forest.

Right: Having high salinity soil, early lot was very tough for the trees to grow. Nonetheless, tireless effort of staff has paid off and has grown to 6 – 7 meters high. Photo shows the very fast tree planted in this Japanese Friendship Forest.

Table 5.7: List of Organization Related to Afforestation

Ministry of Agriculture and Land Reclamation
The Agricultural Research Center
The Desert Research Center
University Alexandria
Environment Affairs Unit

4) Examples of Projects

MALR has promoting tree plantation using treated sewage water to produce high valued timber trees. The projects are in Menofia, Ismailia, Sinai, New Valley, Aswan, Luxor, Giza, and Behira, and giving positive impact on local economy and environment. It is anticipated to turn Egypt from timber consuming nation to timber producing country in 20 years.

Tree species being planted are African Mahogany (Khaya), Eucalyptus, Malberries, Cupressus, and Pinus, wich would be harvested in 10 to 30 years after the plantation. Tree thinning and pruning are performed, and thinned woods are utilized as timber.

Table 5.8: List of Afforestation Site Using Treated Wastewater

Governorate	Forest	Area (Feddan)[1]
Ismailia	Serabium	1,000
Menoufia	Sadat	500
Luxor	Luxor	1,700
Qena	Qena	500
South Sinai	Tour Sinai	200
Aswan	Edfu	300
New Valley	Al-Kharga	300
	Paris	100
Giza	Abu-Rawash	80
Alexandria	9N	60
South Sinai	Sharm El-Shiekh	60
Daqahlia	Gamassa	150
Giza	El Saff	500

[1] Feddan: 1 feddan = 42.01a or 1.038 acre

Table 5.9: List of Afforestation Site Using Treated Wastewater Under Establishment

Governorate	Forest	Area (Feddan) [1]
Aswan	Ballana	500
Aswan	Nasr-Elnuba	100
Aswan	Wadi El-Alakki	550
Beni Swif	El-Wasta	500
New Valley	Mout	700
Nouth Sinai	El-Arish	200
Asyout	Asyout	40
Sohag	Sohag	1,000
Sohag	Al-Kola	250
	Awlad Azaz	267
Red Sea	Hurgada	200
South Sinai	Noyebaa	200

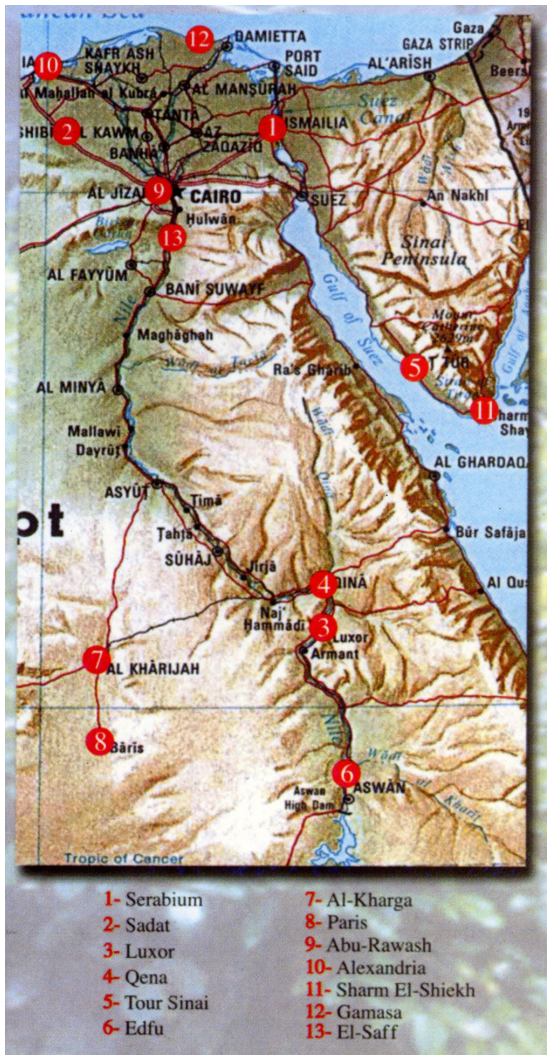


Figure 5.3: Map of Afforestation Site Using Treated Wastewater

5.2 Air Quality

(1) Outline

Poor air quality, especially in urban areas (primarily Greater Cairo, Alexandria and other urban centers), is a major contributor to the high cost of environmental degradation in Egypt. According to an estimate of 1999, the cost of environmental degradation in Egypt is of the order of 4.8% of Gross Domestic Products, or GDP. Of that total amount, 2.1% of GDP (an equivalent to 6.4 billion Egyptian Pounds) is attributed to the impacts of poor air quality on health and quality of life.

The poor air quality is as a result of both natural and anthropogenic sources. These anthropogenic sources may in turn be categorized as stationary (point) sources or mobile (non-point) sources. Stationary sources of air pollution include industrial facilities, thermal power plants and some commercial and residential activities. Other major stationary sources of air pollution include the burning of municipal solid wastes and agricultural residues. Mobile sources indicate passenger cars, buses, trucks and motorcycles. There are an estimated 1.5 million vehicles in Cairo alone.

Photo 5.8: Traffic Congestion in Cairo

For the past five years, there has been continuous public concern related to the degradation of air quality in the major cities of Egypt and, in particular, in Greater Cairo. This concern was sparked by the occurrence of a “Black Cloud” appearing in the skies of the capital around 1999. The cause was a thermal inversion climatic phenomenon trapping air pollutants from a multiple of sources in and around Cairo. One major cause attributed this to the open burning of solid waste in general, and agricultural residues in particular.

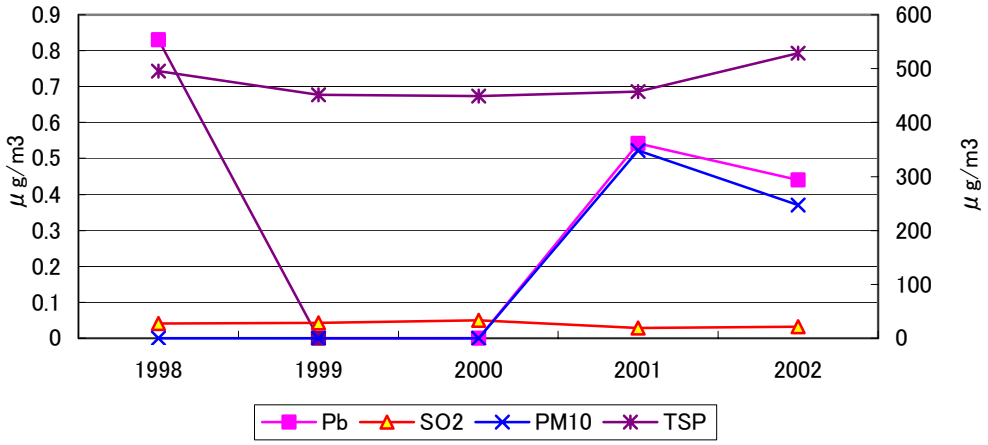
Regarding air pollution, USAID started the Cairo Air Improvement Project in 1997 and completed in 2004. The details and results will be described later.

Following Table 5.10 and Figure 5.4 show the air environmental standard and current air condition in Egypt.

Table 5.10: Ambient Air Quality Limit Values as Given by Law No.4 for Egypt (1994) Compared to the World Health Organization (WHO) Air Quality Guideline Values

Pollutant	Averaging Time	Maximum limit value (μg/m^3)	
		WHO	Egypt
Sulfur Dioxide (SO_2)	1 hour	500 (10 min)	350
	24 hours	125	150
	Year	50	60
Nitrogen Dioxide (NO_2)	1 hour	200	400
	24 hours	-	150
	Year	40-50	-
Ozone (O_3)	1 hours	150-200	200
	8 hours	120	120
Carbon Monoxide (CO)	1 hour	30,000	30,000
	8 hours	10,000	10,000
Black Smoke (BS)	24 hours	50	150
	Year	-	60
Total Suspended Particles (TSP)	24 hours	-	230
	Year	-	90
Particles<10 μm (PM_{10})	24 hours	70	70
Lead (Pb)	Year	0.5-1.0	1

Source: EIMP web site, http://www.eeaa.gov.eg/eimp/limit%20values.html



Note: Pb on left axis, SO_2, PM_{10}, TSP on right axis
Source: Arab Republic of Egypt, Central Agency for Public Mobilisation and Statistics, '1995-2003 STATISTICAL YEAR BOOK of A.R.E', June 2004, pp.374-375

Figure 5.4: Shift in Air Pollutant Density in Cairo

(2) Industrial Air Pollution

- There are 26,000 plants with outdated facilities.
- Fuel conversion is being promoted from mazot, a kind of heavy oil, to CNG. A CIDA supported project established 50 factories using CNG near CNG distribution facility.
- Cement industry is a major stationary source of air pollutants.

Photo 5.9: Brick Factories (mazot combustion)

Photo 5.10: Iron Works at Alexandria

(3) Black Smoke (or Black Cloud)

Since the autumn of 1999, serious air pollution called Black Smoke was started to be observed in Cairo. Sources were unknown in the beginning, but the Analysis Component of the CAIP found that 1) incineration of garbage and farm wastes (mainly straw), and 2) weather condition were both closely related to the occurrence of phenomenon.

Photo 5.11: Generation of Black Smoke from Open Burning

As comprehensive air pollution measures, fuel conversion program, automobile maintenance, industrial pollution control, Black Smoke forecast, and agricultural waste management program were implemented. As a result of these measures, Black Smoke episode is in a downward trend. (See Figure 5.6)

- 2.5 million of rice straws are generating every year and but no efficient way to use. For example, there are only two lumbers in Egypt.
- Systematical measure for transportation system is also necessary besides rice straw utilize technology.

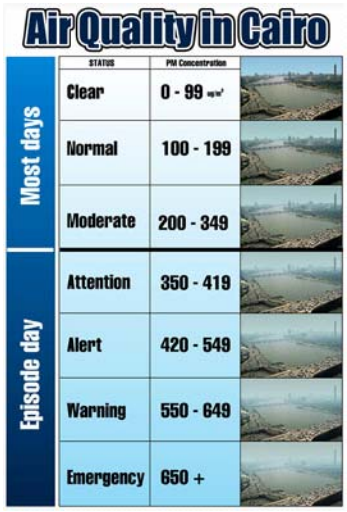
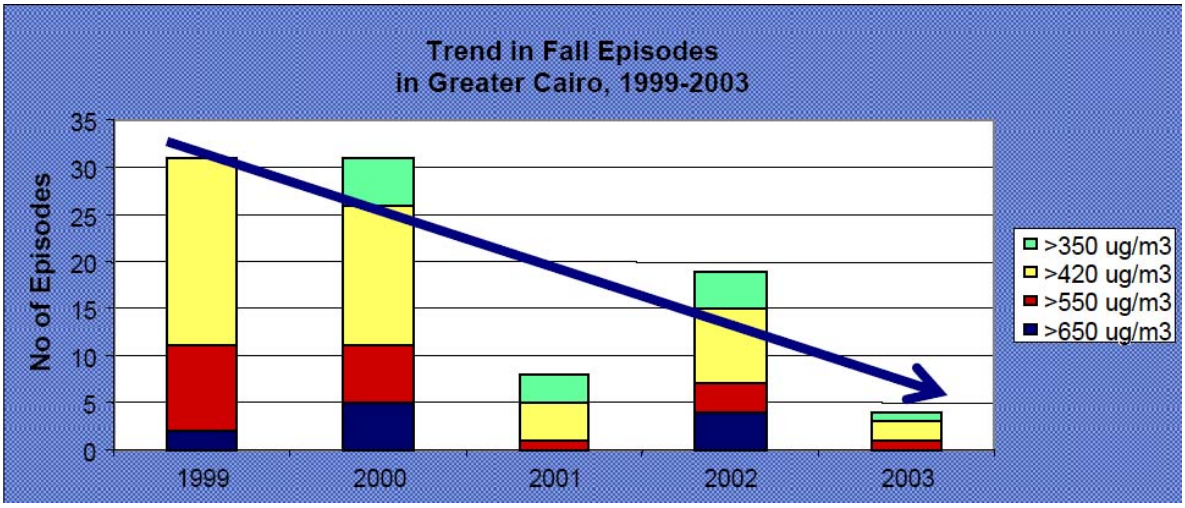


Figure 5.5: Black Smoke Forecast



Source: USAID, "Final Report The Cairo Air Improvement Project – Helping millions live healthier live2s, march 2004, p47

Figure 5.6: Trend in Black Smoke Episodes in Greater Cairo

Table 5.11: Annual Average of Air Pollutant in Each Governorate, Part 1

Governorates	Pb "PM10"					PM10					Pb				
	2002	2001	2000	1999	1998	2002	2001	2000	1999	1998	2002	2001	2000	1999	1998
Cairo	0.214	0.389	0	0	0	246.722	348.68	0	0	0	0.441	0.541	0	0	0.83
Alexandria	0.141	0.164	0	0	0	162	257.606	0	0	0	0.148	0.199	0	0.25	0
Port Said	0	0	0	0	0	0	0	0	0	0	0.13	0.147	0	0.27	0
Suez	0	0	0	0	0	0	0	0	0	0	0.095	0.14	0	0	0
Dmiatta	0	0	0	0	0	0	0	0	0	0	0.12	0.152	0	0	0
Dakahlia	0	0	0	0	0	0	0	0	0	0	0.12	0.16	0	0	0
Sharkia	0	0	0	0	0	0	0	0	0	0	0.11	0	0	0	0
Kalyoubia															
Kafr El Sheikh															
Gharbia	0.081	0	0	0	0	251.42	0	0	412.1	0	0.116	0	0	0	0
Behera															
Ismai1ia															
Beni seuf	0	0	0	0	0	0	0	0	0	0	0.34	0.201	0	0	0
Menia	0.058	0	0	0	0	272.888	0	0	0	0	0.132	0.14	0	0.17	0.27
Asiut	0.172	0.27	0	0	0	263.484	289.286	282.65	0	0	0.318	0.256	0	0.2	0.26
Souhag	0.313	0	0	0	0	648.102	0	0	0	0	0.336	0.221	0	0.2	0
Aswan	0	0	0	0	0	0	0	0	0	0	0.144	0	0	0	0

*Annually Limits allowed: Pb10: 70(Microgram/M3), Pp: 1(Microgram/M3), Smoke:60(Microgram/M3), SO_2:60(Microgram/M4), TSP:90(Microgram/M3),
Source: Ministry of health & Population

Source: Arab Republic of Egypt, Central Agency for Public Mobilisation and Statistics, '1995-2003 STATISTICAL YEAR BOOK of A.R.E', June 2004 pp.374-375

Table 5.11: Annual Average of Air Pollutant in Each Governorate, Part 2

Governorates	TSP					SO_2					Smoke				
	2002	2001	2000	1999	1998	2002	2001	2000	1999	1998	2002	2001	2000	1999	1998
Cairo	528.79	457.55	448.9	452	495.7	21.22	18.9	32.9	28.08	27.1	72.72	89.98	67.3	86.4	75.66
Alexandria	398.16	478.3	372.9	419.2	0	22.41	17.31	14.3	0	0	19.4	18.31	12	11	0
Port Said	224.63	241.41	170.85	202.7	232.97	0	0	6.5	0	0	24.8	28.18	23.9	32	15.7
Suez	183.62	180.65	0	0	364.53	13.27	17.83	0	0	0	22.62	43.83	0	0	28.5
Dmiatta	196.21	149.63	140.9	163.8	169.79	8.02	10.96	6.5	0	0	24.82	25.65	0	21	24.6
Dakahlia	297.39	376.8	0	332.5	0	0	0	0	0	0	31	30.46	0	35	0
Sharkia	267.94	0	0	0	0	33.54	0	0	0	0	52.51	0	0	0	0
Kalyoubia	0	0	0	0	0	24.23	22.3	0	0	0	21.53	20.61	0	0	0
Kafr El Sheikh	0	0	0	0	0	18.2	0	0	0	0	16.59	0	0	0	0
Gharbia	555.69	594.91	654.9	558	540.6	14.04	1.76	0	0	3	154.72	165.72	175.2	189.5	148.4
Behera	0	0	0	0	0	23.65	0	0	0	0	22.69	0	0	0	0
Ismai1ia	0	290.06	0	0	0	8.19	8	0	0	11.8	8.5	11.98	0	0	7.55
Beni seuf	477.71	522.75	0	0	0	0	0	0	0	0	26.67	29.04	0	52	0
Menia	567.13	605.39	0	800.6	853.23	32.33	35.01	0	0	21.3	60.11	64.19	0	56	26.85
Asiut	430.6	425.88	0	352.2	438.18	17.2	17.54	0	0	11.1	46.83	42.14	0	44	42.3
Souhag	1100.38	898.27	0	335.6	0	0	0	0	0	2.22	66.4	67.53	0	59	36.02
Aswan	408.6	365.47	0	367.3	354.35	43.1	31	0	0	30.5	33.44	36.62	0	32	29.5

*Annually Limits allowed: Pb10: 70 (Microgram/M3), Pp: 1(Microgram/M3), Smoke:60(Microgram/M3), SO_2:60(Microgram/M4), TSP:90(Microgram/M3),
Source: Ministry of health & Population

Source: Arab Republic of Egypt, Central Agency for Public Mobilisation and Statistics, '1995-2003 STATISTICAL YEAR BOOK of A.R.E', June 2004 pp.374-375

As Table 5.11 indicates, major air pollutants in Egypt are sulfur dioxide (SO_2), suspended particulate matters (PM10 or TSP) and lead (Pb).

The Environmental Information Monitoring Program (EIMP) with the support from Netherlands started monitoring air quality in 1999 around River Nile, the Delta area and Cairo. Monitoring data is publicized on the EEAA web site every month.

(4) The Cairo Air Improvement Project (CAIP)

The CAIP is USAID run project, which started in 1997 and concluded in March 2004. CAIP aimed to improve the quality of air in the Greater Cairo by including "activities that have some immediate impacts on reducing vehicular emissions and lead while setting the stage for a long term effort through demonstrations and pilot tests of alternative technologies and increased public awareness."

Photo 5.12: Vehicle Emission Testing Center (top)
CNG Fueling Station (left)

Photo 5.13: Lead Smelting; Old Style (left) and New Style Intruded by CAIP (right)

Table 5.12 shows CAIP's main components, activities / results, and future trend.

