MedWetCoast

Project for the Conservation of Wetland and
Coastal Ecosystems in the Mediterranean Region

MANAGEMENT PLAN- WADI GAZA

November 2002

1 BACKGROUND

1.1 Environmental Policy

1.1.1 International Policies

- RAMSAR Convention on Wetlands of International Importance

The RAMSAR Convention[1] sets policies and guidelines for the promotion and conservation of wetlands and introduces the principle of *wise use*. RAMSAR defines the wise use of wetlands as "their sustainable utilization for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem". RAMSAR also calls for conservation of wetlands by establishing and declaring them as adequately wardened nature reserves. The Environmental Quality Authority (formerly the Ministry of Environmental Affairs*) of the Palestine Authority accepts and tries to follow the guidelines and methods of the Ramsar convention recognizing the value, importance and international credibility of RAMSAR.

*During the reforms of the Palestinian National Authority in August 2002 the Ministry of Environmental Affairs was re-organised. The re-organization led to the body being renamed the Environmental Quality Authority.

1.1.2 Palestinian Authority Policies

The Environmental Quality Authority (EQA[2]) aims at achieving a sustainable form of development in Palestine. To meet this aim, a number of broad goals have been set:

- To conserve natural resources and biological diversity.
- To enhance the built environment by maintaining or enhancing the character of the rural areas.
- To meet economic and social needs in ways which are compatible with conservation of natural and cultural resources.

In recognition of its importance as a natural area and as the only wetland in Palestine, Wadi Gaza was declared a ***nature reserve*** in June 2000. Wadi Gaza Nature Reserve was established to conserve the wetland and ecosystem, to halt or slow the degradation of its natural resources and biological diversity and to promote measures for their eventual rehabilitation. The initial boundaries, which extended beyond the wadi itself, were reduced after one year due to community conflicts. As partial compensation, the EQA requested municipalities to revise their land-use plans to ensure that the Wadi bed is respected as a protected area.

1.1.3 Local Policies

For the most effective management of the site the local policy is to work in partnership with other institutions, organizations and other stakeholders, including local communities, in the planning and decision making process.

1.2 Site selection

Wadi Gaza's importance and need for protection was first mentioned in the Regional Plan for the Gaza Governorates (MOPIC, 1998). Survey work* ensued to evaluate the site, assess the level of need and formulate management measures. This demonstrated that Wadi Gaza supports a unique set of habitats for the Gaza Strip, and a rich biodiversity. Both are under threat from human pressures, in particular from sewage derived from recent urban growth within the catchment and from its use as a solid waste dumping

site. This pollution has not only led to severe deterioration of the natural habitats but is having an increasingly negative effect on the well-being of the communities around Wadi Gaza. Measures to solve these environmental problems will also alleviate a serious public health risk.

*The impetus and funding for the survey work came through participation in the MedWetCoast project, a regional program for Mediterranean wetlands which promotes biodiversity conservation through implementation of sustainable management activities, strengthening capacities through training and technical assistance and transfer of Mediterranean experience and skills through networking. The MWC initiative is described more fully in Annex 3.

The area initially selected for protection as a nature reserve comprised both the course of the Wadi and bands of adjacent land either side of the Wadi which were considered to be integral parts of the ecosystem or impinging upon it. However, local opposition led to designation of adjacent land beyond the Wadi banks being dropped in favour of a more restricted area confined to the course of the Wadi and its immediate floodplain and banks. Both the original extent of the nature reserve and the final area designated* are shown in Figure 1.

*The MWC survey work which provided much of the information for this management plan was based on the original designated area. This makes good management planning sense because the outer bands, though no longer given full conservation status, still function as part of the ecosystem and need to be considered if steps are to be taken to maximize environmental conservation within the site. Constant reference is made both to the wider survey area and the current more restricted nature reserve. To differentiate between the two, the entire zone originally designated is referred to throughout this document as the "Wadi Gaza area". The zone within the current more restricted boundaries is called the "Wadi Gaza Nature Reserve" or, more simply, the "nature reserve". Within the nature reserve, the wadi course issues into a lake just prior to the sea. The lake and its surrounding wetland habitats are very important features for nature conservation. To differentiate them, the lake itself is referred to as "the estuary lake" and the lake in conjunction with its surrounding habitats as "the wetland".

The need to conserve Wadi Gaza is driven by international, national and local imperatives:

International Wadi Gaza is one of very few wetlands on the easternmost Mediterranean coast and is important for its rich biological diversity (flora and fauna). The Wadi is also on a major international migration flyway and provides a stop-over point for birds heading between the north Palaearctic and Africa on their spring and autumn migrations. Wadi Gaza is recognised by BirdLife International as an Important Bird Area (IBA) in the Middle East (Evans, 1994; Atrash, 1999).

There is an international need to solve problems caused by pollution for social and environmental reasons, and to preserve the biological diversity which maintains the balance of the ecosystem.

National Wadi Gaza is the only coastal wetland in Gaza and one of the biggest in Palestine. In terms of biological diversity it is unique at the national level and retains outstanding natural landscape features in a country where human activities and development are placing increasing pressure on land, landscapes and wildlife. In addition to conserving these values, safeguarding the site raises its potential as a recreational area, attracting people from throughout the country and beyond.

These attributes have led Wadi Gaza to be identified as an important site for the development of recreational, educational, research and conservation initiatives.

Local Conservation management at Wadi Gaza will bring very important benefits to the local communities north and south of the Wadi.

It will compensate the lack of open spaces and green areas for the communities in the southern part of the Wadi; and it will help to create job opportunities, north and south, in a range of sectors including agriculture, tourism, private business, kiosk owners and much more.

2 SITE DESCRIPTION

General information

2.1 Location and site boundaries

2.1.1 Location

Wadi Gaza Nature Reserve is situated on the Middle East Mediterranean coast in the territory of Gaza Strip, within the Palestine Authority jurisdiction (Figure 1). Its co-ordinates are……

Wadi Gaza springs from the Negev Mountains and the Southern Heights of Hebron City. The length of the Wadi is 105 km from its source, and extends from the Truce line in East Gaza to the coast where it discharges into the sea. Wadi Gaza is located centrally along the Gaza Strip coast, and is bordered in the north-west by the sea, the south-east by the Braij Camp, the south-west by AlNusairat Camp, and the north by AlZahra' City. The maximum elevation of the Wadi is thirty meters above sea level, dropping to sea level where it reaches the Mediterranean. Its circuitous route through the Gaza Strip amounts to 7 km.

The tributaries contributing to Wadi Gaza have their sources in the central mountain areas, the low heights north of Negev, and the west and south-west parts of the Hebron Mountains.

The Wadi is notable for its twists and turns, especially across the Strip where it changes track eight times. The Wadi banks support a number of terraces. The width of the Wadi varies from place to place, and is widest near its mouth where it reaches about 100 m. Six wadis issue into the main Wadi, the most important of which are Abu Qatroun Wadi and Ghalbeh Wadi. Abu Qatroun Wadi cuts through land north and Ghalbeh Wadi land south of Wadi Gaza.

Morphology of Wadi Gaza

Table 1: Summary of Wadi Gaza morphology

Origin source	Hebron mountains and the Northern Negev
Mouth	The Mediterranean Sea
Total length from origin	105 km
Length in Gaza Strip	9 km
Width in Gaza	20-270 m with maximum width at the mouth
Topography in Gaza	30 m AMSL at Gaza border gradually dropping to 0 m AMSL at the mouth
Flow direction	From east to west
Main tributaries	Wadi Ashareeaa, wadi Ashallalah

A high percentage of the land alongside the Wadi lies within municipal boundaries. The rest lies within regional areas. The Wadi is bounded in the north by land under the jurisdiction of three local authorities: AlZahra', AlMughraqa, and the village council of Wadi Gaza. On its southern border, it is bounded by the Nuseirat and Bureij refugee camps.

2.1.2 Site boundaries

The site boundaries as established in 2000 comprised the course of the Wadi plus adjacent areas affecting the Wadi and affected by changes to the Wadi. However, after one year, community conflicts led to boundary changes* which reduced the delineated area to the Wadi bed alone. Figure… shows the current boundaries, whose statutory protection is now enshrined in land-use plans; and the original boundaries of 2000, since rejected.

*The boundary changes place an even greater emphasis on the application of binding conservation measures for the reduced designated area. The RAMSAR convention states that, should a country change the boundaries of the wetland on the basis of "urgent national interest", it can do so but the loss of habitats has to be prevented and the loss of wetland resources has to be compensated by protecting and restoring a proportionate number or area of the wetland habitats.

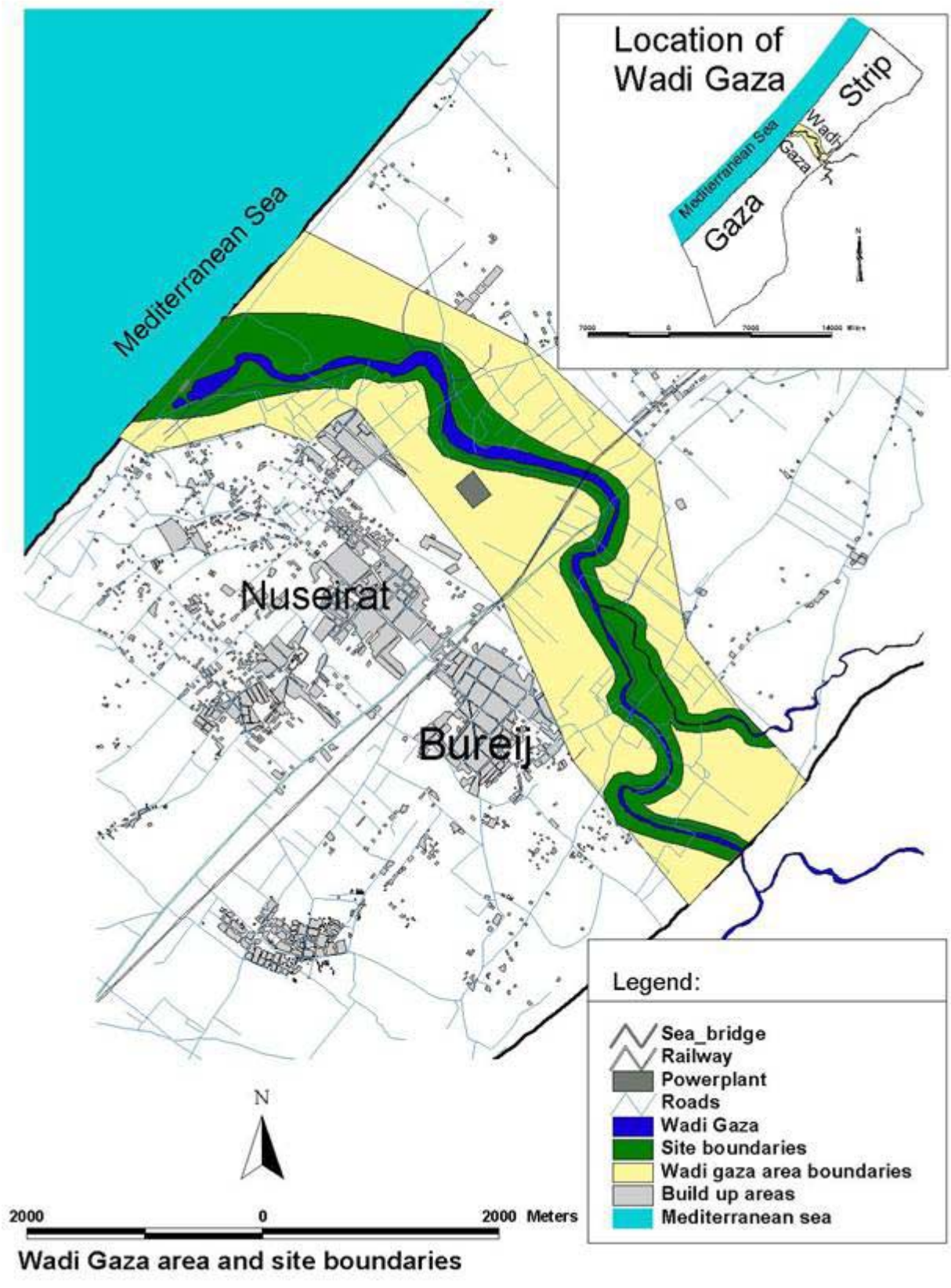


Figure 1: The Wadi Gaza area and site boundaries (source: Environmental quality Authority and Wadi Gaza Project).

2.2 Legal status and rights

2.2.1 Ownership

After the establishment of the Palestine National Authority (PNA) in 1994, rapid development has characterized the whole Gaza Strip. Development in the surrounding area impacted negatively on the wildlife and environment of Wadi Gaza which prompted its declaration as a natural protected area.
The Wadi Gaza area (see **Figure 1**) is approximately 1,313 hectares (13,130 dunums). It is divided into 4 categories. Private, governmental, waqf and Beer Saba'a.
The available information about land ownership in the Wadi Zone is not reliable, and it is not clear what is government land. Current estimates are that about 60% is private land, 27% Beer Saba'a (unregistered land), 12% waqf land and 1% government land (Figure 1).

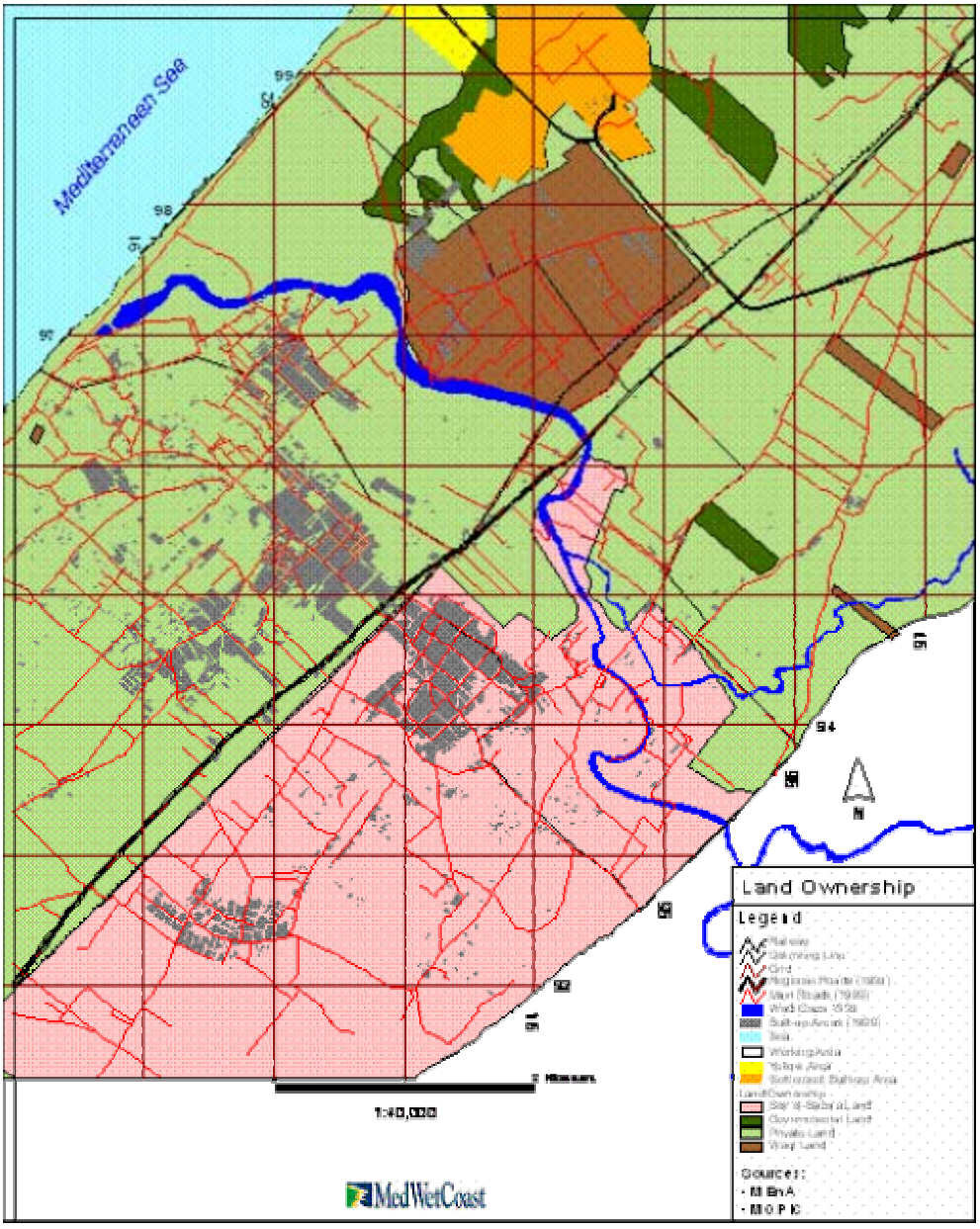


Figure 2: Land Ownership in Wadi Gaza and surrounding areas

Apart from a small area, located just close to the mouth of the Wadi, government ownership is restricted to land along the course of the Wadi.
Beer Saba'a land is land which has never been registered. It is concentrated in the eastern part of the Wadi area and could be private, government land or both. The Ministry of Housing (MOPWH) is working to define and register this land by means of a huge land registration project started in 1999 with the assistance of a Finnish group.
Waqf land is concentrated within the administrative boundaries of el-Moghraga village council. It has been rented to the public for 99 years for agricultural purposes (source: local people). Recently land use of Waqf land has started to shift from agriculture to urban development.
Private land, which occupies the largest percentage of the planning area, has the potential for huge development if strong regulation and enforcement is not applied. The reasons for this include inefficient agricultural production, the property lot structure which divides land into small parcels due to the family inheritance system, and the cheapness of the land.
In order to protect critical habitats on privately owned land, the EQA is currently in negotiation with land owners to change the land use to nature conservation. Land owners in this position are being offered governmental land as compensation.

2.2.2 Legal rights

The main law currently applied to regulate the planning and construction processes in the Gaza Strip is the British Law* no. 28 of 1936. This law requires local authorities to prepare detailed and structured blueprints, to set conditions for licensing, to define specific land use within its boundaries, and to enact enforcement measures upon residents. Residents who do not adhere to these laws risk losing their property. However, they can still receive free connection to municipal water and electricity services provided they sign a pledge not to request compensation in case of governmental expropriation of their property for other purposes.
The Wadi Gaza area lies within more than one administrative sector, being partly within municipal jurisdiction and partly within regional jurisdiction. The areas under municipal jurisdiction lie within the boundaries of four municipalities or local councils and are designated to one of four land use categories: housing, light manufacturing, services or agriculture. Under these municipal laws each category is regulated for building size and proportions (including limitations on height). Regional jurisdiction concentrates on agricultural activities, services and the regional infrastructure. These laws allow for an agricultural house not exceeding 200 square meters to be constructed on each piece of agricultural land of 0.5 hectares or above. This is a reduction on previous Egyptian regulations that permitted house construction within an area not exceeding 200 square meters on each piece of agricultural land exceeding 2.5 hectares.

*From 1918 to 1948 the Gaza Strip was under British Mandate and from 1948 to 1967 under Egyptian rule. The Egyptian law recognised Wadi Gaza as a natural reserve. There were strong restrictions on construction and development during this period, and strong enforcement of the rules.

Additional legislation followed after the creation of the Palestinian Ministry of Environment in 1998 in the form of the Palestinian environment decision no. 7 of 1999. This fixed the boundaries for land development and promoted the protection of natural areas and areas rich in biotic diversity.

2.2.4 Other plans

A number of other plans exist which, though not directly addressing the environmental protection of the site, will have an impact on the way the site is managed. They are:

- Municipal land use plans for the three Refugee Camps, Bureij, Maghazy and Nusseirat, neighbouring the site. These plans were approved by the Minister of Planning and International Cooperation between 1997 and 1999.
- A plan has been agreed for a centralised sewage treatment plant serving the middle portion of the Gaza Strip. The treatment plant will be constructed south of Wadi Gaza, just outside the Wadi Gaza area and east of Al Bureij camp. It is planned to become operational in 2008 and will also treat sewage water that is currently dumped in the Wadi Gaza bed.
- The Regional Plan for the Gaza Governorates was developed by the Minister of Planning and International Cooperation in 1998. This plan concerned land use developments in the whole Gaza Strip but it has never been approved.

2.3 Management infrastructure

2.3.1 Organizations

Wadi Gaza is subject to many jurisdictions; regional, local and PNA institutions play different roles in different fields. In relation to the Wadi Gaza area some of these institutions participate during the planning phase while others participate in the implementation and follow up stages. A number of NGOs also contribute to the development of the site.

The following institutions and organizations are involved in the management of the Wadi Gaza.

1. Environmental Quality Authority (EQA)
2. Ministry of Public Works and Housing (MOPWH)
3. Ministry of Planning and International Cooperation (MOPIC)
4. Ministry of Agriculture (MOAG)
5. Ministry of Tourism and Antiquities (MOTA)
6. Ministry of Local Government (MOLG)
7. Local communities, municipalities
8. Non governmental organizations (NGOs)
9. USAID-UNDP/PAPP*

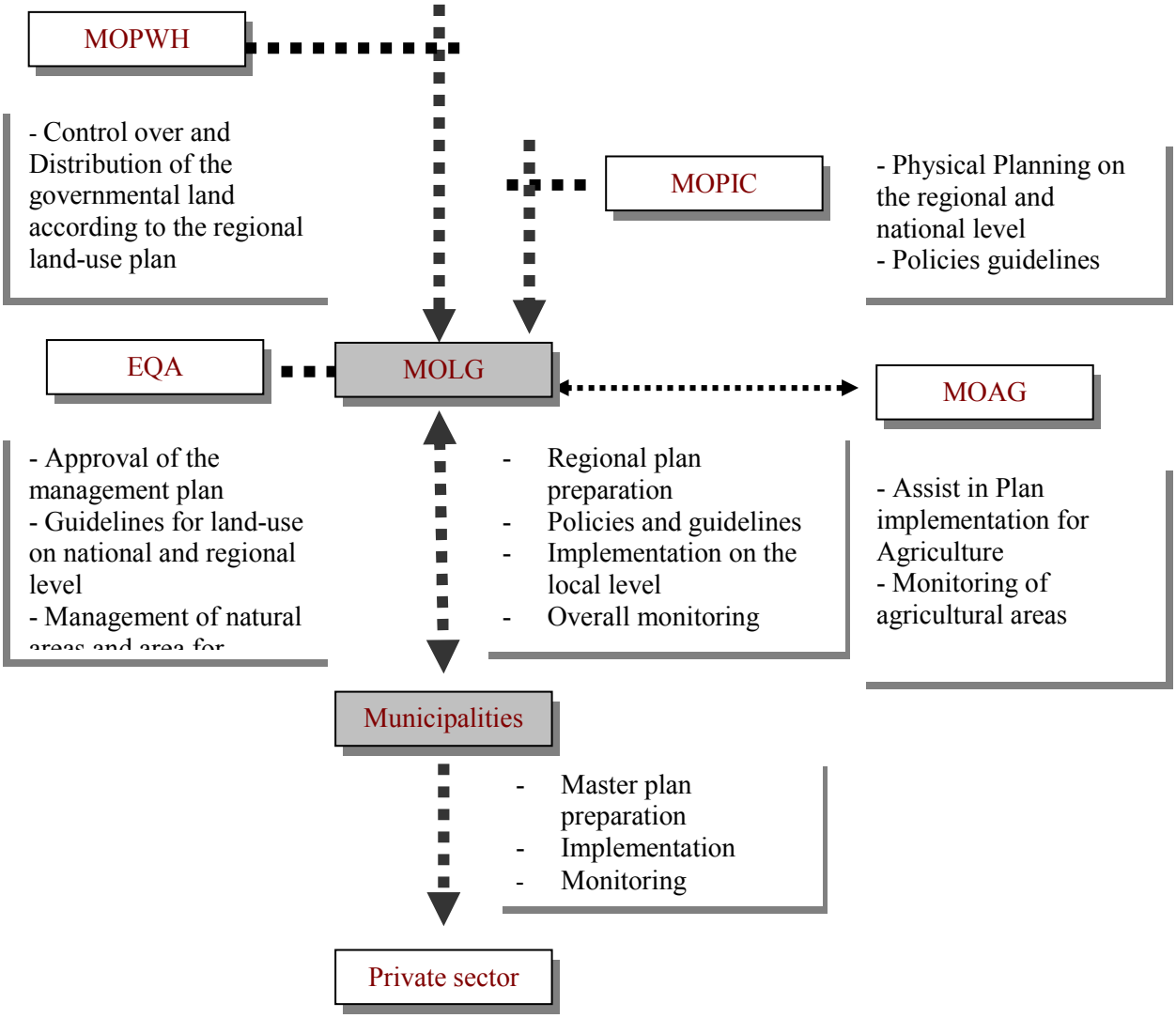
*In February 2001 the Employment Generation in the Development of Wadi Gaza Area and Promotion of Wadi Gaza National Protected Nature Park project,funded by USAID and executed by UNDP/PAPP was launched. This project aims at supporting USAID's effort in generating emergency employment opportunities while at the same time supporting the conservation of the Wadi Gaza site by implementing activities such as cleaning campaigns, removing construction debris, developing a recreational area, building crossing bridges or culverts, hiking trails, building observation towers, water retaining dams (check dams) and planting trees in the site. Furthermore the project is upgrading agricultural roads and building water harvesting ponds in the Wadi Gaza area.

The responsibility of writing the management plan has been with the Environmental Quality Authority under the auspices of the MedWetCoast regional project. The management plan is written with the consultation of all the above mentioned institutions and organizations. The consultation process will be done by representatives of all stakeholders. Final approval of the management plan will be done by the

Environmental Quality Authority. After the approval of the Management Plan, a Management Structure will be formulated. This management structure will establish permanent lines of communication, liaise and consult with institutions, organizations and other stakeholders to implement the activities of the management plan.

2.3.2 Responsibilities

The following chart depicts the role of relevant institutions, along with their responsibilities and activities.



Other organizations with specific roles within the area include MOTA, which is responsible for the excavation of archaeological sites, and MOPWH, which is responsible for maintenance and construction of roads.
In addition a number of NGOs are working closely with the local people, assisting them in agricultural development.

EQA is striving to secure the participation of relevant institutions in the preparation stage of the management plan both through personal contact and at public workshops. At the same time EQA is looking to other agencies to play their role in the implementation period.

2.3.3 Facilities

A small office complex has been established overlooking the site. The complex serves as the base for the conservation of the Wadi Gaza coastal wetland projects and future management activities in the site. Currently it also houses the office and meeting room for the USAID part of the Wadi Gaza rehabilitation project. This complex consists of three mobile home units, connected to telephone, water and electricity. There are plans to develop the complex into an information center for visitors, policymakers and stakeholders. This center will be an important part of the awareness program and will be a starting point for people who visit the site. Several residential buildings are located on the banks of the Wadi. These houses and land that they occupy will be excluded from the management plan. However agreements have to be made with the families living in these buildings to ensure that they respect the boundaries and protected status of the Wadi Gaza reserve.

2.3.4 Services

Roads
In 1996 the coastal road from Gaza City to the southern part of the Gaza Strip was constructed. The construction also involved a bridge over Wadi Gaza. Many dirt roads dissect Wadi Gaza and its natural habitats. There are no regulations or guidelines for the construction and maintenance of these dirt roads. The traffic on these roads has increased rapidly since the Salah ed-Deen road, which also runs from north to south, was blocked by the Israeli army in 2000.

Power plant, pylons and cables
An electricity-generating plant was constructed on the southern flank of the wadi in 1999. Pylons and cables are being erected to provide mid and southern Gaza Strip with electricity. When the power plant becomes operational, pylons and cables will cross the site as they transport the electricity from the power station to the network that runs along the coastal road.

Sewage pipes
Three main sewage pipes or ditches enter Wadi Gaza and discharge untreated sewage into the course of the wadi. Two of these three main outlets have been discharging wastewater since 1991, the source being the three nearby refugee camps. The third one started to discharge from the newly built residential "Alzahra' City" in 1999. At the beginning of June 2001 a channel was made through the Wadi allowing wastewater to reach the wetland and another channel was opened from the seaward end of the estuary lake to the sea.

Barriers and Dikes
In order to bolster the newly erected coastal road bridge against erosion from flash floods, a barrier was constructed blocking the natural flow of the Wadi to the sea. A small artificial freshwater pond next to the coastal road is enclosed with clay dikes. In Wadi Gaza farmers occasionally construct dikes from construction debris to protect their agricultural fields against flash floods. There are no arrangements for the maintenance or construction of these dikes.

The site is located on the peripheries of municipalities and partly within the remit of the regional area. Services and facilities are insufficient and do not cover people's needs. It is the roll of municipalities to provide services to the local communities surrounding the Wadi.

Recently, new activities have been proposed to serve the local communities on both sides of the Wadi. These activities, some of which are already being developed, are as follows:

- Wooden bridge connecting en-Nusairat and el-Moghraga

- Four check dams crossing the Wadi
- Hiking trails
- Recreational area with supporting facilities
- Information center
- Visitor centers for two archaeological sites

2.3.5 Health and Safety

There is no national legislation for health and safety issues and none has been developed for the site. Nevertheless, health and safety regulations have been identified as a key issue for the management plan. Drawing up a health and safety schedule for staff and visitors has been envisaged in preparation for the active management implementation stage. The health and safety schedule will include the following issues:

- Advice leaflets for visitors addressing their personal safety in Wadi Gaza Nature Reserve
- Training of staff on personal safety for visitors, and for themselves
- Provision of a drinking water point for visitors and staff
- Warnings against potentially dangerous plants and animals
- Schedule of "dos" and "don'ts" for visitors and staff, including the need for sufficient water and protective head-wear in hot sunny conditions and where staff can be found in the case of emergency
- Staff protection measures and training for safe handling of live and dead animals
- Safety measures incorporated into constructions such as observation towers and other facilities
- Regular monitoring of safety measures in place for Wadi Gaza reserve facilities
- Regular monitoring of access tracks and public areas for the detection of safety defects or risks
- Remedial measures to be taken as a matter of urgency for any defects or other potential health risks identified as a result of regular monitoring
- Erection of signs and/or fencing advising on and protecting against potential hazards within the site
- Development of contingency plans for evacuation or closure of the site in the face of predictable and unpredictable events (e.g. flash floods)
- Training of staff in first aid and the provision of first aid facilities on site
- Training of staff in the importance and proper use of adequate safety and health equipment
- Education and training of employers and employees in the recognition, avoidance and prevention of unsafe or unhealthy working conditions
- Monitor health and safety issues through an effective program of collection, compilation and analysis of visitors and occupational safety and health statistics

A provisional schedule, addressing health and safety issues for visitors and staff, is given in Annex 5.

2.4 Physical Features

2.4.1 Climate

2.4.1.1 Regional climate

The whole Gaza Strip, including Wadi Gaza, is located in a transitional zone between the temperate Mediterranean climate to the west and north and the arid desert climate of the Negev and Sinai deserts to the east and south. As a result Wadi Gaza has a typical Semi-Arid Mediterranean climate, hot in summer

and cold in winter. The proximity of the Mediterranean Sea has a moderating effect on temperatures and promotes high humidity throughout the year. There are two well defined seasons: the wet season starting in October and extending into April, and the dry season from May to September. Peak months for rainfall are December and January.

2.4.1.2 Wadi Gaza climate

1. *Temperature:* The average daily mean temperature ranges from 25°C in summer to 13°C in winter, with the average daily maximum temperature range from 29°C to 17°C and the minimum temperature range from 21°C to 9°C, in summer and winter respectively.
2. *Humidity:* The daily relative humidity fluctuates between 65% in daytime and 85% at night in summer and between 60% and 80% respectively in winter.
3. *Solar radiation:* The mean annual solar radiation amounts to 2200 J/cm^2/day.
4. *Winds:* There is a considerable variation in the wind speed during the daytime, and the average maximum wind speed velocity is about 3.9 m/s. Storms can occur in winter when maximum wind speeds reach about 18 m/s. In winter the prevailing wind direction is SW with an average speed of 4.2 m/s and during summer the prevailing winds are from the NW sector (MEnA, 2001).
5. *Rainfall:* Daily rainfall data for the Wadi Gaza area are available from two rainfall-gauge sources, Nuseirat Gauging Station and Elmughragah Gauging Station. The average annual rainfall, calculated from 26 years of records from these two stations, is 335 mm. In some years delays in the onset of winter rainfall have led to droughts, adversely affecting rain-fed agriculture.
6. *Evaporation:* The mean daily evaporation in December is about 2.1 mm/d, rising to a maximum of 6.3 mm/d in July.

2.5 Geology and land forms

2.5.1 Bedrock and sediments

The Gaza area is structurally part of the coastal plain geology, which consists of a series of geological formations sloping gradually from east to west. These geological formations are mainly from the Tertiary and Quaternary eras. An important part of these formations is the coastal aquifer of the Gaza area, which consists of the Pleistocene age Kurkar Group and recent (Holocene age) sand dunes. The Kurkar Group includes marine and eolian calcareous sandstone ("kurkar"), reddish silty sandstone (“hamra”), silts, clays, unconsolidated sands, and conglomerates (Camp Dresser *et al*., 1999).

Wadi Gaza remains a unique upper formation of the geological history of the area. The Wadi floor is dominated by considerable aggregations of Pleistocene gravel. This "Gravel Horizon" originated from erosion of the high mountains in the Hebron Area and the Northern Negev. The floor of Wadi Gaza is characterized by the presence of a 1-2 m thick gravel horizon, which is poorly sorted, and rich in pottery pieces (Picard, 1943).

In some localities, excavations of gravel from the Wadi bed have exposed the Pliocene sediments underlying the gravel horizon. This disconformity is composed of medium to coarse-grained sands with some fine pebbly layers showing cross and graded bedding, thus indicating their shallow marine origin. Additionally, a small number of Upper Pliocene sand dunes are located in the course of the wadi. They represented elevated areas during the deposition of gravel, but overlain by loess sediments. These sand dunes are partially hardened and form obstacles to the Wadi Gaza water course (Anan & Elkhodari, 1985). To the west of the main Gaza–Khan Younis road the gravel horizon continues in a downstream direction for a while, but with smaller sized and better sorted pebbles. The gravel horizon is generally overlain by loess sediments ranging in thickness from 12 m to less than 5 m.

2.5.2 Drift material

The mouth of the Wadi is mostly covered by eolian sand dunes. This is a recent formation. These sand dunes are formed by the action of wind on friable sandstones belonging to the Upper Kurkar complex exposed in form of a ridge parallel to the Mediterranean coast.

2.5.3 Erosion/deposition and other processes

The materials that are transported by Wadi Gaza are derived from erosion in the Hebron mountains and Northern Negev. Wind erosion transports fine sand and loess and deposits them in Wadi Gaza. Flash floods that occur during the winter months transport gravel, sand and loam which are deposited in Wadi Gaza.

These deposits lead to the formation of four different features:

a. *Coastal and inland sand dunes*
Coastal dunes extend along the shoreline, and originate partly from Nile River sediments. The depth of these dune deposits is about 15 m. They are narrow in the south, increasing northward to reach a width of 3 km. Two sand dunes occur inland. They are vegetated, which protects them from water and wind erosion. Where vegetation has been cleared, their slopes are heavily weathered.

b. *Sand, loess and gravel beds*
This formation is of shallow depth (about 10 m) and comprises the main layer immediately below the surface substrate.

c. *Alluvial deposits*
Alluvial deposits are scattered generally within the Wadi Gaza area and are about 25 m thick.

d. *Beach formation*
This formation is composed of a relatively thin layer of sand with shell fragments. It is mainly unconsolidated. However, in some places it is cemented through precipitation of calcium carbonate.

2.5.4 Land Forms

Despite its small size, Wadi Gaza possesses a range of land forms. The most notable are:

Sand dunes
Coastal dunes border the wetland on both northern and southern sides. Two inland dunes occur close to but just outside the nature reserve, one bordering the lower and one the central section of Wadi Gaza.

Wadi terraces
Old terraces occur next to the dry Wadi bed in the eastern sector of Wadi Gaza.

Floodplain
Land immediately north of the estuary lake floods when the wadi overflows its banks. The northern part of this floodplain is cut off from floodwater by a man-made dike.

Weathered sand cliffs
The Wadi is bordered in places, particularly where the inland dunes occur, by low, steep to vertical sandy cliffs which are semi consolidated and subject to natural weathering and erosion.

Inland dune slope
Where cliffs do not occur, the inland sand dunes have gentle to moderate vegetated slopes facing the wadi.

Estuary lake
It may seem strange to nominate the estuary lake as a "land form" but it is a major geomorphological feature of the lower wadi.


Weather sand cliff


Inland dune slope

Coastal sand dune

The Estuary lake

Table 2: Geology and geological history of the Gaza Strip. (PEPA, 1994).

Era	Epoch	Age in million year BP	Formation	Environment of deposition	Lithology	Max. Thickness (m)	Water bearing character
Quaternary	Holocene	0.01	Recent	Terrestrial	Sand, loess, calcareous silt and gravel	25	Locally phreatic aquifer
	Pleistocene	1.8	Continental Kurkar Complex	Eolian Fluvial	Calcareous sandstone and loamy sand	100	Main aquifer
			Marine Kurkar	Near shore	Calcareous sandstone, Limestone (sandy and porus)	100	Main aquifer
Tertiary	Pliocene	12	Conglomerate	Near shore		20	Base of the coastal zone aquifer
			Saqiya	Shallow marine	Clay, marl, shale	1000	Aquiclude
	Miocene	25		Marine	Marl, limestone, sandstone and chalk	500	Aquiclude alternating permeable layers with saline water

2.6 Soils and substrates

2.6.1 Major soils and substrate types

Sand is the constituent of the one kilometer wide dunes along the western part of the Wadi. It is perhaps better to categorise this cover as "surface materials" because it does not meet the classical definition of soil, due to the absence of a profile and lack of organic materials (MOPIC, 1996). The sand dunes beside the Wadi are about 10 m above sea level, and topographically flat and wide. The absorption of water in this zone is very high.

Soils in the middle part of Wadi Gaza are comprised of sandy loess, which is a mixture of sand and loam. This area is 10-20 m above sea level, with cliffs on both sides of the Wadi reaching 10-15 m in height and delimiting the width of its course. The absorption of water in this area is relatively high.

The eastern part of the Wadi is composed of loess. This section is relatively higher, lying 20-30 m above sea level, and with a steeper gradient than other areas along the wadi. Cliffs continue to dominate the wadi sides and reach up to 20 m in height. The absorption of water in this area is relatively low.

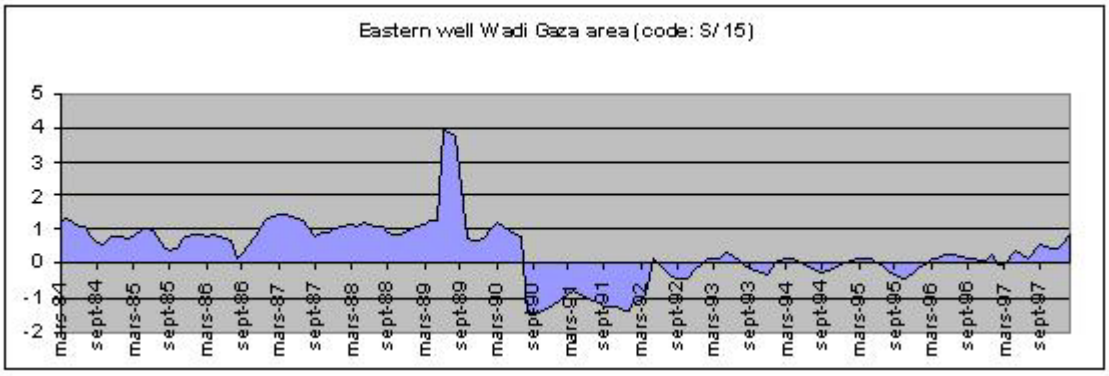
2.7 Hydrology

The hydrology and water quality of Wadi Gaza was studied and measured from June 2000 to July 2001. The hydrology was studied by analysing data on the groundwater flow, geology, climate, water extraction and sewage discharge in Wadi Gaza. Water quality data were collected monthly at three water quality monitoring stations. The Temperature, pH, Electrical Conductivity, Salinity, Total Dissolved Solids, Dissolved Oxygen and Turbidity were measured in the field. Water quality samples were also collected each month. Each sample was later analysed to determine the Biological Oxygen Demand (BOD), Chemical Oxygen demand (COD), Heavy metals, Total Nitrogen and Total Phosphorus. The results of the hydrology and water quality studies were reported in the Wadi Gaza hydrology diagnostic report (Alfaloji, 2002).

2.7.1 Groundwater

The regional groundwater flow that feeds the Gaza Strip is mainly westward towards the Mediterranean Sea. Most of the recharge is at the adjacent uphill eastern aquifer boundary, from dune areas near the coast overlaying the coastal aquifer itself and from the adjacent uphill area in the east zone. The maximum saturated thickness of the aquifer ranges from 120 m near the sea to a few meters near the eastern aquifer boundary located beyond the Eastern Gaza border. Natural average groundwater heads decline sharply east of the Gaza Strip and then more gradually towards the sea. In the Gaza Strip, the coastal aquifer divides into three sub-aquifers. These three sub-aquifers overlay each other and are separated by impervious and clay-rich semi-pervious layers.

Groundwater levels from 7 wells (based on monthly observations) reveal fluctuations which mirror rainfall patterns: higher levels in relatively wet years and lower levels in dry years. This indicates the fast response of the aquifer to surface recharge, which in turn indicates high hydraulic conductivity values. Despite these natural fluctuations, the overall long-term trend is that of a slowly declining groundwater level. Well S/15



(

Figure 3, below) is a typical example of the longer term trend of a lowering water table in Wadi Gaza set against shorter term fluctuations. Over 10 years the mean groundwater level at this well has fallen more than one meter.

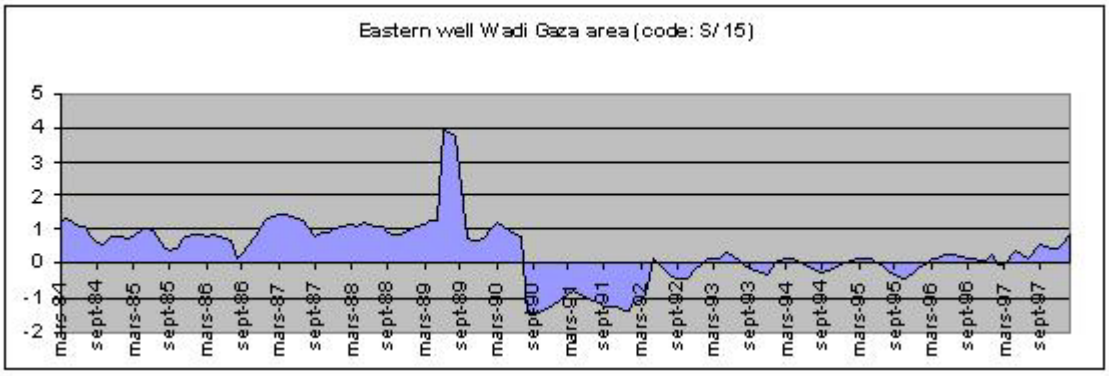


Figure 3: Well S /15 time series

2.7.2 Marine, brackish and freshwater influences

Marine and brackish influence

Until the construction of the coastal bridge at the outlet of Wadi Gaza, there was a constant interaction between the Wadi and the Mediterranean Sea. A barrier was constructed to protect the foundations of the bridge against flash floods, which occur annually. This barrier has blocked the outlet of Wadi Gaza, leading to raised water levels in the permanently flooded part of Wadi Gaza. This area of inundation is referred to in this plan as the Wetland (see **Figure 6**). The blockage of the natural flow has increased sedimentation of sand and other materials either brought down by Wadi Gaza in recent floods or deposited during sea storm events. The sedimentation has further widened the bar between the sea and the estuary lake, thereby reducing the frequency of marine salt water entering the lake. Currently, seawater is only pushed over the barrier during westerly storms. These events temporarily restore brackish conditions to the estuary lake.

Freshwater influences

The main source of freshwater for the Wetland is groundwater from the coastal phreatic aquifer. The water table of the aquifer at the estuary lake intersects with the topography and emerges at the surface. No study has been conducted of the amount of groundwater feeding the Wetland but two estimates are available for the total quantity of standing water held by the wetland. These are 65,000 m^3 from a 1999 survey (Goodson, 1999) and 81,000 m^3 in 2000 (Alfaloji, 2002).

Another source of freshwater is storm water that accumulates during the rainy season. This storm water comes in flash floods that occur on approximately 10 days a year. Estimated volumes for the hydrological years 1994/1995 and 2000/2001 are 20 million m^3 and 18.22 million m^3. Since the early 1970s the volume of water began to diminish considerably due to the implementation of retaining dams and diversion schemes by Israel on the upper course of the Wadi. Since then the volume and duration of flow have decreased significantly, and large flows are restricted to occasional flash floods sweeping down the Wadi bed in wet years.

Another source of water reaching Wadi Gaza is the untreated wastewater discharged from five wastewater outlets. Two of these are minor, but the other three are major outlets collecting wastewater from four residential areas adjacent to the Wadi. The total quantity of this wastewater is about 5000 m^3/day

(DANIDA, 2000). The volume is estimated to reach more than 7000 m^3/day by the year 2003. In the beginning of June 2001 a channel was made permitting wastewater to reach the Wetland.

2.7.3 Drainage flows

Wadi Gaza catchment

The watershed of Wadi Gaza covers more than 3500 km^2 of the Northern Negev Desert, the Hebron Mountains and the small catchment in the Gaza Strip. The Wadi's length from origin to mouth is about 105 km, the last 9 km of which is in the Gaza Strip. The name Wadi Gaza only applies to the last portion, located in Gaza. Wadi Gaza has two main tributaries: Wadi Alshari'a, which collects water from the Hebron Mountains in the West Bank; and Wadi Alshallala, which collects water from the heights of the Northern Negev. The names applied to upper sections of the Wadi, including Wadi Sheneq, Wadi EI-Khalsa, Wadi Thamela and other smaller streams are given in Figure 4. Wadi Gaza continues to flow as one unified course in its last section through the Gaza Strip and down to the Mediterranean Sea. Here, its slope is about 1: 450, which is almost flat. The upper reaches in Negev and Hebron Mountains have a slope of about 1: 100 (Awadallah, 2000).

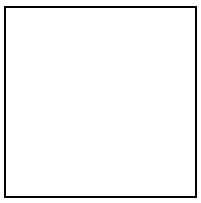


Figure 4: Sewage flowing from the Nusseirat and Bureij refugee camps into the Wadi

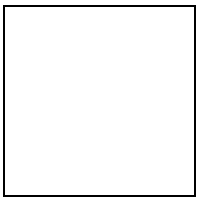


Figure 5: Wadi Gaza and its tributaries (from Awadallah, 2000).

Water flow in the lower part of Wadi Gaza

The Wadi empties into the estuary lake (Figure 6). The lake covers 10.14 hectares and usually holds permanent standing water. However, in some heavily sedimented parts of the lake bed, open water gives way to exposed but still saturated mud during the dry period of June to end of September. Nearest the coast is an outlet which formerly connected the lake and the sea. Water flow was both outward, from lake to sea and, especially during stormy weather, from sea to lake. A sand barrier, later fortified by construction debris to give it more resilience against flash floods, closed this connection but the outlet has recently been re-established restoring some, though impeded, exchange of water. The “flood zone” (Figure 6) covers an area of about 142 hectares and is inundated during winter floods. The main cause for the entire area flooding is the barrier blocking the outlet of the Wadi. The other permanent water feature is a small enclosed pool of about 0.65 hectares, originally established for fishing purposes. This is an artificial freshwater pond, enclosed by man-made ditches, and normally maintained entirely by groundwater. However, during the 2000/2001 hydrological year a flood broke through the clay-based walls of this pond, adding surface freshwater to the groundwater already there.

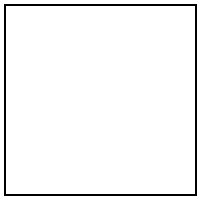


Figure 6: Wadi Gaza wetland area showing the water quality monitoring stations

2.8 Ecosystems (habitats) vegetation and ecological processes

The wetland habitats of Wadi Gaza were classified during a field survey in August 2002. All wetland habitat types were classified using the MedWet Habitat Description System (Farinha *et al*., 1996). This system is hierarchical and structured around a combination of ecological, biological, hydrological and substrate characteristics which permits it to be used across the Mediterranean region. The habitats and their location are given in Figure 7. Some of the habitats, particularly near the coast, are small so, for greater definition, these habitats are depicted on a larger scale in Figure 8. The terrestrial habitats were classified using the Natura 2000 reference list of habitat types and species in the Mediterranean region (ECD-GE, 1999; EEA, 1999). This list was developed for European sites. Therefore, though it proved possible to allocate Wadi Gaza terrestrial habitat types based on the list, there were differences in plant species composition. Other adjacent man-made habitats were classified using the CORINE land cover nomenclature (Bossard *et al.*, 2000; EEA, 2003).

2.8.1 Wetland Habitats

The survey identified fifteen wetland habitat types, representing four different systems: Marine, Estuarine, Palustrine and Riverine.

Marine

Two Marine habitats occur, both along the shore. The only distinction between them is that one is permanently flooded, while the other is only flooded during high seas. Both have a sand substratum. In summary, they are:

1. Marine surface water – sand.
2. Marine non vegetated – sand: This habitat was previously salt marsh but the vegetation was destroyed during the construction of a sea bridge in 1996. Currently a few relict patches of salt marsh persist at the edge of the Wetland.

Estuarine

The outlet of the wadi functions as an estuarine system. This system includes four estuarine habitats:

1. Estuarine surface water – mud. This is the permanently flooded estuarine lake. It is the most important habitat for migratory and resident water birds.
2. Estuarine emergent – persistent. The lake used to be bordered by the tall emergent plants *Typha domingensis* and *Phragmites australis*. The *Phragmites* remains but the *Typha* has largely disappeared.
3. Estuarine Scrub-Shrub – evergreen. The main shrub in this habitat is *Tamarix nilotica*. This habitat is under maritime influence, being subject to inundations from salt or brackish water when strong westerly winds drive seawater into the site.
4. Estuarine non-vegetated and vegetated pioneer. These are regularly flooded areas that are covered by sparse pioneer vegetation. Regular inundation disrupts further vegetation succession.

Palustrine

The site includes six Palustrine or freshwater wetlands:

1. Palustrine aquatic bed – rooted vascular. This habitat occurs close to the outlet of the wadi and is restricted to the permanent artificial freshwater pond. The bottom of this pond is covered by aquatic vascular plants. They appear to consist of just one species, *Eleocharis acicularis*.
2. Palustrine emergent – persistent. This comprises patches of reed *Phragmites australis* fringing the lake.

3. Palustrine water surface – mud. This is a small freshwater pond, dug in 2002 for the purpose of pisiculture (rearing fish).
4. Palustrine non-vegetated – sand. These are non-vegetated areas in the floodplains. The former vegetation was removed by human activities, including construction of earthworks and roads and converting natural vegetation zones into agricultural fields.
5. Palustrine non-vegetated – vegetated pioneer. This habitat is reverting from the non vegetated habitat above. The cessation of human construction or reclamation activities was sufficiently long ago for pioneer vegetation to begin the recolonization process.
6. Palustrine Scrub-Shrub – evergreen. This habitat is largely dominated by *Tamarix nilotica*. It is not affected by brackish conditions; the water supply comes from fresh groundwater and water from winter flash floods.

Riverine

The estuarine habitats are fed by a riverine system. There are three riverine habitats:

1. Riverine water surface – sand. This is the permanently inundated part of the river course that feeds the Wetland.
2. Riverine lower perennial – emergent – persistent. This comprises the stands of reed *Phragmites australis* occupying the course of the wadi.
3. Riverine lower perennial non-vegetated – sand. This is the dry wadi bed that dominates the more upstream parts of Wadi Gaza.

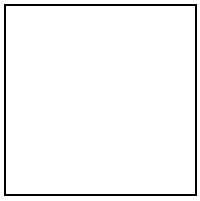


Figure 7: Wetland habitat map of Wadi Gaza

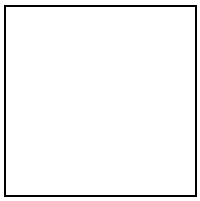


Figure 8: Wetland habitat map of the lower part of Wadi Gaza

2.8.2 Terrestrial habitats

Coastal sand dunes and inland dunes
Three types of dune habitat occur in the site:
- Shifting sand or embryonic sand dunes with *Zygophyllum album* and *Pancratium maritimum*;
- Coastal sand dunes partially covered with grassland;
- Wooded dunes with *Tamarix aphylla*.

These sand dunes support plant species that are not found in other habitats. A considerable proportion of the dunes is used for the cultivation of vines. The vines contribute to the habitat by providing micro habitats for plant and animal species.

Figure 9: *Pancratium maritimum* (left) and grapevines (right) growing on coastal sand dunes.

Natural and semi-natural grassland
Patches of lowland mesophile grassland occur on the Wadi floodplain wherever the Palustrine Scrub-Shrub vegetation has been cleared by human activities.

The locations of the terrestrial habitats are shown in Figure…

2.8.3 Adjacent habitats

Outside the reserve boundaries many habitats have disappeared as a result of intensive agriculture or urban development. A variety of semi-natural habitats still retain environmental values. Agricultural fields, particularly those where few chemicals are used, still support plants and animals. The beach is an important forage area for waders which often roost in the reserve. The sea immediately offshore is frequented by a range of seabirds and other marine life. This not only extends diversity but is an added value for attracting visitors to the site. The juxtaposition of marine and reserve habitats may also be an important factor in maintaining or attracting populations of fish or bird species reliant on a combination of both.

2.8.4 Vegetation communities

The distribution of vegetation communities is given in Figures 10 and 11. The habitats in which each vegetation community occurs is presented in Table …. Five main vegetation communities have been recognised in Wadi Gaza. They are:

Group 1: the ***Centaurea araneosa – Atractylis*** community
Group 2: the ***Tamarix nilotica – Neurada procumbens* & *Xanthium spinosum*** community
Group 3: the ***Tamarix nilotica - Mesembryanthemum crystallinum* & *Cynodon dactylon*** community
Group 4: the ***Tamarix nilotica – Arthrocnemum fruticosum*** community
Group 5: the ***Phragmites australis*** community

The *Centaurea araneosa – Atractylis* community
This is the typical terrestrial vegetation community in the site. It is located in the drier parts of the Wadi terrace and dune slope habitats in the upstream part of the wadi. It has a sparse vegetation cover dominated by characteristic herbs of dry soils or desert areas such as *Centaurea araneosa* and *Atractylis carduus* and small individual desert shrubs like *Alhagi maurorum* and *Artemisia monosperma***.**

The *Tamarix nilotica – Neurada procumbens* & *Xanthium spinosum* community
This community is located in the Wetland edge, floodplain and Wadi terrace habitats. It is a characteristic community of moist areas heavily disturbed by human activities. Patches of *Tamarix nilotica* occur on the drier parts next to the estuary lake. The undergrowth includes characteristic small shrubs of waste places and disturbed areas such as *Ricinus communis*, and characteristic annuals of agricultural fields such as *Silybum marianum, Xanthium spinosum, Cynodon dactylon, Malva parviflora, Avena fatua, Cichorium pumilum, Marrubium vulgare, Solanum elaeagnifolium, Plantago lagopus* and *Urtica pilulifera*. A large proportion of the species in this community is tolerant to seasonal flooding of the wadi banks (e.g. *Cuscuta campestris*, *Polygonum equisetiforme*, *Tamarix nilotica* and *Trifolium tomentosum*).

The *Tamarix nilotica - Mesembryanthemum crystallinum* & *Cynodon dactylon* community
This community is located in the habitats surrounding the estuary lake. It is composed of typical coastal sand dune species (*Mesembryanthemum crystallinum*, *Otanthus maritimus* and *Pancratium maritimum* and halophytic species typical of salt marsh vegetation (*Arthrocnemum fruticosum*, *Salsola kali*, *Tamarix aphylla* and *Zygophyllum album*). This last selection is all that remains of the previously more widespread salt marsh vegetation destroyed by the construction of the bridge over the outlet of Wadi Gaza in 1996. The surviving remnant is located immediately north of the wadi outlet. Two of the species, *Tamarix aphylla* and *Zygophyllum album*, have all but disappeared from Wadi Gaza. The site is disturbed on a regular basis by digging and earth moving activities to maintain and repair an earth barrier established to block the flow at the Wadi outlet and stop annual flooding from both the sea and the wadi. This repeated disturbance creates areas of bare sand which are subsequently colonized by mesophyte annual weeds (*Cynodon dactylon*, *Launaea nudicaulis*, *Malva parviflora*, *Silybum marianum*, *Xanthium spinosum* and *Sonchus oleraceus*) derived from populations growing in agricultural fields adjacent to Wadi Gaza.

The *Tamarix nilotica – Arthrocnemum fruticosum* community
This community is located in the saline depression north-west of the estuary lake. It is characterized by a low number of salt tolerant species. This community has the thickest vegetation cover in the site. The community is almost completely dominated by *Arthrocnemum fruticosum*: a halophyte typical of salt marshes. *Tamarix nilotica* is encroaching in patches. Surprisingly the halophytes occurring in the *Tamarix nilotica - Mesembryanthemum crystallinum* & *Cynodon dactylon* community (see above) are apparently absent in the saline depression. The strong dominance of two species, *Arthrocnemum fruticosum* and *Tamarix nilotica*, suggests a heavily degraded sub-climax of the original salt marsh vegetation.

The *Phragmites australis* dominant aquatic community

The emergent aquatic vegetation consists of *Phragmites australis* and a few scattered clumps of *Typha domingensis*. These are located in permanently flooded parts of the Wadi Gaza in single species stands with no undergrowth.

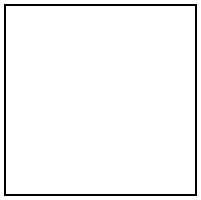


Figure 10: Spatial distribution of the vegetation types. Group 1: the *Centaurea araneosa – Atractylis* community, Group 2: the *Tamarix nilotica – Neurada procumbens* & *Xanthium spinosum* community, Group 3: the *Tamarix nilotica* - *Mesembryanthemum crystallinum* & *Cynodon dactylon* community and Group 4: the *Tamarix nilotica – Arthrocnemum fruticosum* community.

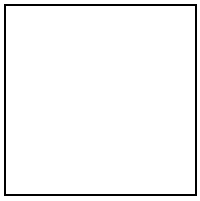


Figure 11: Spatial distribution of the vegetation types in the lower part of Wadi Gaza. Group 1: the *Centaurea araneosa – Atractylis* community, Group 2: the *Tamarix nilotica – Neurada procumbens* & *Xanthium spinosum* community, Group 3: the *Tamarix nilotica* - *Mesembryanthemum crystallinum* & *Cynodon dactylon* community and Group 4: the *Tamarix nilotica – Arthrocnemum fruticosum* community.

Table ..: Distribution of Vegetation Communities in relation to Wadi Gaza Habitats.

HABITATS	**VEGETATION COMMUNITY**				
	1	2	3	4	5
Terrestrial Habitats:					
Shifting sand or embryonic sand dunes			**X**		
Coastal sand dunes			**X**		
Wooded inland dunes	**X**	**X**			
Wetland Habitats:					
Estuarine Emergent – Persistent					**X**
Estuarine Water Surface – Mud					
Estuarine Non vegetated – Vegetated Pioneer		**X**	**X**		
Estuarine Scrub Shrub – Evergreen			**X**	**X**	
Marine Water Surface – Sand					
Marine Non Vegetated – Sand					
Palustrine Aquatic Bed – Rooted Vascular					**X**
Palustrine Emergent – Persistent					**X**
Palustrine Water Surface – Mud					
Palustrine Non Vegetated – Sand					
Palustrine Non Vegetated – Vegetated Pioneer	**X**	**X**	**X**		
Palustrine Scrub Shrub – Evergreen			**X**	**X**	
Riverine Lower Perennial – Emergent Persistent					**X**
Riverine Water Surface – Sand					
Riverine Lower Perennial Non Vegetated - Sand					
Man-made Habitats					
Edges of Agricultural Fields	**X**	**X**			
Fallow Agricultural Fields	**X**	**X**			

Key to Vegetation communities:
1: the *Centaurea araneosa – Atractylis sp.* community

2: the *Tamarix nilotica – Neurada procumbens* & *Xanthium spinosum* community
3: the *Tamarix nilotica* - *Mesembryanthemum crystallinum* & *Cynodon dactylon* community
4: the *Tamarix nilotica – Arthrocnemum fruticosum* community
5: the *Phragmites australis* dominant aquatic community.

2.9 Flora

2.9.1 Lower Plants

Lower plants were not investigated for this management plan and no previous study or information for these groups is known for Wadi Gaza. However, a sudden algal bloom was noted in the summer of 2000, which was attributed to *Cladophora* and other epiphytic blue-green algae and diatoms (M.I. Madi, *pers. obs.*). *Cladophora* is well known as an indicator of waters enriched with sewage and in large quantities to impart disagreeable odours (Bellinger, 1992). In January 2003 a planktonic algal bloom comprising a multitude of microscopic species of unknown identity in suspension had coloured the water of the estuary lake and Wadi green. In contrast, the water of the artificial freshwater pond was clear.