Table 5.12: CAIP Components and Results and Future Trend

	Contents/ Results	Targets	Future trends
1	Clean Alternative Fuel in Transportation		
	Building CNG-fueled Buses • Use of alternative fuel in corroboration with Cairo Transit Authority (CTA) and private bus company (US technology transfer) • CNG buses: 50 buses Garages for CNG-fueled bus • Constructed at two locations (houses up to 400 CNG buses) Developing Human Resources • Training of drivers, maintenance personnel, managers, and top executives Others • CNG-fueled taxi: 20,000 taxis (1999), CNG-fueling station: 17 stations	Mobile emission source	• CTA: Planning to purchase 25 CNG additional buses (2005)
2	VET: Vehicle Emission Test		
	Put legally mandated program to test and tune up vehicles during the vehicle licensing process Phase 1 • Put testing and diagnostic equipment in private fueling stations for a non-mandatory pilot period. • Developing public awareness and technical capacity in low emission tune up. Phase 2 • On-road testing program for more than 50,000 cars, light trucks, and motorcycles. • Design and construct 'model' testing center (not the National Technical Center operated by EEAA).	Mobile emission source	• Training of technicians and engineers (next year) • Plan to expand the program to rest of the country (4 governorates are preparing specification for testing equipment and are sending participates to on-going training in Cairo). • Tightening the emission limits, and other measures

	Contents／Results	Target	Future trends
3	Lead Pollution Abatement		
	Upgrading and relocating lead smelters. Relocating a factory* controlling about 65% of the national production. ・ Relocation of factory (to outside the densely populated area) ・ Extensive engineering design support, economic analysis, and planning for a local landfill. Small and medium smelters ・ Design and financial support ・ Training Old smelter sites (after the relocation) ・ Assessment of contamination ・ Development of preliminary cleanup plan * Reduced air emissions by 99% through CAIP	Stationary source	・ Create specific cleanup implementation procedures for old smelter site, as well as creating national cleanup guidelines ・ Some sites will be cleaned up by subsequent USAID project.
4	Education and Raising Awareness		
	・ Raise overall awareness of air pollution among general public in Cairo (ex; hazard of lead in gasoline) ・ Awareness raising in each component of CAIP	General public and target of each component	・ Support MESA with a comprehensive information dissemination plan, a part of an overall air quality strategy.
5	Monitoring/Analysis		
	Establishing a network of monitoring sites ・ 36 monitoring stations (Pb, PM_{10}, $PM_{2.5}$) ・ Provide Black Smoke (BS) forecast on website Inventory of lead releases to the air in Cairo Source Attribution Study ・ Vehicles, industry and open burning ・ Identify the causes of 'Black Smoke' episode	Mobile / stationary source	・ Continue the monitoring by EEAA
6	Training		
	・ Held more than 220 sessions (more than 2,800 participants)	Technicians and top managers	・ Continued effort on skills enhancement

CAIP completed its mission in March 2004. However, USAID is going to follow up the CAIP as a part of the Livelihood & Income from Environment (LIFE) project, which is going to be conducted for the next four years. The total budget of the LIFE project is 33 million dollars, the U.S covers the half and another half is from Egypt.

5.3 Water Environment

(1) Scarcity and Degradation of Freshwater in Egypt

The water resources of Egypt could be divided into two systems; the Nile system and the groundwater system in desert area. The Nile system consisting of the Nile River, its branches, the irrigation canals, the agricultural drains and the valley and Delta aquifers. These water resources are interconnected. This system is replenished yearly with approximately 58.5 billion m^3 of freshwater, as is given in the survey by MWRI. Egypt depends on the Nile for almost all of water resources; naturally, it is a crucial issue on how to preserve water quality of the River Nile. On the other hand, water in desert area is in deep sandstone aquifer and is generally non-renewable source, though considerable amounts of water are stored in the groundwater system.

Table 5.13: Water Balance of the River Nile

Items	Water balance (billion m^3/yr)	
	Inflow	Outflow & use
HAD release	55.50	
Effective rainfall	1.00	
Sea water intrusion	2.00	
Total inflow	58.50	
Consumptive use agriculture		40.82
Consumptive use industries		0.91
Consumptive use domestic		0.45
Evaporation		3.00
Total use and evaporation		45.18
Navigation fresh water		0.26
Fayoum terminal drainage		0.65
Delta drainage to the sea		12.41
Total outflow		13.31

Source: MWRI

Water demand in Egypt has been increasing due to population growth, higher standard of living, reclaiming new land, and advancing industrialization. Available water per capita per year for all purpose in 1999 was about 900m^3; nonetheless, it is expected to fall to 670m^3 and 536m^3 by the years 2017 and 2025, respectively. A major challenge facing Egypt today is to manage escalating demand for water from growing population and industrialization.

Table 5.14: National Water Resource Utilization and Development Plan

		Unit	2000		2017	
			Value	Ratio	Value	Ratio
Condition	Population	1,000 people	68,166		89,000	
	Irrigated area	Fadden*	8,167,723		12,000,000	
Water resource	The Nile river	Billion m^3/yr	55.50	82.3	64.50	76.4
	Flood discharge	Billion m^3/yr	1.00	1.5	1.0	1.2
	Groundwater (Sinai)	Billion m^3/yr	0.50	0.7	0.50	0.6
	Groundwater (Delta)	Billion m^3/yr	4.80	7.1	7.50	8.9
	Reuse of irrigation water	Billion m^3/yr	4.90	7.3	8.40	10.0
	Reuse of treated water	Billion m^3/yr	0.70	1.0	2.50	3.0
	Total	Billion m^3/yr	67.40	100.0	84.40	100.0
Water utiliza-tion	Irrigation water	Billion m^3/yr	50.66	75.2	60.0	71.1
	Domestic water	Billion m^3/yr	3.94	5.8	8.80	10.4
	Industrial water	Billion m^3/yr	5.90	8.8	12.50	14.8
	River navigation and river mouth outflow	Billion m^3/yr	6.90	10.2	3.10	3.7
	Total	Billion m^3/yr	67.40	100.0	84.40	100.0
	Daily life water per capita	L/day, capita	158		270	

1 Fadden: 0.42 ha

Source: JICA, "Basic design study report on the project for water supply development in northwest part of Sharqiya Governorate in the Arab Republic of Egypt", Sep. 2003

The Ministry of Water Resources and Irrigation monitors and evaluate freshwater quality including that of groundwater. The quality of the River Nile depends primarily on the water quality of Lake Nasser and to some extent and the upper reaches of the Nile. Downstream changes in river water quality occur due to followings:

1. The hydrodynamic regime of the river regulated by different barrages,
2. The water quality of agricultural return flows,
3. Domestic and industrial wastewater discharges.

Individual pollution sources and conditions of water pollutions are described below.

(2) Sewage Treatment

1) Sewage Treatment in Rural Area

An estimated 10 million cubic meters of domestic wastewater is generated by all governorates per day, in which approximately 1.6 billion cubic meters/year receives treatment. Access to sewerage systems is predominantly in urban areas, with about 77% of the population of Cairo connected to sewage collection networks. In rural areas, where about half of the population reside (35 million people), 95% of the people have no access to sewer systems or wastewater treatment facilities.

Table 5.15: Water Supply and Sanitation Coverage across Egypt

Governorates	Population (1,000)	Population connected to public network (%)	
		Water	Sanitation
Cairo	6,810	80.49	75.03
Alexandria	3,339	90.03	60.56
Port Said	472	89.42	41.83
Suez	418	63.24	89.38
Urban Sub-total	11,030	80.42	66.60
Damietta	914	88.94	45.87
Daqahlia	4,224	77.89	44.43
Sharqia	4,281	54.00	28.96
Qalybia	3,301	54.54	22.46
Kafr-El-Sheikh	2,224	66.89	16.01
Gharbia	3,406	69.34	18.33
Menofia	2,706	52.69	6.03
Behira	3,994	51.60	10.88
Ismalia	715	57.63	23.97
Lower Egypt Sub-total	25,819	62.52	23.50
Giza	4,784	71.05	39.14
Beni Suef	1,859	38.35	4.71
Faiyum	1,990	49.37	12.07
Minya	3,310	31.99	2.95
Asyut	2,802	49.74	3.90
Sohag	3,123	45.67	4.38
Qena	2,442	43.71	4.00
Aswan	974	41.61	6.88
Luxor	361	55.47	9.10
Upper Egypt Sub-total	21,646	37.27	9.98
Red Sea	157	46.57	9.92
New Valley	142	80.34	68.60
Matrohh	212	54.52	12.45
North Sinai	252	74.54	22.08
South Sinai	55	33.61	24.75
Frontier Sub-total	818	62.15	26.48
Total	59,313	59.75	26.25

Source: EcoConServ, 'The Study on Status of the Environment and Relevant Policies/Measures in Egypt', 2005

In rural areas, septic tanks are mostly used, and the wastewater is partially cleaned. In the rural areas of the Nile Delta, where high population densities exist along with high groundwater table, serious health risks arise from this practice, as the not-fully treated wastewater seeps into the ground and contaminate the groundwater. Raw sewage is also discharged into the agricultural drains in Upper Egypt. All drains flow back into the Nile. In areas, where wastewater treatment facilities exist, the flows of municipal wastewaters greatly exceed the design capacity of the plants and this overload results in a poor effluent quality. This, in turn, further degrades the water quality in the agricultural drains. As such, mixing drainage water with the freshwater for irrigation purposes brings concern to the use of this water public health.

Photo 5.14: Canal Polluted with Solid Waste

2) Sewage Treatment in Urban Area

Many wastewater collection networks in urban areas, especially in Cairo, serve industries and commercial activities, which bring high levels of potentially toxic substances, such as heavy metals and organic pollutants. These elements become concentrated in the sewage sludge, which also produces a problem for the safe disposal and/ or reuse of this sludge. According to National Water Resources Plan, 2002, an additional capacity of treatment plants equivalent to 1.7 BCM is targeted by the year 2017. Although the capacity increase is significant, it will not be sufficient to cope with the future increase in wastewater production from municipal sources and therefore, the untreated loads that will reach water bodies are not expected to decline.

Table 5.16: Projections of Wastewater Treatment Coverage

Year	Population	People Serves	People Not Served
1997	60 Million	18 Million	42 Million
2017	83 Million	39 Million	44 Million

Source: EcoConServ, 'Study on Status of the Environment and Relevant Policies/Measures in Egypt', Feb. 2005

Table 5.17: Design Capacity and Actual Treatment Amount of Sewage Plant in Each Governorate in 2002

Governorates	Actual sewages (unit: 1,000m^3)	Average capacity (unit: 100m^3/hr)	Design capacity (unit: 100m^3/hr)
Beni-Suef	756	5	6
Fayoum	10,389	15	16
Menia	20,867	93	131
Asyout	9,947	123	157
Suhag	10,870	64	99
Qena	357,318	426	836
Aswan	26,820	718	1,122
Luxur	41,300	540	740
ElWadi ElGidid	8,340	12	17
Matrouh	475	13	69
North Sinai	31,098	43	80
South Sinai	3,587	11	61
Cairo	1,903,293	2354	2,989
Alexandria	2,552,102	2508	6117
Port-Said	36,606	611	687
Suez	606,587	2,920	4,340
Damietta	66,547	88	88
Dakahlia	226,886	345	1,075
Sharkia	77,899	4,868	5,187
Kalyoubia	96,540	1,850	2,027
Kafr-ElSheikh	72,738	804	823
Gharbia	84,435	2,906	8,530
Menoufia	384,143	632	1,613
Behera	335,574	655	1,525
Ismailia	21,883	335	672
Giza	46,415	1,337	13,828
Total	6,511,648	22,213	49,501

Note: The statement include only main stations, exclude the sub stations which pump water to main stations.

Source: Arab Republic of Egypt Central Agency for Public Mobilisation and Statistics, 'the Statistical Year Book 1995-2003', June 2004

The study team visited a sewage treatment plant that was built with the support from USAID. The station adopts activated sludge process and treats 2,350m^3/day, BOD 500mg/L before treatment and BOD50 mg/L after the treatment. Excess sludge was dumped to neighboring MSW landfill site. The interview survey revealed that there were many sewage treatment plants that simply treat the wastewater with sedimentation and aerobic- anaerobic lagoon using commodious land, and do not meet effluent standards. It is easily recognizable to see the poor condition of drainage canals in urban area, like Giza, where wastewater is contaminated with organic and/or humin matters and turned to black. Development of sewage system in urban

and suburban areas, as well as simple and low-cost treatment facility for night soil and domestic wastewater in rural area should be promoted and disseminated in Egypt.

(3) Urban Sewage, Industrial Effluent, and Groundwater

1) Municipal Wastewater

Of the sources of pollution to the River Nile, discharge of raw sewage, especially in the rural areas is the most critical. Most waterways receive raw sewage either directly from housing units or sewage/ sludge emptying trucks.

Photo 5.15: Water Pollution Status of Canal in Cairo

2) Industrial Wastewater

There are estimated to be some 24,000 industrial enterprises in Egypt, of which about 700 are major industrial facilities. In general, the majority of heavy industry is concentrated in Greater Cairo and Alexandria. Approximately 387 million cubic meters of industrial effluents are discharged to the Nile, its canals and drains. Some 34 large industrial facilities discharge into the Nile between Aswan and Cairo. However, ten of these facilities still were not in compliance with some of the effluent concentration discharge standards set in Law 48/1982 (seeTable 5.18). By directing industrial discharges to the sewerage networks, municipal wastewater treatment plants would be overloaded and their efficiency would be reduced.

Table 5.18: Effluent Quality from Major Industries Discharging to the Nile

	Law 48 limits & recorded discharges levels (exceeded standards in bold)								
Source of Pollution	pH (6-9)	BOD 30 mg/L	COD 40 mg/L	TDS 1,200 mg/L	TSS 30 mg/L	Oil & Grease 5mg/L	Nitrate 30 mg/L	In-organ Phosp. 1 mg/L	Fe 1 mg/L
Kima Factory (Aswan)	**9.4**	4	55	**1,920**	15	**6.4**	**450**	0.20	0.11

	Law 48 limits & recorded discharges levels (exceeded standards in bold)								
Source of Pollution	pH (6-9)	BOD 30 mg/L	COD 40 mg/L	TDS 1,200 mg/L	TSS 30 mg/L	Oil & Grease 5mg/L	Nitrate 30 mg/L	In-organ Phosp. 1 mg/L	Fe 1 mg/L
Kom Imbou Sugar Factory	5.7	**83**	**657**	410	**67**	**9.3**	2.1	0.06	0,85
Idfou-1 Sugar Factory	**9.3**	**410**	**1,440**	365	**65**	**5.6**	2.2	0.04	0.23
Idfou-2 Sugar Factory	5.2	**81**	**600**	225	**42**	**5.6**	1.3	0.04	0.74
Qous Sugar Factory	7.5	77	**189**	240	22	--	1.0	0.15	0.40
Sohag Oil Factory	7.6	8.5	33	**1,374**	**145**	**7.3**	3.5	0.04	0.39
Coca Cola Bottling Factory	**11.3**	**83**	**256**	737	**39**	**5.9**	3.5	0.14	0.27
Elhwamdia Sugar Factory	1.1	**440**	**3,850**	**8,192**	**60**	**17.6**	10	**7.50**	--
Salt and Soda Factory	--	**130**	**155**	--	**387**	**9.4**	--	--	--
Talkha Fertilizer Factory	**10.2**	**98**	**204**	**1,350**	**67**	**7.6**	**128**	--	--

Notes: dash (--) indicates information not available.
Source: Ministry of Water Resources & Irrigation, Data as of February 2000

3) Groundwater

Ministry of Water Resources and Irrigation developed underground water quality monitoring network with the support of the government of Netherlands. According to this network, high concentration of TDS, sulfate group and nitric were found from the groundwater in landfill sites in the Nile Delta. In addition, salinity of this groundwater is high, and there is an indication of spread of this contaminated groundwater to another area of the central region. Quality of groundwater in central Delta, Nile Valley and desert area are not deteriorated.

However, in case of groundwater pollution, flux and diffusion velocity of pollutant are extremely slow comparing to surface water. If hazardous groundwater contamination were found in wide-area monitoring, it is easily anticipated that the contamination would have been widely spread already. Once groundwater is contaminated, it is not practical to expect natural mechanism would cleanup the pollution. Also, in case of soil and groundwater contamination, restoration effort requires tremendous amounts of money and time. Therefore, in case of groundwater pollution, wide-area monitoring is necessary but it is also important, in a future, to monitor particular hazardous substances in areas anticipated contamination. Pollution caused

by hazardous substances, like chlorinated organic solvent, and groundwater pollution around waste management facilities in industrial area should be particularly paid attention. The monitoring of hazardous pollutants has not been implemented in full scale according to Groundwater Research Institute.

(4) Agricultural Drainage

1) Water Contamination in Agricultural Drainage Canals

Throughout Egypt, the course of irrigation and drainage canals is a total of approximately 55,000 km. Degradation of water quality in the Nile River and associated irrigation and drainage canals is a major issue in Egypt. Various agencies and ministries undertake water quality monitoring of the Nile River and associated irrigation and drainage canals. Each monitoring program has different objectives, different sampling locations and covers different water quality parameters. Furthermore, most of these monitoring activities are not conducted on a regular basis. Also, there are many gaps in geographical coverage, with the main Nile River receiving the most attention. Monitoring of the canals has only recently been included in the monitoring programs and information about water quality along the length of drains in Upper Egypt is very limited. Most water quality monitoring programs focus on conventional parameters and limited data is available on important parameters such as pesticides, heavy metals and hydrocarbons.

Pollutants included not only agricultural wastewater alone but also industrial wastewater and municipal wastewater as well.

Photo 5.16: Agricultural Drain Polluted with Solid Wastes, Sewage and Dead Animals

Being the largest consumer of water, agriculture is also a contributor to water pollution. Drainage water seeping from agriculture fields is considered a non-point source of pollution.

The water is collected and concentrated in agricultural drains and pollutes the River Nile, the Northern Lakes, and irrigates canals in case of mixing water for reuse. Moreover, these non-point sources of pollution may also influence the groundwater quality. Major pollutants in agricultural drains are salts; nutrients (phosphorus & nitrogen); pesticide residues (from irrigated fields), pathogens (from domestic wastewater), and toxic organic and inorganic matters (from domestic and industrial sources).

The Egyptian Public Authority for Drainage Projects (EPADP) is responsible for the improvement and maintenance of land drainage networks in the agricultural lands of Egypt. It has the following tasks:

- Determine the desired water table conditions that permit an optimum crop production;
- Identify areas where poor drainage conditions limit crop production;
- Design, install, operate and maintain drainage systems for these areas according to a set of design criteria that prescribe effective and efficient water table control;
- Transfer ownership and responsibilities to the system users, i.e. the farmers

EPADP has installed sub-surface and surface drainage systems to reduce water-logging (high water table) and prevent salinization of agricultural lands. The provision of over 2.5 million hectares with drainage systems was started in 1973 and expected to complete in 2010.