A quick check for other lower plants in January 2003 failed to locate any bryophytes or lichens. No conclusions can be drawn from this incomplete survey other than that these groups, if present, will be poorly represented at Wadi Gaza.

2.9.2 Higher Plants

The higher flora was surveyed from February to June 2000. The species composition was assessed using both qualitative and quantitative observations. A sampling technique was used: 41 stands were selected to represent the main habitats in the site The stand size was about 15x15 m in all habitats (as this approximated to the minimal area of the plant communities), except for a few stands whose length and width were adjusted to the natural extension of the plant cover being sampled. In each stand, the annual and perennial vascular plant species were recorded to provide a baseline species list. Nomenclature was according to Zohary (1962) and Danin (1991). The plant cover was estimated quantitatively, using the line intercept method (Canfield, 1941). For application of this estimate 10 parallel lines, each 15 m long, were laid out in each stand. The degree of artificialization (human impact) in each stand was estimated visually. The cover was estimated using the Braun-Blanquet scale.

2.9.2.1 Endemic species

Though no endemic species were encountered within the survey stands, three were found outside. These species are considered endemic at the national level. They are:

1. *Echinops philistaeus*;
2. *Onopordum jordanicolum*;
3. *Rumex cassius*.

Because these species were not encountered in the survey stands, their site status and distribution remain poorly known. A more detailed survey is required to establish their location, distribution and present status.

2.9.2.2 Rare species

National level:

1. *Zygophyllum album*
   This halophyte shrub is restricted to salt marshes and is considered rare at the national level. Just two individuals were encountered during the survey. One was in a stand sampling the

Estuarine Scrub-Shrub habitat just north of the outlet to the sea, and one in a sand dune habitat immediately north of that. The coastal highway occupies what were, prior to its construction, salt marshes. The two *Zygophyllum album* plants are probably relicts of populations formerly occupying these salt marshes.

2. *Vicia bithynica*
   This is another rare species at the national level. It is a legume that usually grows, regionally, in mountain pastures. It was only observed outside the survey stands. A more detailed survey is required to establish the location, abundance and current status of this species at Wadi Gaza.

Site level

Table 3 lists species which are rare at the national, local and site level. Species were classified as rare for the site if they occurred in no more than two survey stands and amounted to fewer than five individuals in the whole survey.

Table 3: Status of endemic, rare and threatened species at National, Local (Gaza Strip) and Site level

Species name	National	Gaza Strip	Wadi Gaza
Anemone coronaria	C	C	R
Echinops philistaeus	E		
Hirschfeldia incana		C	R
Anchusa humilis			R
Onopordum jordanicolum	E		
Pancratium maritimum		C	R
Rumex cassius	E		
Silene succulenta	C	C	R
Sisymbrium irio			R
Tamarix aphylla		T	T
Vicia bithynica	R		
Ziziphus spina-christi	C	C	R
Zygophyllum album	R	T	T

Key: **C**= common; **E**= endemic; **R**= rare; **T**= threatened

Except for *Anemone coronaria*, which occurred at the edge of agricultural land, all of the rare species were found in the Palustrine and Estuarine Scrub-Shrub habitats (see **Chapter 2.8.1** Wetland habitats). *Tamarix aphylla* and *Zygophyllum album* are halophytes and typical of the types of salt marsh habitat which would have occurred alongside the Wadi Gaza outlet before the construction of the coastal highway. *Silene succulenta* is a plant of littoral sands, a habitat also reduced by the highway. Habitat loss may also apply to *Hirschfeldia incana*, although it can also occur on disturbed land. *Anemone coronaria* is one of the most common flowering species in the country. Its occurrence is interesting because in the West Bank it occurs mainly in mountain pastures. *Ziziphus spina-christi* is very common in areas with an arid climate. It is also common in the rest of the Gaza Strip. *Pancratium maritimum* grows mainly on coastal sand dunes. It is common along the Gaza Strip coast. There is not enough information about *Anchusa humilis* and *Sisymbrium irio* to determine their status and distribution within the Gaza Strip.

2.9.2.3 Threatened species

No globally or nationally threatened species were encountered during the survey (see table 3), but two species are at considerable risk and could be lost from the site. Figure .. shows the locations of these species.

1. *Tamarix aphylla*
   A tall shrub species that grows in dry and/or saline areas. It is typical of salt marsh habitats. It is another relict of the salt marsh vegetation that occurred at the wadi outlet prior to construction of the coastal highway. Only two individual plants were observed during the study* (see Table 3). Both are located in one of the survey stands at the outlet of the wadi. The main threats to it, and its habitat, are the construction and maintenance of the barrier that blocks the outlet of the wadi and large scale earthworks to reclaim land for agriculture or house construction next to the coastal highway.

Tamarix aphylla has been introduced to habitats at the edge of the reserve as part of a tree and shrub re-planting program, including as an erosion prevention measure on an inland dune slope. This does not weaken its importance as an indicator of salt marsh vegetation nor undermine the importance of maintaining a natural population within that habitat.

2. *Zygophyllum album*
   Zygophyllum album is a nationally rare and vulnerable species (see **Chapter 2.9.2**). It shares the same habitat as *Tamarix aphylla* and is threatened by the same human activities: the construction and maintenance of the earthworks and dirt roads.

2.9.2.4 Noteworthy species

Tall dominant species

- *Tamarix nilotica*
  A tall salt and drought tolerant shrub that occurred in almost all survey stands though not in the Sand dunes, a habitat in which it is absent. *T. nilotica* seeds profusely, germinates readily and grows quickly. There are insufficient data to evaluate the affects of *Tamarix nilotica* on vegetation communities over a long period of time. However, early observations suggest that, if left undisturbed, it can invade habitats, out-competing, overwhelming and gradually shading out other vegetation types.

- *Phragmites australis*
  A tall reed-bed forming grass which grows in the estuarine and palustrine tall emergent habitats. It forms large naturally occurring monocultures with the potential to invade and severely reduce the area of estuarine open water.

Dominant species in the lower, herbaceous layer

- *Artemisia monosperma*
  A small shrub that is dominant in the undergrowth of the wooded inland dunes, and abundant in the Palustrine non vegetated-vegetated pioneer, fallow agricultural field and field edge habitats. It did not occur in other surveyed habitats.

- *Arthrocnemum fructicosum*
  A small shrub that is extremely dominant in the saline depression close to the outlet of the Wadi. It is also found in the Estuarine and Palustrine Scrub-Shrub habitats.

- *Centaurea araneosa*
  A herb that is dominant in the Wadi terrace habitat. It grows only sporadically in the other habitats.

- *Mesembryanthemum crystallinum*
  A herb that is dominant in the Estuarine and Palustrine Scrub-Shrub habitats.

- *Neurada procumbens*
  A small herb that is dominant in the dry wadi bed. This species does not occur in any of the other habitats.

Dominant agricultural weeds

- *Xanthium spinosum*
  A herb that is abundant in the Estuarine and Palustrine Scrub-Shrub, wooded inland dune, fallow agricultural and field edge habitats.

- *Cynodon dactylon*
  A salt tolerant grass that grows abundantly in all habitats except the Palustrine Scrub-Shrub habitat.

Introduced species

- *Nicotiana glauca*
  A tall ligneous shrub that grows abundantly in all habitats except the Estuarine Scrub-Shrub and Sand dune habitats. It is known to be an invasive species in other Mediterranean countries such as Greece. Alien species, origin: Argentina.
- *Eucalyptus camaldulensis*
  Growing in the Wadi terrace habitat. Like most gum trees* it is unfavourable to conservation in the Mediterranean because of its high water consumption, limited undergrowth and limited value for local fauna. Alien species, origin: Australia.

*Gum trees *Eucalyptus* have been introduced widely in the Mediterranean. They are favoured because of their elegance, shade provision and, especially, rapid growth. They possess long tap roots which reach down to the groundwater aquifer. This allows them to take up large quantities of water, hence their ability to grow quickly. Unfortunately, this large water consumption leads to lowering of the water table, severely so where plantations have been established. In addition, gum trees support a very impoverished Mediterranean fauna, as few invertebrates are able to cope with the oil-rich foliage – consequently, few vertebrates forage in the trees. A combination of shade, slow decomposition of fallen leaves and inimical chemicals leached into the soil also limit ground flora below the trees. Thus from a biodiversity and wider environmental viewpoint they are an unwelcome and potentially damaging addition to Mediterranean habitats.

2.10 Fauna

The vertebrate fauna was surveyed on a regular basis from July 2000 to July 2001, thus encompassing an entire calendar year. To ensure comprehensive coverage, the site was divided into four study areas. Observations were made in each by walking a fixed route along the course of the wadi or adjacent land. At least 1-2 nights and 3 days were spent monthly in each area. In order to standardise the data, observations were made during fixed hours of the day. The tools and equipment used depended on the animal species groups investigated, and included forceps, hand nets, stainless steel sticks, live traps (of different sizes), binoculars, telescope, camera, video camera, zoom lenses and environmental instruments (thermometer, altimeter, hygrometer). All data were recorded on standard record sheets provided by the Regional Coordinator. The location of each observation was plotted and recorded on a grid map of the site. The vertebrate surveys included amphibians, reptiles, birds and mammals, but not fish.

The only other vertebrate information derives from non systematic records of birds obtained in late January 2003.

Invertebrates were not investigated but a few records were obtained in January 2003.

2.10.1 Invertebrates

Only casual observations are available for invertebrates. The most significant observation is that the honey bee *Apis mellifera* is active in the site, even in January. Clusters of bee-hives occur at the edge of the reserve, including behind the planned information center. Bees have environmental and socio-economic values: they are important pollinators of flowers and a local resource for the production of honey.

Several invertebrate species were recorded during a limited, non systematic survey in late January 2003. These included three butterflies, a moth and a fly. The moth, rush veneer *Nomophila noctuella* (Lepidoptera: Pyralidae), and one of the butterflies, painted lady *Vanessa cardui* (Lepidoptera: Nymphalidae), were seen on a number of occasions and in several habitats. Both are classic migrants and had probably come up from north-east Africa on the strong prevailing winds of the previous few days. The other butterflies, two red admirals *Vanessa atalanta* (Lepidoptera: Nymphalidae) and a small white *Pieris rapae* (Lepidoptera: Pieridae), are other known migrants in the Mediterranean area as is the fly, *Eupeodes corollae* (Diptera: Syrphidae), so there was clearly a migration taking place.

Other invertebrates seen included the distinctive scarab beetle *Oxythyrea funesta* (Coleoptera: Scarabaeidae), one individual, and the sandhill snail *Theba pisana* (Mollusca: Stylommatophora: Helicidae) which was abundant in track-side vegetation. Both species are common in the Mediterranean basin.

No other invertebrates have been identified to species as yet, though mosquitos (Diptera: Culicidae) are a well known component of the fauna. Their immature stages are aquatic, and the aquatic invertebrate assemblage is currently completely unknown.

It is not possible to draw many conclusions from these meagre observations, but it is already clear that some invertebrates play a useful environmental and socio-economic role; and Wadi Gaza's importance as a migration staging post appears to extend to insects as well. On the debit side, mosquitos are a known social problem at Wadi Gaza.

The full range of roles of Wadi Gaza invertebrates is likely to be diverse. Their importance and relevance to the ecosystem will not be revealed until further study is carried out; and this is clearly needed.

2.10.2 Fish

No investigations of the fish fauna were carried out in preparation for the management plan. Historically, the estuary lake was an important habitat for fish and supported a local fishery. The fishery targeted marine fishes which had entered the lake by means of its outlet connection with the sea. The fishery was lost as a result of increasing pollution, and natural re-stocking was denied with blockage of the outlet between lake and sea.

The current status of fish in the reserve can, therefore, only be assessed by indirect means. A pair of pied kingfishers *Ceryle rudis* were in residence and observed fishing in the estuary lake in January 2003 indicating that fish fry, at least, still survive despite the poor water quality. A pair of little grebes *Tachybaptus ruficollis* on the artificial pond, which is buffered from wadi pollution, strongly suggest that this site also holds small fish.

The previous species composition of fish in Wadi Gaza is not known. However, information is available for fishes caught commercially offshore (CARE, 1996). Species on that list which habitually enter brackish or freshwater and thus may have entered the Wadi or its estuary lake in the past are given in Table …., along with a summary of their ecology. These species could potentially occur in the future if water quality is improved and the sea to lake connection is maintained.

Table …. Marine fish with brackish and freshwater tendencies, caught commercially in Gaza waters.

Common name	***Scientific name***	**Ecology**
Annular sea bream	*Diplodus annularis*	Young enter brackish water

Round sardinella	*Sardinella aurita*	Inshore shelf and estuaries
Bass	*Dicentrarchus labrax*	Enters estuaries from spring to autumn
Meagre	*Argyrosomus ragius*	Enters lagoons
Grey mullets	*Mugilidae* (at least 3 species)	Estuarine, lagoons
White sea bream	*Diplodus sargus*	Young in brackish water

Source for ecological data: Miller & Loates (1997)

Historically, the fish fauna of the estuary lake and wadi was likely to have been an important part of the ecosystem as well as a socio-economic resource for local people. Knowledge of fish diversity and abundance both during that period, and now, would be valuable to understand the impact of environmental degradation on this group. In addition, fishes have the potential to be an excellent indicator group for evaluating management measures such as improvements to water quality and renewal of former ecosystem functions (e.g. restoration of the link between estuary lake and the sea). However, a baseline of the past and current status of species and population dynamics is necessary if fish are to be used for evaluation purposes.

2.10.3 Reptiles and Amphibians

Wadi Gaza supports an impressive number of reptile species. Eighteen species are known, including one endemic. Details of their status at Wadi Gaza, and nationally, are given in Table 4. Table 5 give similar details for the three amphibian species.

Table 4: The status of, and conservation threats to, reptiles occurring in Wadi Gaza.

Reptiles

Common Name	***Scientific name***	National	Site	Threat
Spur-thighed tortoise	*Testudo graeca*	W	C	T
Stripe-necked terrapin	*Mauremys rivulata*	R	C	T
Turkish gecko	*Hemidactylus turcicus*	Dd	R	N
Semaphore gecko	*Pristurus rupestris*	Dd	R	N
Fan-footed gecko	*Ptyodactylus hasselquistii*	Dd	C	N
Chameleon	*Chamaeleo chamaeleon*	W	C	T
Agama	*Laudakia stellio*	W	C	T
Ocellated skink	*Chalcides ocellatus*	C	U	T
Common skink	*Scincus scincus*	C	R	N
Bosk's lizard	*Acanthodactylus boskianus*	W	C	T
Desert monitor	*Varanus griseus*	Dd	R	H
Worm snake	*Ramphotyphlops braminus*	C	R	N
Palestinian viper	*Vipera palaestinae*	E	R	H
Egyptian cobra	*Naja haje*	C	R	D
Black desert cobra	*Walterinnesia aegyptia*	Dd	S	D
Jan's whip snake	*Coluber rhodorachis*	W	U	D
Cat snake	*Telescopus dhara*	Dd	S	D
Dice snake	*Natrix tessellata*	Dd	R	D

Key:
C = Common, **W** = Widespread, **U** = Uncommon, **S** = Scarce, **R** = Rare, **Dd** = Data deficient,
E = Endemic; **H** = Highly endangered, **D** = enDangered, **T** = Threatened, **N** = Not threatened

Table 5: Amphibian species and their conservation value in Wadi Gaza.

Reptiles

Common Name	*Scientific name*	National	Site	Threat
Green toad	*Bufo viridis*	C	C	T
Levantine frog	*Rana bedriagae*	C	C	T
Savigny's tree frog	*Hyla savignyi*	C	C	T

Key: **C** = Common; **T** = Threatened

Endemic species

One endemic snake, the Palestinian Viper *Vipera palaestinae*, occurs in Wadi Gaza. This snake occurs from the Gaza Strip in the south, east into Jordan and north to the Lebanese and Syrian borders (Disi *et al*., 2001). It is therefore a regional endemic of restricted World range.

Ecology

It is usually encountered from February to October - mainly solitary animals under heaps of straw, rocks and on the banks of unpaved roads. The breeding season is March – May. Its preferred habitats generally are agricultural areas and semi-desert regions with low to moderate vegetation. It has a strong ecological value, as it plays an important role in pest control of smaller rodents such as mice and rats.

Status in Wadi Gaza

Rare: during the survey, solitary individuals were recorded on 14 April 2001 and 9 June 2001.

Threats

Killed by local people, especially farmers, who know it as a very poisonous snake.

Management requirements

An awareness campaign highlighting their value as pest control agents.

Endangered, Rare and Noteworthy species

Palestine lies at the intersection of several distinct biogeographical zones. This is reflected in the diversity of reptile and amphibian species, which includes representatives of Levantine, Middle Eastern, Saharo-Arabian and pan-Mediterranean zones. The number of species also pays tribute to the diversity of habitats at Wadi Gaza.

No fewer than 16 (76%) of the 21 reptile and amphibian species are considered to be threatened, endangered or highly endangered at Wadi Gaza. At the international level, the spur-thighed tortoise *Testudo graeca* is listed as Vulnerable in the IUCN red list (IUCN, 2002). The IUCN definition of Vulnerable is a "high risk of extinction". None of the other reptiles or amphibians are listed as species of conservation concern, though a number may have declining populations in parts or all of their range (Blaunstein & Wake, 1990). Amphibians and terrapins are strongly affected by wetland deterioration or loss, and terrestrial reptiles are vulnerable to direct persecution and habitat change (Disi *et al*., 2001).

Eight species, all reptiles, are considered to be rare in Wadi Gaza. However, reptiles can be hard to detect and longer term monitoring will be needed to confirm or modify these findings. One species, the stripe-necked terrapin *Mauremys rivulata* is considered rare at the national level. This is because of its narrow habitat requirement of open waters, a scarce habitat in the region. It proved impossible to establish the status of some species at the national level because of a lack of data. Data deficient does not necessarily mean that the species is rare, but the possibility cannot be ruled out for some of the species.

Reptiles especially, and to a certain extent amphibians, tend to have a poor image, perhaps because they are cold blooded. Nevertheless, they all serve a very useful service, the large ones as predators of pests such as mice and rats, and the smaller species for their control of nuisance and pest invertebrates. They are, without exception, noteworthy for their positive contribution to ecological balance within the site, including services to agriculture and human well-being.

Threats

Reptiles and amphibians are subject to a series of threats at Wadi Gaza. They are as follows:

- ***Direct persecution***. There is a wide perception that all Wadi Gaza snakes are poisonous. The only venomous snakes which are potentially dangerous to people are the Palestinian viper and the two species of cobra. Ignorance, both of the fact that four snake species are no threat to humans and that all snakes play an important role in controlling pests, leads to unnecessary and pointless killing. The desert monitor *Varanus griseus* is also persecuted by farmers and is particularly vulnerable because it is easily seen and killed.
- ***Habitat loss***. This is probably the most important single factor affecting reptile and amphibian populations. Loss in area of sand dunes has been identified as affecting the common skink *Scincus scincus* population; removal of trees, bushes and other vegetation through over-exploitation has been been identified as negative for the spur-thighed tortoise, chameleon *Chamaeleo chamaeleon*, Agama *Laudakia stellio*, ocellated skink *Chalcides ocellatus*, Bosk's lizard *Acanthodactylus boskianus*, desert monitor, Jan's whip snake *Coluber rhodorachis*, Levantine frog *Rana bedriagae* and tree frog *Hyla savignyi* populations; and conversion of natural habitats to agriculture as negative for the tortoise, agama, ocellated skink, Bosk's lizard, desert monitor and whip snake.
- ***Habitat degradation***. Much of the habitat degradation at Wadi Gaza is due to pollution. Raw sewage lowers water quality and promotes a chain of events which severely affect the aquatic ecosystem. Oils and insecticides, used as mosquito larvae control agents, compound the problem. Degradation of the aquatic habitats adversely affects all three amphibian species and the stripe-necked terrapin.
- ***Human disturbance***. Human disturbance has been identified as a threat to the spur-thighed tortoise, agama, ocellated skink and Bosk's lizard populations.

Management requirements

The main management requirements for the protection of Wadi Gaza reptile and amphibian populations are:

- An awareness campaign to highlight the values of this group as pest control agents and as an integral part of a rich and diverse ecosystem. This measure is to counter the threats derived from Direct persecution and Human disturbance.
- Enactment of measures to prevent further habitat loss, to restore degraded habitats, to introduce schemes for the controlled, sustainable use of shrubs and other vegetation for grazing and other purposes, to end dumping of untreated sewage into the wadi by establishing suitable sewage treatment facilities, and to address the mosquito problem without recourse to dumped oils or insecticides.

Reptiles and amphibians can be used as indicators of the success of management measures enacted on their behalf. However, a knowledge base is required to do this. Insufficient information is currently available to interpret the population dynamics or ecological requirements for individual species. Standard survey and monitoring activities are required to collect basic information on status, distribution and population dynamics. Survey work should also aim to identify habitat requirements for individual species, their annual activity patterns, particularly in relation to breeding, and breeding sites. Some species can be semi-colonial, e.g. terrapins, particularly when suitable breeding substrates are scarce. In such cases one inappropriate event, such as dumping or road construction, can lead to major population loss. Knowledge of breeding sites and other aspects of reptile and amphibian ecology is, therefore, needed to anticipate and prevent inappropriate activities; and can guide future positive management for vulnerable species.

2.10.4 Birds

The geographical position of Palestine and the location of the Gaza Strip at the corner of the land bridge connecting the continental blocks of Africa and Eurasia, makes it a bottleneck for migratory birds (Safadi *et al*., 2002). The importance of Wadi Gaza within that bottleneck is recognised in its inclusion in a list of the Middle East's Important Bird Areas by *BirdLife International* (Evans, 1994; Atrash, 1999). Six criteria were used by *BirdLife International* to select Middle East IBAs. They were:

1. sites supporting globally threatened species;
2. sites where birds concentrate in important numbers, either when breeding, or on passage, or in winter;
3. sites for species which are threatened or declining throughout all or large parts of their range in the Middle East;
4. sites for species which have relatively small total world ranges with important populations in the Middle East;
5. sites for representative, rare, threatened or unique habitats possessing characteristic associated bird communities;
6. sites important for bird conservation because of their value for education, research or tourism.

The status of birds in Wadi Gaza Nature Reserve derives from the vertebrate survey in 2000-01 and an incomplete four-day survey from 29 January to 1 February 2003. Despite the relative brevity of these surveys, the data indicate at least 3 of these criteria (1, 3 and 6) apply to Wadi Gaza.

Endemic species

The **Palestine sunbird** *Nectarinia osea osea* is the only endemic bird species occurring in the Gaza Strip. It is a regional endemic, its range extending to southern Lebanon and Syria, Jordan and some parts of the Arabian peninsula.

Ecology

The Palestine sunbird is a Wadi Gaza resident. Breeding occurs from March to May and sometimes June. The nest usually contains 2-4 eggs, and is suspended in dense trees or shrubs. It occupies a wide range of vegetated habitats, particularly in agricultural areas. It takes invertebrates but also nectar, therefore it is strongly attracted to habitats with nectar-providing trees and bushes. Its feeding activities have both ecological and agricultural values because it plays an important role in pollinating flowers, including fruit crops. It belongs to a largely tropical family and is one of only two nectar specialist species in the whole Mediterranean region. Therefore, it also has a very high biodiversity value.

Status in Wadi Gaza

Common: tends to occur in pairs or as single individuals, but distributed throughout the site. Wadi Gaza's sunbirds are an integral part of a wider Gaza Strip population which is common and widespread.

Threats

Because it is part of a wider population, the Wadi Gaza sunbird population is under no particular threat. However, direct destruction of nests by small boys and shepherds and indirect destruction due to cutting of trees and shrubs have a local impact. The conversion of natural habitats to agriculture also impacts negatively on local birds.

Management requirements

Protection of nests can be achieved through the following measures:

- Prevention of tree and shrub cutting during the months of March to May.
- An awareness program which emphasises the values of the species and discourages nest destruction.

Other management measures with benefits to the Wadi Gaza Palestine sunbird population include:
- Prevention of natural habitat loss.
- Restoration of natural habitats.
- Introduction of schemes for the controlled, sustainable use of shrubs for grazing and other purposes.
- Promotion of schemes in agricultural land outside the nature reserve which encourage planting of fruit trees and other agricultural plants pollinated by sunbirds.

The need to utilise trees and shrubs for livestock should be at its minimum during spring as this is a period of maximum plant growth and grazing resources are at their most abundant. Therefore, a moratorium on cutting during the March to May period should be achievable with minimum negative impact on traditional activities. The awareness program should be targeted especially at the young and agriculturalists. A knowledge of habitats and, particularly, flowering plants preferred by the sunbirds will help to guide habitat restoration measures. In order to gather this knowledge, investigation of the relationship between Palestine sunbirds and nectar providing plants and habitats is required.

There was a strong southerly movement of over 200 yelkouan shearwaters *Puffinus yelkouan* close offshore on 29 January 2003. Though not a Palestinian endemic, its breeding range is confined to the eastern Mediterranean so it is a species of restricted World range. Though not recorded within the site, its presence offshore will be seen by birdwatchers as an added value for Wadi Gaza.

Endangered species

The main reference point for endangered species was the IUCN Red List (IUCN, 2002). Four IUCN Red List species were recorded during the survey. Because of the site's geographical location, the Convention on the Conservation of Migratory Species of Wild Animals (CMS, 2002) was also consulted. Eighteen Wadi Gaza species, including the four Red List species, appear in Appendix I or II of the CMS. It was also considered appropriate to consult Annex I of the EEC Directive on the conservation of wild birds (EU, 2003). Though outside the European Community area, Wadi Gaza hosts birds of European conservation concern which are listed in Annex I of the Directive. A further 12 species appear in this Annex. The status of these birds at Wadi Gaza is given in Table….

Table …: the status of internationally important bird species at Wadi Gaza

Common Name	***Scientific name***	IUCN	CMS	EU	Site status
Cormorant	*Phalacrocorax carbo sinensis*			An I	C; *w*
Night heron	*Nycticorax nycticorax*			An I	U; *r*
Little egret	*Egretta garzetta*			An I	C; *r*
Great white egret	*Egretta alba*		Ap II	An I	R; *p*
White stork	*Ciconia ciconia*		Ap II	An I	S; *p*
Glossy ibis	*Plegadis falcinellus*		Ap II	An I	U; *p*
Greater flamingo	*Phoenicopterus ruber*		Ap II	An I	U; *p*,*w*,*s*
Black kite	*Milvus migrans*			An I	C; *r*; B+
Marsh harrier	*Circus aeruginosus*			An I	R; *w*
Booted eagle	*Hieraaetus pennatus*			An I	R; *w*
Lesser kestrel	*Falco naumanni*	Vu	Ap I		R; *p*
Quail	*Coturnix coturnix*		Ap II		U; *p*,*w*
Baillon's crake	*Porzana pusilla*		Ap II		S; *p*
Corncrake	*Crex crex*	Vu	Ap II		C; *p*
Purple gallinule	*Porphyrio porphyrio*			An I	R; *w*
*Coot	*Fulica atra*		Ap II		A; *r*; B++
Black-winged stilt	*Himantopus himantopus*			An I	C; *r*
Avocet	*Recurvirostra avosetta*		Ap II	An I	R; *p*
Stone-curlew	*Burhinus oedicnemus*		Ap II	An I	C; *r*; B+
Golden plover	*Pluvialis apricaria*			An I	R; *w*
Sociable plover	*Chettusia gregaria*	Vu	Ap I		R; *p*
Wood sandpiper	*Tringa glareola*			An I	R; *w*
Great black-headed gull	*Larus ichthyaetus*		Ap II		R; *p*
Little tern	*Sterna albifrons*		Ap II	An I	R; *s*
Sandwich tern	*Sterna sandvicensis*		Ap II	An I	R; *s*,*w*
Turtle dove	*Streptopelia turtur*		Ap II		C; *p*,*s*; (B)
Kingfisher	*Alcedo atthis*			An I	S; *p*,*w*
Bee-eater	*Merops apiaster*		Ap II		C; *p*,*s*; (B)
Bluethroat	*Luscinia svecica*			An I	S; *w*
Syrian serin	*Serinus syriacus*	LR	Ap I		R; *p*

Key
IUCN: Vu = vulnerable (defined as "high risk of extinction"); LR (defined as "lower risk")
CMS: Ap I = Appendix I (highly unfavourable conservation status; Ap II = Appendix II (unfavourable conservation status) **NB – Appendix II, Coot: Mediterranean and Black Sea populations only*
EU: An I = Annex I
Site Status
abundance: A = abundant, C = common, U = uncommon, S = scarce, R = rare.
occurrence: *p* = passage migrant, *r* = resident, *s* = summer visitor, *w* = winter visitor.
breeding ecology: B++ = common annual breeder, B+ = annual breeder, (B) = probably breeds.

Nearly half (13) of the 30 species of international conservation concern were recorded on only one or two occasions and are therefore currently considered to be rare. However, 17 occur frequently enough to demonstrate that they are using the site on a regular basis. These include one in the highest endangered category, corncrake *Crex crex*, which is common on passage. At least three and probably five of the species breed at Wadi Gaza. A pair of purple gallinules *Porphyrio porphyrio* was holding territory in January 2003 and could, potentially, remain to breed. This species breeds in very few sites throughout its Mediterranean range. The species of conservation concern include residents, passage migrants, summer

and winter visitors. Therefore, the international importance of the site for birds is confirmed for all seasons of the year.

Rare species

Since survey work began in July 2000 a total of 151* bird species have been recorded in Wadi Gaza. Nearly half (64 species; 42%) were recorded fewer than four times. This is not unexpected, bearing in mind the location on a major migration route and at the intersection of several biogeographical zones. Rare species occurred in spring, summer, autumn and winter. They were also distributed widely in the reserve and in all habitats. Some of the species occurred offshore. Though not strictly within the boundaries of Wadi Gaza, they are of education and tourism values because they add to the bird diversity for visitors. Records of offshore species include the east Mediterranean endemic, yelkouan shearwater *Puffinus yelkouan*, and gannet *Sula bassana*, a north Atlantic seabird which is rare winter visitor to the eastern Mediterranean.

*The total of 151 includes unverified records of species which are extremely rare in the entire region, including several which are endangered species. As these are unverified, they have been excluded from the "endangered" section of this plan. They will need confirmation before they can be accepted officially. Only further, regular observations over a series of years will establish their true status at Wadi Gaza. Nevertheless, the range of species reported demonstrates how important the site is for birds and the value of Wadi Gaza for their protection.