2) Water Quality in Agricultural Drains in Upper Egypt

According to a recent survey of water quality in the Nile River system in Egypt carried out by the USAID funded Agricultural Policy Reform Program, there are 67 agricultural drains discharging into the Nile River in Upper Egypt (from Aswan to the Delta Barrage). The data indicates that out of the 43 major drains in Upper Egypt, only 10 are in compliance with the standards set by Law 48/1982 (Article 65) regulating the quality of drainage water which can be mixed with fresh water. Table 5.19 shows the water quality of 43 points of agricultural drains and Table 5.20 shows the organic loads (COD load, BOD load) and inorganic loads. In terms of organic load, it was found that the highest organic load was discharged from Com Ombo drain (21.8 ton COD/day, 5.97 ton BOD/day). This is followed by El-Berba drain (17.3 ton COD/day; 6.5 ton BOD/day). It is worth mentioning that these two drains contribute 76% of the total organic load (calculated as COD) discharged into the Nile by drains from Aswan to Delta Barrage.[1]

Table 5.19: Water Quality of Agricultural Drains in Upper Egypt

[1] Calculation based on data shown in Table 5.19 will indicates the highest COD / BOD value in Esta; however, it is most likely the calculation made in the referred data (from USAID) was wrong. According to EcoConServ, discharge at Com Ombo may be 1.4 million m^3/day, instead of 0.14 million m^3/day.

No.	Drain name	Location (km)	Discharge mm^3/day	COD mg /l	BOD mg /l	DO mg/l	TDS mg/l	FC MPN/100ml	Heavy Metals
	Consent standard			15 mg/l	10 mg/l	5 mgO_2/l	500 mg/l	5.00E+03	3 mg/l
1	Khour El sail Aswan	9.9	0.10	102	32.80	1.91	1190	3.25E+04	0.31
2	El Tawansa	37.3	0.01	8	1.01	6.16	710	3.50E+03	0.50
3	El Ghaba	46.6	0.19	11	1.00	7.8	570	1.85E+03	0.75
4	Abu Wanass	47.2	0.20	7	1.28	7.03	463	3.00E+03	0.39
5	Main Draw	48.9	40 l/s	17	1.48	7.34	460	3.00E+04	0.61
6	El Berba	49.1	0.15	113	42.70	3.85	414	2.25E+04	0.70
7	Com Ombo	51.0	0.14	151.6	41.50	2.25	325	2.25E+04	2.15
8	Menaha	55.0	-	4	1.52	7.86	285	7.50E+03	0.26
9	Main Ekleet	57.0	0.02	4	1.53	9.21	340	1.50E+03	2.44
10	El Raghama	64.7	0.04	10	1.55	8.56	390	1.75E+03	0.30
11	Fatera	70.5	0.78	5	2.04	7.7	564	3.50E+03	0.54
12	Khour El sail	70.8	0.17	2	1.05	9.07	500	2.00E+03	0.34
13	Selsela	73.9	50 l/s	3	1.25	6.38	380	3.20E+03	1.26
14	Radisia	99.9	0.13	16	3.06	9.02	1430	2.30E+03	0.22
15	Edfu	116.2	0.27	15	1.59	9.49	817	3.00E+03	2.37
16	Houd El Sebaia	139.5	0.05	16	1.83	6.77	495	1.75E+04	0.76
17	Hegr El Sebaia	149.1	0.05	19	2.55	7.82	670	4.50E+03	0.51
18	Mataana	187.7	0.12	39	3.15	6.45	613	1.75E+04	1.29
19	El Zeinia	236.0	NA	NA	NA	*	*	*	NA
20	Habil El Sharky	237.7	0.08	30	1.78	8.45	560	4.00E+02	1.06
21	Danfik	251.6	0.01	34	2.52	8.51	367	1.50E+03	1.05
22	Sheikia	265.3	0.06	37	1.72	7.55	662	3.75E+03	4.68
23	El Ballas	270.7	0.01	144	10.78	9.17	1395	1.50E+04	0.59
24	Qift	275.9	0.03	30	1.60	9.11	375	2.50E+03	0.39
25	Hamed	331.2	0.07	11	1.00	7.18	1015	9.00E+02	0.35
26	Magrour Hoe	340.4	0.06	21	3.24	8.2	185	1.60E+03	1.05
27	Naga Hammadie	377.8	0.21	13	2.17	8.11	375	3.30E+03	1.67
28	Mazata	392.8	0.01	10	2.19	8.37	495	2.50E+02	0.23
29	Essawia	432.7	0.07	9	2.43	6.61	200	1.50E+03	0.51
30	Souhag	444.6	0.05	9	2.81	7.42	440	8.00E+02	0.38
31	Tahta	486.4	0.01	21	2.01	7.86	980	1.40E+03	0.29
32	El Badary	525.4	0.12	6	3.27	7.25	255	9.00E+02	0.48
33	Bany Shaker	588.6	0.02	13	2.25	7.47	485	1.00E+04	0.30
34	El Rayamoun	637.4	NA	21	15.85	2.77	290	1.50E+03	0.16
35	Etsa	701.2	0.57	100	38.00	1.58	575	3.50E+04	0.19
36	Absoug	780.5	0.19	29	1.89	7.34	640	3.00E+03	0.34
37	Ahnasia	807.2	0.54	14	1.31	7.08	610	3.75E+03	0.26
38	El Saff	871.3	NA	NA	NA	*	*	*	NA
39	El Massanda	879.6	0.14	45	4.99	5.57	715	3.00E+03	0.19
40	Ghamaza El	884.5	0.06	42	2.52	6.37	235	9.50E+02	0.46

No.	Drain name	Location (km)	Discharge mm^3/day	COD mg /l	BOD mg /l	DO mg/l	TDS mg/l	FC MPN/100ml	Heavy Metals
	Consent standard			15 mg/l	10 mg/l	5 mgO_2/l	500 mg/l	5.00E+03	3 mg/l
	Soghra								
41	Ghamaza El Kobra	885.0	0.05	32	3.79	7.39	290	7.50E+02	0.28
42	El Tibeen	898.1	0.02	25	15.20	3.71	840	3.25E+04	0.39
43	Khour Sail Badrashin	910.2	NA	NA	NA	*	*	*	NA

Note: FC=number of fecal coliforms, ＊: unknown
Source: based on EcoConServ, "Study on Status of the Environment and Relevant Policies/Measures in Egypt", 2005

Table 5.20: Loads of Organic and Inorganic Pollutants Discharged into the Nile from Upper Egypt Drains

No.	Drain name	Location (km)	Discharge $1000m^3$/day	COD (kg /day)	BOD (kg/day)	Heavy metals (kg/day)
1	Khour El sail Aswan	9.9	98.84	1,008.14	324.19	30.33
2	El Tawansa	37.25	6.48	5.19	0.66	3.25
3	El Ghaba	46.55	194.09	213.50	19.41	146.34
4	Abu Wanass	47.15	199.06	139.34	25.48	78.33
5	Main Draw	48.85	3.46	5.88	0.52	2.11
6	El Berba	49.1	152.82	17,268.66	6,525.41	107.20
7	Com Ombo	51	143.87	21,809.93	5,970.40	309.12
8	Menaha	55	NA	NA	NA	NA
9	Main Ekleet	57	20.17	8.07	3.09	49.17
10	El Raghama	64.65	44.71	44.71	6.93	13.35
11	Fatera	70.45	779.49	389.75	159.02	418.20
12	Khour El sail	70.75	170.39	34.08	17.89	58.02
13	Selsela	73.85	4.32	1.30	0.54	5.45
14	Radisia	99.85	130.7	209.12	39.99	29.08
15	Edfu	116.2	268.9	403.35	42.76	637.43
16	Houd El Sebaia	139.5	48.99	78.38	8.97	37.26
17	Hegr El Sebaia	149.1	49.54	94.13	12.63	25.24
18	Mataana	187.7	122.50	477.75	38.59	158.21
19	El Zeinia	236	NA	NA	NA	NA
20	Habil El Sharky	237.7	79.12	237.36	14.08	84.22
21	Danfik	251.55	8.22	27.96	2.07	8.66
22	Sheikia	265.3	59.83	221.37	10.29	279.79
23	El Ballas	270.7	6.38	91.92	6.88	3.79
24	Qift	275.9	32.64	97.91	5.22	12.74
25	Hamed	331.2	67.07	73.78	6.71	23.24
26	Magrour Hoe	340.35	58.71	123.29	19.02	61.50
27	Naga Hammadie	377.8	214.9	279.37	46.63	359.21
28	Mazata	392.75	5.87	5.87	1.29	1.33
29	Essawia	432.7	74.20	66.78	18.03	37.732
30	Souhag	444.55	47.5	42.75	13.35	18.26

No.	Drain name	Location (km)	Discharge 1000m^3/day	COD (kg /day)	BOD (kg/day)	Heavy metals (kg/day)
31	Tahta	486.4	6.28	13.18	1.26	1.83
32	El Badary	525.4	119.94	71.96	39.22	57.03
33	Bany Shaker	588.6	19.60	25.48	4.41	5.97
34	El Rayamoun	637.4	NA	NA	NA	NA
35	Etsa	701.15	567.98	5,679.76	2,158.31	105.36
36	Absoug	780.5	194.39	563.72	36.74	66.97
37	Ahnasia	807.2	541.65	758.31	70.96	138.93
38	El Saff	871.3	NA	NA	NA	NA
39	El Massanda	879.6	141.48	636.66	70.60	26.24
40	Ghamaza El Soghra	884.5	59.62	250.39	15.02	27.21
41	Ghamaza El Kobra	884.95	48.04	153.72	18.21	13.62
42	El Tibeen	898.1	20.17	50.43	30.66	7.80
43	Khour Sail Badrashin	910.15	NA	NA	NA	NA
Total			0	51,663.21	15,785.41	3,449.52

Source: Data from EcoConServ, "Study on Status of the Environment and Relevant Policies/Measures in Egypt", 2005

3) Water Quality of Agricultural Drain in the Delta Region

Delta drains receive discharge from predominantly untreated or poorly treated wastewater (domestic & industrial), as well as drainage of agricultural areas. Furthermore the drainage water in the Delta region is becoming more saline; on average its salinity increased from 2,400 g/m^3 in 1985 to 2,750 g/m^3 in 1995. The salinity concentrations also exhibit an increasing trend in a northwards direction. For example, in the southern part of the Nile Delta drainage water has salinity between 750 and 1,000 g/m^3, whereas the salinity in the middle parts of the Delta reaches about 2,000 g/m^3 and in the northern parts between 3500 and 6000 g/m^3. In a recent study published by the Drainage Research Institute (2000), it has been estimated that the Delta and Fayoum drains receive about 13.5 billion cubic meters of wastewaters per year. Almost 90% of which is contributed from agricultural diffuse source, 6.2% from domestic point sources, 3.5% from domestic diffuse sources and the rest (3.5%) from industrial point sources. It was also found that Bahr El-Baqar drain received the greatest amount of waste water (about 3 billion cubic meters/year). In terms of organic loads, as expressed by COD and BOD values, Bahr El-Baqar drain also receives the highest load. See Annex (Chap. 5.1.3, pp36) for the water quality of major drainages.

Table 5.21: Breakdown of Inflow into Agricultural Drainages in the Delta Area

Unit: (1,000m^3/day)

Drain	Domestic Point sourcees	Industrial Point Sources	Domestic Diffuse sources	Agricultural Diffuse sources	Total
Bahr El-Baqar	184	64	123	4,522	6,549
Bahr Hados	80	6	208	4,836	5,130
Faraskour	2	0	13	187	203
El-Serw El-Asfal	8	0	19	509	535
El-Gharbia Main	157	44	293	3,928	4,422
Tala	0	0	45	1,087	1,134
Sabal	79	0	40	1,196	1,315
No. 8	0	0	42	470	512
Bahr Nashart	22	14	109	969	1,114
No. 7	13	0	40	390	442
No. 1	39	21	78	1,205	1,343
No. 9	0	0	88	596	684
Zaghloul	0	0	2	123	125
Edko	20	7	57	4,232	4,317
Borg Rashid	0	0	0	311	311
El-Umoum	25	0	82	5,163	5,270
Abu-Keer	0	23	16	622	660
El-Batts	22	0	26	1,468	1,517
El-Wadi	3	0	13	1,600	1,617
Total (m^3/day)	2,312	180	1,295	33,413	37,200
Total (Billion m^3/year)	0.84	0.066	0.47	12.2	13.6
% Ratio	6.20%	0.50%	3.50%	89.70%	

Canal Operation

Photo 5.17: Pump Station at Alexandria

In Egypt, there are 32 pump stations centering on the Delta area. Eight stations are forced to stop their operation because of water quality degradation caused by inflow of untreated domestic wastewater, factory effluent, agricultural wastewater and solid waste dumping.

Photo 5.18: Dragged Material Containing Municipal Waste in Canal at Alexandria

Although canals are dredged periodically, sediments and waste after dredging are piled around canals (right photo). The dredged sediments and wastes are back into the canal after awhile (left photo). These scenes are seen in water supply, drainage and agricultural canal.

(5) Pollution in Brackish–Water Lake in Northern Delta

Four coastal lagoons fringe the North coast of the Nile Delta area in Egypt: Lake Manzala, Lake Mariout, Lake Edku and Lake Burullus. One further lake also borders the Mediterranean Sea in the North of Egypt, Lake Bardawil in the Sinai Peninsula. The environmental quality of Lake Bardawil, which is a Ramsar site is considered to be pristine. The other four lakes on the North coast of Egypt, however, suffer from a great deal of environmental pressures.

Figure 5.7: Location of Brackish-Water Lakes

- <u>Lake Manzala</u>

  Lake Manzala is located on the northeastern edge of the Nile Delta, separated from the Mediterranean Sea by a sandy beach ridge. The two water bodies are connected at three points, allowing for some water exchange. The lake is large, shallow, and brackish and exposed to high levels of pollutants from industrial, domestic, and agricultural sources. The Bahr El Baqar drain transports water from eastern Cairo for 170 kilometers to the lake, carrying large amounts of particulate matter, nutrients, bacteria, heavy metals, and toxic organics. Methane and hydrogen sulphide bubble up to the surface, releasing greenhouse gases.

  Fish production overall is high and once supplied 30 percent of Egypt's total catch. In recent years, however, Lake Manzala's fish have had a reputation for being chemically and microbially contaminated. Tainted drinking water from the lake leads to enteric diseases. Fish and bird species have substantially declined in the area. Land reclamation has also reduced the lake surface by half, and, despite declining quality of life and standards of living near the lake, human populations are increasing, exacerbating the lake's problems.

- **Lake Mariout**

Composed of five main basins separated by sand banks, with an approximate total area of 17,000 feddans, Lake Mariout is the smallest of the Northern lakes. It is also considered to be the most polluted. Also, being approximately 20 meters away from the Mediterranean Sea, it does not have a direct discharge point out to sea to aid in its purification. The depth of the water in Lake Mariout ranges between 3-5 meters. The only discharge point from the lake is through the Mex pumping station, which regulates the water level in the lake (2.2-2.4 meters above sea level).

Agricultural drains are the major sources of water for the lake but the effluents from a petroleum refinery and a number of other industries also directly discharge their effluents into the lake. The discharges to the lake may be divided agricultural drainage water from Omum drain (60%), agricultural drainage water from Nubariyah Canal (22%) and untreated industrial effluents and partially treated sewage (13%).

The next table shows the inflow water quality into the lake but harmful substance condition such as heavy metals are unknown. The lake sediments contain high levels of heavy metals. During the summer months, and especially in the eastern portion, the lake may exhibit anaerobic conditions resulting in emissions of noxious gases (ammonia and hydrogen sulphide).

Table 5.22: Water Quality of Lake Mariout

Parameter	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Standard according to Law 48/ 1982
Temperature (°C)	29.5	25.7	25.6	26	27.6	26.8	Not to exceed 5 ° C more than ambient (35°C)
Turbidity (NTU)	20	4	40	32	12	0	Maximum 50 NTU
pH	7.1	7.8	7.2	8.5	8.0	8.0	7.0-8.5
Salinity (%)	0.1	0.28	0.28	0.22	0.38	0.28	No standard
Dissolved Oxygen (mg/l)	0.5	0.5	3.1	6.9	6.8	8	Minimum 4 mg/l
COD (mg/l)	227	44	73	132	117	7.5	No standard
TDS (mg/l)	1,139	2,444	3,869	4,930	5,260	3,849	Maximum 650 mg/l

Key:

Sample 1: Basin 1 from in front of the discharge point of the Western wastewater treatment plant
Sample 2: Center of basin 1
Sample 3: Omum Drain
Sample 4: Center of basin 2
Sample 5: Navigational channel
Sample 6: Basin 3

- **Lake Edku**

Lake Edku lies 40 km east of Alexandria and 18 km west of Rosetta. It is a shallow (1.0-1.5 m depth) brackish water lake with one connection to the Mediterranean at El Meadia. The surface area of the lake has decreased considerably over the past century due development on the shallow areas of the lake, currently reaching 19-20,000 feddans from an original 51,000 at the end of the 19th century. Since the construction of the drainage network in the Beheira Governorate in the 1920's, the lake has become a repository for the waters emanating from the drainage of a catchment area of 200,000 feddans. The lake receives water from three drains along the southern and eastern sides. Seawater is primarily affecting the western side of the lake near the outlet. After construction of the Aswan High Dam, the annual drainage in the lake has increased.

The waters of Lake Edku are composed of 90% agricultural drainage water and 10% seawater. As a result of this the salinity of the lake has decreased considerably and this has led to significant changes in the biological and chemical characteristics of the lake. Agricultural drainage water is conveyed to the lake through three main drains: Edku Khairy drain, Tard El-Boseily drain and Tard Barseek drain. The drainage water is also polluted by untreated domestic and industrial wastewaters which ultimately reach the lake.

(6) Marine Pollution

1) Pollution of Red Sea, Suez Canal, Gulf of Suez and Gulf of Aqaba

a. Background

The Red Sea is a long, narrow body of water separating northeast Africa from the Arabian Peninsula. It is nearly 2,000 km of navigable waters connected at the south with the Indian Ocean, and joins the Mediterranean Sea at the north of the Gulf of Suez. The Red Sea is 1932 km long and averages 280 km in width, and is shared by Egypt, Sudan, Ethiopia, Republic of Yemen, Saudi Arabia, Jordan and Israel. It is a semi-enclosed, narrow water body with no river inputs. The area of the Red Sea is about 438 km^2 and its mean depth is 491 m. The deeper basin of the Red Sea is separated from the Gulf of Aden by shallow channel shoals about 100 m deep, off Hannish Island. The Red Sea and its gulfs, Gulf of Aqaba and Gulf of Suez, constitute a unique and valuable ecosystem. The Red Sea is valuable, not just as a unique environment, but as one of a high diversity, great scientific and ecological sensitivity and of great beauty and tourist-value. Their natural resources provide a substantial economic support for the region. The Red Sea resources contribute substantially to Egypt's economy, particularly in the areas of oil production, navigation, tourism and fisheries.