Threats

There are a number of threats to Wadi Gaza bird species. They are as follows:

- ***Habitat degradation***. This is the most serious immediate threat to bird species at Wadi Gaza. Degradation is largely due to pollution: untreated sewage entering the system, domestic waste, construction debris, the application of oils and insecticides. Overgrazing and uncontrolled cutting of vegetation also leads to habitat degradation and change. These activities threaten endangered, rare and commoner species and are of particular concern for wetland species.
- ***Habitat loss***. This threat is closely allied to and sometimes the ultimate outcome of habitat degradation. The main reasons for habitat loss are: conversion of habitats to agricultural fields, urbanization or dirt roads; works to divert or block the wadi flow, particularly at the outlet to the sea; and removal of natural vegetation. Virtually all species are negatively affected, but the most vulnerable to habitat loss are the rare and endangered species.
- ***Hunting and trapping***. Hunting and trapping of birds is a threat to most species. Hunting and trapping is mainly indiscriminate. This means that common, rare and endangered species are equally vulnerable to killing or capture. Unfortunately, whereas populations of commoner birds may absorb the hunting pressure, it will have a far more adverse effect on populations of rare and endangered species. Birds of prey are also at risk from targeted activities to capture them for the falconry trade.
- ***Pesticides***. Birds at the top of the food chain are particularly vulnerable to pesticide poisoning. This is a particularly threat to birds of prey, which are already well represented amongst the endangered and rare species at Wadi Gaza.
- ***Human disturbance***. Both direct and indirect human disturbance can have a negative impact on Wadi Gaza bird populations. The taking of eggs and destruction of nests is a direct problem. Intentional or unintentional disturbance during the breeding season can both lead to nest failures and at other times of year can interrupt essential foraging and resting patterns.

Management requirements

The main management requirements for the protection of Wadi Gaza bird populations are:

- Enactment of measures to prevent further habitat degradation and loss, to restore degraded habitats, to end dumping of untreated sewage into the wadi by establishing suitable sewage treatment facilities, and to end the input of oils and insecticides.

- Enforcement of legislation to prevent natural habitats being converted to agriculture or urbanized, using existing legislation and where necessary revision of current legislation.
- Prevention, through agreement and legislation, of the construction of further dirt roads.
- Agreement with local stakeholders on schemes for the controlled, sustainable use of shrubs and other vegetation for grazing and other purposes.
- Ban hunting and trapping in the western part of the reserve, including the estuary lake and surrounding wetland habitats.
- Investigation of the impact of hunting and trapping in other parts of the reserve in order to assess future management, including the possibility of phasing out, controlling or otherwise restricting these activities.
- An awareness campaign directed to agriculturalists and other users of pesticides to highlight the dangers of pesticide use, including to bird species of value to agriculture, and to advise on legal requirements and wise use of chemicals.
- An awareness campaign directed at local people of all age groups to improve their knowledge and appreciation of birds, including the economic benefits which may be derived generally from birds through their role in attracting tourists and other visitors in the future; and more specifically for groups such as birds of prey for their value in controlling populations of mice, rats and insectivorous species in controlling other pests.

Surveys have already demonstrated that a number of rare and endangered bird species occur on a regular basis, widely within the site and in a large range of habitats. This means that effective management measures need to be implemented throughout the reserve and throughout the year. This can only be achieved through better knowledge of how the birds use the site, and its habitats. In order to achieve this, the following management activities are also required:

- Regular survey and monitoring to ascertain which species are using which habitats. Priority needs to be given to 1) breeding birds, 2) habitat preferences and population size of endangered species, 3) habitat preferences and population size of rare species. Such surveys will establish a baseline which can also be used to evaluate the success of the management measures listed above.
- Training of staff in identification, survey and monitoring methodologies. This is essential if survey work is to be effective.
- Involvement of local people. Participation by local people not only extends the data collection facility but can enhance the popularity of the group, support public awareness measures and add another layer of training (e.g. in guiding skills) in preparation for the eventual development of eco-tourism.

2.10.5 Mammals

The mammals of Wadi Gaza reflect the geographical position of Palestine. The mole-rat *Spalax leucodon* and garden dormouse *Eliomys melanurus* are Asiatic elements, while the Egyptian mongoose *Herpestes ichneumon* represents the Afrotropical component. Other species, such as the wild cat *Felis silvestris* and Cape hare *Lepus capensis* have distributions which span the Afrotropical and Palaearctic realms. Nine species were recorded during survey work.

Historical information on mammals is mainly anecdotal, but larger mammals such as Dorcas gazelle *Gazella dorcas* used to occur throughout the Gaza Strip but were largely eliminated by uncontrolled hunting during the 1950-65 period (Safadi *et al*., 2002). These species still occur in the wider region but natural re-colonisation is currently prevented by the security fences which enclose the Gaza Strip and block access by wandering animals.

Nine species were recorded during survey work. Details of their status at Wadi Gaza, and in the Gaza Strip, are given in Table . The table does not include one or more unidentified species of small bat which were observed at dusk at the end of January 2003.

Table …: The status of, and conservation threats to, mammals occurring in Wadi Gaza.

Reptiles

Common Name	***Scientific name***	Gaza Strip	Wadi Gaza	Threat (GS)
Long-eared hedgehog	*Hemiechinus auritus*	R	C	D
Egyptian fruit bat	*Rousettus aegypticus*	C	C	N
Cape hare	*Lepus capensis*	R	C	H
Mole-rat	*Spalax leucodon*	C	C	N
Black rat	*Rattus rattus*	C	C	N
House mouse	*Mus musculus*	C	C	N
Asian garden dormouse	*Eliomys melanurus*	C	C	N
Eyptian mongoose	*Herpestes ichneumon*	R	C	H
Wild cat	*Felis silvestris*	R	C	H

Key: **C** = Common, **R** = Rare;
H = Highly endangered, **D** = enDangered; **GS** = Gaza Strip

Endemic species

No endemic species are known from Wadi Gaza. However, three species are represented by subspecies of restricted world range. These are the Cape hare *Lepus capensis arabicus*, wild cat *Felis sylvestris libyca* and mole-rat *Spalax leucodon ehrenbergi*. This mole-rat subspecies occurs from Libya east and north into Palestine but is often referred to as the Palestine mole-rat and is elevated by some authors (e.g. Kingdon, 1997) to species status under the name *Nannospalax ehrenbergi*.

Endangered species

The Asian garden dormouse *Eliomys melanurus* is recognised as Lower Risk/near threatened in the IUCN Red List (IUCN, 2002). Surprisingly, it is still common in the Gaza Strip. Four species are threatened at the regional, Gaza Strip level: long-eared hedgehog *Hemiechinus auritus*, Cape hare, Egyptian mongoose *Herpestes ichneumon* and wild cat. The hedgehog is considered endangered and the other three highly endangered.

Rare species

All five globally or regionally endangered species were found to be common at WG. This is a very important finding because it signifies that WG is an important refuge for these species.

Noteworthy species

The survival of the wild cat at Wadi Gaza has cultural as well as environmental significance. The domestic cat was derived from this species and records suggest that Palestine, along with Mesopotamia, were amongst the first places to domesticate the cat, at least 8000 years ago (Haltenorth & Diller, 1980). The mole-rat has been the subject of extensive genetic and medical studies of human relevance, in particular for the study of scabies. Indeed, scabies was present on some mole-rats collected at Wadi Gaza. The black

rat *Rattus rattus* and house mouse *Mus musculus* are agricultural and domestic pest species. This negative value needs to be balanced with their position in the food chain, providing prey items for endangered bird and mammal predators. Egyptian fruit bats *Rousettus aegyptius* cause damage to fruits, especially dates and guava, but the role of bats in the ecosystem may also be positive. Insectivorous bats, currently unidentified but known to be present in large numbers, probably have a major impact on nocturnal insect populations, including mosquitos.

Threats

The threats to Wadi Gaza mammal species are largely the same as those which threaten other vertebrate groups. Habitat degradation and loss affect mammals as much as they do the birds and reptiles. Uncontrolled use of agricultural pesticides is a threat particularly to the predators. Several mammal species are either seen as agricultural pests or as highly edible. Species which are killed as agricultural pests include the mole-rat, black rat and house mouse. The Egyptian mongoose and wild cat are also persecuted as predators of domestic chickens, pigeons and rabbits. The long-eared hedgehog and Cape hare are hunted or trapped for food.

Management requirements

The highest priority needs to be given to measures which protect the one internationally endangered species (Asian garden dormouse) and four endangered or highly endangered species at the regional, Gaza Strip, level (long-eared hedgehog, Cape hare, Egyptian mongoose and wild cat). The most immediate threat to these species is direct human persecution. The main management requirements for these species, therefore, are:

- Ban hunting and trapping of the five endangered species within the nature reserve.
- Appoint and train nature reserve staff to enforce this measure.
- A publicity campaign outlining the endangered status of these species, the threats to Gaza populations and the need to protect them in Wadi Gaza, and more widely.
- An awareness campaign directed at local people of all age groups to improve their knowledge and appreciation of mammals, and in particular endangered species; including the benefits of mammal predators in the control of mice and rats, and hedgehogs and insectivorous bats in the control of invertebrate pests.
- An awareness campaign directed to agriculturalists and other users of pesticides to highlight the dangers of pesticide use to predators, and to advise on legal requirements and wise use of chemicals.

Wadi Gaza provides a refuge for mammals which are under severe pressure elsewhere in the Gaza Strip. However, Wadi Gaza populations should not be seen as separate from other Gaza Strip populations of the same species and long-term survival for threatened species may well depend on their population dynamics throughout the region. Therefore, in order to protect Wadi Gaza populations long-term, a further management measure is required. This is:

- Seek legislation which affords protection to endangered species throughout the Gaza Strip.

Other measures identified as necessary for the protection of reptiles, amphibians and birds - such as habitat protection and restoration, reduction and eventual elimination of pollution and other damaging activities, and regulating resource exploitation through sustainable use programs - will also be of benefit to mammals.

Wadi Gaza is clearly an important site for endangered mammals and has a responsibility for their protection. Specific measures to maintain and enhance critical populations depends upon good information and understanding of their ecology, including how they use the site and the habitats they require. In order to achieve this, a further set of management activities are required:

- Regular survey and monitoring to ascertain which species are using which habitats. Priority needs to be given to 1) breeding activities, including sites, seasons, number of young, 2) habitat preferences

and population size of endangered species, 3) habitat preferences and population size of other species. Several species may be suitable for capture-recapture studies of marked individuals, which will provide indices of densities, habitat use and population dynamics. Such studies will establish a baseline which can also be used to evaluate the success of the management measures listed above.

- Training of staff in identification, survey and monitoring methodologies. This is essential if survey work is to be effective.
- Involvement of local people. Participation by local people not only extends the data collection facility but can enhance the popularity of the group, support public awareness measures and add another layer of training (e.g. in guiding skills) in preparation for the eventual development of eco-tourism.

Finally, though larger mammals do not occur currently at Wadi Gaza, they could potentially in the future – but only if measures are taken to allow passage by wandering animals between the Gaza Strip and adjacent territories.

2.11 Human use within the site

2.11.1 Nature conservation

The EQA now coordinates all activities affecting the Wadi. Establishment of office facilities on site was the first step. These will form the basis of an information center. Its function is to provide information and improve awareness for visitors, both from the local community and from academic institutions. This was accompanied by the appointment of a number of wardens to monitor and stop illegal activities along the Wadi, particularly related to grazing, hunting and waste disposal. Most importantly of all, the EQA is working to persuade the municipalities to amend land-use plans so that the natural values of the Wadi are protected and activities leading to further deterioration prohibited.

2.11.2 Agriculture

The agricultural fields surrounding Wadi Gaza have steadily expanded to within the site boundaries. This has led to loss of natural vegetation which is cleared and later planted with fruit trees such as date palms or grapevines. Construction debris is sometimes dumped at the edges of the agricultural fields to protect them against winter flash floods.

2.11.3 Forestry

The USAID project (see **Chapter 2.3.1**) includes some, generally small-scale planting of trees and shrubs to counteract losses through over-exploitation of forestry resources for firewood and grazing purposes.

2.11.4 Recreation

Between 1948-1967 when the Gaza Strip was under Egyptian rule, the reserve was a *recreational site* for the people of the Gaza Strip. Wadi Gaza was especially popular in summer. In those years the area was still covered with lush natural vegetation, and pristine sand dunes stretched all the way to the sea. This is no longer the case, a severe reduction in visitors and the generally degraded state of the site, including litter and noxious smells from the pollution, has reduced the site's attractiveness and use for recreation.

2.11.5 Hunting and fishing

Hunting and poaching activities mainly target birds. A large range of bird species are hunted with guns or poached using more indiscriminate methods such as nets and bird lime. The relatively small size of the site limits the number of birds available, thus the amounts taken are rarely sufficient to be used for commercial purposes. Most of the take is for domestic consumption or is discarded. Mammals are also taken for food and other species killed as predators or pests. Many reptiles, particularly snakes, are seen as a threat by local people and are consequently killed. Fishing activities were pursued in the estuary lake. Fish were plentiful and formed a source of living for the local people. Now, upstream levee constructions by the Israeli Authorities prevent rainwater from flowing to the lower reaches resulting in reduced amounts of open water and a consequent lower number of fish in the Wadi area. The fish which remain are in contaminated water which is unsuitable for fishing. These environmental problems have severely restricted or halted fishing in the wetland. Recently, however, a small artificial pond was constructed for rearing freshwater fish.

2.11.6 Extraction

The Wadi bed is one of the few sources for stone and gravel materials in the Gaza Strip. Sand, stones and gravel from the Wadi bed were extracted on a large scale for construction purposes during the period

1948-1964. These resources are still extracted for the same purpose but on a smaller scale. These extraction activities leave one-meter deep pits in the Wadi bed.

2.11.7 Water use

According to local people the water in the Wadi used to be potable and was used as drinking water. The current water quality is poor and unsuitable for drinking but the Wetland surface water is extracted directly to irrigate adjacent agricultural lands and to supply an artificial fishpond.

2.11.8 Education, demonstration and research

Education

School trips to Wadi Gaza were organized in 2000 and 2001. Staff of the Environmental Quality Authority joined these trips to talk about the value and diversity of the Wadi and the factors that are threatening it.

During the period 1999 to 2001 students of the Islamic University of Gaza collected data in the site which was used for the Flora and Fauna site diagnosis reports. The results of these reports were published in 2002. One MSc. student did a research study on landscape protection in Wadi Gaza (Awadallah, 2000).

Research

Flora and vegetation, Vertebrate terrestrial Fauna, Hydrology, Land use, and Socio-economic studies have been made in the site from September 1999 to October 2002 for the *Conservation of Wetlands and Coastal Areas in the Mediterranean Region* project (Alfaloji, 2002; Madi & Barten, 2002; Qadan & Barten, 2002; Safadi *et al*., 2002; and see Annex 3).

2.11.9 Other uses

Grazing

Some Bedouin families have resided in the site since the mid nineteenth century. The livelihoods of these families depend to a large extent on grazing their livestock (mostly goats and camels) on the natural vegetation of Wadi Gaza.

Sewage discharge

The wadi bed currently functions as a discharge for 5000 to 7000 m^3 of untreated sewage water per day. The main part of the sewage water comes from of the three Refugee Camps, Bureij, Maghazy and Nusseirat and a large amount sewage from Gaza City.

Garbage dump

Construction debris and domestic waste are frequently dumped in the site, especially when the route to the main Gaza Strip landfill is closed by the Israeli army.

2.12 Human use outside and affecting the site

The Global Management Consulting Group (Global), in cooperation with the Palestinian Agricultural Relief Committees (PARC), conducted a socio-economic study in 2001 in order to determine the current socio-economic situation in Wadi Gaza. This study employed the Participatory Rapid Appraisal (PRA) as its main methodology; fieldworkers distributed 280 household questionnaires in order to ascertain the knowledge-level, attitudes and practices of Wadi Gaza residents. Other stakeholders have been consulted during official meetings.

2.12.1 Agriculture

Rain-fed areas of agriculture are located in the eastern part of Wadi Gaza. These areas have no fresh groundwater resources and the rainfall rate is relatively lower than for Gaza as a whole. Agricultural production in these areas is gradually declining because of irregular rainfall and loss of interest in traditional methods of agriculture.

Vegetables are becoming the main contributor to agricultural production stimulated by new methods of cultivation and considerable investment in that sector, alongside a dramatic switch away from citrus cultivation. The cultivation of vegetables is concentrated in the western part of Wadi Gaza and land bordering the sand dunes.

Citrus cultivation has long been a major crop in Gaza. In 1986 citrus represented 48 % of production, but today it represents only 32 % (MOPIC, 1998). This decrease is due to factors such as increased water salinity, reduced water availability and export obstacles. If the situation continues at the same level it is expected to decline further during the years to come.

The main effects of intensive agriculture on Wadi Gaza are the creation of new agricultural fields inside the site, new access roads to service these fields and the leaching of agricultural chemicals. Creation of the new agricultural fields is driven by the current profitability of vegetable cultivation and the lack of income generation alternatives.

2.12.2 Water Use

Agricultural land is divided into rain-fed and irrigated areas, according to the main water source. The annual rainfall is insufficient for most cultivation, so all farmers depend on groundwater for irrigation. Water in the Gaza Strip is mostly extracted through wells. There are 37 abstraction wells in the Wadi Gaza area, most of them agricultural. Over-pumping of these wells contributes to a gradual lowering of the groundwater table and lower groundwater quality (because the lower volume of groundwater results in increased concentrations of nitrates). The Ministry of Agriculture (MOAG) has been monitoring water levels in 7 wells on a monthly basis since the 1970s. Water quality is monitored twice a year on average in 12 wells in the area. Chloride concentration and electrical conductivity have been monitored since the 1970s, while nitrate concentration monitoring started in the 1990s.

2.12.3 Other uses: Built-up areas

Land use plans were drawn up for the areas surrounding the Wadi, originally coming mainly under regional authority and then passing to local authority. There were tight restrictions on construction and development during this period, backed up by enforcement. The closest urban areas were mainly the central Gaza refugee camps (el-Bureij and en-Nusairat) which were constructed in the early 1950s. They lie just south of the Wadi, 1000 m from its course. Refugee camp boundaries were fixed and it was difficult to expand the camp for political reasons, so development was concentrated inside the camp itself. A few farmers' houses were constructed in the northern part of the Wadi in el-Moghraga and Johr ed-Deek to assist agricultural development.

2.13 Economic aspects and population

The resident population of the Wadi banks and immediate surrounding area totals around 10,000 people, distributed in discrete, extended family groups (communities) of variable density. Nationals represent 45% of the total population, refugees about 51% and nomadic bedouins 4%.
One important socio-economic aspect is that the local community of the area still abides very much by traditions and tribal rules which are based on the extended family or the tribe as the most important social

entity for all members of that family or tribe. The heads of these families, known locally as "Mukhtars", have considerable influence on all members of the family or the tribe.

Two local village councils administer the eastern and central portions of the Wadi Gaza north of the actual wadi. They are the Wadi Gaza Local Village Council and Almughragah Local Village Council respectively. They provide very limited services.

The Wadi community has a youthful profile. Children comprise 40%, and the youth 50% of the community. The following table illustrates the distribution and allocation of labour. The figures are based on estimates and opinions of the residents and the heads of the local councils.

Table 5: The distribution of labour

	Labour Force Category	**Numbers**	**%**
1	*Workers in Israel	1300	50
2	Agriculture	520	20
3	Government Employees	208	8
4	Unemployed	442	17
5	Vocational workers	52	2
6	Fishermen	52	2
7	Shepherds	26	1
	Total	2600	100

* Before Al-Aqsa Uprising of September 2001 (this figure will have declined considerably after this event).

Not included in the table is the contribution by women. They do the housework and most of the agricultural activities, and raise domestic animals, but their work is not generally acknowledged or paid for. A very small percentage has employment outside the house or agricultural holdings. After the Al-Aqsa uprising, the percentage of unemployed is estimated to have increased to 70%. The proportion of families without any income source also rose, from 7% before to 36% after the uprising.

The area around Wadi Gaza has been subjected to a range of activities which affect the main resources of the reserve, activities which have been inherited and passed down the generations. Agricultural activities and hunting are considered the most prominent activities of the family heads. In a study prior to the preparation of this plan, 53% of the family heads surveyed stated that they practised farming as a primary economic activity. Figure 11 depicts the primary economic activity per family head. Over a third (35%) named services as their primary activity. Very few are principally involved in other activities, ranging from transportation and communication activities (4%), construction (4%), trade (3%) and mining (1%).

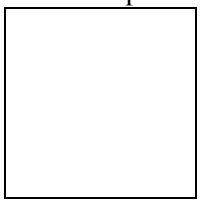


Figure 12: Distribution of Heads of Households by Main Economic Activity.

Responses regarding location of work and economic activity gave a similar result: 54% of the working family heads practised their economic activity in agriculture in the Wadi area, 35% practice their economic activity in another district, 5% work in the same community but outside the Wadi area, 4% work in the same district but outside their residential community and 2% work inside Israel and the settlements.

2.14 Past human land-use

Changes in land use in the Wadi Gaza area have been extensive. Agriculture was the main land use in the Wadi Gaza area until the 1980s. Since then, there has been a marked increase in the development of urban areas. This has led to the transformation of the Wadi Gaza area from a predominantly agricultural to a major urban built-up area. Transformation has been driven by the excessive needs for urbanization in surrounding districtsas a massively increased human population strives to meet its basic needs. The changes in land use were studied for the Wadi Gaza diagnostic report (Qadan & Barten, 2002). The source material was aerial photographs and maps of the Gaza Strip. The aerial photographs were three from 1994 on the scale of the Gaza Strip (MOPIC, 1995) and one from 1999 on the scale of Wadi Gaza (MOPIC, 1999). The maps were prepared in 1978 and 1986. Both sources showed marked and obvious land use changes over the last 24 years.

Formerly, the wetland provided a profitable site for commercial fishing. These activities lasted until the 1970s when the wetland habitats became increasingly polluted by sewage effluents.

2.15 Cultural heritage

Cultural heritage sites are essential to the understanding of an area, and their conservation enhances the identity and character of the site and region. The area bordering the Wadi to the north was the original Gaza City. It is one of the richest parts of the Gaza Strip historically. Protecting and conserving the archaeological sites is urgently needed and will enhance the site's attractiveness for tourists.

The following are the most important archaeological sites adjacent to the Wadi Gaza on its northern flank:

1. *Tall Ajjoul Ancient Site*

Dunes currently cover this site so that its foundations are not exposed. The surrounding areas are cultivated without any consideration for the importance of the site, and the infrastructure for investigation and interpretation of the site is lacking. In its favour, the site can be developed and preserved without any land ownership obstacles, as the site is Waqf land.

2. *Tell Sakan*

Located one kilometer to the north of the Wadi, 5-6 km from Gaza City center, Tell Sakan, together with Tell Ajjoul, represents the first urbanization in Palestine. This site was discovered during the British mandate in 1917, and until 1998 was covered by dunes. Careful surveys of the area were made many times during the period 1917-1998. Today, the site is threatened with total destruction, a huge housing project having already destroyed its southern part.

3. *Tal As-Sanam*

Located next to the site, 50 meters east of the estuary lake. This site is located on privately owned land. It is still largely buried although the owner has regularly uncovered objects, which he has sold to private collectors of antiquities in Israel.

4. *Tal Al-Khbeineh*

Located next to the site, 700 m south-east of Salah ed-Deen Bridge. There is currently little information on this site. It is also located on privately owned land and is therefore not uncovered.

5. *Tal Umamer*

This site is located 1500 m south of Wadi Gaza. It is not located in the Wadi Gaza area but is an additional nearby attraction for people drawn to Wadi Gaza for the purpose of visiting archaeological sites. It has many excavations, exhibiting mosaics and structures of a Byzanthine church (see Figure 13).

Currently efforts are being made by the Ministry of Tourism and Antiquities to further excavate the site and protect recent excavations against rainfall and the sun.

Figure 13: Mozaic (left) and structure of a Byzanthine church (right) excavated at Tal Umamer

2.16 Landscape and aesthetic qualities

Analysis of observations from the many site visits and the aerial photographs (MOPIC, 1995; 1999) has resulted in the following classification of local landscapes. Five categories have been defined. Four are largely homogenous in terms of views, colors and texture, in sharp contrast to the fifth..

The first category is the *coastal zone* or *sand dunes*, occupying the western sector north of the Wadi. It is characterized by flat landscapes of open fields, vineyards and unimpeded views to the sea. With heights ranging from 3 to 5 m, the area is only marginally above sea level. It has some of the highest quality landscape features of any area along the Wadi or elsewhere in the Gaza Strip. The land is largely unspoiled and has not been adversely affected by human activities.

The next highest in landscape quality outside the actual Wadi is centred on "Johr el-Deek", located north of the Wadi close to the eastern border of the Gaza Strip. It comprises open fields on gently sloping land of contrasting colors. Rain-fed agriculture and olive trees, green houses and scattered development, cover the area. The area is 30-40 m above sea level and, despite the distance, has an unobstructed view to the sea. Settlement is limited to low density rural development, with farmhouses clustered linearly along the road which links el-Burieje south of the Wadi with Johr el-Deek to the north. This landscape extends from the the eastern border to 500 m east of the Salah ed-Deen road.

The third category, in the central section of the Wadi, extends for 500-1500 m both sides of Salah ed-Deen road. This area is characterized by horticulture, olive and citrus groves, and linear urban development - especially in the western segment, “el-Moghraga”. The western segment is a potential site for individual housing developments because of cheap land. Salah ed-Deen road bisects the area and interrupts the landscape continuity of this particular zone.

The fourth category relates to the area south of the Wadi from el-Burieje in the east to en-Nusairat in the west. This landscape is characterized by a patchwork of urban areas and agriculture land. The urban areas are clustered and in huge blocks. Urban development extends to within 50 m of the Wadi bed in the western part, close to the sea. Relatively speaking, this area has less landscape quality overall than other areas along the Wadi.

The fifth category is the Wadi Gaza wetland itself. The wetland is an outstanding landscape feature, its bright colours and varied topography adding diversity to and constrasting with surrounding landscapes (see Figure 14 below). This landscape is not replicated elsewhere in the Gaza Strip.

Figure 14: The wadi Gaza wetland in its surroundings

2.17 Additional descriptive material

The preparation for this plan involved a number of original surveys complemented by background information derived from publications, databases, maps and photographs. This material has been collated to provide a checklist of sources (below) for future reference.

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2.17.4 Ground photographic coverage

The ground photographic source material comprises a file of 206 photographs, mainly taken in 2000 and 2001, and illustrating many aspects of physical and environmental relevance for Wadi Gaza. A full list of the photographs, including description and year, is given in Annex 6.

2.17.5 Aerial and satellite photographic coverage

Two aerial photographs, one in three parts, were available as source material for the site diagnosis phase which preceded the preparation of this plan. Both are archived with the EQA, Gaza City. They are:

MOPIC. 1995. *Aerial photograph of the Gaza Strip* [in 3 parts]. Ministry of Planning and International Cooperation, Gaza City.

MOPIC. 1999. *Aerial photograph of Wadi Gaza*. Ministry of Planning and International Cooperation, Gaza City.

3 EVALUATION AND OBJECTIVES

In order to meet the policy requirements established for protection of Wadi Gaza (described in **Chapter 1.1.2** above) specific objectives must be formulated based on the ecological character, economic and social criteria and potential value of the site. Evaluation is a means of identifying the ecological, socio-economic and cultural characteristics to be taken into account in the management planning process. Equally importantly, it assists in determining the objectives which will guide that process.

3.1 First evaluation

3.1.1 Ecological criteria

The ecological character of Wadi Gaza has been evaluated based on a series of criteria. In reality, there is considerable overlap, with one criterion often linked to, dependent on or the result of one or more of the others. For instance, the fragility of certain habitats makes them vulnerable to disturbance, inappropriate use or pollution, which in turn leads to a reduction of diversity, loss of naturalness and increasing rarity of certain plants, animals or habitats. This has been taken into account in the following evaluation.

Fragility
The lower part of Wadi Gaza with its permanently flooded Wetland and palustrine freshwater habitats is the most fragile. This sector includes the annually flooded Scrub-Shrub habitats belonging to the *Tamarix nilotica - Mesembryanthemum crystallinum* & *Cynodon dactylon* community. The fringes of these habitats are gradually losing their diversity of fauna and vascular plant species and becoming fragmented because of increasing pressure from human activities.

Rarity
Wadi Gaza is the only coastal wetland in Palestine. Regionally, the En Afek nature reserve of Israel is the only Wetland site of any significance on the Mediterranean coast. Therefore Wadi Gaza has wetland habitats which are unique at the national level and rare regionally. These habitats support a number of rare species. They include one reptile, 30 birds and 4 mammals which are rare or threatened at the regional or international level, and considerably more which are rare locally.

Naturalness
Human activities in and outside the Wadi Gaza area have affected all the Wetland habitats and vegetation communities. However, many natural features remain. These include the beach of the Mediterranean Sea, the reed-beds and the aquatic bed of the freshwater pond. As there are few feral dogs and cats within the site, the fauna is also largely natural. On a larger scale, Wadi Gaza is a major natural feature in a landscape which has otherwise been largely shaped by man. Invasive species are a threat to the natural characteristics of several habitats. These include agricultural weeds invading from surrounding agricultural fields, which have come to dominate the *Tamarix nilotica – Neurada procumbens* & *Xanthium spinosum* and *Tamarix nilotica - Mesembryanthemum crystallinum* & *Cynodon dactylon* vegetation communities; and the introduced invasive species, *Nicotiana glauca*, which has colonised all vegetation communities except the *Tamarix nilotica – Arthrocnemum fruticosum* community, where the conditions are too saline for *N. glauca* to grow. Natural habitats have also been lost to agriculture and urbanization and degraded by pollution, road building and other damaging human activities.

Typicality

Although degraded, Wadi Gaza retains many of the characteristics of a coastal wetland site with a succession of habitats proceeding from marine through estuarine to palustrine and riverine. These habitats still support typical wetland bird communities as well as providing cover and refuge for other fauna. The terrestrial habitats and vegetation communities in the upper part of Wadi Gaza are replicated elsewhere in the Gaza Strip and region. Protection of the site may preserve typical examples of these ecological features at a time when they under increasing threat from developments driven by an increasing human population.

Special interest

The wetland habitats are of special interest because of their uniqueness in the immediate region. The site also attracts migratory birds, including a range of rare and threatened species. The site provides a refuge for a range of fauna which are threatened or declining elsewhere. For instance, good populations of four mammal species which are endangered or highly endangered in the Gaza Strip and nearly 20% of bird species so far recorded at Wadi Gaza are included on international lists as endangered or species of conservation concern. Some, such as the corncrake *Crex crex*, occur in some numbers and on a regular basis. Though not strictly in the reserve, the marine waters offshore attract a wide range of seabirds, including rarities. In flora, *Zygophyllum album* and *Tamarix aphylla* are of special interest because of their rarity and because they are relicts of the original salt marshes which have been all but lost. Wadia Gaza also supports populations of several endemics or species of restricted world range. They include the Palestine sunbird *Nectarinia osea*, the Palestinian viper *Vipera palaestinae* and three subspecies of mammal. The site is particularly rich in vertebrates. The most obvious of these are the birds, which are numerous and diverse at all seasons. This richness has the potential to attract birdwatchers and other lovers of wildlife.

Size

Wadi Gaza Nature Reserve is rather small. Nevertheless it is one of the largest of very few quality or recuperable areas for wildlife anywhere in the Gaza Strip. Individual habitats vary in size and some are very restricted in area. The *Tamarix nilotica - Mesembryanthemum crystallinum* & *Cynodon dactylon* community covers the largest area but is heavily fragmented (see Figure 1). The most restricted ecological features within the nature reserve are the Marine habitats and terrestrial vegetation communities such as the *Centaurea araneosa – Atractylis* and *Tamarix nilotica – Neurada procumbens* & *Xanthium spinosum* communities. However, these are not restricted on a wider scale. The marine habitats extend all along the coast of the Gaza Strip and Mediterranean coast of Israel; and the terrestrial vegetation communities are well represented over large areas of the Gaza Strip and southern part of Israel.

Initial studies show that the site continues to support or provide refuge to an elevated biodiversity and maintains species or habitats which would otherwise be lost to the Gaza Strip. A wide range of fauna use the site throughout the year. This indicates that, despite degradation of habitats, the impact of pollution on water quality and other notable pressure on the site, the ecosystem continues to function. This suggests that size is not an issue in maintaining a viable ecosystem – provided measures are taken to reduce and eliminate the various impacts which are currently damaging the site.

Diversity

As the only coastal wetland in the country, Wadi Gaza has wetland habitats and aquatic species not replicated elsewhere locally. This adds diversity at the regional level, diversity which is enhanced further by the occurrence of fifteen wetland habitat types and four different habitat systems within the site (see **Chapter 2.8**).

In terms of the number of species and the limited area, Wadi Gaza can be considered one of the richest sites in the region. Many of these species fill ecological niches which are not present elsewhere in the Gaza Strip. A total of 216 plant species, from 50 familes and 150 genera, have been recorded in Wadi Gaza, including 129 species of 40 families and 108 genera in the most recent survey (Madi & Barten,

2002) . Vertebrates are also well represented. Eighteen reptile, 3 amphibian and 9 mammal species are known. The mammal tally will certainly rise as more than one unidentified bat species is using the site. The total of 151 bird species is minimal and is likely to rise considerably with regular survey and observations.

Stability and instability

Very few of the habitats are stable, as the whole site is in forced transition from pristine to heavily degraded. A few resilient communities, such as those dominated by *Phragmites australis* or *Tamarix nilotica* have prospered under the assault of a range of human pressures but more sensitive habitats are in decline or suffering reductions in quality or diversity. The deterioration of aquatic habitats has resulted from the inflow of polluted water, while construction activities, dirt roads and the conversion of natural habitats into agricultural fields leave bare ground or, at best pioneer vegetation. Subsequent recovery is only partial and tends towards *Tamarix* dominated communities. A return to a more stable and enhanced condition is possible but only through elimination of the human induced changes, and by active management to recuperate damaged habitats and systems. Without these actions, the site will eventually lose its viability for wildlife and biodiversity.

Ecological position

The site is the only coastal wetland in the country and therefore has unique habitats and species. It is strategically placed on the eastern branch of the Africa-Eurasia bird migration flyway and provides an important resting and refuelling site for migrants using the flyway. A total of 98 migratory bird species have been observed so far in Wadi Gaza. Because of its strategic position and huge Eurasian catchment area, this total is expected to rise under appropriate site management. Its ecological position has been recognised by BirdLife International which has listed Wadi Gaza as an Important Bird Area for the Middle East (Evans, 1994; Atrash, 1999).

Replaceability

The lower permanently flooded part of Wadi Gaza with its surrounding vegetation communities would be difficult to replace or restore if severely damaged or destroyed. This system is therefore non replaceable. All other features, including the marine and riverine habitats and the terrestrial vegetation communities, are already heavily degraded but, with appropriate and determined management, can be restored to a more pristine condition. Studies for this plan have shown that the ecosystem is still functioning, though severely stressed. This means that the basic elements are still there for successful restoration of ecological values. Indeed, restoration is likely to lead to an ecosystem which is both viable and very rich. Ecological reconstruction is relatively straightforward, but will require planning, targeted actions and the resources to implement those actions. Therefore restoration of values is technically easy, but in terms of conservation requirements and resource needs may prove difficult to replace or restore.

3.1.2 Socio-economic criteria

The adherence to traditions and tribal rules of the extended family or the tribe under the influence and direction of "Mukhtars" (see **Chapter 2.13** above) remains an important cohesive factor in the social fabric of local communities. Another tangible socio-economic factor is rising levels of unemployment, leading to a five-fold increase (7% to 36%) in the percentage of families without any income source after the Al Aqsa uprising.

Table 6: The distribution of labour

	Labour Force Category	**Numbers**	**%**
1	*Workers in Israel	1300	50
2	Agriculture	520	20
3	Government Employees	208	8
4	Unemployed	442	17
5	Vocational workers	52	2
6	Fishermen	52	2
7	Shepherds	26	1
	Total	2600	100

The PRA survey found that the majority of the residents of the area expressed their commitment to support the project as long as it does not limit their access to or use of their agricultural lands (for those who own land at the sides of the wadi course) and as long as it grants them tangible benefits including alleviation of the problems afflicting them. Some respondents went to the extent of threatening to prevent the project, if it targets their land ownership. The economical conditions for the inhabitants of the area are bad, unemployment rates are very high and incomes are decreasing rapidly especially after Al-Aqsa upraising (these conditions are also valid for other areas in the Gaza Strip).

In addition, the area of Wadi Gaza lacks basic infrastructure, health and educational facilities. The people of the area are also suffering from the bad health and poor environmental conditions of their neighborhoods. Most of them have expressed concern over the bad environmental conditions of Wadi Gaza and a desire to see it returned to the condition of 20 years earlier, when no wastewater or solid waste were dumped into the wadi course.

Most residents acknowledge that safeguarding Wadi Gaza through a management plan has many benefits, but the residents worry that these will be at the expense of their own interests, especially regarding the issue of land ownership. Nevertheless, the residents envisage the following benefits:

- Increased land prices in the area;
- Generating job opportunities in new fields;
- Provision of clean, safe drinking water and water for agriculture;
- Elimination of wastewater and other waste problems;
- Ease of movement within and passage over the Wadi;
- Elimination of mosquitos and epidemic diseases.

3.1.3 Potential value

Wadi Gaza Nature Reserve has enormous potential value. The opportunity exists to apply management measures which can bring both ecological and socio-economic benefits. Measures to clean up and restore the site would bring ecological, landscape and visual improvements. It would improve health and environmental conditions for local people, bring new opportunities in education, recreation, tourism and

research and maintain or restore a range of cultural, social and historical heritage values. Restoration work to achieve a healthy, fully functioning environment and subsequent maintenance of the high quality values that work would bring also has job creation implications. It has the potential to present a number of new avenues of income generation for local people. The obstacles to achieving those values and benefits, and the means of overcoming those obstacles, are described below.

Ecological improvement

Most of the habitats and vegetation communities are degraded because of the high pressure of human activities. The main pressures are overgrazing, pollution from untreated sewage and discarded oils, cutting and burning of the natural vegetation, building, roads and agricultural encroachment, and hunting and poaching. These pressures can all be reduced, and ecosystem functions and productivity restored, through management.

- ***Pollution***: elimination or reduction of pollution by sewage and discarded oils would improve the estuarine and riverine habitats. After improvements to water quality, appropriate aquatic plants can be planted in the bed of the lake. Populations of aquatic invertebrates will benefit from increased cover and also as a result of the improved water quality. This, in turn, will attract more migratory water birds. Fortunately, restoration of the ecosystem is feasible because the small freshwater pond at the outlet of the Wadi, which is still unpolluted, can act as a source for aquatic plants and invertebrates. The sewage problem is due to the absence of water treatment facilities to cope with the large increase in people. The discarded oils are used as mosquito control agents. The provision of adequate facilities is required to solve the sewage problem, while alternative environmentally friendly methods need to be devised for mosquito control. These actions need to be supplemented by public education and awareness campaigns against all forms of pollution.
- ***Overgrazing, cutting and burning***: reduction of these activities in some habitats and complete elimination in others would bring undoubted environmental benefits. Stopping or reducing grazing pressure and cutting and burning of the natural scrub-shrub vegetation would improve the scrub-shrub habitats. A reduction in grazing pressure would encourage regeneration of plant species cut for livestock fodder so that they can compete with species that are not palatable to camels and sheep. The outcome would be a gradual increase in the diversity of scrub and shrub species. This process could be accelerated by actively planting seedlings of naturally occurring species. Cutting could be allowed in certain habitats or zones but on a limited, sustainable scale. Cutting should be limited to *Tamarix nilotica* and the invasive alien *Nicotiana glauca*. Designating *Tamarix nilotica* as a priority species for cutting would allow other currently out-competed species to recover. Fire is not part of the local ecology and should be banned completely in the scrub-shrub areas. Control of these activities can be achieved through a program of sustainable resource utilisation, established through consultation and agreement with users of these resources.
- ***Building, roads and agricultural encroachment***: prevention of further clearance of habitats to construct buildings, roads or agricultural fields would halt habitat degradation and loss due to encroachment. Halting the loss of natural habitats is necessary to ensure the ecological integrity of the site. Prevention of such activities through land use plans, enforcement of existing legislation and, if necessary, introduction of new legislation is required to eliminate the problem of encroachment.
- ***Hunting and poaching***: measures to eliminate poaching and limit or eliminate hunting would improve the conservation status of threatened vertebrate populations and reduce disturbance to the site. Enforcement and awareness programs are needed to implement these measures.

Another measure which would restore the natural ecological functions of the site is the re-opening of the connection between the estuary lake and the Mediterranean Sea in order to increase the saline conditions around the outlet of the wadi. This would expand the area capable of supporting halophytic plant species, thus restoring parts of the original salt marsh vegetation. **Landscape improvement / visual improvements**

Clean-up actions have already removed tons of garbage from Wadi Gaza. Preventing or stopping people from dumping garbage and construction debris inside the site boundaries would greatly improve the visual

appearance of Wadi Gaza. Stopping the sewage pollution (discussed above) would be a major improvement in the overall appearance and appeal of Wadi Gaza. Preventing or stopping construction and cultivation activities in Wadi Gaza would also improve the visual appearance of the site and preserve it as a part of the natural landscape. A cleaned-up Wadi Gaza would complement and add diversity to the surrounding cultivated landscape. It has the potential to become a "green heart and lung" to surrounding built up areas, provided urban sprawl is halted along the site boundaries. Dumping of solid waste stems from lack of adequate waste disposal facilities. The provision of adequate facilities is required to solve this problem. These actions need to be supplemented by public education and awareness campaigns for a pristine Wadi Gaza.

Education / research opportunities
The high number of bird and other animal species at Wadi Gaza, and its cultural and historical values, make the site an excellent location for raising public awareness through environmental education. No long-term research projects have been conducted within the site. Short-term investigations, comprising ecological, hydrological, social and land use surveys of the site and its surroundings, have been conducted. However the relative rarity and typicalness of the habitats make the site highly suitable for research activities and there is a clear need for a better understanding of the many ecological, social and archaeological issues that are related to the site. Establishment of management and facilities on site will form a focus and stimulation for such studies to take place.

Generation of revenues for the owner and local communities
The *Phragmites australis* reed-beds are not exploited in Wadi Gaza. Harvesting a regulated amount of the reed-beds could provide material for creating baskets or other crafts that can be sold locally, the reeds can be used for roof cover, *Arundo donax* stems can be used for making furniture and the young shoots of the reed-beds can be used for livestock fodder. At the same time harvesting of reed-beds will prevent them from invading the estuary lake. Reeds are known for their ability to take up nutrients and other chemicals from water. There is potential for reed-beds to be used in conjunction with more traditional water treatment methods. A water treatment plant is planned (**Chapter 2.2.4**) to receive the sewage which is currently discharged into the Wadi. This will partially clean the water. Establishing reed-beds especially to receive this partially cleaned water, in pools upstream from the estuary lake, would allow for secondary treatment in the water purification process. Not only would the reeds act as natural agents for water cleansing, but such a project would increase the reed-bed habitat. Harvesting the reeds could also play a part by exporting part of the nutrients away from the site. The substratum of the reed-bed will accumulate phosphates. Parts of it can be collected and used as fertilizer for agriculture. The water from a reed-bed filtration system could be made available for both environmental and socio-economic purposes. Prior to recent upstream hydrological disruption to surface flows, highest water inputs to the wadi were during the winter months. In summer, natural surface inputs to the wadi have always been low but demands for agriculture and domestic uses are at their highest. A system could be established which mimicked the previous volume and pattern of inputs to the wadi, whilst also supplying re-cycled, naturally purified water to agriculturalists and local communities. Recycled water also has potential as a resource for fish-farming in ponds dug specifically for that purpose.

The diversity of wetland habitats and migratory birds, together with the archaeological sites, are excellent assets for the development of eco-tourism. This could be an income generating activity for both the owner and local communities. Eco-tourism would be a new and potentially very rewarding source of revenue but will not happen if the visual appearance of Wadi Gaza is not improved. The major environmental problems of untreated sewage, other pollution and inappropriate human activities (see above) also need to be solved. In the present political situation eco-tourists will be deterred from coming to the Gaza Strip. Eco-tourism has huge potential but can only be developed in a period of political calm.

Demonstration possibilities to other land managers

Wadi Gaza is the first designated nature reserve in the Palestinian territories. Hence, many of the management activities are new and have never been applied elsewhere in the territories. Careful, well planned and well resourced management implementation can establish a model and learning opportunity for other land managers and decision makers. One early example is the cheaper and more environmental friendly techniques to control mosquitos which have been trialled successfully in Wadi Gaza. Techniques trialled or pioneered at Wadi Gaza have a great potential for application in other parts of the Gaza Strip and West Bank.

Stronger protection through legislation or designation

Currently there is little legislation that guarantees the protection of Wadi Gaza's wetland habitats. Although the site is designated as a reserve, the boundaries of the site are not clearly defined or communicated to the people who will be affected by it. During the current political situation there is no enforcement of existing legislation as it applies to Wadi Gaza. There is great potential for creating stronger legislation, which is clear and which is communicated to and developed with the involvement of all stakeholders. The installation of wardens committed to the aspirations of the reserve and trained in issues of legislation is required to ensure legislation enforcement.

Public or visitor enjoyment

Public access and visitor enjoyment can be enhanced by improving the overall visual appearance of the site. Developing facilities like hiking trails and observation towers will improve access and possibilities to observe and enjoy the wildlife. Visitors can learn more about the nature and history of Wadi Gaza once an information center has been developed and the archaeological sites opened to the public. The information center can provide information about the wildlife and plants of the site, the environmental problems in the Gaza Strip (water issues) and the history of Wadi Gaza. Enjoyment of the archaeological sites can also be enhanced by the provision to visitors of materials and information which interpret the sites and their history.

Cultural, social and historical heritage

In nature reserves the emphasis is given, not unnaturally, to environmental and wildlife issues. However, knowledge of the cultural, social and historical traditions of the site can widen its appeal to visitors and also places the environmental values into their local context. Communities throughout the world appreciate their heritage, especially those where local culture is highly valued and a traditional way of life maintained. Traditional activities lend themselves to the development of schemes for sustainable resource use, because the user understands that the resource must be renewable for the activity to continue. Wadi Gaza is one such site, and consultation with and inclusion of users and other stakeholders in planning issues can produce positive measures which sustain both environment and heritage. Wadi Gaza is an ideal site to promote cultural, social and historical heritage alongside, and without damage to, environmental imperatives.

3.2 Ideal objectives for Wadi Gaza

The evaluation demonstrates that Wadi Gaza has a range of qualities but these require active management in order to halt degrading processes and eventually restore, maintain and enhance ecological values. Targeted management can also contribute to diversifying and assisting social and economic conditions and develop the site's potential in a range of ways. However, a long-term vision is required to protect values and maximize potential. This vision is best expressed as a series of objectives which give a long-term view of what management should strive to achieve. At this stage in the planning process, it is sufficient to prepare a list of objectives which would ideally be applied to the site. These objectives may be difficult to achieve in the short term because of the inevitable constraints on management (assessed in detail in **Chapter 3.3** below), and are thus best seen as ideal or long-term objectives. Based on the evaluation, the ideal objectives for Wadi Gaza are:

1 **To maintain and conserve the diversity of wetland habitats, animal and plant species that characterize Wadi Gaza.**

2 **To rehabilitate and restore the wetland habitats and ecosystems that characterize Wadi Gaza.**

3 **To use the wetland resources of Wadi Gaza in a sustainable manner, to the long term benefit of the site and the local communities around it.**

4 **To improve the socio-economic situation and opportunities of the local communities around Wadi Gaza.**

5 **To raise public awareness for Wadi Gaza in particular and environmental issues in general.**

3.3 Constraints or modifiers

3.3.1 Potentially occurring constraints or modifiers within the site

Ecological change
Ecological change has accelerated in recent years as a result of intense pressure from human activities in and outside the site. This has led to loss or deterioration of several habitats and vegetation communities; and with it a loss of biological diversity. There have been beneficiaries of recent ecological change. These include the *Phragmites australis* dominated emergent and *Tamarix nilotica* dominated vegetation communities, which are increasing. The invasive alien shrub *Nicotiana glauca* is another beneficiary. Thus, Wadi Gaza vegetation communities are becoming dominated by a few species. The quality and ecology of the permanently flooded areas is steadily deteriorating because of the inflow of raw sewage. Construction activities, dirt roads and the conversion of natural habitats into agricultural fields result in areas stripped of vegetation or, at best, with scattered patches of pioneer vegetation. These areas subsequently develop into the *Tamarix* dominated vegetation communities. The terrestrial habitats and vegetation types, such as the dry Wadi bed and the *Centaurea araneosa – Atractylis* and *Tamarix nilotica – Neurada procumbens* & *Xanthium spinosum* communities, do not seem to regress or become degraded as a result of the increasing human pressure. However, this is because they are already in a highly degraded state and the plants which remain are adapted to the disturbance caused by human activities.
Climate
Successive dry years can lower the groundwater level, which lowers the level of the estuary lake and other standing water. This heightens yet further the stress on a wetland ecosystem already exposed to damaging human impacts such as pollution, hunting, grazing, wood cutting and water extraction in and outside the site boundaries.

Physical factors that affect the site
Pollution is the major physical constraint in the site. In addition to the sewage water of the three Refugee Camps, Bureij, Maghazy and Nusseirat, a large amount of sewage from Gaza City has been allowed to drain into Wadi Gaza. This sewage is polluting the wetland habitats and causing eutrophication of the estuary lake. Discarded oils and insecticides further pollute the open waters of the wadi. These chemicals have been applied to control the number of mosquitos. Construction debris and domestic waste are frequently dumped in the site. These have effectively covered and destroyed natural vegetation communities. Effluent from the stone cutting industry sometimes drains into the waters of the Wadi. The effluent results in turbidity which prevents light from reaching the wadi bottom. Without light, the submerged plant life dies. Agricultural chemicals that are dumped in the site have a lethal effect on many wild animals and are also dangerous for local residents.

Land use and economic trends

Extraction
The uncontrolled stone quarrying in the Wadi Bed often results in the destruction of the natural vegetation.

Woodcutting
Trees and shrubs are cut for the supply of support poles for vineyards or fodder for camel and sheep. This activity is conducted with little or no control or consideration for sustainable use of the resource.

Grazing

The natural vegetation communities in the site are subject to heavy grazing by camel and sheep. These domestic stock are a disturbance factor for the wild animals of the site and contribute strongly to degradation of the natural vegetation communities.

Hunting
Many birds are hunted with guns or poached with more indiscriminate methods such as through the use of bird lime and nets. Reptiles, and in particular poisonous snakes, are mostly seen as a threat to people in the site and are consequently killed. Regionally rare mammals are hunted for food or as pests.

Fish ponds
Natural vegetation communities are occasionally converted to small ponds for the purpose of raising fish. These pools tend to be short-lived and quickly revert to natural communities, such as reed-beds.

Transportation
Numerous dirt roads run through the reserve and are used daily by agricultural, municipal and private vehicles.

Resources / staff
There are no proper administrative facilities and resources to achieve the long-term objectives. Neither the financial resources nor trained staff are currently in place. These resources need to be provided and developed as a requisite part of the long-term planning and implementation of management programs.

Expertise
There is a general lack of expertise and experience in fields related to wetland conservation and planning. Capacity building in biodiversity monitoring skills, hydrology, land use planning and poverty alleviation is needed to achieve long-term objectives.

Technology
The techniques to control the number of mosquitos include spraying discarded oils and insecticides on open waters in the site. Two new roads were created to facilitate the access of municipal vehicles used for spraying chemicals. The construction of these roads has led to the destruction of many natural habitats.

Policies
The deteriorated political situation in the Gaza Strip has weakened the authority of the Ministry of Environment in Wadi Gaza. The authorities have been reluctant to impose restrictions on communities already in a desperate state. Enforcement of legislation which protects the wetland habitats has therefore been severely reduced or stopped altogether.

Legislation
Municipalities around Wadi Gaza have designated parts of the site for urban or agricultural development within their land use plans. These plans also designated parts of the site for the construction of municipal roads. To achieve the long-term objectives there is a need for a clear and single land use plan that is adhered to by the local municipalities and respects the site's boundaries and environmental values.

3.3.2 Potentially occurring constraints or modifiers outside the site

The primary causes for the deterioration of Wadi Gaza and the wetland within it have been: 1) the pressure put on land, groundwater and the physical environment of the site after the second Palestinian migration, which led to the concentration of large numbers of people in the small area of Gaza Strip; and, 2) a decrease in hydrological flows following Israeli water diversion and abstraction activities upstream.

Land use

Urban sprawl

Urban sprawl is a problem which extends to the boundaries of the reserve and has increased enormously in recent years.

Agriculture

More than 90% of the original natural habitats of Wadi Gaza have been converted into agricultural fields. Agricultural fields extend to the site boundaries and many agricultural vehicles pass through the site daily. Fertilizers and other chemicals used on the fields leach into the reserve and pollute the wetland habitats. Chemical use has increased in recent years, allied to recent movements away from citrus fruit to the cultivation of vegetables.

Extraction of groundwater

Excessive pumping for agricultural and domestic purposes is lowering the groundwater table in the whole Gaza Strip. A lower groundwater table means a reduction in the Wadi Gaza wetland area because the wetland is mainly fed directly by groundwater, which reaches the surface there (see **Chapter 2.7.2**).

Retention of water in the upstream part of Wadi Gaza

Since the early 1970s the amount of water derived from catchment run-off has fallen markedly due to the construction of check dams and implementation of diversion schemes by Israel in the upper course of the Wadi. Since then the volume and duration of surface water flow has decreased considerably, apart from occasional flash floods sweeping down the Wadi bed in wet years.

Groundwater pollution

Analysis of 12 Wadi Gaza wells (Alfaloji, 2002) showed that the groundwater contained high levels of chloride, nitrate concentrations and electrical conductivity. The highest levels of groundwater pollution were found on the west bank of Wadi Gaza. This groundwater is part of the same resource which feeds the wetland.

Economic trends

Before the start of the Palestinian Uprising the income of 50% of the communities around Wadi Gaza was completely dependent on labour in Israel. Since the start of the uprising all these families had to look for alternative sources of income, which were mainly sought in agriculture, governmental wages and social welfare. The need for alternative sources of income has increased the pressure on the wetland habitats for subsistence use and heightens the risk that they will be converted to agriculture.

Technological change

An electricity plant has been build next to the wadi. When it becomes operational the emissions are likely to have an impact on the site. The extent of the impact is unknown but could be considerable, particularly as the Israeli authorities have restricted the chimneys to one-third the standard height.

Expertise or knowledge

During the past decade there has been a large influx of new people settling in and around Wadi Gaza. These people usually earn their money in Gaza City or Israel and have no experience or interest in using the wetland resources of Wadi Gaza. This influx has led to a shift from agricultural land use to urbanization and a much greater proportion of the surrounding population with no experience or knowledge of the site.

Social or cultural changes

The Bedouin families living in the central part of Wadi Gaza had a traditional nomadic way of life. Due to their confinement to a specific area in the Gaza Strip and the scarcity of land they can no longer pursue this migratory lifestyle. Despite these restrictions, they maintain a cultural and social identity centered upon livestock husbandry. This means they remain almost fully dependent economically on their livestock. The outcome is larger concentrations of livestock on less land, and this leads to overgrazing. Vegetation which previously gained respite through movement of livestock is now grazed on a much more frequent basis. This is a particular problem for the wetland habitats of the central part of Wadi Gaza where there are large concentrations of sheep and camels, and consequently severe overgrazing.

Legal factors

Generally there is a lack of regulations in the Palestinian Authority and weak enforcement in relation to protection of natural areas in the Palestinian Territories.

Political factors

The political situation in the Gaza Strip has led to some important consequences which threaten the site:

Restriction of movement in certain parts of the Gaza Strip

The Israeli army has blocked the Salah ed-Deen road, the main artery connecting the north and south of the Gaza Strip. This has led to traffic diverting on to the dirt roads skirting or passing through the site, turning them into major thoroughfares for traffic heading north or south. A tenfold increase in traffic has ensued, which has a negative effect on the wildlife of the site.

Fenced borders

The electrified wire netting which seals the borders of the Gaza Strip forms an effective barrier for wandering wild animals, isolating Gaza Strip populations, disrupting gene flow and undermining the recovery of species currently in low numbers or locally extirpated. This is a particular problem for the larger mammals.

3.4 Second evaluation

3.4.1 Principal objectives

All the constraints and modifiers present a challenge to management. Human impacts, especially, are real, pressing and have accelerated in recent years. Without urgent action, the site could be irreparably damaged. This management plan is, therefore, a timely document. The implications of constraints and modifiers are various. They do not change the long-term objectives, but they do change the way in which they are achieved. They cannot be achieved by a Wadi Gaza management team alone. Successful management will require close partnership and collaboration between all stakeholders, from local and regional authorities to the local communities reliant on Wadi Gaza and its resources. Implementation of management measures will require commitment by participants, enhanced awareness of the long-term benefits management will bring and, where necessary, legislation and enforcement to support management actions. Fortunately, the long-term objectives for Wadi Gaza incorporate these requirements. They are an overall vision of what needs to be achieved and set a balanced framework from which to design and develop a management action plan. For the action plan itself, a further more specific series of objectives need to be generated to guide activities and provide a measure for future evaluation of the extent to which each activity produces the required results. In order to differentiate between them, the specific objectives which determine individual management activities are referred to here as "operational" objectives and the long-term ones as "principal" objectives. The list of principal objectives is as follows:

1 To maintain and conserve the diversity of wetland habitats, animal and plant species that characterize Wadi Gaza.

2 To rehabilitate and restore the wetland habitats and ecosystems that characterize Wadi Gaza.

3 To use the wetland resources of Wadi Gaza in a sustainable manner, to the long term benefit of the site and the local communities around it.

4 To improve the socio-economic situation and opportunities of the local communities around Wadi Gaza.

5 To raise public awareness for Wadi Gaza in particular and environmental issues in general.

Achieving the long-term objectives is not possible without a supporting framework of proper administrative facilities and institutions to implement them. Therefore, one further principal objective is required:

6. To establish and provide the necessary administrative facilities and institutions to implement and achieve the long-term objectives of the management plan.

3.5 Operational objectives

Operational objectives are the means by which the principal objectives can be converted into a series of practical management measures. They form the basis for operations which must be carried out in the site to ensure that the principal objectives are met. They are thus a natural development from, and inextricably linked, to the principal objectives. In light of the first evaluation, and assessment of feasibility in relation to the various constraints and modifiers, a series of operational objectives have been developed which meet the requirements of each principal objective as they apply to Wadi Gaza. These are listed below:

Principal objective:

1 To maintain and conserve the diversity of wetland habitats, animal and plant species that characterize Wadi Gaza.

Operational objectives:

1.1 To collect data on the dynamics and diversity of Wadi Gaza wetland habitats.
1.2 To collect data on bird diversity, abundance and distribution in Wadi Gaza.
1.3 To collect data on the diversity and dynamics of the vegetation communities in Wadi Gaza.
1.4 To collect data on the diversity and abundance of fish and aquatic invertebrate fauna in Wadi Gaza.
1.5 To eliminate hunting and poaching in the Wadi Gaza site.
1.6 To collect baseline data on the types and quality of soils in Wadi Gaza.
1.7 To protect the wetland habitats and ecosystems of Wadi Gaza from urban sprawl and construction activities.
1.8 To protect the wetland habitats and ecosystems of Wadi Gaza from agricultural encroachment.

Principal objective:

2 To rehabilitate and restore the wetland habitats and ecosystems that characterize Wadi Gaza

Operational objectives:

2.1 To restore the natural flow between Wadi Gaza and the Mediterranean Sea.
2.2 To restore the diversity of the natural vegetation communities around the estuary lake of Wadi Gaza.
2.3 To reduce and eventually halt the eutrophication of the wetland habitats in Wadi Gaza.
2.4 To prevent pollution with diesel, oil and kerosene in Wadi Gaza.
2.5 To stop the uncontrolled dumping of domestic, industrial wastes and construction debris in the Wadi Gaza site.
2.6 To restore the movements of wandering wild animals to and from the Gaza Strip.

Principal objective:

3 To use the wetland resources of Wadi Gaza in a sustainable manner, to the long term benefit of the site and the local communities around it.

Operational objectives:

3.1 To eliminate overgrazing, uncontrolled woodcutting and sand and stone quarrying in Wadi Gaza.
3.2 To prevent further lowering of the groundwater table in the Gaza Strip.

Principal objective:

4 To improve the socio-economic situation and opportunities of the local communities around Wadi Gaza.

Operational objectives:

4.1 To facilitate the improvement of the environmental municipal services of local communities around Wadi Gaza.
4.2 To promote income generating activities in the site that are compatible with the conservation objectives for Wadi Gaza.
4.3 To study the possibilities for sustainable use of medicinal plants in Wadi Gaza.