The Gulf of Aqaba in the northern Red Sea is a warm water body, approximately 180 km long and on average 8 km wide. It is a deep basin with narrow shelves, which comprises two isolated depressions separated by a submarine sill. The northern depression is about 1,100 m deep and the southern depression is about 1,420 m deep. The maximum depth within the Gulf of Aqaba is observed near the east coast with a depth of 1,829 m. The maximum depth within the Gulf of Aqaba is observed near the east coast with a depth of 1,829 m.

The Gulf of Aqaba is a marine environment enclosed by arid lands that experience extremes of temperature and exceedingly low levels of precipitation. These conditions have led to the evolution of unique, and hence internationally important, coral reef and marine ecosystems, which are particularly susceptible to damage from pollution or other forms of environmental impact. The Gulf of Aqaba also represents a natural resource of major economic significance to the four riparian countries (Egypt, Israel, Jordan, and Saudi Arabia) in terms of access to sea transportation and the development of tourism and other industries along its shores.

The Gulf of Suez is relatively shallow, with a maximum depth of about 64 m and has a relatively flat bottom. Hence, the Gulf spreads a shallow basin filled with the surface water of the Red Sea. The Gulf of Suez is the area the most at risk of pollution in the Red Sea, particularly oil pollution.

Photo 5.19: Oil Contamination in the Gulf of Suez

Sinai Peninsula is a strategic national security zone for Egypt. Sharm El-Sheikh area, located at the southern part of Sinai, was declared as a protected area because of the diversity of wildlife species and other available natural resources. Sharm El-Sheikh area is characterized by barren terrain with limited vegetation cover, diversity of landscapes, clear skies and clear water with shallow coral reef community. The entire Sinai region is deeply dissected by the river valleys (or wadis) that eroded at earlier

geological periods. These river valleys break the surface of the plateau into series of detached massifs with a few oases scattered here and there. Oceanographic and meteorological conditions such as air temperature, winds, rainfall, tide, water movement, water temperature, salinity, dissolved oxygen, acidity/alkalinity or nutrients in the Gulf of Aqaba and Gulf of Suez is described in Chap.5.2 of Annex, (pp41-58).

b. Costal Zones and the Marine Environment Preservation System in Egypt

Tourism has been well developed in Egypt and accounts for nearly 12% of Egypt's GDP. In 2000, it was estimated that 5.5 million visitors spending nearly US$4.5 billion at upper Egypt area, Cairo or the Red Sea. Increase in the number of hotel rooms and resident population followed a similar trend. These tourism development at the Red Sea, the Gulf of Aquaba and Gulf of Suez have a great impact on the marine environment of around those areas.

The Table 5.23 covers affiliated institutions for coastal environment conservation in Egypt.

Table 5.23: Responsible Institutions of Coastal Environment Conservation of Egypt

Authority Affiliated/Agency	Costal Zone Responsibility
Shore Protection Authority (SPA)	● Shoreline protection and management ● Regulation activities within coastal setback areas in coordination with EEAA.
Minister of State for Environmental Affairs, Egyptian Environmental Affairs Agency（EEAA）	● Coordination of the CZM plan. ● Review and evaluation of EIA's ● Regulation activities within coastal setback area in coordination with SPA ● Implementing marine ambient water quality monitoring ● Enforcement for the provisions of law 4/1994, in coordination with Governorates ● Management of marine protected areas ● In coordination with other organizations, preparing oil spill contingency plans
Ministry of Tourism, Tourism Development Authority (TDA)	According to the provisions of law 7/1991 and the presidential decree 374/91: ● Preparation of tourism development plans and setting priorities for their implementation ● Preparation, review and evaluation of tourism development program and projects and monitoring their implementation ● Carrying out preliminary land allocation for tourism development projects ● Execution of infrastructure projects and developing infrastructure framework schemes for tourism development ● Participation in the EIA process as the Competent Administrative Authority
Ministry of Petroleum, Egyptian General Petroleum Corporation (EGPC)	● Exploration and concessions

Authority Affiliated/Agency	Costal Zone Responsibility
Local Administration Governorates	● Governorate development plan ● Coordination of environmental activities within Governorate ● Environmental inspection and enforcement in coordination with EEAA ● Participation in the EIA process as the Competent Administrative Authority
Ministry of Planning	● Integrated development plans for a number of coastal areas.

Source: Tarek M. Genena, 'A Consultant Report on the Country Environmental Analysis', Dec. 2003

2) Levels of Pollution

EEAA conducts regular monitoring of the coastal water quality through the Environmental Information and Monitoring Program (EIMP) with the support of The Danish Agency for Development Assistance (DANIDA). A total of five field-sampling studies are undertaken in the Red Sea coastal areas by the EIMP throughout 2003

a. Gulf of Suez

The marine environment of the Suez bay is subjected to mixed sources of pollution (industrial, agricultural and domestic sewage) through the direct discharge of El-Kabanon drain, which is considered the main industrial and sanitary drain. Approximately 120,000 m^3 /daily of sewage is dumped through El-Kabanon drain into the Suez Bay. The sewage discharged into the Suez Bay contains 93.76 ton/year of ammonia, 0.305 ton/year of nitrite, 0.397 ton/year of nitrate, 52.93 ton/year of inorganic phosphate, 0.409 ton/year of copper, 3.65 ton/year of zinc, and 0.120 ton/year of lead.

In the Gulf of Suez region, the Ras Gharib beach suffers from the highest levels of bacterial pollution. This is primarily due to the discharge of raw sewage from the city of Ras Gharib directly into the Gulf of Suez. Other locations with the Gulf of Suez where high levels of bacterial counts were identified include Kabanon beach (where the source of pollution is the discharge of wastes from the area's meat processing facility), Raks beach (source of pollution is nearby port) and Attaka port (where the primary source of pollution is the ship-building industry). Nutrient levels (ammonia, nitrate, phosphate and chlorophyll) were found to be highest in the area surrounding Suez city

Research was carried out on heavy metal pollution in Suez Bay, where the bay is subjected to industrial run-off from oil refineries, fertilizer plants, and power station in addition to sewage and garbage. The heavy metal concentrations ranged from 7.2 to 147.7μg/l for Zn, 10 to 62.6μg/l for Cu, 0.7 to 12.1μg/l for Pb and 0.01 to 1.27 μg/l for Cd, respectively. Adabiya station showed the highest values because of the various pollution sources discharged (i.e., harbours, sewage, and industrial drains), while in contrast the station of Ain Sokhna showed the lowest concentrations.

In the Suez area, investigating the possibility of using seaweed as an indicator for trace metals pollution was carried out in 2003. The study investigated the trace metals concentration within sediment, water, and seaweed. In water, the annual mean concentrations were 0.272, 0.166 and 0.438 ppb for dissolved, particulate, and total Cadmium (Cd), respectively. While in sediment the Cadmium concentration was 5.670 ppm. Lead (Pb) in water showed annual mean concentrations of 1.096, 2.085, and 3.181 ppb for dissolved, particulate, and total lead, respectively; while in sediment lead concentration was 29.748 ppm. The annual mean concentration of Copper (Cu) in water was 0.972, 0.782 and 1.561 ppb for dissolved, particulate, and total copper, respectively. The total annual mean concentration of copper in sediment was 8.785 ppm with the highest value being 10.454 and the lowest being 3.506 ppm. Finally the recorded Zinc (Zn) annual mean concentrations were 20.76, 258.54, and 279.30 for dissolved, particulate, and total zinc, respectively. The mean Zinc concentration in sediment was 22.771 ppm. The study concluded that sediment is highly polluted by cadmium and in less degree by lead. Also the metal concentrations correlated with industrial activities.

The Ain Sukhna area in the Gulf of Suez was also found to suffer from extensive chronic petroleum pollution inputs as it is evident in the vicinity of the SUMED pipeline company terminals, which include both floating and land-based receiving terminals.

In the Suez area, a study was carried out in 2003 to measure nutrient salts around the Suez Bay and down to Ain Sukhna area. Nitrate concentration ranged between 0.650µg at-N /l and 25.780µg at-N /l. The highest value of nitrate recorded was attributed to the fertilizer waste from El-Nasr fertilizer factory and sewage waste disposal from El-Kabanon drain. El-Nasr Factory produces 1500 ton/day of nitrate salt and discharges 14000m^3/ day of low saline wastewater. Nitrite concentration varied in water sea was between 0.150 – 3.740 µg at-N /l. The nitrite concentration recorded was higher than that recorded previously in 1999 (0.00- 2.90 µg at-N /l). Ammonia concentrations ranged from 0.57 -89.290 µg at-N /l with an annual mean of 9.952 µg at-N /l. Also, ammonia concentration recorded in 2003 was higher than the one recorded in 1999, which ranged from 0.14 to 19.39 µg at-N /l. Finally, the recorded values of Phosphate ranged between 0.22 – 1.64 µg at-P /l while the recorded values in 1999 was lower and ranged between 0.04 -1.21µg at-P /l.

b. Gulf of Aqaba

The sewage problem in Sharm El-Sheikh area is very limited or eventually controlled because of the Law 4/1994 where any direct discharge of untreated or treated sewage to the marine environment is prohibited. All hotels have to comply with these requirements and have acquired a sewage treatment system, or have been connected to the city sewer system. The treatment should be of tertiary or at least secondary treatment, where the remaining sludge is trucked away to the city municipal dumping area and the liquid effluents is treated. The bacterial counts for total coliforms recorded in Sharm El-Maya (in Sharm El-Sheikh) and the

acceptable counts in the guidelines were 9–26 and 100 (cfu/100ml), respectively. The presence of faecal bacteria was attributed to the previous use of Sharm El-Maya as a berthing site for more than 200 motorized boats. These boats evacuate their waste in the water directly (none of the boats had holding tanks for their waste, and there was an absence of onshore waste receiving facilities). After 1999 the count of total coliform decreased as a result of moving the boats to the new jetty. A new port established in 1999 at El-Sharm Bay (TRAVCO Port) forced, by law, 300 diving boats anchoring there to carry septic tanks for wastewater, which are later pumped to the city sewer system by special receptors in the jetties. Only 80% of the boats, however, apply this system, while the remainder still discharge their wastewater directly into the Gulf of Aqaba without treatment, causing serious pollution and damage to the habitats of the bay and the adjacent reef.

During the rehabilitation of Sharm El-Maya project in 1999, the heavy metal concentrations in the bay sediments were measured. Generally, the measured metals (Copper,Cu,; Zinc, Zn; Cadmium, Cd; and Lead, Pb) showed significantly higher levels (7.3, 68.9, 3.5, and 20.8 ppm) i.e., 2 to 4 times higher compared to the control site concentration (4.8, 29.4, 1.2, and 5). Although, trace metals in the bay sediment showed clearly higher levels than the control site, most of the values were found to be within the range of the comparative survey made on sediment samples collected in 1983 and 1984. The range of the metals were 13-80, 15-100, 0.1-2 and 0.8-15 mg/kg-dry weight sediment for Cu, Zn, Cd, and Pb, respectively. On the other hand the metal concentrations in Sharm El-Maya water ranged between 0.08- 0.115, 0.131-0.509, 0.143-0.169, and 0.390-0.533 mg/l for Cu, Zn, Cd, and Pb, respectively.

In 1999 levels of Total Petroleum Hydrocarbons (TPH) were measured at Sharm El-Maya bay in sediments and water samples. The calculated mean of TPH in surface and deep water (close to the bottom) was 351.3 – 295.3 ppb, respectively; and 43.1 – 32.2 ppb at the control site. In the surface water of the bay, TPH concentrations ranged between 185.6 – 591.8 ppb. While in deep waters, the concentrations were 134.5 and 618.7ppb. The Total Petroleum Hydrocarbon content was analyzed in surface (0 – 20 cm) and deep sediments (20 – 40 cm). The highest concentrations were found to be in the surface sediments rather than the deep sediments at all the investigated sites including the control site. The minimum levels were recorded in the surface and deep sediments of the control site (14 and 6 ppm). The highest concentration was found in the inter-tidal sediments (1263.5 ppm) while the lowest concentration was recorded in the deep sub-tidal sediments (57.1ppm).

c. Other Red Sea Coast Areas

In other areas along the Red Sea coast, the primary source of elevated bacterial counts is the discharge of untreated sewage, whether from human settlements, tourist villages or directly from recreational boats. In general, dissolved oxygen levels were found to be within acceptable levels, with the notable exception of the coastal areas bordering major cities, ports

and a number of tourist villages, where discharges of untreated sewage and industrial wastewater result in severe localized deterioration of the water quality. In these areas, dumping of solid wastes and litter into coastal waters is also a major environmental problem. The results of surveys showed that most of the litter originated from safari and diving boats. The different items collected were shredded car tires used as boat fenders, empty food and beverage cans, gas lighters, glass bottles, oil filters, and empty barrels.

3) Pollution Sources and Natural Pollution

a. The Gulf of Aqaba

The Gulf of Aqaba's environmental problems are primarily induced by tourism and associated activities as well as maritime traffic, which result in marine, aquifer, soil, and noise pollution, and destruction of coral reef and desert ecosystems. In addition, environmental issues, which are related to the management of wastewater and solid waste, are exacerbated by the increasing resident population of the coastal cities and the numbers of tourists visiting the area. Human impact on the environment can be summarized into seven broad categories, as follows: tourism, ship-based activities, wastewater management practices, solid waste management practices, ferry traffic, marine aquaculture, and cruise-boating. Environmental threats from natural causes are also of concern and can be categorized into floods and southern winds.

- **Tourism**

An estimated 500,000 tourists visited the Gulf of Aqaba coastal zone in 1996 and more than 3 million are expected in 2017. The relatively rapid growth of tourist visitation since the late 1980s has spurred interest in further development of tourism as an additional source of foreign income. The infrastructure needed to attend to the needs of tourism, i.e. shopping centers, hotels, airports, roads, dive boats, resort construction, all increase the environmental stressors on the coral reefs, but perhaps the greatest single threat from tourism is sheer ignorance. Dive clubs, which send divers into the reef without instructions or guidance, bear much of the blame for such actions, but even appropriate diver behavior is linked to reef degradation at high levels of activity. It has been estimated that sites hosting more than 6,000 dives per year degrade rapidly. Coral photographers, eager to get closest to the reef and distracted by their equipment.

- **Ship-based Activities**

Between 1985 and 1991, an average of 1,600 vessels handling 13 to 20 million tons of cargo each year, including oil, minerals and chemicals, entered the Gulf of Aqaba through the Strait of Tiran. The lack of a local capacity to contain and control any significant

accidental spills of oil is a major concern. Other environmental issues relate to marine pollution resulting from frequent small spills of oil and other contaminants. In addition, waters are polluted by garbage and animal carcasses thrown overboard by ferries and ships. Reefs are also destroyed by ships that accidentally miss the navigational waterway through the Strait of Tiran.

However, on a day-to-day basis, small, recurrent leaks from cargo and pleasure ships, land-to-sea transfers, and the discharge of oily ballast water produce more pollution and do more environmental damage overall than one-time events like a large spill. Indeed, 97% of all oil spills into the sea are in amounts smaller than 4,000 liters. In the Gulf of Aqaba, such recurrent spills around the ports are already associated with the degraded health of local reef ecosystems.

- **Waste Water Management**

All urban areas are connected to biological oxidation sewage treatment systems. However, the population of Dahab and Nuweiba are not fully serviced due to insufficient infrastructure or lack of maintenance. This problem may affect up to 60% of the resident population. The remainder of the sewage is poorly treated before being released into the desert. Sewage treatment facilities in the Middle East region are poor in general, often amounting to little more than open settling pools. The impact of sewage on coral reefs can be unpredictable. Sewage creates localized areas of high nitrogen, which leads to algal blooms and deoxygenated "dead zones." In addition, sewage sediment settles on corals, particularly in regions without strong currents, choking the coral to death.

- **Solid Waste Management in Cities**

The cities in South Sinai, the port of Nuweiba, and the tourism resorts currently generate about 50 tons of solid waste per day. This has increased to 120 tons per day in 2002, and is expected to further increase to 220 tons in 2017. The municipal dumps are located unfenced and open to desert areas near the coastal desert road. Environmental concerns relate to the effectiveness of both the collection and disposal systems, which have resulted in the presence of unsightly refuse in urban areas to the town dump where open burning of rubbish also results in air pollution.

- **Ferry Traffic**

Oil transport into Nuweiba is minimal. A current problem is that of shipboard waste from the Gulf of Aqaba ferry between Nuweiba and Aqaba. Much of this waste is non-biodegradable and is carried ashore by currents, adding to the problems on the coral reef and Sinai coastline. In addition, similar problems arise from land-originated solid waste from the three bordering countries.

- **Marine Aquaculture**

The rapid development of marine aquaculture in the Eilat region of Israel has already resulted in severe pollution of the marine waters surrounding the clusters of fish cages. This is raising concern of further eutrophication of marine waters in the Taba Area of Egypt.

- **Cruise-Boating**

A visible marine pollution problem from maritime activities is the condition of the waters of the small harbor at Sharm El-Maya, in Sharm El-Sheikh. There is an accumulation of oil and sludge from the fleet of diving boats and other vessels that occupy the harbor. On-board sewage and solid waste are discharged indiscriminately into the harbor waters, with obvious and detrimental impacts on the nearby hotel beaches. The potential for increasing the number of boats using the harbor poses a major localized environmental threat.

- **Floods**

Desert sheet floods sporadically supply large amounts of rainwater. Such floods have occurred in the 1950s and in 1979 and 1980.

- **Southern Winds**

The common storms on the Gulf of Aqaba which are accompanied by winds of up to 23 to 41m/s knots provide considerable bursts of energy to water currents.

b. Gulf of Suez

- **Tourism**

The negative impacts of coastal tourism are evident in Suez Canal's lakes and Ain Sukhna. These impacts include physical destruction of coastal habitats by construction works, dredging, and pollution from wastewater discharge from coastal resorts. The lack of proper land-use planning, including effective zoning and environmental review procedures in the coastal zone, particularly with regards to urban development and tourism expansion, is a growing problem in many parts of the region.

- **Ship-based Activities**

One of the main sources of marine pollution in Suez Canal and Gulf of Suez is from ship-based sources. Transport of oil continues to play a critical role in marine pollution in the northern Gulf of Suez and Suez Canal. This transport traffic results in chronic marine pollution from discharges of oily ballast water and tank washings by vessels, operational spills from vessels loading or unloading at port, accidental spills from foundered vessels, and leaks from vessels in transit in Suez Bay. Other forms of ship-generated waste

include oily sludge, bilge water, garbage and marine debris.