Principal objective:

5 To raise public awareness for Wadi Gaza in particular and environmental issues in general.

Operational objectives:

5.1 To promote and facilitate scientific research studies in Wadi Gaza.

5.2 To raise public awareness amongst local communities of the values of Wadi Gaza and environmental issues which impact upon those values

5.3 To raise public awareness concerning Wadi Gaza and environmental issues amongst the youth of the Gaza Strip and West Bank.

5.4 To promote eco-tourism in Wadi Gaza.

Principal objective:

6 To establish and provide the necessary administrative facilities and institutions to implement and achieve the long-term objectives of the management plan.

Operational objectives:

6.1 To recruit and develop the capacity of a local team to implement the management plan in Wadi Gaza.

6.2 To provide a management advisory structure which includes local stakeholder access to management implementation and the decision making process.

6.3 To develop and maintain the physical infrastructure and equipment needed by staff to implement the management plan..

4 IMPLEMENTATION

4.1 Management strategies

4.1.1 Areas of activity covered by management strategies

Maintaining or enhancing habitats, habitat structure and the diversity of habitats and species

The maintenance and enhancement strategy will focus on habitats and vegetation communities, and includes the following subjects.

Maintaining habitats, habitat structure and the diversity of habitats and species:

Collecting data and information
Gather further data on the ecology, numbers and distribution of the wetland habitats, vegetation communities and species in Wadi Gaza. The initiation of the data collection programs will occur during the first year of the management plan. The information collection activities will be ongoing.

Regulation and legislation
Develop regulations and legislation that exclude activities detrimental to the maintenance and values of Wadi Gaza habitats. This strategy has a high priority as there is a severe lack of regulations affording adequate protection to Wadi Gaza's characteristic features. All measures to establish these regulations and legislations will take place during the first and beginning of the second year of the management plan.

Enhancing habitats, habitat structure and the diversity of habitats and species:

Stop pollution
Reduction and elimination of major pollution in the site: e.g. pollution by raw sewage, oil residues, garbage and construction debris. Stopping pollution by raw sewage and oil residues is of highest priority because they are the most polluting sources. Elimination of this problem will be addressed during the first year of the management plan. Preventing pollution by garbage and construction debris will be done in the second year of the management plan.

Restore natural balances and functions
Increase the natural flow and saline conditions, control or reduce the cover of dominant and alien invasive plant species and reintroduce characteristic plant species of Wadi Gaza. These activities have a medium priority and will be scheduled for the second year of the management plan.

Improve the socio-economic situation and opportunities of the local communities

The strategy addressing socio-economic improvement for local communities will focus on staff recruitment, income generation and services.

Staff recruitment
Staff will be recruited from local communities to help implement the management plan. This not only creates jobs for local people but utilises local knowledge and gives local people a stake in, and ownership

of, the reserve and its development. Staff recruitment and training will take place during the first year of the management plan.

Income generation
Management planning should include promotion of income generating activities in the site that will be compatible with the conservation objectives for Wadi Gaza. Income generating activities will be developed and instigated during the second and third year of the management plan.

Municipal services
The management process will include measures which assist local communities in the development and improvement of basic services such as a sewage infrastructure and garbage collection system. The lack of these services is the major cause of pollution in the site. Stopping this pollution has a high priority. A series of measures to address this issue are therefore planned during the first and second year of the management plan.

Public use, recreation, visitor facilities, education/demonstration and study or research

The public use, visitors, education and research strategy will focus on access issues and improvements to facilities.

Open access
The site will be developed for recreation, education/demonstration, study and research. This needs to be supported by a program of access, through the establishment of designated trails, which will ensure these activities do not disturb sensitive areas such as breeding sites for birds. The access program will be instigated during the first year of the management plan.

Partially open
Controlled, partial access will be allowed for uses such as woodcutting and grazing. Exploitation will be regulated to ensure that resources are utilised sustainably and in harmony with environmental objectives. A sustainable resource management program will be developed during the first year of the management plan and will be ongoing.

No access
No access will be allowed for inappropriate activities such as stone quarrying, hunting and poaching. Measures to phase out inappropriate activities will begin during the first year of the management plan.

Facilities
Visitor facilities will be constructed to provide visitors with a recreational park, observation towers, information panels, roads, trails and signposts. An information center will inform visitors about the site and assist in education and awareness programs. The development and introduction of visitor facilities is scheduled for the second and third years of the management plan.

Study and research
Facilities and research equipment will be established for the management team and made available to encourage scientific research in the site. Assistance and back-up support for researchers will be provided by management and staff. This collaborative approach should extend to sharing of knowledge and data, which will be of mutual benefit to researchers and the site management team. Facilities for study and research are scheduled for development and introduction in the second and third years of the management plan and therafter will be ongoing.

Publicity

A series of active and special promotions will be undertaken in relation to reserve developments and linked to initiatives such as education and awareness programs. These promotions will be ongoing from year 1, and coincide with activities as they occur.

4.2 Zoning and prescriptions

4.2.1 Units

The area delineated by the site boundaries will be treated as one single unit for the management plan. This is because the Wadi Gaza site is relatively small and under pressure from factors in the entire catchment. A substantial proportion of management activities are therefore targeted at the communities and areas outside the site boundaries.

However, for management activities inside the site boundaries, priority areas have been identified in relation to conservation value and restoration requirements. These have been termed "management zones".

4.2.2 Management zones

Figure 14 shows the management zones for the Wadi Gaza area. The estuary lake and its borders is defined as the "Wetland" and the surrounding vegetation communities and habitats are located in the protected area designated as the "nature reserve".

The management zones are delineated according to the management strategies and main aims and will serve the following purposes:

Agricultural land use
Designation of management zones allows for the development, introduction and enforcement of regulations for the protection and conservation of the wetland habitats of Wadi Gaza against agricultural encroachment inside the site boundaries. This will also promote restoration of Wadi Gaza wetland habitats by limiting use within the zone of polluting agricultural chemicals such as fertilizers and pesticides, and reducing groundwater extraction.

Conservation of grapes
The traditional grape cultivation that takes place in this area is not threatening to encroach into the site because it requires a well drained soil. Instead management activities should be aimed at protecting habitats and vegetation communities by reducing the pollution from agricultural chemicals used in grape cultivation.

Protected area
The wetland habitats and vegetation communities in this area have the highest conservation value. Management activities are based on measures to protect and enhance the conservation interest: e.g. by increasing the understanding and information on the ecology of habitats, vegetation communities and species of Wadi Gaza; and excluding inappropriate activities such as hunting. Other measures for the restoration of wetland habitats in this zone include reducing pollution (sewage, garbage, construction debris,kerosene and oil residues), reintroducing/planting characteristic plant species, and cutting of dominant and invasive alien plant species to restore the natural state and composition of vegetation communities.

Recreational area
The main focus will be to raise public awareness and to improve visitors' enjoyment of the site.

Rural development area
The main focus will be on the improvement of the socio-economic situation and opportunities for local communities. Activities will also be directed toward the maintenance and protection of the wetland

habitats by developing rules and regulations that prevent urban encroachment to within the site boundaries.

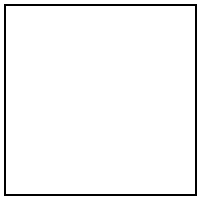

Figure 15: Wadi Gaza management zones

Tourism area
Activities promoting eco-tourism will achieve the objectives of raising awareness, and improving the socio-economic situation through the creation of income earning opportunities for local communities. The establishment of facilities for tourism will place Wadi Gaza in a strong position to take advantage of future improvementsin the political situation in the Gaza Strip.

Wadi Gaza bed
The Wadi Gaza bed comprises that part of the Wadi Gaza course which remains dry all year apart from during flash floods. Management activities will largely focus on eliminating inappropriate activities such as the dumping of construction debris, the inflow of sewage and direct or indirect pollution by chemicals.

Wetland
The "Wetland" comprises the permanently flooded estuary lake and its immediate wetland fringes. Many of the management activities designed to rehabilitate and restore Wadi Gaza wetland habitats and ecosystems will be directed to and/or benefit this zone. This will be achieved by restoring the natural flow between the lake and sea, reducing eutrophication by positive measures to limit the nutrient content of water entering the zone and reducing other pollution sources.

4.2.3 Buffer zones

A twenty-meter wide buffer zone is planned around the course of Wadi Gaza. The location of the buffer zone is shown in Figure 14. The main purpose of this zone is to exclude inappropriate activities that would have a negative effect on the estuary lake close to the outlet of Wadi. These activities include pollution by domestic wastes, fertilizers, agricultural chemicals, oil residues and kerosene, and hunting and poaching. Also construction activities should be excluded from this area.

The development of a buffer zone should be accompanied by the development of rules and regulations that guarantee the protection of the wetland habitats and vegetation communities in the site.

There is a need for a similar but wider buffer zone around the designated nature reserve. The sensitivity and conservation value of wetland habitats and vegetation communities in this area is very high. The exact extent of this buffer zone has not been decided and is therefore not shown in Figure 14. The reason for this is that this buffer zone will exclusively occupy privately owned land. The establishment of a buffer zone would therefore need to be negotiated with the land owners; and be supported by suitable legislation and controls enshrined in local development plans and similar planning documents.

4.3 Projects

The operational objectives, outlined in **Chapter 3.5** above, define what is required but not the actions and activities which are necessary to deliver the objective. They are nevertheless the foundation on which a series of outputs and projects can be established, and ensure that the work program corresponds to and meets the requirements of the principal objectives.

The step-wise progress: *principal objective → operational objective → output → project* allows the work program to be designed in a structured manner which all participants and other interested parties can follow and understand.

The Wadi Gaza actions and activities which form the basis of the work program have been organised into a series of six themes which correspond to the six principal objectives. They are:

- Maintenance and conservation measures
- Rehabilitation and restoration measures
- Sustainable resource use
- Socio-economic development
- Public awareness
- Administrative

The rationale for sub-dividing the work program into themes is justified by:

- the complexity and diversity of the projects required to deliver the objectives;
- the need to ensure that each project relates clearly to the principal and operational objectives which drive it;
- the need to fit each project coherently into a well-structured action plan;
- the need to design an action plan which is easy to understand, follow and implement.

The action plan which follows has evolved from this process and approach. Note that each principal objective engenders more than one operational objective and that some operational objectives instigate more than one output and project.

The action plan takes the form of a series of projects. These projects have been arranged in relation to the principal objective (theme) and operational objective to which they relate. In order to meet these objectives successfully, the action plan requires a clearly defined, easy to follow structure. This is provided by describing the projects in summary form (see below) and allocating each a priority*, duration, methods and evaluation indicator, as well as assumptions to be taken into account.. Responsibility has also been allocated. More detailed information, including full project descriptions, will be available from the people or organizations named as responsible for each project.

*__Priority__. The action plan comprises a large series of projects which, in an ideal world, would receive equal attention and be applied vigorously from the very start. However, this is not feasible. Constraints include limitations on manpower, budgets and other resources; and time delays in obtaining agreement for collaborative or on contentious issues. It has therefore been necessary to make a judgement on urgency and need, and this has led to prioritization for each individual project.

Priorities, Timetable, Method, Responsibility, Indicator and Assumptions

I. Three levels of **Priority** have been recognised

Priority 1: Projects that must be completed within the stated time period. They include, for example, essential projects that safeguard the site from further deterioration.

Priority 2: Projects that should be completed within the started time period. The main difference between priority 1 and 2 is that priority 2 has an element of flexibility.

Priority 3: Projects that are desirable but are dependent on time and resources being available.

II. Timetable: the period during which the project should be implemented.

III. Method: brief details of the method(s) to be used to implement the project.

IV. Responsibility: the organisation or individual(s) with primary responsibility for implementing or ensuring implementation of the project.

V. Indicator: the measure by which the success of the project in meeting its objective is evaluated.

VI. Assumption: the issue or issues which need to be in place for the project to be successfully implemented.

Project program: The Action Plan

The Project program is arranged as a series of headings corresponding to the six themes derived from the principal objectives (see **Chapter 4.2**). They are:

- Maintenance and conservation measures (***Chapter 4.3.1***)
- Rehabilitation and restoration measures (***Chapter 4.3.2***)
- Sustainable resource use (***Chapter 4.3.3***)
- Socio-economic development (***Chapter 4.3.4***)
- Public awareness (***Chapter 4.3.5***)
- Administrative (***Chapter 4.3.6***)

Within these headings the projects are arranged according to operational objective, following the structure set out in **Chapter 3.5**.

Project numbers

As an easy reference, each project has been allocated a project number comprising three digits and a letter.
- The first digit refers to the principal objective (1-6) using the numeration set out in **Chapter 3.4.1**
- The second digit refers to the operational objective (see **Chapter 3.5**)
- The third digit relates to the project itself, within the sequence established for its particular operational objective
- The letter indicates the form of action or activity involved. The key is:
  A = Administrative; **C** = Conservation management; **E** = Education; **F** = Facilities; **L** = Legal regulations & policies; **M** = Monitoring and survey; **P** = Public awareness & interpretation; **S** = Studies & research; **T** = Training and capacity building

4.3.1 PROGRAM: MAINTENANCE AND CONSERVATION MEASURES

Operational objective 1.1: to collect data on the dynamics and diversity of Wadi Gaza wetland habitats.

Project: Habitat monitoring	**Project Number: 111M**

Output: development and implementation of a monitoring program for habitat dynamics and diversity.

- Priority: 1

- Key issues:
  - To monitor the dynamics and diversity of wetland habitats;
  - to monitor the dynamics and diversity of terrestrial and adjacent habitats.

- Timetable: Initial 4 months for the development of the program (January to April 2003) followed by 3 months each year between the months of January and April.

- Method: Develop a monitoring program for the wetland habitats; identify staff; train staff in habitat sampling techniques; establish database and familiarize the staff with the methods; conduct a Pilot study; establish the location of the survey areas and plots; confirm the documentation procedures and statistical methods; initiate fieldwork.

- Responsibility: The Wadi Gaza management team; one team member trained in habitat, bird and vegetation monitoring.

- Indicator: The pilot study has been completed and the monitoring has started.

- Assumption: The expertise and resources to develop the program and meet training needs are available.

Operational Objective 1.2: To collect data on bird diversity, abundance and distribution in Wadi Gaza.

Project: Bird monitoring	**Project number: 121M**

Output: development and implementation of a monitoring program for the bird species in Wadi Gaza.

- Priority: 1

- Key issues:
  - Repeated surveys of breeding birds;
  - To monitor bird mortality caused by overhanging cable in the site.

- Timetable: Initial 4 months for the development of the program (January-April 2003) followed by data collection over two periods each year, between January and April and August-November: total of 6 months per annum.

- Method: Develop an ornithological monitoring program (methodology, data storage & organization, documentation procedure and analysis); identify staff; train staff in monitoring techniques and bird identification skills; establish database and familiarize the staff with the methods; conduct a Pilot study; establish the location of the survey areas and routes; confirm the documentation procedures and statistical methods; initiate fieldwork.

- Responsibility: The Wadi Gaza management team; one team member trained in habitat, bird and vegetation monitoring.

- Indicator: The pilot study has been completed and the first monitoring survey has started.

- Assumption: The expertise and resources to develop and conduct the monitoring program and meet training needs are available.

Project: Status of threatened birds	**Project number: 122S**

Output:implementation of conservation measures derived from better knowledge of the ecology of, and local threats to, endangered bird species at Wadi Gaza.

- Priority: 1

- Key issues:
  - Repeated survey of threatened species and their key habitats;
  - Study activity and habitat utilization of threatened bird species.

- Timetable: One year from January 2003 to January 2004.

- Method: Survey the numbers and locations of endangered species, throughout the year. Map the locations of forage and roosting sites. Hire expertise to identify key habitats that need to be protected for the conservation of these endangered species. Pay particular attention to the ecology, including habitat needs and threats, of corncrakes *Crex crex*.

- Responsibility: The Wadi Gaza management team; one team member trained in habitat, bird and vegetation monitoring.

- Indicator: The study is completed and the results have been reported.

- Assumption: The expertise and resources to develop and conduct the study are available. The numbers of corncrake and other endangered species remain frequent enough to be able to make a study.

Project: Visitor participation.	**Project number 123P**

Outputs: participation schemes developed, volunteer training in bird identification and survey, production of interpretive material.

- Priority: 3

- Key issues:
  - Develop bird guides of Wadi Gaza in Arabic and English;
  – Collect, analyse and make readily available data on bird observations collected by visitors.
- Timetable: 4 months from August 2003 to December 2003.
- Method: Develop materials that can help people with the taxonomy of bird species in Wadi Gaza. Develop forms that can be filled in by visitors to the site. Develop a datasheet in the bird-monitoring database where the information from visitors can be stored and analysed. Post observations daily in Information Center.

- Responsibility: The Wadi Gaza management team; one team member trained in habitat, bird and vegetation monitoring.

- Indicator: The materials and database to collect and store information on birds collected by visitors in Wadi Gaza are developed. The first visitors have submitted information on bird species.

- Assumption: There is an interest amongst people in birds and helping the Wadi Gaza site management in collecting information on birds.

Operational Objective 1.3: To collect data on the diversity and dynamics of the vegetation communities in Wadi Gaza.

Project: Vegetation monitoring.	**Project number 131M**

Output: development and implementation of a monitoring program for the vegetation communities in Wadi Gaza.

- Priority: 1
- Key issues:
  - Monitor the species diversity, abundance and composition;
  - Monitor the structure of vegetation communities;
  - Monitor the aquatic plant communities.
- Timetable: Initially 4 months for the development of the program from January 2003 to April 2003; after that, data is collected during 3 months every year from January to April.
- Method: Develop a monitoring program (methodology, data storage & organization, documentation procedure and analysis) for the vegetation communities of Wadi Gaza. Identify and train staff in the monitoring techniques and plant taxonomy. Establish database. Familiarize the staff with the methodology. Conduct a Pilot study. Establish the location of the survey areas and plots. Confirm the documentation procedures and statistical methods, start first survey of vegetation communities.
- Responsibility: The Wadi Gaza management team; one team member trained in habitat, bird and vegetation monitoring.
- Indicator: The pilot study has been completed and the first monitoring survey has started.
- Assumption: The expertise and resources to develop and conduct the monitoring program and meet training needs are available.

Project: Distribution and ecology of endemic plants	**Project number: 132S**

Output: implementation of conservation measures derived from better knowledge of the distribution of, and threats to, the endemic plants of Wadi Gaza.

- Priority: 1
- Key issues:
  - Establish occurrence of *Echinops philistaeus*, *Onopordum jordanicolum* and *Rumex cassius* at Wadi Gaza;
  - record locations, habitats, population size, ecological requirements and threats to their conservation.
- Timetable: regular surveys between March and June, annually.

- Method: Survey distribution, habitat requirements and conservation ecology of all three endemic species. Map locations and anticipated threats to those locations. Identify conservation needs. Implement protection or recuperation measures if required.

- Responsibility: The Wadi Gaza management team; one team member trained in survey, habitat and botany skills.

- Indicator: Distribution maps are drawn up, abundance figures produced and, if necessary, conservation measures implemented.

- Assumption: The expertise and resources to develop and conduct the study are available. Plants of one or more of the three endemic species still survive at Wadi Gaza.

Operational Objective 1.4: To collect data on the diversity and abundance of fish and aquatic invertebrate fauna in Wadi Gaza.

Project: Fish and Aquatic invertebrate survey.	**Project Number 141M**

Output: development and implementation of a survey program for the fish and aquatic invertebrate fauna in Wadi Gaza.

- Priority: 1

- Key issues:
  - Survey the aquatic invertebrate fauna;
  - Survey fish species.

- Timetable: Three months for the development of the survey methodologies and training staff in the taxonomy of fish and aquatic invertebrates from January 2003 to April 2003. Baseline data is collecting on a monthly basis during one year; after that, data is collected during 3 months every year from July to November.

- Method: Develop the survey methodology, data storage & organization, documentation procedure and analysis of the fish and invertebrate aquatic fauna data. Identify and train staff in the survey methodologies and training staff in the taxonomy of fish and aquatic invertebrates. Conduct a Pilot study. Establish the location of the survey areas and plots. Confirm the documentation procedures and statistical methods.

- Responsibility: The Wadi Gaza management team; one team member trained in habitat, bird and vegetation monitoring & experts on invertebrate and fish taxonomy.

- Indicator: Baseline data on fish and aquatic invertebrate fauna has been collected and analysed.

- Assumption: The expertise and resources to develop and conduct the survey and meet training needs are available.

Operational Objective 1.5: To eliminate hunting and poaching in the Wadi Gaza site.

Project: Hunting regulations.	**Project Number 151L**

Output: development and enforcement of legal regulations that prevent hunting in Wadi Gaza.

- Priority: 1
- Key issues:
  - Study the hunting pressure in the site;
  - Propose hunting and poaching regulations for the site.
- Timetable: January 2003– December 2003.
- Method: Define the fauna species that need to be protected according to their fragility and the areas where hunting and poaching should be forbidden or restricted. Communicate these fauna species and boundaries to the responsible authorities and local communities. Develop regulations for access and hunting at Wadi Gaza. Negotiate these rules and regulations with the MOPWH, MOLG and local communities. Develop a final report on rules and regulations for hunting in the Wadi Gaza site.
- Responsibility: The Environmental Quality Authority in close collaboration with the Wadi Gaza management team.
- Indicators: A reduction in the number of poached animals, wardens are trained and installed.
- Assumptions: Regulations are approved by the relevant authorities and accepted by the stakeholders.

Operational Objective 1.6: To collect baseline data on the types and quality of soils in Wadi Gaza.

Project: Soil survey.	**Project Number 161M**

Output: development and implementation of a soil survey.

- Priority: 2
- Key issues:
  - Soil classification of the site;
  - Analysis of soil characteristics.
- Timetable: Six months from March 2005 to September 2005.
- Method: Contract an external expert or institution to develop and conduct the survey methodology, data storage & organization, documentation procedure and analysis of the soil data. Build the capacity of the staff of Wadi Gaza in the use and analysis of the soil data.
- Responsibility: Contracted local institution specialized in soil classification and analysis.
- Indicator: Soil survey has been completed. Soil maps of the site have been produced.
- Assumption: The expertise and institutions to conduct a soil survey are available in the Gaza Strip.

Operational Objective 1.7: To protect the wetland habitats and ecosystems of Wadi Gaza from urban sprawl and construction activities.

Project: Defining urban growth areas. Project number 171L

Outputs: prevention of urban encroachment.

- Priority: 1
- Key issues:
  - Define and communicate Wadi Gaza boundaries;
  - Define and communicate buffer zones.
- Timetable: 6-9 months January 2003 to September 2003.
- Method: Approved structural plan for Wadi Gaza area, clarifying urban growth boundaries and protected areas.
- Responsibility: The Ministry of Planning and International Cooperation in close collaboration with the Environmental Quality Authority and the Wadi Gaza management team.
- Indicator: Maps of the urban growth areas are produced and approved.
- Assumption: The relevant authorities are willing to approve defined urban development areas.

Project: Maximizing current urban land use. Project number 172S

Outputs: Maximization of current urban land use.

- Priority: 3
- Key issues:
  - Alternative and intensive use of urban areas.
- Timetable: January 2005 to December 2006.
- Method: Study the possibilities for a more intensive use of urban areas to increase the density inside the vacant lands and in the urban areas, while maintaining or improving the quality of the residential areas. Disseminating (publish) the results of the studies to the Ministry of Housing or responsible authorities. After preparation of all studies, a pilot project should be adopted inside the urban areas to demonstrate its effect. (*This pilot study will be responsibility of the Ministry of Public Works & Housing*)
- Responsibility: The Ministry of Public Works & Housing in close collaboration with the Ministry of Planning and International Cooperation, the Environmental Quality Authority and the Wadi Gaza management team.

- Indicator: Densification study is completed and results submitted to the Ministry of Housing.
- Assumption: MOPWH is willing to incorporate the results and recommendations of the study in their urban development policy.

Project: Land use planning and policies in Wadi Gaza. Project number 173L

Output: Recognition of Wadi Gaza conservation status in land use planning policies.

- Priority: 1
- Key issues:
  - Land use planning and zonation in the Wadi Gaza area.
- Timetable: July 2003 to March 2004.
- Method: Development of policies, to be integrated within approved land use plan or structural plan, which clearly define and differentiate protected zones from areas of agricultural, urban and rural development.
- Responsibility: The Ministry of Planning and International Cooperation in close collaboration with the Environmental Quality Authority, the Ministry of Public Works & Housing and the Wadi Gaza management team.
- Indicator: Land use plan including detailed land use maps for the wadi Gaza site is produced and approved by the actors and relevant authorities.
- Assumption: all stakeholders can find an agreement over the land use plan.

Project: Regulations to prevent urban encroachment. Project number 174L.

Output: development and enforcement of new regulations that prevent urban encroachment into Wadi Gaza.

- Priority: 1
- Key issues:
  - Formulate regulations that apply on all construction activities in the Wadi Gaza area;
  - Formulate regulations that apply on all construction activities outside the Wadi Gaza area that will have an effect on the site.
- Timetable: July 2003 to September 2004.
- Method: Development of procedures, to be integrated within approved land use plan or structural plan, which regulate all construction activities in the Wadi area and promotehabitat protection in the wetland and surrounding area.

- Responsibility: The Environmental Quality Authority in close collaboration with the Ministry of Planning and International Cooperation, the Ministry of Public Works & Housing and the Wadi Gaza management team.

- Indicators: Regulations on urban construction in the Wadi are approved and legislated by the relevant authorities, reserve wardens are trained and installed.

- Assumptions: The relevant authorities are willing to approve legislation that gives the Wadi Gaza site protective status.

Operational Objective 1.8: To protect the wetland habitats and ecosystems of Wadi Gaza from agricultural encroachment.

Project: Alternative agricultural growth areas. Project Number 181S

Output: prevention of agricultural encroachment into Wadi Gaza.

- Priority: 1

- Key issues::
  - Study potential areas for urban expansion;
  - Study alternative agricultural practices.

- Timetable: 6-9 months, January 2003 to September 2003.

- Method: Study potential agricultural development areas. The study should also include the possibilities for developing urban agriculture. The results will be translated into a proposed agricultural plan for the Wadi Gaza area, clarifying agricultural boundaries and protected areas.

- Responsibility: The Ministry of Agriculture in close collaboration with the Environmental Quality Authority, the Ministry of Planning and International Cooperation and the Wadi Gaza management team.

- Indicator: Proposed agricultural development plan.

- Assumption: The relevant authorities are willing to accept the agricultural development plan.

Project: Regulations to prevent agricultural encroachment. Project Number 182L

Outputs: development and enforcement of new regulations that prevents agricultural encroachment into Wadi Gaza.

- Priority: 1

- Key issues:
  - Formulate regulations that apply to all agricultural activities in the Wadi Gaza area;

- Formulate regulations that apply to all agricultural activities outside the Wadi Gaza area that will have an effect on the site.

- Timetable: July 2003 to September 2004.

- Method: Development of regulations, to be integrated within approved land use plan or structural plan, which regulate all agricultural uses in the Wadi area and promotehabitat protection in the wetland and surrounding area.

- Responsibility: The Ministry of Agriculture in close collaboration with the Environmental Quality Authority, the Ministry of Planning and International Cooperation and the Wadi Gaza management team.

- Indicators: Regulations on cultivation in the Wadi are approved and legislated by the relevant authorities, reserve wardens are trained and installed.

- Assumptions: The relevant authorities are willing to approve legislation that gives the Wadi Gaza site a protective status.

4.3.2 PROGRAM: REHABILITATION AND RESTORATION MEASURES

Operational Objective 2.1: To restore the natural flow between Wadi Gaza and the Mediterranean Sea.

Project: Regulations for the natural flow of Wadi Gaza. Project Number 211L

Outputs: development of regulations to restore the natural flow of Wadi Gaza and its connection to the Mediterranean Sea, establishment ofa single regulating body to execute and enforce the regulations.

- Priority: 1

- Key issues:
  - Formulate regulations that apply to all human activities in the Wadi Gaza area which alter the Wadi Gaza flow;
  - Formulate regulations that apply to all human activities outside the Wadi Gaza area which effect the Wadi Gaza flow.

- Timetable: July 2003 to December 2003.

- Method: Define the natural water flow of Wadi Gaza and the criteria for the restoration of the natural flow. Report these criteria to the responsible authorities and local communities and lobby for the restoration and protection of the natural flow of the Wadi. Develop regulations which restrict changes in the Wadi course by controlling or prohibiting activities such as creating barriers at the outlet of the Wadi and in the estuary lake. Negotiate these rules and regulations with the MOLG and MOPWH responsible authorities and local communities. Develop a final report on rules and regulations concerning the water flow in the Wadi Gaza site. Negotiate this report with the Ministry of Justice (MOJ) and PLC so that it forms the basis of a legal document forthe protection of the Wadi Gaza wetland habitats. Install a single institution that will be

responsible for executing these rules and enforcing them through wardens that are hired, trained and installed in the site for the overall enforcement of the reserves rules.

- Responsibility: The Environmental Quality Authority in close collaboration with the Wadi Gaza management team.

- Indicators: Natural flow of Wadi Gaza is defined, criteria for the restoration of the natural flow is submitted to the responsible authorities, rules and regulations for the flow of the wadi are developed and submitted to the responsible authorities.

- Assumptions: Responsible authorities accept and are willing to approve regulations for the protection of the wadi flow.

Project: Restoration of natural flow. Project Number 212S

Output: document outlining the options for restoring the natural flow of Wadi Gaza.

- Priority: 2

- Key issues:
  - Study the natural flow and sediment load of Wadi Gaza;
  - Study possibilities for the restoration of Wadi Gaza;
  - Conduct an environmental impact assessment for proposed restoration activities.

- Timetable: January 2004 to September 2004.

- Method: Study the effects of the sand barrier on the site as a whole. Study other possibilities or technologies, e.g. constructing a sluice, to restore the natural flow between Wadi Gaza and the Mediterranean Sea. Make an impact assessment of the removal of the barrier. Submit the results of these studies as criteria to make a demand for the removal of the sand barrier and the restoration the natural flow of the Wadi.

- Responsibility: The Wadi Gaza management team in close collaboration with the Environmental Quality Agency.

- Indicators: Impact assessment has been completed and submitted.

- Assumptions: The responsible authorities are willing to accept the study.

Operational Objective 2.2: To restore the diversity of the natural vegetation communities around the estuary lake of Wadi Gaza.

Project: Restoration of vegetation diversity. Project Number 221C

Output: re-establishment of viable populations of plant species characteristic of Wadi Gaza natural habitats which have declined as a result of human activities.