The Suez Harbour has always been an important Egyptian gate on the Red Sea since historical times. The growing activity of this harbour has led to an increasing rate of urbanization in the whole region. Taking advantage of the site location, several industries have been established all of them along the western coastal stretch of the Suez Bay in the south. The growing industrial activities coupled with the fact that Suez represents the southern entrance of the Suez Canal have resulted in the transformation of the whole Suez Bay into a large harbour. More than 100 ships and tankers are waiting daily to cross the canal to the Mediterranean.

- **Wastewater Management**

The first elements of a municipal wastewater collection and disposal system for Suez were installed during the mid 1920s. The system was expanded and modified during subsequent years, providing service to Port Tewfik area and to about 70 percent of the urbanized area of Suez at the time hostilities broke out in 1967. During that conflict, a considerable amount of damage was done to the system. Until August 1995, the treatment plant was primitive and of limited efficiency. It included primary treatment ponds of 5 acres. The wastewater was then discharged into the bay through El-Kabanon Drain, an open drain, 6 km south of Suez. The sewerage system was constructed to serve 98% of the domestic and commercial wastewater, while 2% were discharged directly to the sea. In 1999, the discharge amounted to 75,000m^3/day in winter, increasing to 85,000 m^3/day in summer.

A new wastewater treatment plant has been constructed, and is fully operational. It provides treatment capable of meeting the legal effluent standard for BOD (Biological Oxygen Demand) and TSS (Total Suspended Solids). The planned system of treatment includes 4 aerated oxidation ponds and 2 basins for mechanical separation of settled solids. The precipitated sludge is dredged every 6 –12 months (depending on the amount of solid material), transported to drying lagoons and then stockpiled for possible use for agriculture purposes. The plant is designed to treat 260,000 m3/day. However, the discharge of municipal wastewater at Lake Timsah and Suez Bay continues to present considerable management problems. In the region, especially on Lake Timsah and south of Suez, the discharge of domestic sewage contributes, through nutrient loading and high biological oxygen demand, to the eutrophication of coastal waters around selected population centers, major ports and tourist facilities.

- **Industrial Activities**

The development of Suez is seen as centering on a mix of labor and capital-intensive industries, developed on the existing base of petroleum and petrochemical plants. Industries in Suez City that are functional at present include a fiberglass boat building plant,

machine shop and assembly plant, merchant steel mill, ship scrapping yard, general engineering foundry, ceramic tiles plant, and denim plant. Industrial effluents, in the form of thermal pollution from power and desalinization plants, hypersaline brine water from desalinization plants of Ain Sukhna hotels, particulate matter and mineral dust from fertilizer and cement factories, and chemicals and organic wastes from food processing factories at Suez City, contribute to the land-based sources of pollution affecting coastal waters in the Gulf of Suez and neighbouring water bodies.

From the fertilizer and chemical industry, El-Nasr Company produces 1,00 ton/day of ammonium nitrate, 500 ton/day of calcium nitrate and 50 ton/day of ammonium sulfate, besides, aqua-ammonia, sulfuric acid and nitric acid as byproducts. The company is located 2 km inland at about 8 km southwest of Suez City. The factory uses freshwater for cooling and the effluent discharge amounts to $60x10^3$ m^3/day of low saline water (2.5%). As expected, this water is loaded with ammonia, phosphate and nitrate in addition to certain metals e.g. Cu, Zn and Pb (Copper, Zinc and Lead, respectively). As for the cement industry, Suez Cement Factory lies 40 km south of Suez City. It was estimated that more than 10 g Pb and 600 mg Cd per ton of cement produced is released into the atmosphere. The cement factory lies on the coastal strip of the Gulf of Suez (5 km inland). Its location and the prevailing northwest winds heighten the amount of heavy metals and dust contributed by the factory to the marine ecosystem.

- **Dredging and Filling Operation**

Dredging operations of Suez Canal, and dredging and filling operations are a significant source of environmental degradation in the region. Sedimentation from these operations suffocates the surrounding benthic communities and has an adverse effect on other ecosystems to which currents transport the suspended sediment. The net results are the irreversible loss of the most productive coastal ecosystems – sea grass beds and dependent marine communities.

- **Offshore and Inshore Oil Production**

Extensive oil production operations are taking place in the Gulf of Suez, both inshore and offshore. The spills from oilrigs and ships have severely affected the inter-tidal zone in the central and southern parts of the Gulf of Suez. Many rocky shores are blanketed with oil pavements and oil is found buried beneath a thin veneer of wind blown sand in some beach areas. Not only are the direct effects of spills of importance, but also, of much concern are the drilling operations themselves. The discharge of drill mud and rock cuttings during operations results in high turbidity of water probably extending for a few kilometers in depth. The sediment loading from drilling operations has killed hermatypic corals.

There are two major refineries in Suez: El-Nasr Petroleum Co., and Suez Petroleum Co.

They are located in the Zeitia area about 3 – 5 km south of Suez City. Atmospheric pollution is mainly caused by sulfur oxides, hydrocarbons, nitrogen oxides, and carbon monoxide. The refineries in Suez have old burners and the combustion of released gases is not complete, therefore causing a high emission factor for gases. Emission of elements such as As, Cd, Co, V, Ni and Cu (Arsenic, Cadmium, Cobalt, Vanadium, Nickel, and Copper) are also included.

- **Power Generation**

  The thermal power station at Ataqa (8 km South of Suez) is one of the largest in Egypt designed to generate 900 megawatt/hour of electric power. Cooling water is taken from the Suez Bay via an open canal extending over a half kilometer into the sea. The cooling effluent is about 200 m^3/hour, while the sewage discharge is 100 m^3/day.

- **Fishing**

  Improper resource management, in conjunction with a lack of low enforcement, is a barrier to sustainable development of the marine resources in the Gulf of Suez. The status of fisheries is unknown because of a lack of stock assessment and incomplete and unreliable fisheries statistics. Interviews of fishermen reported declines in catches and average size of fish landed, which indicates over-fishing and stock depletion. The present situation is attributed to destructive fishing practices, possible exploitation beyond maximum sustainable yield, the absence of fisheries management plans, and a lack of surveillance and enforcement of existing regulations.

5.4 Environmental Monitoring

(1) EIMP（Environmental Information and Monitoring Programme）

This section describes about Air Environment Monitoring Network Program, which was conducted as a part of EIMP with the financial support from DANIDA. During 1997 to 1999, 42 monitoring stations were established to monitor air environment throughout Egypt. The project was conducted as a EEAA's project, but actual monitoring and data analysis were done by the Centre for Environmental Hazard Mitigation (CEHM) of Cairo University and the Institute of Graduate Studies and Research(IGSR DANIDA) of University of Alexandria with guidance from experts sent by DANIDA.

Table 5.24: Outline of the EIPM Program

Monitoring Station	Greater Cairo area; 14 stations Alexandria are; 8 stations Delta area; 7 stations Suez Canal area; 3 stations Upper Egypt and Sinai peninsula area; 10 stations breakdown;12 stations in industrial area, 9 stations in central urban area, 3 stations in roadside, 15 stations in residential area, 3 stations in countryside and background area
Sampling instrument	SO_2, NO_x, PM_{10}, O_3, CO_2; 46 Continuous gas monitoring equipment Sequential samplers for SO_2, NO_x; 14 samplers High volume sampler for TSP; 5 samplers Dust jar for dust fall; 18 dust jars High volume sampler for PM_{10}; 26 sampler Others; Passive sampler for SO_2, meteorological station
Parameters	Monitor; SO_2, NO_x, PM_{10}, O_3, CO_2 Samplers; SO_2, NO_x, PM_{10}, BS, VOC, TSP, DF, PS

BS; Black Smoke
VOC; Volatile Organic Compounds
TSP; Total Suspended Particulate Matter
DF; Dust Fall
PS; Passive sampler

(2) Water Quality Monitoring

Currently, MOWRI is in charge of fresh water quality monitoring and started monitoring in 1976 for agricultural waste drainage. After that, the Ministry started water quality monitoring for the Nile River and groundwater as well. Nowadays, those programs are integrated and conducted as The National Water Quality Monitoring Program. The project aims to the followings:

- Evaluate water quality of influx water to Egypt and runoff water from the Lake Nasser
- Comprehend seasonal water quality change of the Nail River and irrigation canals
- Comprehend quantitative water quality change of irrigation drainages related to existing pollution sources.
- Examine reusable water amount and quality for agricultural use.

Table 5.25 shows the outline of three components of the National Water Quality Monitoring Program. Monitoring of irrigations and drainage canals of the Nile River Delta are conducted monthly, the River Nile monitoring is done twice in a year whereas groundwater is monitored annually. Parameters of the monitoring are shown below:

Surface Water

Package A: Physical Parameters, Water Quality Parameters, Oxygen Demands (BOD, COD), Nutrient Salts, Major Ions, Heavy Metals, Pesticides, and Parameters related to Microorganisms

Package B: Physical Parameters, Water Quality Parameters, Oxygen Demands (BOD, COD), Nutrient Salts, Heavy Metals, and Parameters related to Microorganisms

Package C: Physical Parameters, Water Quality Parameters, Oxygen Demands (BOD, COD), Nutrient Salts, Heavy Metals, Pesticides, and Parameters related to Microorganisms

Package D: Physical Parameters, Water Quality Parameters, Oxygen Demands (BOD, COD), Nutrient Salts, Heavy Metals, and Parameters related to Microorganisms

Groundwater

Package E: Physical Parameters, Nutrient Salts, Major Ions, and Heavy Metals

Table 5.25: Summary of National Water Quality Monitoring Program

	River Nile	Irrigation and drainage canals in Nile Delta Region	Groundwater Monitoring
Implementing Body	Nile Research Institute, NRI	Drainage Research Institute, DRI	Research Institute for Ground Water RIGW
Frequency of Sampling	Twice in a year (in Feb. & Aug.)	Once in every month	Once in a year
Number of Sampling Points	Lake Nasser; 4 River Nile; 18 Damietta tributary; 4 Rosetta tributary; 3 Rayah; 2 Major canals in upper Egypt; 9 Major drainages in upper Egypt; 29	Irrigation canals in Faiyum Governorate; 4 Irrigation canals in Eastern Delta; 19 Irrigation canals in Central Delta; 11 Irrigation canals in Western Delta; 14 Irrigation & Drainage canals in Faiyum Governorate; 7 Irrigation & Drainage canals in Eastern Delta; 41 Irrigation & Drainage canals in Central Delta; 35 Irrigation & Drainage canals in Western Delta; 32	195 Monitoring point nationwide (approximately 60% of monitoring wells in groundwater increment areas of River Nile)
Parameters	Lake Nasser; Package B River Nile; Package C Damietta tributary; Package C Rosetta tributary; Package C Layafs; Package A Major canals in upper Egypt; Package A Major drainages in upper Egypt; Package D	Irrigation canals in Nile Delta and Faiyum Governorate; Package A Irrigation & Drainage canals in Nile Delta and Faiyum Governorate; Package D	Monitoring Wells (Package D)

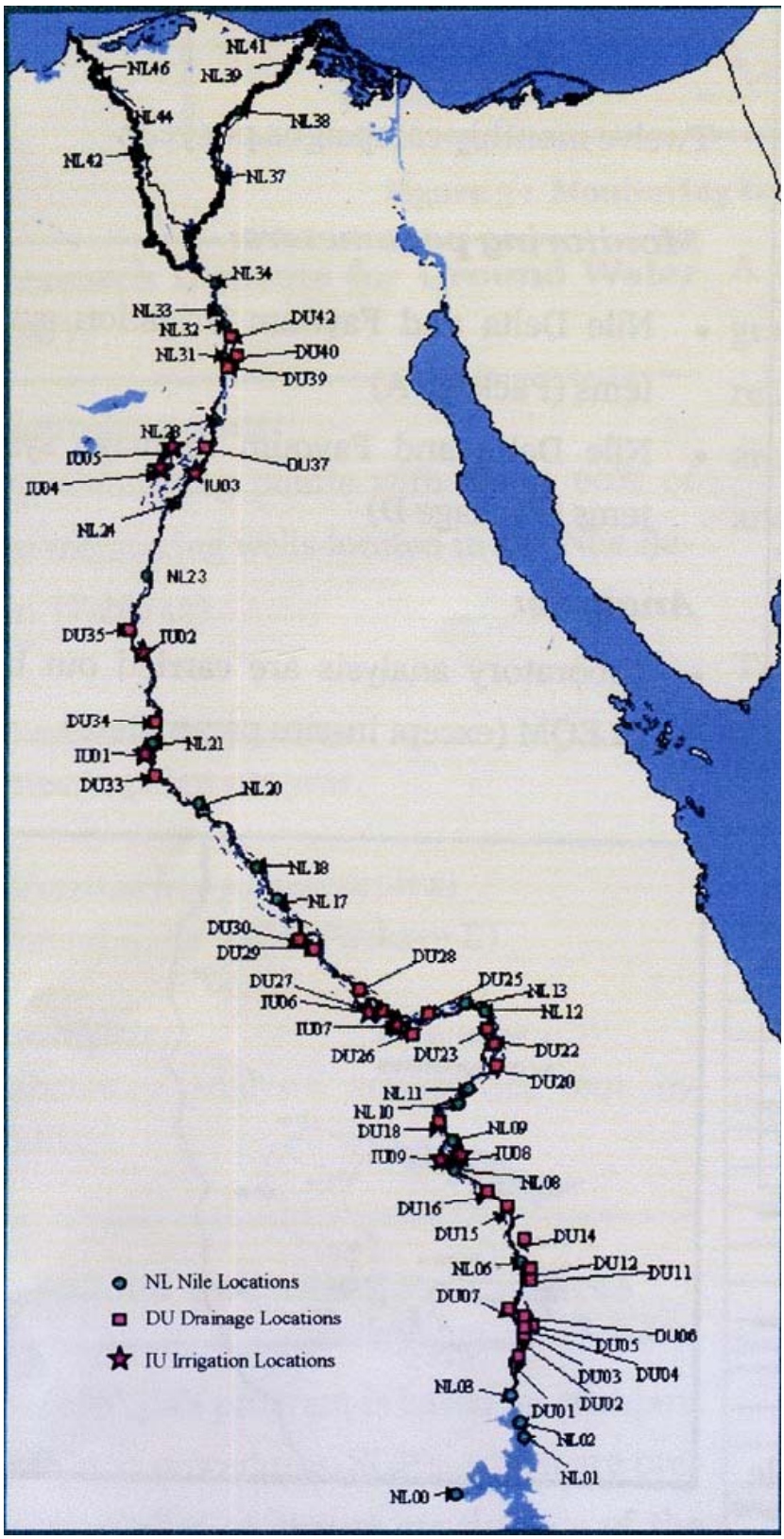


Figure 5.8: Location of Monitoring Points on River Nile by Nile Research Institute

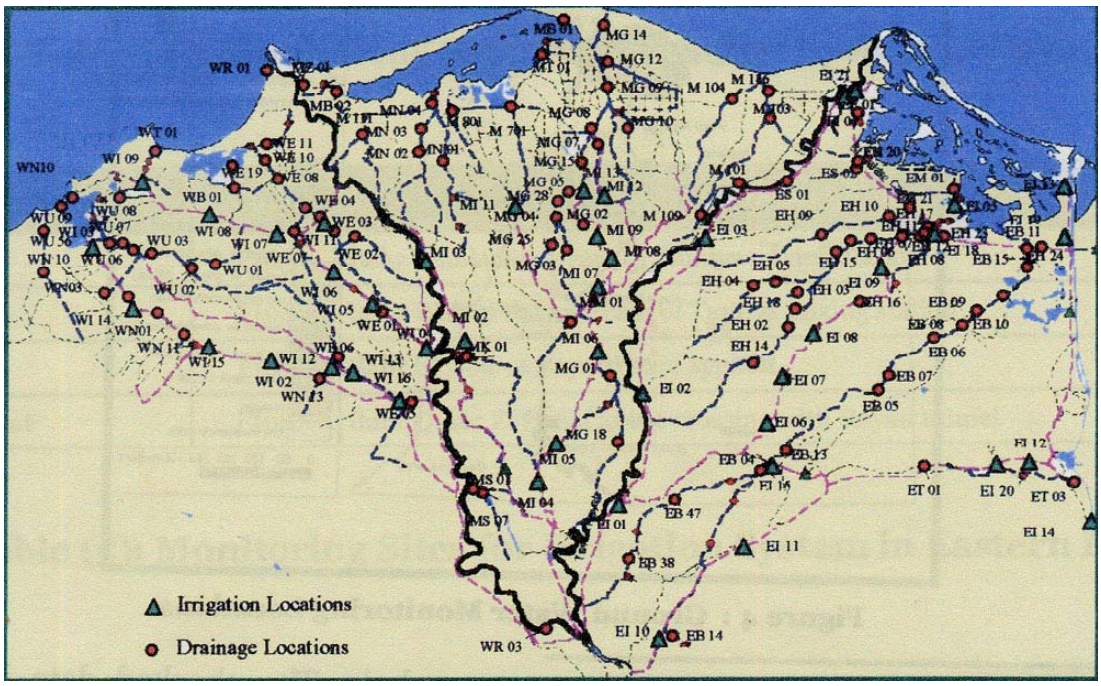


Figure 5.9: Location of Monitoring Points for Irrigation and Drainage Water by Drainage Research Institute