- Priority: 2

- Key issues:
  - Select areas that need to be restored;
  - Develop a nursery for native shrub and tree species;
  - Study a program to control the encroachment of dominant species.

- Timetable: Development of a nursery, January 2003 to January 2005. The program itself will be continuous.

- Method: Develop a nursery to reintroduce plant species that are characteristic of the wetland vegetation communities but have declined as a result of human activities (e.g. *Tamarix aphylla*), develop an aquatic nursery for replanting the aquatic bed of the estuary lake and reduce and/or control the encroachment of dominant species such as *Tamarix nilotica* and *Phragmites australis* in other vegetation communities and/or wetland habitats. Undertake re-planting scheme using nursery plants where natural recolonisation is not possible.

- Responsibility: The Wadi Gaza management team in close collaboration with the Environmental Quality Agency.

- Indicators: Plant species that are characteristic of the wetland vegetation communities have been introduced. The dominance of species like *Tamarix nilotica* and *Phragmites australis* has been reduced.

- Assumptions: The resources and expertise to develop a nursery and control encroaching plant species are available. The pollution of the estuary lake can be stopped.

Project: Rehabilitation of saline and brackish habitats. Project Number 222C

Outputs: restoration of saline and brackish conditions to the western part of the estuary lake and adjacent vegetation communities.

- Priority: 2

- Key issues:
  - Study possibilities to restore saline and brackish conditions to the western seaward part of the estuary lake;
  - Prepare an environmental impact assessment of the restoration possibilities.

- Timetable: Development of a restoration plan. June 2004 to January 2005.

- Method: Develop a plan that evaluates measures to increase the frequency and quantity of seawater input from the Mediterranean Sea in order to restore saline conditions to the areas that are covered by remnants of the halophyte vegetation.

- Responsibility: The Wadi Gaza management team in close collaboration with the Environmental Quality Agency.

- Indicators: Plan for the restoration of saline and brackish conditions project has been completed. Saline conditions in the areas that are covered by remnants of the halophyte vegetation have increased.

- Assumptions: The expertise and resources to develop the restoration plan are available.

Project: Impact and control of alien plants.	**Project number 223C**

Output: reduction and control of the impact of alien plant species on the native vegetation.

- Priority: 2
- Key issues:
  - Develop a program to control the encroachment of alien plants in native vegetation communities.
- Timetable: Start June 2004, the control activities to be done on an annual basis from April to August.
- Method: Study the impact of alien plants on the diversity of native flora and fauna in Wadi Gaza and minimize the impact of alien plants where necessary.
- Responsibility: The Wadi Gaza management team; one team member trained in habitat, bird and vegetation monitoring.
- Indicators: The study of the impact of alien plants on the diversity of native flora and fauna in Wadi Gaza has been completed. Activities to minimize the impact of alien plants have started.
- Assumptions: The expertise and resources to do the study of the impact of alien plants on the diversity of native flora and fauna in Wadi Gaza are available in Gaza.

Operational Objective 2.3: To reduce and eventually halt the eutrophication of the wetland habitats in Wadi Gaza.

Project: Wastewater treatment and infrastructure.	**Project number 231L**

Outputs: elimination of the discharge of untreated sewage into the Wadi bed; measures which promote and facilitate the development of a wastewater infrastructure for the local communities around Wadi Gaza.

- Priority: 1
- Key issues:
  - Study possibilities for a temporary solution or local treatment methodology;
  - Develop and submit a project proposal for the selected sewage treatment.
- Timetable: January 2003 to December 2004.
- Method: Study possibilities such as mobile compact sewage treatment units, central treatment of all sewage discharged in the Wadi or other options, and select the most suitable ones. Develop a project proposal for the selected sewage treatment technology and find funding. Implement and

supervise the construction of the selected sewage treatment facility. Match the technical possibilities for a sewage infrastructure to the proposed sewage treatment facility and report the technological options to EQA and local municipalities. Promote the local municipalities (en-Nusairat, and el-Buraije) need for the development of a sewage infrastructure in the refugee camps around Wadi Gaza. Assist the local communities with the development of a proposal and acquiring funds for a sewage infrastructure.

- Responsibility: The Environmental Quality Authority and the Wadi Gaza management team in close collaboration with the Ministry of Planning and International Cooperation, the Ministry of Public Works & Housing and international donor institutions.

- Indicators: the treatment facility is installed and functioning. The sewage infrastructure in the municipalities around the wadi is promoted. Donors for the sewage infrastructure have been found.

- Assumptions: The funding and means for the treatment facility becomes available. The municipalities are willing to cooperate in the development of a local sewage infrastructure. Donors are willing to invest.

Project: Hydrology and water quality monitoring. Project Number 232M

Outputs:establishment of a baseline for hydrology and water quality issues affecting Wadi Gaza; establishment of a monitoring program for evaluation of change, including positive change due to management.

- Priority: 1

- Key issues:
  - Study the quantity and sediment load of flash floods;
  - Study the quantity of groundwater flow to the site;
  - Study water quality in relation to pollutants in the site.

- Timetable: Initially 3 months for the development of the program, from January 2003 to April 2003; after that, collect data monthly. The results of the monitoring program to be reported annually.

- Method: Develop a monitoring program (methodology, data storage & organization, documentation procedure and analysis) for the hydrology and water quality in the site. This program will largely extend monitoring activities already conducted, therefore the methodologies and monitoring locations have already been identified. A database and the methods for the analysis and reporting of the water quality and hydrology data need to be developed.

- Responsibility: The Wadi Gaza management team; one team member trained in hydrology and water quality.

- Indicator: The database and methodologies for analysis have been developed. The report on the first year's results has been completed.

- Assumption: The expertise and resources to continue and further develop the monitoring program are available.

Project: Best use of fertilizers in agriculture. Project Number 233S

Output:reduction in runoff and infiltration of nutrient rich water from the agricultural fields around Wadi Gaza.

- Priority: 3

- Key issues:
  - Study of nutrient flows on agricultural fields;
  - Study possibilities of organic farming.

- Timetable: January 2005 to December 2005.

- Method: Study the nutrient flow on agricultural fields around Wadi Gaza. Study possibilities for a reduction of the amount of fertilizer that is used on the agricultural fields e.g. organic farming, conservation agriculture and report the results. Communicate and extend these alternative-farming practices to the farmers in the Wadi Gaza area.

- Responsibility: External experts on nutrient flow and alternative agricultural practices in close collaboration with the Wadi Gaza management team and the Ministry of Agriculture.

- Indicator: The report on the best use of fertilizers in agricultural fields around the Wadi Gaza is produced, communication of these results to the farmers has been done.

- Assumptions: the expertise and means for this study are available in the Gaza Strip.

Operational Objective 2.4: To prevent pollution with diesel, oil and kerosene in Wadi Gaza.

Project: Techniques for mosquito control. Project number 241S

Output:introduction of effective and non-polluting techniques to control mosquitos.

- Priority: 1

- Key issues:
  - Study the mosquito ecology in the Wadi Gaza area;
  - Study alternative mosquito control techniques;
  - Assess the impact of mosquito control techniques.

- Timetable: Yearly from June to October, starting June 2003.

- Method: Study alternative, more effective and less polluting mosquito fighting techniques such as the application of BTI and other options. Apply these alternative techniques in the site. Monitoring the effects of the mosquito fighting techniques on the mosquito larvae and the site as a whole.

- Responsibility: External expert on mosquito ecology in close collaboration with the Wadi Gaza management team and the Environmental Quality Authority.

- Indicators: The number of mosquito larvae in breeding pools has been reduced to at least 30% of the original numbers.

- Assumptions: A baseline of mosquito larvae numbers at the start of the study is known or can be established. The alternative mosquito fighting techniques are effective in reducing the number of mosquitos in the Wadi Gaza area.

Project: Mosquito control regulations and enforcement. Project Number 242L

Outputs: establishment and enforcement of regulations for mosquito control in Wadi Gaza.

- Priority: 1

- Key issues:
  - Formulate regulations that apply to mosquito control activities in the Wadi Gaza area.

- Timetable: January 2003 to June 2003.

- Method: Install a single institutional body that will be responsible for combatting mosquitos in the site. Define the boundaries of the site for which the regulations will apply. Develop regulations for combatting mosquitos in the site. Negotiate these rules and regulations with the EQA, MOLG, UNRWA and the local communities or municipalities. Develop a final report on rules and regulations for the access and human use of the Wadi Gaza site. Negotiate this report with the Ministry of Justice and PLC so that it forms the basis of a legal document for the protection of the Wadi Gaza wetland habitats. Hire, train and install wardens to deter detrimental mosquito fighting techniques from being executed in the site.

- Responsibility: The Environmental Quality Authority in close collaboration with the Wadi Gaza management team.

- Indicators: institution for combatting mosquitos is installed, regulations for combatting mosquito fightings in the site are developed and approved by the PLC, and wardens are trained and installed.

- Assumptions: Alternative mosquito fighting techniques are effective, authorities are willing to approve mosquito-fighting regulations.

Operational Objective 2.5: To stop the uncontrolled dumping of domestic, industrial wastes and construction debris in Wadi Gaza.

Project: Prevention of dumping. Project number 251L

Outputs: development and enforcement of regulations that forbid the dumping of garbage, industrial wastes and construction debris in Wadi Gaza.

- Priority: 1

- Key issues:
  - Formulate regulations that stop garbage dumping in the Wadi Gaza area.

- Timetable: July 2003 to December 2003.

- Method: Develop regulations that forbid the dumping of garbage and construction debris in the Wadi Gaza site. Negotiate these rules and regulations with the MOLG, MOPWH and local communities. Include these rules in a final report on rules and regulations for the access and human use of the Wadi Gaza site. Negotiate this report with the MOJ, PLC so that it will form the basis of a legal document for the protection of the Wadi Gaza wetland habitats. Hire, train and install wardens in the site to enforce these rules and regulations.

- Responsibility: The Environmental Quality Authority in close collaboration with the Wadi Gaza management team and local municipalities.

- Indicators: Regulations are developed and approved by the responsible authorities, wardens are trained and installed.

- Assumptions: The responsible authorities are willing to approve the regulations, alternative dumping sites are available.

Operational Objective 2.6: To restore the movements of wandering wild animals to and from the Gaza Strip.

Project: Technical solutions for the re-establishment of animal migration. Project number 261S

Output: feasibility study and recommendations for replacement of current fences around the Gaza Strip with fences which allow passage of wandering terrestrial animals.

- Priority: 3

- Key issues:
  - Study migrations by ground mammals in and outside the Gaza Strip.

- Timetable: 4 months, January 2006 to April 2006.

- Method: Study migratory routes of terrestrial animals and ways of restoring terrestrial migration between Israel and the Gaza Strip, e.g. by means of animal tunnels or animal sized openings in the fences. Report results. Submit the report to relevant authorities to be taken into consideration during future political negotiations.

- Responsibility: External expert on animal migration in close collaboration with the Wadi Gaza management team and the Environmental Quality Authority.

- Indicators: Study on the restoration of animal migration has been completed and submitted to the relevant authorities.

- Assumptions: The results of the study are taken into consideration during the political negotiations between Israel and the Palestinian Territories.

Project: Plan for the restoration of terrestrial animal migration. Project number 262L

Outputs: plan for the restoration of terrestrial animal migration between Israel and the Gaza Strip that can be included in future political negotiations.

- Priority: 3
- Key issues:
  - Study possibilities to restore terrestrial animal migration in and outside the Gaza Strip.
- Timetable: 4 months, May 2006 to August 2006
- Method: Study international agreements concerning natural reserves and parks in the Middle East. Report the international legal obligations concerning nature reserves together with the possibilities for the restoration of (ground bound) animal migration between Israel and the Gaza Strip. Submit this report to the responsible authorities so that it can be included in future political negotiations.
- Responsibility: External expert on animal migration in close collaboration with the Wadi Gaza management team and the Environmental Quality Authority.
- Indicators: Study on international agreements concerning natural reserves and parks in the Middle East has been completed and submitted to the relevant authorities.
- Assumptions: The results of the study are taken into consideration during the political negotiations between Israel and the Palestinian Territories.

4.3.3 PROGRAM: SUSTAINABLE RESOURCE USE

Operational Objective 3.1: To eliminate overgrazing, uncontrolled woodcutting and sand and stone quarrying in Wadi Gaza.

Project: Sustainable grazing management. Project number 311C

Outputs: development and implementation of sustainable grazing management and regulations for Wadi Gaza.

- Priority: 1
- Key issues:
  - Study grazing impact on the vegetation communities;
  - Develop and propose a sustainable grazing regime in the site.
- Timetable: January 2003– December 2003.
- Method: Define the zonation of habitats (or areas) in need of protection because of their sensitivity to grazing. Communicate these boundaries to the responsible authorities and local communities. Develop regulations for access and human use in terms of grazing for each of the zones. Negotiate these rules and regulations with the MOLG, MOAG and local communities.

Develop a final report on rules and regulations for grazing in the Wadi Gaza site. Negotiate this report with the Ministry of Justice and PLC so that it will form the basis of a legal document for the protection of the sensitive Wadi Gaza wetland habitats. Hire, train and install wardens to enforce the regulations concerning grazing in the site.

- Responsibility: External expert on grazing management in close collaboration with the Wadi Gaza management team and the Environmental Quality Authority.

- Indicators: Regulations for grazing in the Wadi Gaza site are developed and approved by the relevant authorities, wardens are trained and installed.

- Assumptions: Authorities are willing to approve regulations, regulations are acceptable by the stakeholders.

Project: Regulations for woodcutting. Project Number 312C

Outputs: development and implementation of regulations for woodcutting in Wadi Gaza.

- Priority: 1

- Key issues:
  - Study the impact of woodcutting on the vegetation communities;
  - Develop and propose a sustainable woodcutting program in the site.

- Timetable: January 2003– December 2003

- Method: Define the zonation of habitats (or areas) and plant species in need of protection because of their sensitivity to woodcutting. Communicate these boundaries to the responsible authorities and local communities. Develop regulations for access and human use in terms of woodcutting for each of the zones. Negotiate these rules and regulations with the MOLG, MOAG and local communities. Develop a final report on rules and regulations for woodcutting in the Wadi Gaza site. Negotiate this report with the Ministry of Justice and PLC so that it forms the basis of a legal document for the protection of the sensitive Wadi Gaza wetland habitats. Hire, train and install wardens to enforce the regulations concerning woodcutting in the site.

- Responsibility: External expert on vegetation community dynamics in close collaboration with the Wadi Gaza management team and the Environmental Quality Authority.

- Indicators: Regulations for woodcutting in the Wadi Gaza site are developed and approved by the relevant authorities, wardens are trained and installed.

- Assumptions: Authorities are willing to approve regulations, regulations are acceptable by the stakeholders.

Project: Regulations for sand and stone quarrying. Project Number 313C

Outputs: development and implementation of regulations for sand and stone quarrying in Wadi Gaza.

- Priority: 1

- Key issues:
  - Study the impact of sand and stone quarrying pits on the ecology of the site;
  - Develop and propose a sustainable quarrying program in the site.

- Timetable: January 2003– December 2003.

- Method: Define the zonation of habitats (or areas) in need of protection from destruction by sand and stone quarrying activities. Communicate these boundaries to the responsible authorities and local communities. Develop regulations for access and human use in terms of sand and stone quarrying for each of the zones. Negotiate these rules and regulations with the MOLG, MOAG and local communities. Develop a final report on rules and regulations for sand and stone quarrying in the Wadi Gaza site. Negotiate this report with the Ministry of Justice and PLC so that it forms the basis of a legal document for the protection of the sensitive Wadi Gaza wetland habitats. Hire, train and install wardens to enforce the regulations concerning sand and stone quarrying in the site.

- Responsibility: The Wadi Gaza management team in close collaboration with the Environmental Quality Authority.

- Indicators: Regulations for sand and stone quarrying in the Wadi Gaza site are developed and approved by the relevant authorities, wardens are trained and installed.

- Assumptions: Authorities are willing to approve regulations, regulations are acceptable by the stakeholders.

Operational Objective 3.2: To prevent further lowering of the groundwater table in the Gaza Strip.

Project: Reduction of groundwater extraction. Project Number 321L

Outputs: proposals for thereduction of pumping and the wise use of groundwater in the Gaza Strip.

- Priority: 3

- Key issues:
  - Study the volume and trends of current groundwater extraction;
  - Monitor the groundwater level.

- Timetable: January 2005 to March 2006.

- Method: Study the amount that is pumped up by wells in the Gaza Strip on a yearly basis. Compare with historical data. Study the current regulations for the extraction of groundwater in the Gaza Strip. Develop a proposal for regulations which reduce the amounts of groundwater pumped from wells and introduce a quota system based on levels of sustainable use. Submit and negotiate the proposal with the PWA, EQA and MOPIC. Lobby the responsible authorities to install a single institutional body that will be responsible for the regulation, control and enforcement of groundwater extraction in the Gaza Strip.

- Responsibility: The Wadi Gaza management team in close collaboration with the Environmental Quality Authority.

- Indicators: The proposal for the regulations of groundwater pumping in the Gaza Strip is developed and submitted to the relevant authorities.

- Assumptions: The proposed reduction in groundwater extraction is acceptable by the relevant authorities and that it has a significant impact on the groundwater level in the Gaza Strip.

Project: Sustainable water management. Project Number: 322L

Output: development of a sustainable water management plan for Wadi Gaza as part of an overall water management plan for the Gaza Strip.

- Priority: 3

- Key issues:
  - Study water use in the Wadi Gaza area;
  - Study more efficient water use and water harvesting techniques.

- Timetable: January 2005 to November 2005.

- Method: Study the areas in and around the Wadi Gaza site where water resources are used inefficiently and look for possibilities to apply more efficient water use techniques. Submit the results of the local water use study in the site to relevant institutions and NGOs currently working on the management of water resources in the Gaza Strip. Cooperate with these institutions and NGOs in implentation of findings.

- Responsibility: External institute specialized in water conservation and water harvesting in close collaboration with the Wadi Gaza management team and Environmental Quality Authority.

- Indicators: Results of the water use study in and around the Wadi Gaza site are submitted to PWA, MOPIC, MOAG and relevant NGOs, agreements have been made on cooperation with other institutions to ensure a more sustainable management of water resources in the Gaza Strip.

- Assumptions: Expertise and budget for the study are available, other institutions are willing to cooperate.

4.3.4 PROGRAM: SOCIO-ECONOMIC DEVELOPMENT

Operational Objective 4.1: To facilitate the improvement of the environmental municipal services of local communities around Wadi Gaza.

Project: Garbage collection and processing. Project Number: 411L

Output: proposals which promote and facilitate a collection and processing system for the solid wastes of the local communities around Wadi Gaza.

- Priority: 2

- Key issues:
  - Garbage collection system.

- Timetable: July 2004 to December 2004.

- Method: Lobby municipalities and the relevant authorities for the development of a garbage collection system. Assist the municipalities with finding funds and submitting proposals to fund the establishment of garbage collection services. Identify potential alternative dump sites outside the sensitive area of Wadi Gaza. Encourage local initiatives to organize garbage collection at the municipality level.

- Responsibility: The Wadi Gaza management team in close collaboration with the local municipalities and the Environmental Quality Authority.

- Indicators: Proposals to fund garbage collection services are submitted to potential donors, alternative dump sites are identified.

- Assumptions: Donors are prepared to fund garbage collection services

Operational Objective 4.2: To promote income generation activities in the site that are compatible with the conservation objectives for Wadi Gaza.

Project: Plan for income generating activities. Project Number: 421S

Output: plan for income generating activities in the Wadi Gaza site.

- Priority: 2

- Key issues:
  - Study possibilities for income generating in the site;
  - Assess the impact of income generating activities in the site.

- Timetable: January 2004 - January 2005.

- Method: Hire people from the local community and train them in reserve management and protection. Develop and implement a plan to stimulate income-generating activities in the site.

- Responsibility: External institute specialized in local community development in close collaboration with the local communities, Wadi Gaza management team and Environmental Quality Authority.

- Indicators: People from the local community are hired for the conservation of the site (site management). A plan for income generating activities in Wadi Gaza has been completed.

- Assumptions: Budget and expertise are available to hire and train people, all regulations for the site are developed and approved (wardens), income-generating activities can be developed which are compatible with the conservation of the site.

Project: Capacity building for income generation. Project number 422T

Outputs: capacity building workshops for local groups in income generating activities in the Wadi Gaza site; income generating activities diversified.

- Priority: 2
- Key issues:
  - Provide training in local craftwork and other income generating activities in the site.
- Timetable: January 2005 – January 2006.
- Method: Conduct training and workshops, and provide facilities for people from local communities to engage in income generating activities in the site. This project derives from the outcome of the plan to stimulate income-generating activities (Project 421S).
- Responsibility: External institute which is specialized in local community development, in close collaboration with the local communities, Wadi Gaza management team and Environmental Quality Authority.
- Indicators: Training and workshops for income generating activities have been conducted. Income generated activities in the site have started.
- Assumptions: People from the local community are willing and able to participate in the training and workshops.

Project: Aquaculture regimes study. Project number 423S

Outputs: feasibility study of options for aquaculture regimes that contribute to a decrease in nutrient pollution and enhance ecosystem functions; field tests.

- Priority: 2
- Key issues:
  - Study possibilities for aquaculture ponds in the site;
  - Study possibilities of aquaculture with treated wastewater;
  - Assess the impact of aquaculture in the site.
- Timetable: January 2004 – January 2005.
- Method: Investigation of potential regimes for fish stocking which also contribute to reducing nutrient pollution (underwater weed and algae control, metabolizing detritus, etc.) and generating income for the local community. Trials to test options and results.
- Responsibility: External institute specialized in aquaculture in close collaboration with the local communities, Wadi Gaza management team and Environmental Quality Authority.
- Indicators: The most suitable regimes for fish stocking have been identified and tested.
- Assumptions: Regimes for fish stocking can be developed which are compatible with conservation and restoration of the diversity of species, habitats and communities of Wadi Gaza.

4.5.1 PUBLIC AWARENESS

Operational Objective 5.1: To promote and facilitate scientific research studies in Wadi Gaza.

Project: Reference and baseline data. Project number 511F

Outputs: database and reference material readily accessible to scientists, researchers, staff and for educational purposes.

- Priority: 2
- Key issues:
  - Publication of all available information on Wadi Gaza.
- Timetable: July 2004 – January 2005.
- Method: Develop a comprehensive database that contains all survey material, GIS and baseline data that has been collected for Wadi Gaza. Develop copies of the diagnostic reports and management plan to provide to scientists as background information for their research.
- Responsibility: The Wadi Gaza management team and the Environmental Quality Authority.
- Indicators: Comprehensive database has been developed. 20 copies of the diagnostic reports and management plan have been developed.
- Assumptions: Expertise to develop a comprehensive database is available. Resources to produce the copies of diagnostic reports and management plan are available.

Project: Ringing station. Project number 512F

Outputs: establishment of a ringing station; implementation of bird migration studies.

- Priority: 2
- Key issues:
  - Join with a partner organization;
  - Develop a local ringing station.
- Timetable: August 2003 – August 2004, registering and ringing activities are conducted annually during periods of bird migration.
- Method: Training of project, governmental, and/or appropriate NGO staff in Basic skills for bird ringing and registration, the procurement of all necessary equipment, implementation of ringing activities. Collaboration with other ringing stations along the Eastern Mediterranean/Middle East bird migration flyway.

- Responsibility: Partner organization and the Wadi Gaza management team

- Indicators: Training of project, governmental, and/or appropriate NGO staff in Basic skills for bird ringing and registration has been completed. All necessary equipment is procured. Ringing activities have started in Wadi Gaza. Ringing station collaborating with other sites in the Eastern Mediterranean migration flyway network.

- Assumptions: Expertise and resources for training and procurement of necessary equipment are available. Experienced ringers available until staff and local ringers sufficiently trained.

Operational Objective 5.2: To raise public awareness amongst local communities of the values of Wadi Gaza and environmental issues which impact upon those values.

Project: Awareness program for local stakeholders. Project number 521P

Outputs: development of a public awareness program for local NGOs; development of a public awareness program for local farmers; development of a public awareness program for local municipalities; collaboration with local stakeholders in the implementation of conservation measures including habitat restoration, eliminating pollution and developing programs of sustainable use in Wadi Gaza.

- Priority: 2

- Key issues:
  - Develop a public awareness program for local non governmental organizations;
  - Develop a public awareness program for local farmers;
  - Develop a public awareness program for local municipalities.

- Timetable: January 2004 to December 2006.

- Method: Prepare meetings, public workshops and informative field tours for the local communities to raise awareness of the conservation values of Wadi Gaza site, restoration, pollution and sustainable use in Wadi Gaza and explain how they can contribute to ensure the future of the site. Invite comments and suggestions from participants. These activities are a follow-up of the ongoing awareness campaign activities.

- Responsibility: External institute specialized in public awareness in close collaboration with the local communities, Wadi Gaza management team and Environmental Quality Authority.

- Indicators: Meetings, workshops and informative tours with the local community have been organised. Feedback from participants.

- Assumptions: The local community is interested and able to attend awareness activities in Wadi Gaza.

Project: Information Center. Project Number 522F

Output: establishment of a fully equipped information center for visitors.

- Priority: 2

- Key issues:
  - Design an information center;
  - Develop a laboratory in the information center.

- Timetable: July 2004 to December 2006.

- Method: Develop and implement a plan or design to upgrade the current on-site facilities to full information center status accommodating educational activities, displays and presentations, training, and all the facilities for the project staff (e.g. library, offices, materials etc.).

- Responsibility: The Wadi Gaza management team.

- Indicators: Design for the information center has been completed. The information center has been completed.

- Assumptions: The resources for building an information center are available.

Project: Wadi Gaza volunteers. Project Number 523P

Outputs: special events and promotions for visitors; formal and informal programs of participation and integration of voluntary support within the reserve.

- Priority: 2

- Key issues:
  - Organise special events and promotions which publicise and draw people to the site;
  - Study possibilities to involve people in management activities.

- Timetable: Periodic events starting from January 2004 to January 2007.

- Method: Develop and implement periodic special events within Wadi Gaza, in which people can help and participate with management activities. Invite comments and suggestions from participants.

- Responsibility: The Wadi Gaza management team.

- Indicators: Periodic events in Wadi Gaza have been organised and people have participated in these events. Feedback from participants.

- Assumptions: People are interested in participating in these events.

Project: Visitor management and facilities. Project number 524F

Outputs: establishment ofeffective visitor management services and facilities.

- Priority: 2

- Key issues:
  - Establish hiking trails, 3 observation towers and a recreational area in the site;
  - Implement and maintain visitor facilities;
  - Provide a drinking water facility, garbage bins and signposts.

- Timetable: Establish hiking trails, 3 observation towers and a recreational area, January 2003 to November 2003; provide drinking water facility, garbage bins and signposts, January 2005 to November 2005; implementation and maintenance of facilities, November 2003 to January 2006.

- Method: Implement visitor facilities (e.g. hiking trails, garbage bins, signposts, observation towers etc.). These facilities have been planned and supported in conjunction with the USAID funded component of the Wadi Gaza project.

- Responsibility: The implementation of facilities will be the responsibility of the USAID funded Employment Generation in the Development of Wadi Gaza Area project team. The maintenance of these facilities and implementation of new facilities will be the responsibility of theWadi Gaza management team and the Environmental Quality Authority.

- Indicators: All the planned visitors' facilities are implemented.

- Assumptions: The political situation in the Gaza Strip and the available resources permit the implementation of all planned facilities.

Operational Objective 5.3: To raise public awareness concerning Wadi Gaza and environmental issues amongst the youth of the Gaza Strip and West Bank.

Project: Environmental awareness school program. Project Number 531E

Output: a school program based on Wadi Gaza as a case study for raising awareness on environmental issues in the Gaza Strip.

- Priority: 2

- Key issues:
  - Develop a public awareness school program for primary school students;
  - Develop a public awareness school program for secondary school students;
  - Develop a public awareness program for higher degree and university students.

- Timetable: March 2003 to December 2006.

- Method: Develop and organize a teacher- training program on wetland and water conservation issues within the Palestinian Territories. Develop wetland and water school programs for primary, secondary and tertiary level students.

- Responsibility: External institute specialized in public awareness in close collaboration with the local schools and universities, Wadi Gaza management team and Environmental Quality Authority.

- Indicators: Teacher- training and school programs have been developed.
- Assumptions: The teacher program and wetland and water school program can be fitted into the yearly school programs in the Palestinian Territories.

Project: Education room. Project number 532F

Output: creation of a room dedicated for educational purposes within the information center.

- Priority: 3
- Key issues:
  - Design and implement an education room in the information center.
- Timetable: July 2006 to December 2006.
- Method: Design and develop a room in the information center to serve as an education room. The displays and information of the education room should fit the elements of the wetland-and-water school program.
- Responsibility: The Wadi Gaza management team.
- Indicators: Education room has been designed and developed.
- Assumptions: The information center has been constructed or completed.

Operational Objective 5.4: To promote eco-tourism in Wadi Gaza.

Project: Tourism development plan. Project number 541L

Output: a Tourism Development Plan for the Wadi Gaza area.

- Priority: 3
- Key issues:
  - Define the key attractions for eco-tourism development.
  - Assess the needed resources for eco-tourism development.
- Timetable: The development of a plan will be from July 2005 to July 2006. The tourism development plan to be implemented as soon as the political situation is improved.
- Method: Work on a tourism development plan for Wadi Gaza in cooperation with other ministries and non-governmental institutions that are involved in tourism in the Palestinian Territories.
- Responsibility: The Wadi Gaza management team and the Ministry of Tourism and Antiquities in close collaboration with the Environmental Quality Authority and local communities.

- Indicators: The tourism development plan has been completed and agreed upon by all organizations and institutions that have been involved in the development of the plan.

- Assumptions: The political situation will at some stage improve sufficiently to re-open the Gaza Strip to tourists.

4.3.6 PROGRAM: ADMINISTRATIVE

Operational Objective 6.1: To recruit and develop the capacity of a local team to implement the management plan in Wadi Gaza.

Project: Team recruitment. Project number 611A

Output: engagement of a team of staff necessary for the implementation of the management plan.

- Priority: 1

- Key issues:
  - Recruitment of the management team.

- Timetable: January 2003 to January 2004.

- Method: Recruit staff to implement the essential activities of the management plan.

- Responsibility: The Environmental Quality Authority and Wadi Gaza site manager in close collaboration with the local communities.

- Indicators: Staff members are selected and recruited.

- Assumptions: Long-term resources for staff salary and training or development needs are available.

Project: Staff training. Project Number 612T

Outputs: capacity building and skill enhancement among Wadi Gaza staff.