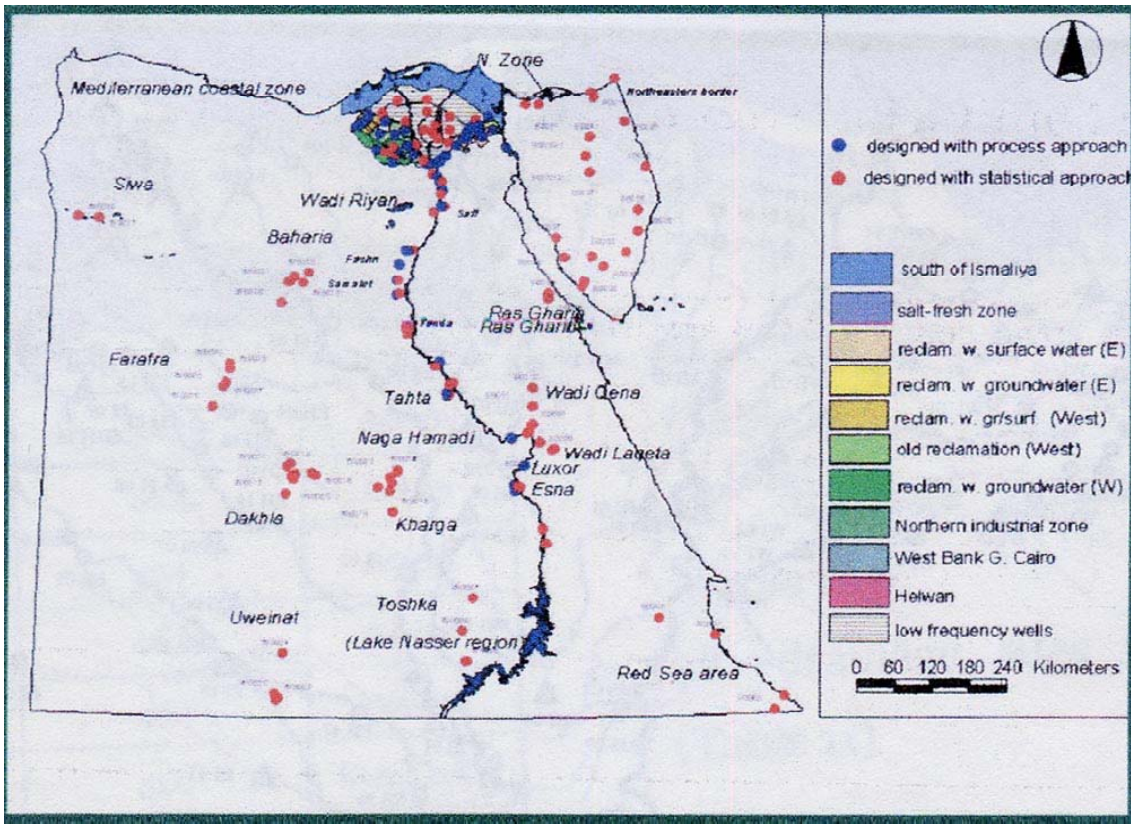


Figure 5.10: Location of Groundwater Monitoring Points by Research Institute for Ground Water

(3) EMTP: Environmental Monitoring and Training Center Project

The Government of Egypt established the Environmental Protection Law (Law 4/1994) and set environmental standards and discharge standards that are put fully in force and applied for existing facility from February 1998. EEAA was given the authority for implementing this law. There has been a need for EEAA to continuously monitor the compliance of business establishment for environmental standards, but lacked such monitoring system. Thus, the Egyptian government established Cairo Central Center (CCC) that has ordinary lab capabilities and function as training center, and 8 Regional Branch Office (RBO) under EEAA. This environmental monitoring network covers all of Egypt. Technical assistance (Environmental Monitoring Center Project) was based on grand aid scheme and aimed to provide basic analytical instruments and train personnel to utilize the instruments. The project lasted from 1997 to 2002. After the project ended, two experts were dispatched from Japan during 2002 to October of 2004 to conduct study focusing on hot spots as well as repeating practices for improving technical expertise. With the seven years of technical assistance, various analytical instruments were provided to Egyptian side (see Table 5.26 below), and analytical methods and basic monitoring procedures were successfully transferred.

Table 5.26: Major Instruments Provided by JICA to EEAA Laboratories

		CCC	GC	Alex.	Suez	Tanta	Mansoura
EMTP	AAFL	X	X	X	X	X	X
	AA	X					
	IC	X					
	HPLC	X		X			
	GC-FID	X		X			
	GC-ECD	X		X			
	GC-FPD	X		X			
	GC-MS	X					
Grant	AA		X	X	X	X	X
2003	IC		X	X	X	X	X
	GC-FID				X		

AAFL; Flameless Atomic Absorption
AA; Atomic Absorption Spectrophotometer
IC; Ion Chromatography
HPLC; High-Performance Liquid Chromatography (High Pressure Liquid Chromatography) (High Purity Liquid Chromatography)
GC-FID; Gas Chromatograph - Flame Ionization Detector
GC-ECD; Gas Chromatography Electron Capture Detector
GC-FPD; Gas Chromatography with a Flame Photometric Detector
GC-MS; Gas Chromatograhy-Mass Spectrometry

5.5 Waste Management

(1) Current Condition

It is estimated that 60 million tons of solid wastes are generated every year in Egypt. The following Table 5.27 shows the breakdown of solid wastes. The municipal wastes generation unit is within 0.3-1.0kg/capita day.

Table 5.27: Breakdown of Waste Stream of Egypt

Types of Waste	Generation (Million ton /year)
Municipal Waste from Major Cities	9.3
Municipal Waste from Rural areas	5.6
Agricultural Wastes	3.5
Hospital Wastes (Hazardous and Non-hazardous)	0.13
Construction Wastes	4.0
Non-Hazardous Industrial Wastes	5.9
Hazardous Industrial Wastes	0.3
Dredged sludges from canals	29.4
Sludges from Municipal Wastewater treatment	2.0

Source: National Solid Waste Management Programme, December 2000

Only 30-60 % of wastes are collected and many wastes are scattering throughout towns and streets without being treated. In rural area, especially the Delta area has a flourishing agriculture since old age, and lands are mostly owned by individuals for farm land, then, there are not enough public land for waste treatment. In this are, plenty of wastes are dumped into vacant ground or agricultural drainage and such problem is getting serious. Governorates of the Delta areas are concerning to dispose collected wastes in desert area.

Photo 5.20: Scatting of Wastes at the Delta Area

Table 5.28: Scatted Amount of Solid Waste, 1999

Governorates	Scatted Solid Wastes Amount (m^3)
Cairo	2,2236,500
Giza	447,050
Qualubyia	504,395
Gharbyia	1,235,000
Aswan	386,350
Red Sea	107,022
Kafr El Sheik	225,500
Qena	251,700

Source: National Solid Waste Management Programme, December 2000

In Cairo and Giza, the traditional system called Zaballeen sorts, recycle and dispose the wastes. Also private enterprises provide solid waste management services but not in main stream yet. There are currently 56 composting plants distributed in all governorates and the number of plants seems to be growing but there are not so many successful cases.

On the other hand, privatization movement of municipal waste management with foreign support is getting really active. Received contracts from governorates, international enterprises have been operating their services of collecting and treating wastes in big cities such as Cairo, Giza and Alexandria. In some of small cities, local businesses undertake waste treatment services but they are taking open dumping as a main method. Seen smoking and ignition always from waste treatment facilities, it seems that wastes are not treated appropriately.

Photo 5.21: Wastes Management by Private Sector (FCC: Covers Giza and Cairo)

Except newly established 10th of Ramadan City, there are no waste treatment and disposal facilities for industrial wastes so that industrial wastes are treated with municipal wastes. There is only one treatment plant for hazardous waste in Alexandria. Reduction of the total amount of wastes and development of recycle plan will be the urgent issues of the Solid Waste

Management Strategy developed by EEAA in order to implement the 3Rs aspects of the strategy. .

(2) Municipal Waste

Table 5.29: Roles of Governmental Institutions in Municipal Waste Management

Organizations	Roles
National Government through EEAA	● Establishes the institutional and legal frameworks for MSW ● Provides local governments with guidelines and /or capacity building measures in the field of financial management, technical systems. ● Coordinates with the local units to identify the sites for waste disposal and treatment
Local Government	● Local government is divided into four levels: governorates, markaz, districts (sub-divisions of the major cities) and local units (at the village level). A governorate is made up of a number of markaz. In each markaz, there is a main city and a number of mother villages. Each mother village has associated satellite villages and (ezab) hamlets. ● Governorates approve the budget and investment plans for MSW management and distribute the budgets to the districts and local units who are responsible for executing MSW management. The local authorities (districts or units) are also responsible for the collection of street waste and waste from public spaces, operating existing composting plants and supervising the landfill and dumpsite operation. In case to contract private companies to carry out these survives, local authorities remain responsible for regulating and controlling the activities and the performance of these enterprises. The local authorities are charged with monitoring the adherence to article 39 of the executive regulations to Law 4/ 1994, which stipulates that collectors of garbage and solid waste shall be held to maintain the cleanliness of garbage bins and vehicles ● At districts and local units, the provision of MSW management services is the responsibility of the "Cleansing Department" or what is currently known as the "Environmental Improvements and Cleansing Department". ● In coordination with EEAA, the local authority specifies the site of solid waste treatment, burning or disposal facilities. ● Issuing the licenses related to the transport and disposal of these MSW.
MWRI	● Protection of the River Nile, its branches (Rosetta and Damietta) and waterways from pollution caused by municipal wastes. ● Fine violators with the aid of Waterways Police.

Source: EcoConServ, 'Study on Status of the Environment and Relevant Policies/Measures in Egypt', Feb. 2005

The main legislation relating to solid waste management in Egypt is the Law 38 for 1967 as amended by the Law 31 for 1976. The law regulates the collection and disposal of solid waste

from residential areas, commercial and industrial establishments, and public places. It prohibits the placement of wastes or wastewaters in areas other than those specified by the local council. It is important to note that the law only applies to cities and villages that have designated by a Governor's decree. A summary of the most significant articles of the relevant solid waste management laws is provided in the following Table 5.29.

Table 5.30: MSW Management Relevant Legislation

Law and Article	Description
Law 38/1967, Article 6	Requires that the local council issue a license for all workers employed as waste collectors.
Law 38/1967, Article 8	Stipulates that local councils may impose a cleanliness tax on all housing units. The money collected from this tax enters a fund for public cleanliness.
Law 38/1967, Article 10	States that the rules of this law are applicable to cities and the villages that are specified by a decree by the governor.
Ministry of Housing Decree # 134/1968	Implements Law 38/1967 and declares specifications and locations of dumping places, and methods of treatment.
Law 31/1976	Defines "garbage and solid wastes" as including domestic and industrial waste. It also specifies garbage containers, means of transportation, and the periodicity of solid waste collection.
Ministry of Justice Decree (MoJ 3137/1976)	Identifies local government employees as having authority to enforce Law 38/1967
Law 4/1994, Article 37	Requires EIA of new developments, including municipal solid waste related establishments. Prohibits the burning, disposal or treatment of solid waste except in designated areas far away from housing or industrial or agricultural areas as well as from waterways. The local units, in agreement with EEAA, assign the sites for dumping, treatment, or burning solid waste according to the requirements of this article.
Prime Minister's Decree No. 338/1995, Article 38	Promulgates the Executive Regulations of the Law 4/1994. Prohibits the burning, disposal or treatment of solid waste except in designated areas far away from housing or industrial or agricultural areas as well as from waterways. Permits the incineration of infectious waste generated by medical care in hospitals and health centers, with certain provisions.
Prime Minister's Decree No. 338/1995, Article 39	States that collectors of garbage and solid waste shall maintain their garbage bins and vehicles in a clean state

Source: EcoConServ, 'Study on Status of the Environment and Relevant Policies/Measures in Egypt', Feb. 2005

A Ministerial Solid Waste Management Committee co-chaired by the Minister of Environment and the Minister of Local Development was established. In December 2000, the committee, with the participation and input from the relevant ministries, prepared the "National Program for Waste Management." The following Table 5.31 gives an idea of the main elements of the program and their estimated costs.

Table 5.31: Waste Category, Participating Ministry and Management Costs

Waste Category	Participating Ministry	Estimated Cost LE million
Municipal solid waste	Ministry of Local Development (governorates), EEAA	145
Agricultural Waste	Ministry of Agriculture and Land Reclamation	25
Hospital Waste	Ministry of Health and Population	365
Waste from Cleaning Waterways	Ministry of Water Resources and Irrigation	473
Municipal Sludge	Ministry of Housing, Utilities and Urban Committees	273.5

Source: Tarek M. Genena, 'A consultant report on the country environmental analysis', Dec. 2003

The Government of Egypt planned to privatize MSW services and gave priority to governorates that have large cities and tourist areas. In 1999, severe air pollution in Greater Cairo caused by open burning of municipal solid wastes received close public attention.

Two important and long awaited policy decisions were taken. The first was a Cabinet decree allowing collection of the solid waste management fee on the electricity bill in proportion to the electricity consumption, with the range between LE 1 to LE 12 per household. However, implementation of this measure still requires the approval of the local popular council of the Governorates. Currently a number of Governorates have already started to collect the solid waste management fee

The other important policy was to introduce economic incentives for the MSW management services. These include a tax break for at least 5 years, as well as exemption of the equipment used in waste management services from custom duties.

Alexandria Governorate was the first body issued an international tender for integrated solid waste management services of municipal wastes, hospital wastes and hazardous wastes. The composting plant, which was built by grant aid from Japan, is also operated by French based operation/maintenance enterprise, issued by Alexandria Governorate. (See Photo 5.22)

Table 5.32 provides data concerning Governorates that have completed their privatization.

Photo 5.22: Compost Plant in Alexandria

Table 5.32: Outline of Completed Privatizations

Governorate		Total Quantity of Waste Tons/day	Operator N; National R; Regional I; International	Annual Contract Value LE million	Average cost LE/ton
Alexandria		2,700	I (French)	85	86
Cairo	North	NA	I	52	NA
	East	NA	I	59.5	NA
	West	NA	I	55	NA
Giza	Urban Northern	1,400	I (Spanish)	36	70
	Urban Southern	1,600	I (Spanish)	44.9	77
Suez		325	R	9	75
Aswan		435	Consortium N&I	12	75

Source: Tarek M. Genena, 'A consultant report on the country environmental analysis', Dec. 2003

Many Governorates followed the exact footsteps of Alexandria Governorate. However, some governorates did not fully understand the process of municipal waste service privatization and sometimes international tender were suspended. The following problems are noted to date.

- Governorates tender on the basis of insufficient and unreliable information with regard to quantities of waste generated and the composition of waste. In addition, tender documents did not always reflect the conditions and requirements.
- In some cases, financial resources and collective methods were not shown.
- Governorates and Districts are incapable to evaluate the performance of the international private operators.
- In general, no properly sited landfills and/or areas designated for landfills were available.

- The modalities of co-operation between operators, local NGOs, Zabbaleen[1] and small private operators are uncertain.
- Given extended nature of the contracting period of services (10-15 years), clear mechanisms were not identified in the contract to address unforeseen inflation rates as well as changes in exchange rates of foreign currencies.
- There is a general lack of SWM expertise in the Egypt, especially outside the major cities. Support provided by central government was insufficient.

The above mentioned problems have resulted in a situation that some Governorates have decided to cancel tenders or re-tender, postpone or freeze the services.

(3) National Integrated Solid Waste Management Strategy

A national strategy addressing solid waste management in the period of 2000-2010 has been developed. The National Strategy defines a planning framework for the establishment of an integrated municipal solid waste management system. The outline of the strategy includes:

- Central government shall be the facilitator for the establishment and implementation of the National Strategy.
- Implementation of the National Strategy shall be the responsibility of the governorates.
- Operations of the solid waste management system shall be the responsibility of the governorates/ local governments either by direct ownership and operation or through contracting services to capable private companies.
- Central government and governorates planning shall be integrated and shall foster a "Government-Public-Private-Community Partnership"
- The "Polluter Pays Principle" and full cost recovery shall be applied as being essential for private-sector entrance and system sustainability.
- Adherence to the "reduce, reuse, recycle and recover" hierarchy will be required.
- The public shall be fully involved in and made aware of all steps of the planning, development and implementation of the Strategy.
- The strategy stresses the need for the establishment of local solid waste management data collection and reporting system, which can be connected to a national network.

In Egypt, there is no law defining the "Industrial Waste". The word "Waste" means wastes collected and treated by Governorates but also include industrial waste generated from factories. The term 'waste' used in the strategy means accordingly.

The targeted values of the strategy are below.

[1] Zabbaleen is a person or businesses, which collect or recycle wastes in Informal Sector.

Table 5.33: Targeted Value of the SWM National Strategy

Target	Performance Indicator	Targeted value	
		5 years	10 years
Minimum collection coverage: Large cities Capital of governorate Provincial towns Large villages	Collective Efficiency	 90% 80% 70% 60%	 99% 90% 80% 70%
Sanitary landfill disposal	% of landfill vs. total generated	80%	90%
Recovery Composting Recycling	% of landfill vs. total generated	 50% 40%	-
Source separation	% of separated vs. total generated	40%	50%
Source reduction	% of reduction referred to normal growth		5%
Cost recovery		100%	NA
Funding	% of GDP	0.35%	-

Source: EcoConServ, 'Study on Status of the Environment and Relevant Policies/Measures in Egypt', Feb. 2005

Based on the national strategy, Local Governorates are expected to develop action plans that include objectives related to:

- Coverage level of collection and transfer of the daily-generated waste in urban and rural areas.
- Coverage level of treatment and final disposal
- Minimization of the amount of waste to be treated and disposed.
- Increasing of re-use and recycle
- Institutional set-up
- Participation of NGOs
- Removal of existing accumulations

Table 5.34: Supports from Donor Agencies and Foreign Government for Municipal Waste Management

Donor Agencies	Contents
USAID	Support of privatization of Qualubyia Governorate in Cairo (South zone)
KFW, GTZ (Germany)	Provided F/S studies to support the privatization efforts of Qena and/or Kafr El Sheikh Governorate.
Netherlands	Conducted integrated solid waste management projects for tow districts in the Fayoum Governorate
DFID (Denmark)	As a part of SEAM, provided SMW relating technical support for many governorates
Finland	Support for Beni-Suef city
EU	Identifying the possible site for landfill for some Governorates

(4) Municipal Waste Management in Rural Area

For the rural areas, the National Strategy for Integrated Solid Waste Management sets an ambitious target of 60% collection rate in larger villages by the year 2005. However, rural areas are subject to a set of limiting conditions and constraints, which necessitate that innovative municipal solid waste management systems and financing schemes.

- Geographically scattered rural communities, each containing relatively small populations and relatively large distances separating them
- Poor accessibility within the villages, due to their unpaved, narrow streets;
- The limited availability of land that can be used for disposal has led to the waste being dumped into agricultural drains and irrigation canals;
- Being low-income areas, the ability and willingness of the residents to pay for solid waste management services is limited;
- Limited technical capacity in rural municipalities areas about sound municipal solid waste management practices;
- Insufficient profitability making it unattractive to private sector companies

Photo 5.23: Condition of Waste Disposal Site in the Delta Area, Tanta

(5) Hazardous Waste

The framework of hazardous waste management in Egypt is regulated by the Law 4/1994.

- It is forbidden to displace hazardous substances and waste without a license from the competent administrative authority. (Article 29)

- Management of hazardous waste shall be subject to the rules and procedures laid down in the executive regulations of this law. (Article 30)

Hazardous substances and competent administrative authorities are below.

Ministry of Agriculture	: Agricultural Wastes
Ministry of Industry	: Industrial Wastes
Ministry of Healthcare	: Healthcare Wastes, laboratory wastes, domestic insecticide wastes
Ministry of Petroleum	: Petroleum Wastes
Nuclear Energy Agency of Energy Ministry of Electricity and Energy	: Radioactive Waste
Ministry of Interior	: Combustible and explosive wastes

Handling of hazardous substances can only be carried out after concerned authorities, which are six ministries mentioned above, issue permits. An Egyptian Hazardous Substances Information and Management System have been developed and provide basic guidelines and information.

According to the National Environmental Action Plan of 2002, Egyptian industries produce an estimated 4 to 4.5 million tons of solid wastes per year. Of this amount, hazardous industrial wastes form an estimated 100-150 thousand tons per year. The competent authorities involved in hazardous waste control and licensing include EEAA (and its regional branch offices), six line ministries, and the Governorate Environmental Management Units (EMU). However, EMUs are small institutions and not qualified enough, therefore, actual law enforcement system of hazardous waste is still weak in Egypt.

Photo 5.24: Hospital Wastes Dumping

Photo 5.25: Wastes Mixed with Hospital Wastes

The Hazardous Wastes Management Program of Alexandria, with the support of Finland, can be seen as a successful example of hazardous waste management. The project's second phase is currently undertaking. The controlled type landfill site of hazardous wastes was constructed by this project, and service was started in the winter of 2004. The detail about this site is described in page 98. Although, hospitals generate 25 thousands tons of hazardous wastes, Egypt has only one hazardous waste management facility in Alexandria. Generally, these hazardous wastes are dumped mixed with municipal wastes; therefore, in the Nile Delta area, where the groundwater level is high, risk on groundwater contamination is inevitably great. In addition, EEAA realized the seriousness of agro-chemical containers are dumped with municipal wastes.

The next section mentions about hazardous and non-hazardous waste management at industrial complex citing the examples of the 10th of Ramadan Industrial City.

The 10th Ramadan Industrial City

The 10th of Ramadan Industrial City is the oldest and largest industrial city in Egypt at the time of 2000.

This industrial city was established as an industrial development measure of the government. The Government of Egypt promulgated Law No. 59 of 1979 for Establishing New Communities. The law created the New Communities Authority in the Ministry of Housing, Construction and New Communities (MHCNC) to administer a City Development Agency for each new industrial city. The law provided land and utilities for industrial and residential purposes at subsidized prices. It also gave a 10-year tax exemption for all types of projects established in the new cities. By mid-1999, there were 11 new industrial cities under development with 2,352 production factories, providing about 2.7 million jobs.

The construction of the city began in 1978. The current plan is to build the city through four development phases. The first two phases have been completed. Work is proceeding on the third phase of the city and the fourth phase of the development process should be completed by 2017. By mid-1999, the number of producing industrial plants in the 10th of Ramadan reached 961 with 144,000 workers. The full-time residential population of the city is about 50,000. The other workers commute to the city daily from Cairo and Sharkia. From 1997 through 1998, USAID sponsored an initiative to design an Integrated Environmental Management System (IEMS) for the 10th of Ramadan Industrial City. As such, each city is managed by a City Development Agency (CDA) established by and reporting to the New Communities Authority in the MHCNC.

The 10th of Ramadan CDA is the responsible agency for managing solid waste in the city. Since there are 50,000 residents in this city, municipal waste and industrial waste are big issue of waste management. Recently, CDA privatized waste collecting and transfer

services and collected wastes are transferred to the existing public dumpsite, located six kilometers south to the City. In addition, much of illegally disposed garbage is seen on streets. CDA is planning to allocate budget to change above dumping site to sanitary landfill.

In this city, hazardous wastes and non-hazardous wastes are treated by the same method without separation and it means that hazardous wastes are dumped into the municipal wastes dumping site mentioned above.

In Egypt, the classification system of hazardous wastes, which is described below, follows the classification of the Basel Convention.

Egyptian Ministry of Industry Draft Hazardous Waste List (1997) and List of Hazardous Materials	1) Listed Wastes ● General hazardous waste generated from non point emission sources ● Hazardous Wasted generated from point emission sources （20 industries） 2) Hazardous Wastes which contain noxious matter 12 character include explosively Following two lists are added: Hazardous wastes which do not need permission from the Ministry of Industry and a list of hazardous wastes which required permission

According to the survey of 1999, 67 facilities in the 10th of Ramadan Industrial City had been identified as hazardous waste generators, with a total production of approximately 850 tons of hazardous waste per month. Seventeen of the facilities generate at least one ton of hazardous waste per month, representing 88 percent of the total hazardous waste generation. Two companies generate 750 tons of the total hazardous waste: Arabi for Steel, and Al Ezz Steel, which are reported as generating iron furnace slag. Other factors, nonferrous metal powder, waste oil, insulating firebrick waste of furnace, pharmaceutical waste, and asbestos are also generated.

The 10th Ramadan Industrial City has plans on separation of non-hazardous wastes include municipal wastes, recycling, final disposal facility, storage of hazardous wastes and construction of final disposal facility, however the Waste Research Group of USAID proposes the following concept which includes non-hazardous wastes from outside of the industrial city.

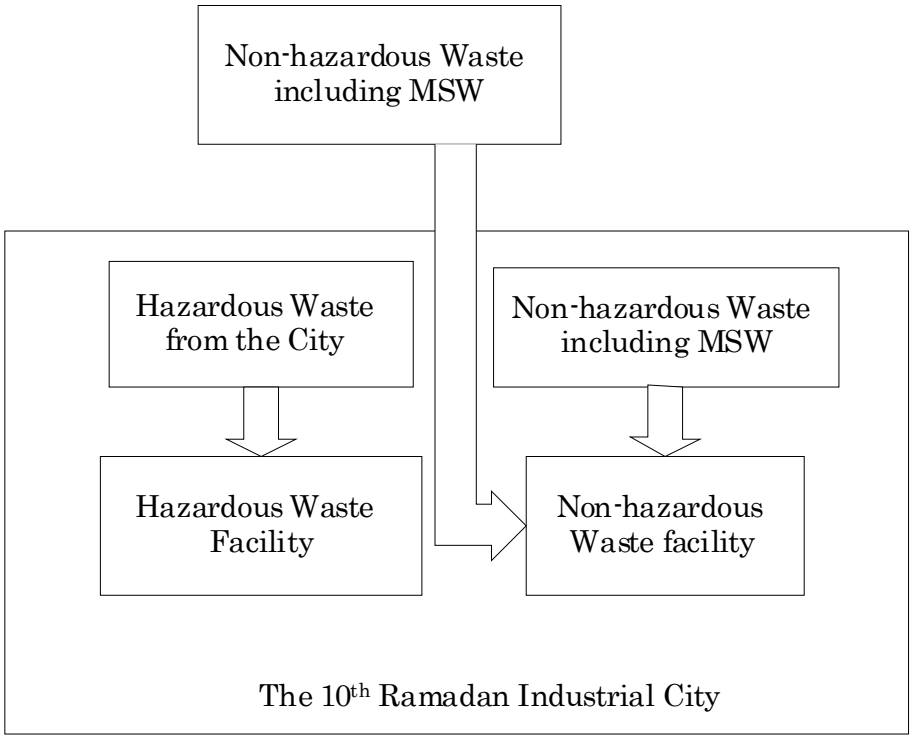


Figure 5.11: Planned Waste Management at the Ramadan Industrial City

The following Table 5.35 explains outline of the hazardous wastes landfill plan of the 10th of Ramadan Industrial City.

Table 5.35: The Outline and Costs of the Hazardous Waste Management Facility in The 10th of Ramadan Industrial City

Outline	Treatment amount of hazardous wastes; 1,000 t/month Operating life; 5 years Hazardous wastes weights 1.2 t/m3 Final cover soil is 10% of wastes The depth of the landfill 5.5m Final cover will be Ground level Occupation; 10,000m^2	
Capital cost (000L.E)	Landfill	3,500
	Building and Associated Equipment	152
	Vehicles and Heavy Equipment	620
	Design	427.2
	Subtotal	4,699.2
	Contingency Fee	704.88
	Total	5,404.08
O/M Cost (000L.E)	Personnel	200
	Maintenance and Administration	30
	Total	230

Source: Avijit Dasgupta, et al, 'Hazardous and non- hazardous solid waste management in the 10th Ramadan industrial city, Volume 1', June 2000

The next section describes the only one hazardous waste final disposal plant of Egypt, developed by Alexandria Governorate with the support from Finland. （See page 99 for photos）

- Primary contractor: Alexandria Governorate

<Outline>

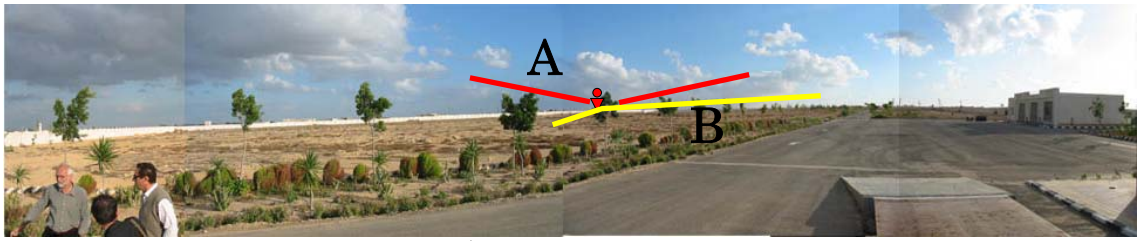
- Total area of the site: 14 hectare
- Facility: Controlled type of landfill with liner facilities, leachate holding pond, laboratory, and administration office etc.
- Construction of a physical and chemical treatment plant is scheduled to start from January or February of 2005 and begin operation from the autumn of 2005.
- Leachate Holding Pond: Store leachate at holding pond. With arid climate of Egypt, leachate will be evaporated without treatment and dispose remnant to landfill. Drainage from physical and chemical treatment plant will be also evaporated in the same way.

<Landfill Site>

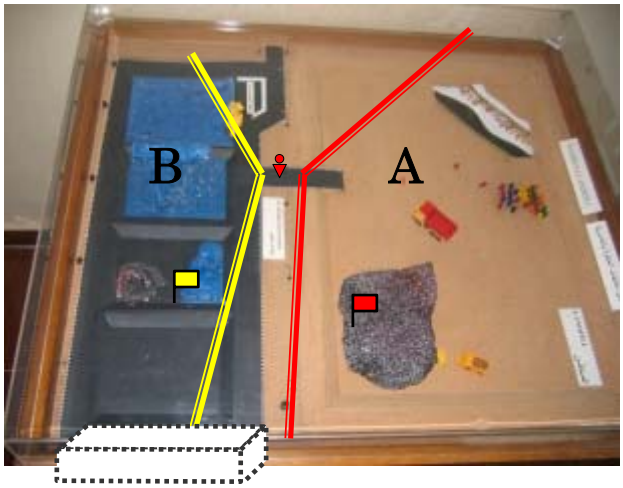
- Total area of the site: 1.4 hectare, capacity: 40,000m^3
- Lifetime of the site: assuming inflow of waste stream as 3,000m^3/year, more than 10 years of lifetime for each cell. 3 more cells can be developed.
- Height of covering soil: up to 3 meters.
- At the time of on site survey, small quantity of asbestos was accepted and as the operation of the site had just began.

<Others>

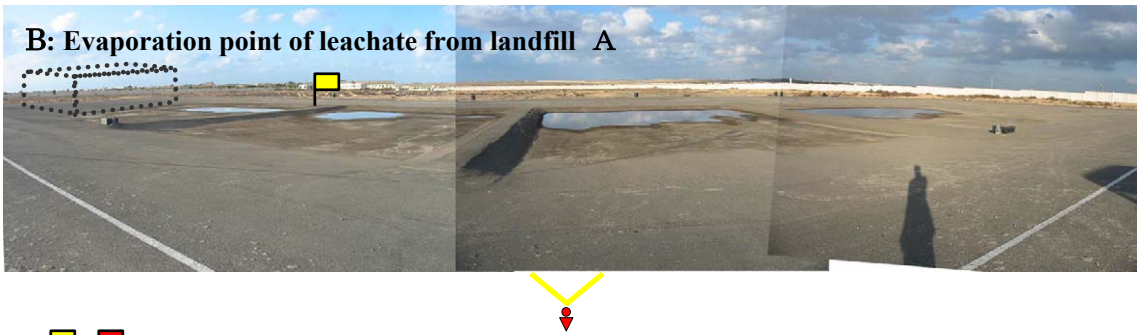
- Operation cost should be covered by user fee. However the operation had been just started and not enough wastes were coming in. Alexisandria Governorate has paid for staff wages.
- User Fee: 238 LE/ton (will be 300 LE with transportation cost)
- This site currently can not treat organic hazardous waste which need thermal treatment. There is no plan for a construction of thermal treatment facility like incinerator, however, considering to corporate with cement factory. There are two cement factories in and near Alexandria. The one is French based Lafarge and the other is Portuguese factory. Lafarge is recognized as a better partner equipped with better facilities and has many years of experiences in hazardous waste management.



1) View of the site



2) Detail model of the area shown above



show points match to the model

indicates the planned construction site of physical and chemical treatment facility. The physical and chemical treatment facility will be developed on the left of evaporation pond.

Photo 5.26: Hazardous Waste Disposal Site in Alexandria

5.6 Others

(1) Chemical Substances

The Government of Egypt signed the Stockholm Convention in May 2002 and started to take measures on Persistent Organic Pollutants (POPs). Development of the National Implementation Plan (NIP) is underway with the support of Global Environment Facility.

The content of the NIP include:

- Preliminary assessment of the stockpiles of POPs and waste products contaminated with POPs.
- Safe handling methods, including opportunities for disposal.
- Build capacities to report Conference Of Parties
- Build capacities to identify sites contaminated by POPs.

So far, this project developed preliminary inventory and founded 10 sources including cement, chemical and hospital wastes. Action Plan will be developed by June 2005.

Moreover, Table 5.36 shows all treaties that Egypt has already signed regarding chemical substances.

Table 5.36: International Accords Regarding Hazardous Substances

Accords	Date of Ratifications
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	01 Aug. 93 (Accession)
Stockholm Convention on Persistent Organic Pollutants (POPs)	17 May 2002 (Signature) 02 May 2003 (Ratification)
Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa	30 Jan. 1991 (Signature)
Convention on Civil Liability for Damage Caused during Carriage of Dangerous Goods by Road, Rail and Inland Navigation Vessels (CRTD), Geneva, 1989	-
Amendment to the Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention), Basel, 1989	13 Dec. 2003 (Ratification) 22 Sep. 1995 (Signature)
Convention on the Transboundary Effects of Industrial Accidents, Helsinki, 1992	-
Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific Region (Waigani Convention), Waigani, 1995	-
European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR), Geneva 1957	-
FAO International Code of Conduct on the Distribution and Use of Pesticides, Rome, 1985	-
Convention on Liability and Compensation for Damage in	-

Accords	Date of Ratifications
Connection with the Carriage of Hazardous and Noxious Substances by Sea (HNS), London 1996	

Note: - unknown
Source: Data from web-page 'Countrywatch.com' http://aol.countrywatch.com/

(2) CDM and Energy

1) CDM

Egypt signed the Kyoto Protocol on March 15, 1999, and ratified on January 12, 2005 (Kyoto Protocol was put in effect on February 16, 2005). Climate Change Unit of EEAA was listed as a focal point for Kyoto Mechanism in Egypt.

The Climate Change Unit was designated as a central unit for promoting CDM strategy in Egypt, and currently has five staffs working on the case. The council for capacity development was established in September 2004. There has no concreted project (as of Study Team's visit in late November, 2004) for CDM project, but CDM projects are expected to be executed in the following field after the Protocol put into effect on February 16, 2005: farmland, waste management, afforestation and industry. Within industrial arena, NOx (Alexisandria), fertilizer, project in Upper Egypt, textile (conversion of energy to natural gas), wind-farm (Alexandria) are anticipated.

CDM Projects

CDM projects have been reviewed in June 2002. Table 5.37 shows the portfolio of the projects.

Table 5.37: List of CDM Project Under Consideration in Egypt

Project Code	Project	Initial Investment (M$)	GHG reduction (t-C/y)	CSC ($/tC)	Pbp (years)
1. Electricity Generation I.1 Electricity Generation by Wind Farm					
1.1.1	60MW Wind Farm	54	40138	30	No Pbp
I.2 Electricity Generation by Integrated Solar Thermal System					
I.2.1	CDM Integrated Solar Thermal Combined Cycle System 300MW	240	49664	107.5	No Pbp
II. Other renewable Energy Applications II.1 Other Solar Energy Applications					
II.1.1	Toshka PV Water Pumping	0.6	39.4	2141	No Pbp
II.1.2	Solar Food Dehydration	2	1691	156.8	No Pbp
III. Transportation Projects III.1 Railway Electrification Projects					
III.1.1	Cairo-Alex. Railway Electrification	355	21073	1604.5	No Pbp
III.2 Underground					
IIL2.1	Alex. Underground	687	11579	3169.9	NoPbp

Project Code	Project	Initial Investment (M$)	GHG reduction (t-C/y)	CSC ($/tC)	Pbp (years)
III.3 Waterway Transportation					
III.3.1	Development of Cargo River Nile	174	31855	97	No Pbp
III.4 Switching to N.G in Transportation					
III.4.1	Install dedicated NCG engines to replace low efficiency diesel engines.	12.3	2580	-300.6	3.8
IV. Energy Efficiency IV.1 Control Systems and Energy Saving Equipment					
IV.1.1	Control Systems and Energy Saving Equipment at Zenotex Dyers	1.1	1932	-76.2	6.2
IV.2 Waste Heat Recovery					
IV.2.1	Using N.G & Regenerative Burners in Ezz Steel Co.	4.0	3956	-21.3	9.5
IV.3 Cogeneration					
IV.3.1	Beni Soeif Cement	8.3	6336	-125	8.5
IV.3.2	Industrial Investments Co.	0.3	185	-174	7.8
IV.3.3	Misr Elmonifia (Textile)	1.6	911	-237	6.3
IV.3.4	Mohm (Metal Works)	0.3	369	-133	5.5
IV.3.5	Egypt Air Hospital (Building)	0.3	59	-488	8.5
V. Waste Management V.1 Solid Waste Management					
V.1.1	Feed Stock from Organic Waste	1	377336	-3.9	6.1
V.1.2	Organic Solid Waste Digestion	40	127000	163	No Pbp
VI. Land Use, Land-Use Change and Forestry (LULUCF[2]) VI.1 Protecting Some New Cities By Tree Plantations Using Sewage Water					
VI.1.1	Establishment of Forest Plantation and Shelters Around 10th of Ramadan City	0.473	1,946	12.29	Not applicable n.a
VI.1.2	Establishment of Forest Plantation and Shelters around El-Arish Sewage Water Station	0.653	349	32.62	n.a.
VI.2 Protection of Irrigation and Drainage Canals					
VI.2.1	Protection of Ei-Hager Canal and El-Omom Main Drainage Canal by Windbreaks	0.151	281	14.11	n.a.
VI.3 Stabilization of Coastal Sand Dunes					
VI.3.1	Sand Dune Fixation of North Sinai Governorate	0.170	1,019	7.11	n.a.
VI.4 Protection of Road and Highway					
VI.4.1	Afforestation of a Part of Cairo-Aswan Highway	0.274	428	17.71	n.a.
Shaded region Projects evaluated to have the highest possibilities.					

Note: GHG: Greenhouse Gas, CSC: Cost of Saved Carbon:, Pbp: Payback Period
Source: TIMS/E2RC, 'Egypt's Strategy on CDM', June 2002

[2] Land Use, Land-Use Change and Forestry

In private sector, activities of the NGO, which was establishes in 1999[3] covers Kyoto Protocol issues and preparing for CDM investment and identify joint implementation and sponsorship by petroleum capital for CDM projects.

2) Energy

Energy sector in Egypt contributes 6.7% of the country's Gross Domestic Products. According to the New & Renewable Energy Authority (NREA), the current share of renewable energy in Egypt is approximately 1 % (excluding hydropower), and NERA is aiming to increase the figure to 3 % by 2010.

Table 5.38: Contribution of Energy Sector in GDP

Unit: million LEI

Year	GDP	Contribution of Energy Sector			Share		
		Petroleum	Electricity	Total	Petroleum	Electricity	Total
2001/2002	299,300	14,400	5,800	20,200	4.18%	1.94%	6.75%
2000/2001	290,300	14,000	5,600	19,600	4.82%	1.93%	6.8%
Growth rate	3.1%	2.9%	3.6%	3.06%			

Source: Organization for Energy Planning, 'Energy in Egypt 2001/2002'

a) Hydropower

Hydropower accounts for approximately 20% of electricity generated in Egypt. Installed capacity of the hydropower is as follows: Aswan Reservoir 615MW, Aswan High Dam 2,100MW, and Esna Hydropower Station 90MW. Also, there are 165MW of hydropower potential at Nagah Hamady and Assiut.

b) Coal

Coal is extracted in Bedah, Thoura, Eioun Mousa, Klabcha, and Maghara. Maghara is especially important for Egypt with 27 million tons of coal reserves. Egypt imports approximately 1.6 million tons of coal annually.

c) Solar Energy

Egypt lies between latitudes 22 and 32 degrees North with a daily sunshine of 9 to 11 hours. An average solar radiation in all regions is about 1,900 - 2,600kWh/m^2/year. About 220,000 domestic hot water collectors using solar energy have been constructed and are used particularly in new desert cities. Besides using solar energy for hot water, Egypt also has been pushing Photo Voltaic (PV) technology, in facilities/industry of: water pumping, desalination, the ice industry, refrigeration for vaccines, navigation aids, wireless stations, highway billboard illumination, lighting of remote areas, and petroleum pipelines cathode protection.

[3] Energy Services Business Association (ESBA)

Ms.Laila Abd-El-Kawy of NREA, vice chairman for R&D Technical Affairs, expressed desires to the Study Team to promote Solar Thermal Cooling system especially in Sinai Peninsula. Furthermore, she also mentioned the issues to be tackled in near future as follows: increasing efficiency of PV cells, development of energy strategy for remote areas (needs for F/S), information gathering, water pumping and irrigation from Nile River by electricity generated by solar energy.

d) Wind Energy

Egypt enjoys considerable wind energy resources with an average wind speed of 10 meter per second in Gold of Suez and 7 meters per second in East Owainat area. Wind warm with capacity of 140MW has already been in operation while another 205MW worth of wind farm is underway. Combined with existing wind farm, Egypt plans to produce 2.4 billion KWh/year by the year 2010. (This will save about a half million tons of oil equivalent per year).

e) Biomass Energy

Production of biomass energy using agricultural, animal, human, and solid wastes has high potential. This can be a cheap source of thermal energy and fertilizer, as well as improving the environment by disposing of wastes. Future challenge lies in development of inexpensive technology and technical transfer for using biomass resources. However, attention should be paid for occurrence of the Black Smoke episodes emerged in recent years.

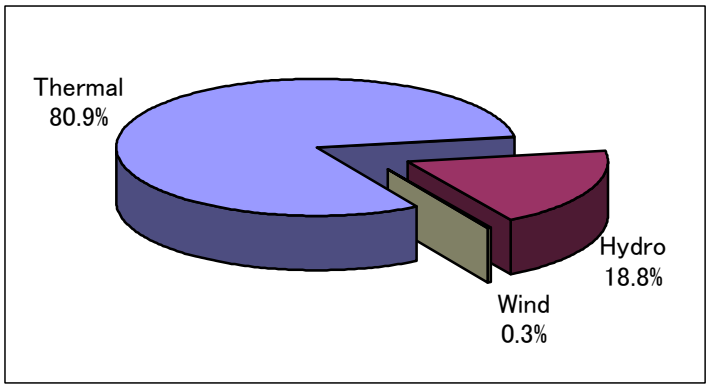
Furthermore, development of a testing facility will be necessary for agricultural wastes derived bio-fuel.

Table 5.39: Primary Energy Production

(MTOE)

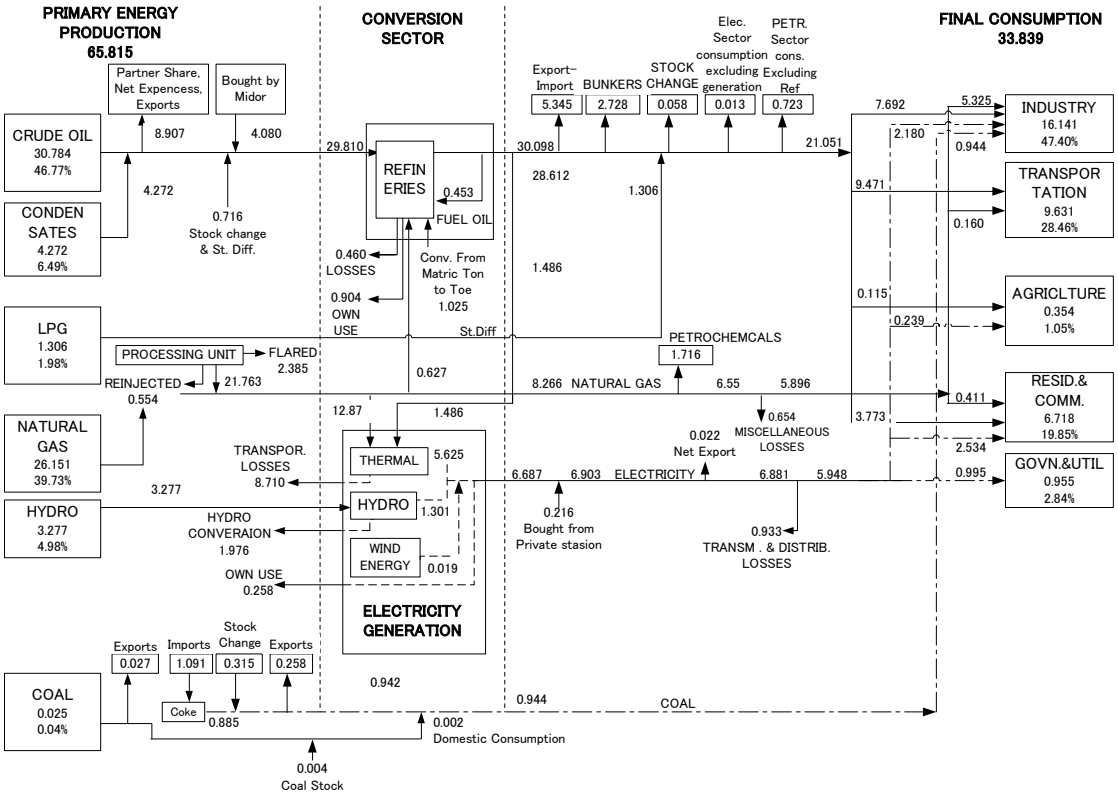
Primary Energy	2001/2002	2000/2001	Growth Rate
Crude Oil	30.784	32.115	(4.14%)
Natural Gases	31.729	25.344	25.19%
Natural gas	26.151	20.390	-
Condensates	4.272	3.599	-
LPG	1.306	1.355	-
Hydropower	3.277	2.997	-
[T.W.h]	[15.130]	[13.697]	10.46%
Coal	0.025	0.039	(35.9%)
Total	65.815	60.495	8.79%

TOE: Tons of Oil Equivalent
Source: Organization for Energy Planning, 'Energy in Egypt 2001/2002'



Source: Data from Organization for Energy Planning, 'Energy in Egypt 2001/2002'

Figure 5.12: Supply of Electricity by Generation Methods in 2001/2002



Source: Organization for Energy Planning, 'Energy in Egypt 2001/2002'

Figure 5.13: Energy Balance in Egypt in 2001/2002

(3) EPAP: Egyptian Pollution Abatement Project

1) Cleaner Production

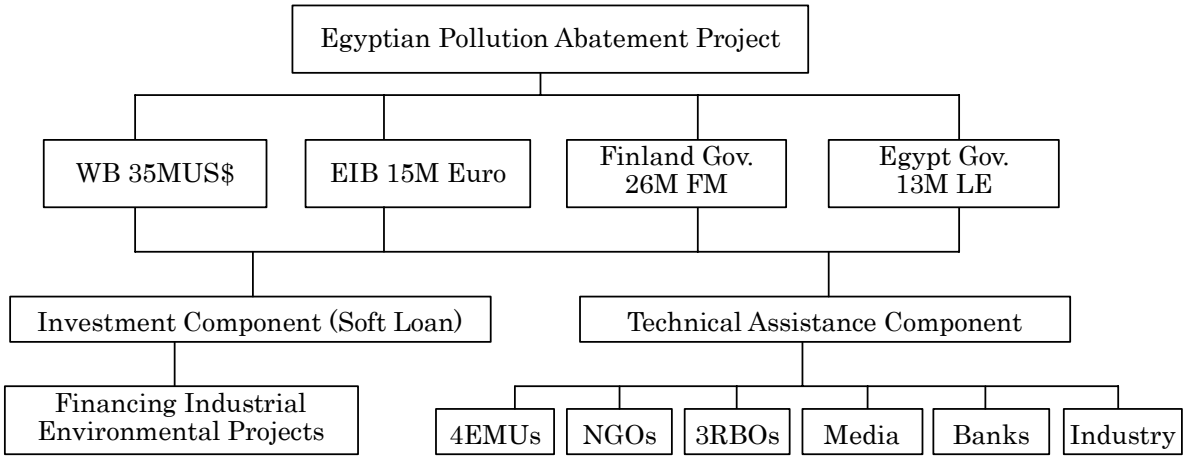
The World Bank estimated that Egyptian environmental pollution costs, excluding industrial sector, in 1999 reached to 4.8% of GDP. Industrial sector was excluded because of the lack of necessary data on pollution and the difficulties of quantifying impact of environmental

pollution. Although the Government of Egypt has been implementing anti-pollution measures like development of the standards over the past several years, the capacity of Egyptian government to enforce the law remained relatively limited due to the institution deficiency.

The main sources of air pollutions in big cities are automobile exhaust emissions, and factory smoke is also major source in Helwan, Alexandria and Suez. Major sources of water pollution are domestic wastewater and wastewater drainage from factories located in particular area. Small factories of lead secondary smelting (lead), bark tannery (Cr, COD), brick making (SO_2), textile, detritus, coal, lime are also considered as major sources of pollution as well as other large plants. The Government has been relocating these plants from the Greater Cairo, however, many of plants are still remained in the vicinity and generating quantity of pollutants. Recently, the Government with supports from other donors has been introducing End-of-Pipe (EoP) facilities and Cleaner Production equipments to these small factories. Examples of Cleaner Production projects are the Achieving Compliance with Environmental Regulation in Industry (ACI) provided by DANIDA and Egyptian Pollution Abatement Project (EPAP) with supports of the World Bank, FINNIDA, EIB etc. EEAA is a counterpart of both projects.

2) EPAP1

Figure 5.14 shows the component of EPAP1, implemented from 1997 to March 2005. EPAP was a project targeted both public and private businesses and aimed to reduce industrial pollution.



4 Governorates(EMUs); Cairo, Qualiobia, Alexandria, Suez
3 RBOs; Cairo, Alexandria, Suez

Figure 5.14: Component of EPAP

EPAP1 consists of soft and technical components, providing CP and EoP facilities to businesses as soft and technical components. The soft component is financed with 35 million US$ from

the WB and 15 million Euro from EIB. 26 million FM from the Government of Finland and 3 million LE from the Government of Egypt support technical component.

3) EPAP2

As stated above, EPAP1 was concluded in March 2005 and EEAA is considering implementation of EPAP2 with loans from the WB, GEF, Carbon Fund and JBIC. According to the pollution control division of the EEAA, GoE has intention to officially request the assistance to JBIC, but it is uncertain to when the Ministry of Foreign Affairs of Egypt and president will approve this matter. Greater Cairo area, Alexandria and two cities in the Gulf of Suez, Suez and Ismailia will be the target in EPAP2.

(4) NGOs

The Government of Egypt recognizes NGOs as an important partner for development and enacted Law 153/1999 in order to promote the development of the civil society. Areas that NGO could operate had been limited for only 7 areas by the previous law 53/1999, but the Law 153/1999 removed the restriction specified in the previous law. Some of the eased restriction includes allowing international NGOs to operate in Egypt and foreigners to join Egyptian NGOs.

As an example of new NGO activities in environmental arena, the EESBA (Egyptian Energy Service Business Association), which was established in 1999, is promoting the energy manager training, cleaner productions, switching to CNG in automobiles and global warming countermeasures.

The following Table 5.40 is the list of NGOs.

Table 5.40: Domestic and Regional NGOs

Names of NGOs	Governorates	Yr. Established	Activities
Friends of Trees Association	Cairo	1973	Environmental protection, education and regional development
Egyptian Association for Packaging Development	Cairo	1974	Environmental protection
Arab Office for Youth and Environment (AOYE)	Cairo	1978	Environmental protection and regional development
Association for the Protection of the Environment (APE)	Cairo	1984	Environmental protection
Central Association for Environmental Protection	Cairo	1989	Environmental protection
Egyptian Association for Development of Local Communities	Cairo	1993	Environmental protection and regional development
Friends of the Environment and Development Association (FEDA)	Cairo	1993	Environmental protection

Names of NGOs	Governorates	Yr. Established	Activities
Association of Enterprises for Environmental Conservation	Cairo	1996	Environmental protection and regional development
Participation and Conversation Forum for Development	Cairo	2000	Environmental protection and regional development
Liberty Association for Community Development	Alexisandria	1966	Environmental protection and regional development
Friends of the Environment Association	Alexisandria	1990	Environmental protection
Egyptian Association for Industry and Environment	Alexisandria	1991	Environmental protection
Association of Commendable Efforts in Shebin El Kom	Menoufia	1982	Environmental protection and regional development
Association for Development and Environment	Ismilia	1993	Environmental protection and regional development
Coptic Evangelical Organization For Social Services (CEOSS)	Minya	1960	Environmental protection and regional development
The National Association for Environmental Protection	El Arosh	1989	Environmental protection
Baladi Association	Portside	1973	Environmental protection and regional development
Association of Islamic Youth	Beni suef	1967	Environmental protection and job training
Association for Local Community Development	Beni suef	1982	Environmental protection and regional development
Association of Environmental Conservation in Fayoum	Fayoum	1991	Environmental protection
Association for Environmental Protection and Children Protection in Etay El Baroud	Beheira	1996	Environmental protection and regional development
The Women Association for Health Improvement	Sohang	1966	Environmental protection and medial services
Association for Environmental Protection in Assiut	Assiut	1991	Environmental protection
Association for Development and Environmental Protection in Dakahliya	Dakahliya	1993	Environmental protection and regional development
Association For Community Development and Environmental Protection in Kafr El Dawar	Beheira	1995	Environmental protection and regional development
Association for Environment and Family Development in Qena	Qena	1991	Environmental protection and regional development
Association for Local Community Development	Sharkyia	1983	Environmental protection and regional development
Association for Community Development in the New Salhyia	Sharkyia	1984	Environmental protection and regional development
Hurghada Environmental Protection and Conservation	Hurghada	1992	Protection and conservation of land and marine ecosystem,

Names of NGOs	Governorates	Yr. Established	Activities
Association			and coral reef in and around Red Sea.

Source: JICA, "Country Profile on Environment -Egypt" Feb. 2002

Table 5.41: International NGOs

Names of NGOs	Governorates	Yr. Established	Activities
Near East Foundation	Cairo	1915	Promotion of sustainable development, equal distribution and efficient use of resources, enhancement of manpower possibility and improvement of service delivery system in host countries.
Cooperative for American Relief Everywhere (CARE)	Cairo	1954	Development of small enterprises, regional development, environmental development and food preservation.
Catholic Relief Services	Cairo	1956	Release economical and social distresses of people who live in old and new areas of upper Egypt.
Ford Foundation, Cairo Office	Cairo	1957	Reduction of poverty and corruptions, enhancement of democratic values, enhancement of international corporation and advancement of people's achievements.
Agricultural Cooperative Development International	Cairo	1963	Increase trades and support for agro-related organization and independent organizations.
Medicins Sans Frontiers	Cairo	1975	Provide services regarding environment and sanitation through corporations with local institutions.
Institute of Cultural Affairs Middle East and North Africa (ICA)	Cairo	1976	Organizational improvement through program, which is highly participated and corporate with other organizations.
Plan International	Cairo	1980	Support environmental improvement, establish and repair clinics and hospitals.
Save the Children/USA	Cairo	1982	Risk reduction of hygiene aspect by providing sanitary system for sewage, waste and drainage.
Fredrich-Ebert foundation	Giza	1976	Economical reform and job in small size industries

Source: JICA, "Country Profile on Environment -Egypt" Feb. 2002

Table 5.42: NGO Networks

Name of Network	Governorate	Yr. Established	Activities
Arab Network for Environment and Development (RAED)	Cairo	1978	Collect, release and exchange information regarding various environments and development problems
The National NGOs Center for Population & Development (NCPD)	Cairo	1995	Networking, capacity building, proposal development and provide technical support for local NGOs through money required for project maintenance.
Cooperation and Development Association for Egyptian and European Youth (CDAEEY)	Giza	1997	Cultural, educational, social and charity projects, meeting, conversation, seminar, training program, competition, environmental recreation through festivals, sports activities

Source: JICA, "Country Profile on Environment -Egypt" Feb. 2002