- Priority: 1

- Key issues:
  - Assess training needs of newly recruited staff members.

- Timetable: June 2003 to January 2004.

- Method: Identify the training needs and suitable training courses for each of the staff members.

- Responsibility: The Environmental Quality Authority and Wadi Gaza site manager.

- Indicators: Staff members are trained according to their training needs.
- Assumptions: Resources for training are available.

Operational Objective 6.2: To provide a management advisory structure which includes local stakeholder access to management implementation and the decision making process.

Project: Local Management Advisory Committee. Project number 621A

Outputs: establishment of a local Management Advisory Committee inclusive of local stakeholders; creation of a forum for local representation in management implementation and the decision making process.

- Priority: 1
- Key issues:
  - Involvement of stakeholders in the decision making process.
- Timetable: January 2003 to July 2003.
- Method: Conduct meetings with local communities, ministerial and non-governmental institutions that are stakeholders in Wadi Gaza, for the selection and establishment of a local Management Advisory Committee. Determine the mandate and position of the committee in the decision making process for the management of the site.
- Responsibility: The Wadi Gaza management team in close collaboration with all stakeholders
- Indicators: The Local Management Advisory Committee has been established.
- Assumptions: Stakeholders are interested in forming a balanced Local Management Advisory Committee.

Operational Objective 6.3: To develop and maintain the physical infrastructure and equipment needed by staff to implement the management plan.

Project: Vehicles, tools and machinery. Project number 631A

Outputs: acquisition of appropriate vehicles, tools and machinery; establishment of measures for adequate storage and maintenance.

- Priority: 1
- Key issues:
  - Identify need equipment for the implementation of management activities.
- Timetable: January 2003 to January 2004.

- Method: Identify which vehicles, tools and machinery are needed to implement the activities of the management plan. Purchase the vehicles, tools and machinery and transport them to Wadi Gaza. If required, train staff member in the use, storage and maintenance of the purchased vehicles, tools and machinery.

- Responsibility: The Wadi Gaza management team, the Environmental Quality Authority and international donor organisations.

- Indicators: Vehicles, tools and machinery that are needed for implementing the management plan activities are acquired.

- Assumptions: Resources to purchase and maintain the vehicles, tools and machinery are available.

Project: Library. Project number 632F

Outputs: establishment and maintenance of a collection of reference material relevant to the management and operation of Wadi Gaza.

- Priority: 1

- Key issues:
  - Identify needed literature for the implementation of management activities.

- Timetable: Ongoing, starting from January 2003.

- Method: Develop a library starting with the reference material collected for the development of the diagnostic reports and management plan of Wadi Gaza. Develop a database to facilitate the organization of reference materials and identify a single location to store the library.

- Responsibility: The Wadi Gaza management team, the Environmental Quality Authority and international donor organistions.

- Indicators: Library has been installed including a database with all the names, authors etc. of all reference materials.

- Assumptions: Single location for all reference material can be identified. Resources are available to purchase required reference material.

4.4 Work Plans

4.2 Work plans

The following work plans present the breakdown of the management activities on an annual basis. The management plan is for a four-year period from January 2003 to January 2007.

Table 7: Work plan for the year 2003

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-03	Mar & Apr-03	May & Jun-03	Jul & Aug-03	Sep & Oct-03	Nov & Dec-03	
111M	**Habitat monitoring**								
	Develop monitoring program	Habitat monitoring expert							
	Identify staff and develop database and formats	Site manager & habitat monitoring expert							
	Set up plots & Conduct pilot study	Fauna & vegetation monitoring staff							
	Confirm methodologies and conduct habitat survey	Fauna & vegetation monitoring staffs							
121M	**Bird monitoring**								
	Develop monitoring program and develop database and formats	Fauna monitoring expert							
	Identify and train staff	Site manager & bird monitoring expert							
	Conduct pilot study	Fauna monitoring staff							
	Confirm methodologies	Fauna monitoring staff							
122S	**Status of threatened birds**								
	Survey the numbers and locations of target species, including corncrakes	Fauna monitoring staff							
	Map the locations of forage and roosting sites	Fauna monitoring staff; GIS staff							

Table 9 (continued): Work plan for the year 2003

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-03	Mar & Apr-03	May & Jun-03	Jul & Aug-03	Sep & Oct-03	Nov & Dec-03	
123P	**Visitor participation**								
	Develop materials that can help people with the identification of bird species	Fauna monitoring staff							
	Develop forms that can be filled in by visitors	Fauna monitoring staff							
	Update bird monitoring database	Fauna monitoring staff							
131M	**Vegetation monitoring**								
	Develop monitoring program and develop database and formats	Expert vegetation monitoring							
	Identify and train staff	Site manager & expert vegetation monitoring							
	Set-up plots, conduct pilot study & confirm methodologies	Vegetation monitoring staff							
141M	**Fish and Aquatic invertebrate fauna survey**								
	Develop the survey methodology	Local experts fish & aquatic invertebrates							
	Identify and train staff	Local experts fish & aquatic invertebrates							
	Conduct pilot study	Local experts fish & aquatic invertebrates							
	Confirm methodologies and conduct fish & aquatic invertebrates survey	Fauna monitoring staff							

Table 9 (continued): Work plan for the year 2003

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-03	Mar & Apr-03	May & Jun-03	Jul & Aug-03	Sep & Oct-03	Nov & Dec-03	
151L	**hunting regulations**								
	Define fauna species that need to be protected and areas where hunting needs to be prohibited	Local fauna expert							
	Develop regulations for hunting in the site	Fauna expert, Site Manager, legal expert							
	Submit these regulations to the MOLG and local communities.	Site Manager, EQA staff							
	Follow up to get approval for these regulations so that it can act as a legal document to regulate hunting in the site.	Site Manager, EQA staff							
161M	**Soil survey**								
	No activities planned for this year								
171L	**Defining urban growth areas**								
	Survey & map alternative growth areas	Land use & GIS specialists							
	Impact assessment for growth areas	EQA staff							
	Present results to Ministry of Local Government	Land use & GIS specialists							
172S	**Maximising current urban land use**								
	No activities planned for this year								

Table 9 (continued): Work plan for the year 2003

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-03	Mar & Apr-03	May & Jun-03	Jul & Aug-03	Sep & Oct-03	Nov & Dec-03	
173L	**Land use planning and policies in Wadi Gaza**								
	Study current land use, policy and ownership	Land use specialist							
	Study alternative land use possibilities	Land use specialist							
	Propose results to Ministry of local government & Local Municipalities	Site manager + land use specialist							
	Follow up on approval for the new land use policy in Wadi Gaza	Site manager + land use specialist							
174L	**Regulations to prevent urban encroachment**								
	Define and map protected zones in Wadi Gaza	Fauna & Flora experts, GIS & Land use specialists							
	Communicate protected zone boundaries to Ministry of local Government & Municipalities	Site manager							
	Develop a final report on the regulations for construction in the Wadi Gaza site	Fauna & Flora experts, GIS & Land use specialists + Legal expert							
181S	**Alternative agricultural growth areas**								
	Study potential agricultural development areas	GIS & Land use specialists							
	Develop proposed agricultural plan for Wadi Gaza	GIS & Land use specialists							

Table 9 (continued): Work plan for the year 2003

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-03	Mar & Apr-03	May & Jun-03	Jul & Aug-03	Sep & Oct-03	Nov & Dec-03	
182L	**Regulations to prevent agricultural encroachment**								
	Define and map protected zones in Wadi Gaza	Fauna & Flora experts, GIS & Land use specialists							
	Communicate protected zone boundaries to Ministry of local Government & Municipalities	Site manager							
	Develop a final report on the regulations for cultivation in the Wadi Gaza site	Fauna & Flora experts, GIS & Land use specialists + Legal expert							
211L	**regulations for the natural flow of Wadi Gaza**								
	Define natural flow and criteria for restoration of natural flow of Wadi Gaza	Hydrology specialist							
	Develop regulations that ensures the restoration of the natural flow of Wadi Gaza	Site Manager, EQA staff, Legal adviser							
212S	**Restoration of natural flow**								
	No activities planned for this year								
221C	**Restoration of vegetation diversity**								
	Develop a vegetation restoration program	Site staff							
	Develop a nursery for native plants	Site staff / warden							
	Control the encroachment of dominating species	Site staff / warden							

222C	**Rehabilitation of saline and brackish habitats**								
	No activities planned for this year								

Table 9 (continued): Work plan for the year 2003

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-03	Mar & Apr-03	May & Jun-03	Jul & Aug-03	Sep & Oct-03	Nov & Dec-03	
223C	**Impact and control of alien plants**								
	No activities planned for this year								
231L	**Wastewater treatment and infrastructure**								
	Study possibilities for central or local treatment technologies and infrastructure	Site Manager & wastewater treatment specialist							
	Develop a project proposal for the selected sewage treatment and infrastructure	Site Manager, local municipalities & EQA							
	Present proposal to potential donors	Site manager							
232M	**Hydrology and water quality monitoring**								
	Develop a monitoring program for the hydrology and water quality								
	Develop database and the methods for the analysis and reporting								
	Collection of water quality data								
233S	**Best use of fertilizers in agriculture**								
	No activities planned for this year								
241S	**Techniques for mosquito control**								
	Study alternative mosquito fighting techniques	Site Manager & EQA staff							
	Apply these alternative techniques in the site	Site Manager & EQA staff							
	Monitor the effects of these techniques on the mosquito larvae and the site as a whole	Site Manager, municipalities & EQA staff							

Table 9 (continued): Work plan for the year 2003

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-03	Mar & Apr-03	May & Jun-03	Jul & Aug-03	Sep & Oct-03	Nov & Dec-03	
242L	**Mosquito control regulations and enforcement**								
	Develop a single institution that will be responsible for the mosquito fighting in the site	Site Manager, UNRWA, Local municipalities							
	Develop regulations for combatting mosquitos in and around the site	Site Manager, UNRWA, MOLG							
	Submit and negotiate these regulations with EQA, MOLG, UNRWA and the local communities and municipalities	Site Manager							
	Follow up to get approval for these regulations so that it will act as a legal document	Site Manager, EQA staff							
251L	**Prevention of dumping**								
	Develop regulations that forbid the dumping of wastes in Wadi Gaza	Site Manager, EQA staff, Legal adviser							
	Submit and negotiate these regulations with the MOLG, MOPWH and local municipalities	Site Manager, EQA staff							
261S	**Technical solutions for the re-establishment of animal migration**								
	No activities planned for this year								
262L	**Plan for the restoration of terrestrial animal migration**								
	No activities planned for this year								

Table 9 (continued): Work plan for the year 2003

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-03	Mar & Apr-03	May & Jun-03	Jul & Aug-03	Sep & Oct-03	Nov & Dec-03	
311C	**Sustainable grazing management**								
	Define the areas or habitats that need to be protected against grazing	Flora & Fauna experts, GIS specialist							
	Develop regulations for access and human use in terms of grazing	Flora & Fauna experts, Site manager, Legal adviser							
	Submit and negotiate these rules with the MOLG, MOA and local communities	Site manager, EQA staff							
	Follow up to get approval for these regulations from the Ministry of Justice and PLC so that it will act as a legal document	Site manager, EQA staff, Legal adviser							
312C	**Regulations for woodcutting**								
	Define the areas or species that need to be protected against wood cutting	Flora & Fauna experts, GIS specialist							
	Develop regulations for access and human use in terms of woodcutting	Flora & Fauna experts, Site manager, Legal adviser							
	Submit and negotiate these rules with the MOLG, MOA and local communities	Site manager, EQA staff							
	Follow up to get approval for these regulations from the Ministry of Justice and PLC so that they will act as a legal document	Site manager, EQA staff, Legal adviser							
313C	**Regulations for sand and stone quarrying**								
	Define the areas or species that need to be protected against quarrying	Flora & Fauna experts, GIS specialist							
	Develop regulations for access and human use in terms of quarrying	Flora & Fauna experts, Site manager, Legal adviser							

Table 9 (continued): Work plan for the year 2003

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-03	Mar & Apr-03	May & Jun-03	Jul & Aug-03	Sep & Oct-03	Nov & Dec-03	
	Submit and negotiate these rules with the MOLG, MOA and local communities	Site manager, EQA staff							
	Follow up to get approval for these regulations from the Ministry of Justice and PLC so that they will act as a legal document	Site manager, EQA staff, Legal adviser							
321L	**Reduction of groundwater extraction**								
	No activities planned for this year								
322L	**Sustainable water management**								
	No activities planned for this year								
411L	**Garbage collection and processing**								
	No activities planned for this year								
421S	**Plan for income generating activities**								
	No activities planned for this year								
422T	**Capacity building for income generation**								
	No activities planned for this year								
423S	**Aquaculture regimes study**								
	No activities planned for this year								
511F	**Reference and baseline data**								
	No activities planned for this year								

Table 9 (continued): Work plan for the year 2003

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-03	Mar & Apr-03	May & Jun-03	Jul & Aug-03	Sep & Oct-03	Nov & Dec-03	
512F	**Ringing station**								
	Training of project, governmental, and/or appropriate NGO staff in Basic skills for bird ringing and registration	Expert bird monitoring and ringing							
521P	**Awareness program for local stakeholders**								
	No activities planned for this year								
522F	**Information center**								
	No activities planned for this year								
523P	**Wadi Gaza volunteers**								
	No activities planned for this year								
524F	**Visitor management and facilities**								
	Implement the facilities that are necessary for visitors (e.g. hiking trails, garbage bins, signposts, observation towers etc.).	Site manager, Project staff USAID							
531E	**Environmental awareness school program**								
	Develop a teacher- training program on wetland and water conservation issues	Staff member for Public awareness program							
	Organize a teacher- training program on wetland and water conservation issues	Staff member for Public awareness program							

Table 9 (continued): Work plan for the year 2003

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-03	Mar & Apr-03	May & Jun-03	Jul & Aug-03	Sep & Oct-03	Nov & Dec-03	
532F	**Education room**								
	No activities planned for this year								
541L	**Tourism development plan**								
	No activities planned for this year								Budget ($)
611A	**Team recruitment**								
	Recruit staff to implement the essential activities of the management plan	Site manager							
612T	**Staff training**								
	Identify the training needs and suitable training courses for each of the staff members	Site manager							
	Organising the training for each of the staff members	Administrative staff member							
621A	**Local Management Advisory Committee**								
	Conduct meetings with local communities, ministerial and NGOs, that are stakeholders in Wadi Gaza, for the selection and establishment of a local Management Advisory Committee	Site manager							

Table 9 (continued): Work plan for the year 2003

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-03	Mar & Apr-03	May & Jun-03	Jul & Aug-03	Sep & Oct-03	Nov & Dec-03	
631A	**Vehicles, tools and machinery**								
	Purchase the vehicles, tools and machinery and transport them to Wadi Gaza	Site manager							
	Train staff member in the use, storage and maintenance of the purchased vehicles, tools and machinery	Site manager							
632F	**Library**								
	Purchase reference material	Administrative staff member							
	Develop a database to facilitate the organization of reference materials	Administrative staff member							

Table 8: Work plan year 2004

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-04	Mar & Apr-04	May & Jun-04	Jul & Aug-04	Sep & Oct-04	Nov & Dec-04	
111M	**Habitat monitoring**								
	Conduct habitat survey	Fauna & vegetation monitoring staffs							
121M	**Bird monitoring**								
	Conduct bird species surveys	Fauna monitoring staff							
122S	**Status of threatened birds**								
	Survey the numbers and locations of target species, including corncrakes	Fauna monitoring staff							
	Hire expertise to identify key habitats	Site manager							
	Report on threatened species biology in Wadi Gaza	Expert bird biology							
123P	**Visitor participation**								
	Update forms that can be filled in by visitors	Fauna monitoring staff							
	Update bird monitoring database	Fauna monitoring staff							
131M	**Vegetation monitoring**								
	Conduct vegetation survey	Vegetation monitoring staff							
141M	**Fish and Aquatic invertebrate fauna survey**								
	Conduct fish and aquatic invertebrate survey	Local experts fish & aquatic invertebrates							
151L	**Hunting regulations**								

	Train and install wardens to enforce the hunting regulations	Site manager & fauna monitoring staff							

Table 10 (continued): Work plan for the year 2004

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-04	Mar & Apr-04	May & Jun-04	Jul & Aug-04	Sep & Oct-04	Nov & Dec-04	
161M	**Soil survey**								
	No activities planned for this year								
171L	**Defining urban growth areas**								
	Follow up to get the approval for growth area	Site manager							
172S	**Maximising current urban land use**								
	No activities planned for this year								
173L	**Land use planning and policies in Wadi Gaza**								
	Follow up on approval for the new land use policy in Wadi Gaza								
174L	**Regulations to prevent urban encroachment**								
	Submit this report to Ministry of local Government & Municipalities	Site manager							
	Get approval for these regulations from the Ministry of local Government & Municipalities so that it will act as a legal document for construction in Wadi Gaza	Site manager & Ministry of local government							
	Train wardens in the site to ensure the enforcement of these rules and regulations	Site manager, Flora & Fauna experts							

181S	**Alternative agricultural growth areas**								
	Completion of project								

Table 10 (continued): Work plan for the year 2004

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-04	Mar & Apr-04	May & Jun-04	Jul & Aug-04	Sep & Oct-04	Nov & Dec-04	
182L	**Regulations to prevent agricultural encroachment**								
	Submit this report to Ministry of local Government & Municipalities	Site manager							
	Get approval for these regulations from the Ministry of local Government & Municipalities so that it will act as a legal document for cultivation in Wadi Gaza	Site manager & Ministry of local government							
	Train wardens to ensure the enforcement of these rules and regulations	Site manager, Flora & Fauna experts							
211L	**regulations for the natural flow of Wadi Gaza**								
	Submit these regulations to the MOLG and MOPWH and local communities	Site Manager, EQA staff							
	Follow up to get approval for these regulations from the MOJ and PLC so that they will act as a legal document	Site Manager, EQA staff, Legal adviser							
212S	**Restoration of natural flow**								
	Study the impact of the sand barrier at the mouth of the Wadi	Hydrology specialist							
	Impact assessment of the removal of the sand barrier	EQA staff							
	Submit the results of these studies to the MOPWH	Site Manager, EQA staff							

221C	**Restoration of vegetation diversity**								
	Planting of nursery seedlings	Site staff / warden							
	Control the encroachment of dominating species	Site staff / warden							

Table 10 (continued): Work plan for the year 2004

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-04	Mar & Apr-04	May & Jun-04	Jul & Aug-04	Sep & Oct-04	Nov & Dec-04	
222C	**Rehabilitation of saline and brackish habitats**								
	Evaluate possibilities to increase the frequency and quantity of seawater that flows in from the Mediterranean Sea	Hydrology specialist							
	Develop a plan to restore saline and brackish conditions	Fauna & Flora experts, Hydrology specialist							
223C	**Impact and control of alien plants**								
	Study the impact of alien plants on the diversity of native flora and fauna	Vegetation monitoring staff & Flora expert							
231L	**Wastewater treatment and infrastructure**								
	Present proposal to potential donors	Site manager							
	Follow up on the project proposal	Site manager							
232M	**Hydrology and water quality monitoring**								
	Collection of water quality data								
233S	**Best use of fertilizers in agriculture**								
	No activities planned for this year								
241S	**Techniques for mosquito control**								

	Apply these alternative techniques in the site	Site Manager & EQA staff								
	Monitor the effects of these techniques on the mosquito larvae and the site as a whole	Site Manager, municipalities & EQA staff								

Table 10 (continued): Work plan for the year 2004

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-04	Mar & Apr-04	May & Jun-04	Jul & Aug-04	Sep & Oct-04	Nov & Dec-04	
242L	**Mosquito control regulations and enforcement**								
	Follow up to get approval for new regulations so that they will act as a legal document	Site Manager, EQA staff							
251L	**Prevention of dumping**								
	Follow up to get approval from the MOJ and PLC so that it will act as a legal document	Site Manager, EQA staff, Legal adviser							
261S	**Technical solutions for the re-establishment of animal migration**								
	No activities planned for this year								
262L	**Plan for the restoration of terrestrial animal migration**								
	No activities planned for this year								
311C	**Sustainable grazing management**								
	Follow up to get approval for these regulations from the Ministry of Justice and PLC so that they will act as a legal document	Site manager, EQA staff, Legal adviser							
	Train wardens to ensure the enforcement of these rules and regulations	Site manager, EQA staff							

Table 10 (continued): Work plan for the year 2004

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-04	Mar & Apr-04	May & Jun-04	Jul & Aug-04	Sep & Oct-04	Nov & Dec-04	
312C	**Regulations for woodcutting**								
	Follow up to get approval for these regulations from the Ministry of Justice and PLC so that they will act as a legal document	Site manager, EQA staff, Legal adviser	■	■					
	Train wardens to ensure the enforcement of these rules and regulations	Site manager, EQA staff				■			
313C	**Regulations for sand and stone quarrying**								
	Follow up to get approval for these regulations from the Ministry of Justice and PLC so that they will act as a legal document	Site manager, EQA staff, Legal adviser	■	■					
	Train wardens to ensure the enforcement of these rules and regulations	Site manager, EQA staff				■			
321L	**Reduction of groundwater extraction**								
	No activities planned for this year								
322L	**Sustainable water management**								
	No activities planned for this year								
411L	**Garbage collection and processing**								
	Lobby with municipalities and the relevant authorities for the development of a garbage collection system		■	■	■				
	Assist the municipalities with finding funds				■	■	■		
	Study potential alternative dumping sites that are outside the sensitive area of the Wadi							■	
	Look for possibilities for local initiatives to organize							■	

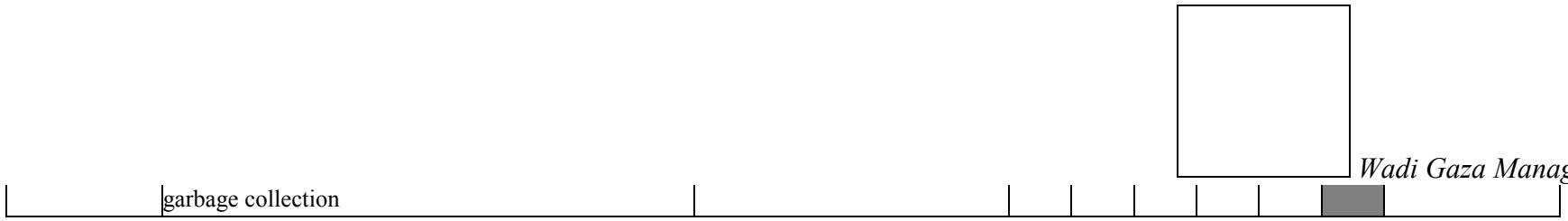
garbage collection

Table 10 (continued): Work plan for the year 2004

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-04	Mar & Apr-04	May & Jun-04	Jul & Aug-04	Sep & Oct-04	Nov & Dec-04	
421S	**Plan for income generating activities**								
	Develop and implement a plan to stimulate income-generating activities	Site manager, socio-economic expert, fauna flora monitoring staff							
422T	**Capacity building for income generation**								
	No activities planned for this year								
423S	**Aquaculture regimes study**								
	Determine & study potential fish stocking regimes for the site	Aquaculture specialist							
	Test recommended fish stocking regimes for the site	Site manager & aquaculture specialist							
511F	**Reference and baseline data**								
	Develop a comprehensive database that contains all data for the site	Wadi Gaza Staff							
	Produce copies of Wadi Gaza reports	Wadi Gaza Staff							
512F	**Ringing station**								
	Procurement of all necessary equipment	Site manager							
	Registering and ringing activities	Bird monitoring staff member							

Table 10 (continued): Work plan for the year 2004

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-04	Mar & Apr-04	May & Jun-04	Jul & Aug-04	Sep & Oct-04	Nov & Dec-04	
521P	**Awareness program for local stakeholders**								
	Prepare meetings, public workshops and informative field tours	Staff member for Public awareness program							
	Conduct planned meetings, public workshops and informative field tours	Staff member for Public awareness program							
522F	**Information center**								
	Develop a plan or design to upgrade the information center	Site manager, architect							
523P	**Wadi Gaza volunteers**								
	Develop periodic special events within Wadi Gaza, in which people can help and participate with management activities	Staff member for Public awareness program							
	Implement periodic special events within Wadi Gaza, in which people can help and participate with management activities	Staff member for Public awareness program							
524F	**Visitor management and facilities**								
	Implement the facilities that are necessary for visitors (e.g. hiking trails, garbage bins, signposts, observation towers etc.).	Site manager, Project staff USAID							

Table 10 (continued): Work plan for the year 2004

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-04	Mar & Apr-04	May & Jun-04	Jul & Aug-04	Sep & Oct-04	Nov & Dec-04	
531E	**Environmental awareness school program**								
	Organize a teacher- training program on wetland and water conservation issues	Staff member for Public awareness program							
	Develop wetland and water school programs for primary, secondary and tertiary level students	Staff member for Public awareness program							
	Submit wetland and water school programs to local schools	Staff member for Public awareness program							
532F	**Education room**								
	No activities planned for this year								
541L	**Tourism development plan**								
	No activities planned for this year								
611A	**Team recruitment**								
	Completion of project								
612T	**Staff training**								
	Completion of project								
621A	**Local Management Advisory Committee**								
	Completion of project								
631A	**Vehicles, tools and machinery**								

	Completion of project								

Table 9: Work plan year 2005

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-05	Mar & Apr-05	May & Jun-05	Jul & Aug-05	Sep & Oct-05	Nov & Dec-05	
111M	**Habitat monitoring**								
	Conduct habitat survey	Fauna & vegetation monitoring staffs					■		
121M	**Bird monitoring**								
	Conduct systematic bird surveys	Fauna monitoring staff	■	■	■	■	■	■	
122S	**Status of threatened birds**								
	Survey the numbers and locations of target species, including corncrake	Fauna monitoring staff	■	■	■	■	■	■	
	Report on threatened species biology in Wadi Gaza	Fauna monitoring staff						■	
123P	**Visitor participation**								
	Update forms that can be filled in by visitors	Fauna monitoring staff	■						
	Update bird monitoring database	Fauna monitoring staff			■			■	
131M	**Vegetation monitoring**								
	Conduct vegetation survey	Vegetation monitoring staff	■	■					
141M	**Fish and Aquatic invertebrate fauna survey**								
	Conduct fish and aquatic invertebrate survey	Local experts fish & aquatic invertebrates				■	■		

151L	**Hunting regulations**									
	Monitor the number of poached animals	Fauna monitoring staff								

Table 11 (continued): Work plan for the year 2005

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-05	Mar & Apr-05	May & Jun-05	Jul & Aug-05	Sep & Oct-05	Nov & Dec-05	
161M	**Soil survey**								
	Contract an external expert or institution and conduct soil survey	Site manager							
	Build the capacity of the staff in the use and analysis of the soil data	Soil expert / institution							
171L	**Defining urban growth areas**								
	Completion of project								
172S	**Maximising current urban land use**								
	Study intensive use urban areas	Urban planning staff							
	Disseminating results to the responsible authorities	Site manager & urban planning staff							
173L	**Land use planning and policies in Wadi Gaza**								
	Completion of project								
174L	**Regulations to prevent urban encroachment**								
	Completion of project								
181S	**Alternative agricultural growth areas**								
	Completion of project								

Table 11 (continued): Work plan for the year 2005

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-05	Mar & Apr-05	May & Jun-05	Jul & Aug-05	Sep & Oct-05	Nov & Dec-05	
182L	**Regulations to prevent agricultural encroachment**								
	Completion of project								
211L	**Regulations for the natural flow of Wadi Gaza**								
	Train wardens to ensure the enforcement of these rules and regulations	Site Manager, EQA staff							
212S	**Restoration of natural flow**								
	Completion of project								
221C	**Restoration of vegetation diversity**								
	Planting of nursery seedlings	Site staff / warden							
	Control the encroachment of dominating species	Site staff / warden							
222C	**Rehabilitation of saline and brackish habitats**								
	Implement plan to restore saline and brackish conditions								
223C	**Impact and control of alien plants**								
	Cutting of alien plants where necessary								
231L	**Wastewater treatment and infrastructure**								
	Completion of project								

Table 11 (continued): Work plan for the year 2005

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-05	Mar & Apr-05	May & Jun-05	Jul & Aug-05	Sep & Oct-05	Nov & Dec-05	
232M	**Hydrology and water quality monitoring**								
	Collection of water quality data		■	■	■	■	■	■	
233S	**Best use of fertilizers in agriculture**								
	Study nutrient flow on agricultural fields around Wadi Gaza	Specialist in nutrient flow in agriculture	■	■					
	Study alternatives to reduce the use of fertilisers	Specialist in ecological farming		■	■				
	Communicate these alternatives to farmers and promote them	MOA & Agricultural NGO's				■	■	■	
241S	**Techniques for mosquito control**								
	Apply these alternative techniques in the site	Site Manager & EQA staff		■					
	Monitor the effects of these techniques on the mosquito larvae and the site as a whole	Site Manager, municipalities & EQA staff		■	■	■	■		
242L	**Mosquito control regulations and enforcement**								
	Train wardens to ensure the enforcement of new rules and regulations	Site Manager, EQA staff	■						
251L	**Prevention of dumping**								
	Train wardens to ensure the enforcement of new rules and regulations	Site Manager, EQA staff	■						
261S	**Technical solutions for the re-establishment of animal migration**								
	No activities planned for this year								

Table 11 (continued): Work plan for the year 2005

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-05	Mar & Apr-05	May & Jun-05	Jul & Aug-05	Sep & Oct-05	Nov & Dec-05	
262L	**Plan for the restoration of terrestrial animal migration**								
	No activities planned for this year								
311C	**Sustainable grazing management**								
	No activities planned for this year								
312C	**Regulations for woodcutting**								
	No activities planned for this year								
313C	**Regulations for sand and stone quarrying**								
	No activities planned for this year								
321L	**Reduction of groundwater extraction**								
	Study the amount of water that is currently pumped up in the Gaza Strip	Hydrology specialist							
	Study the current regulations for water extraction in the Gaza Strip	EQA staff							
	Develop a proposal for the regulation of groundwater extraction in the Gaza Strip	EQA staff, Legal advisor							
	Submit the proposal to PWA, EQA and MOPIC	Site Manager, EQA staff							
	Lobby with the PWA, EQA and MOPIC to implement these regulations	Site Manager, EQA staff							

Table 11 (continued): Work plan for the year 2005

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-05	Mar & Apr-05	May & Jun-05	Jul & Aug-05	Sep & Oct-05	Nov & Dec-05	
322L	**Sustainable water management**								
	Study more efficient water use possibilities in Wadi Gaza	Hydrology specialist							
	Submit results to EQA and NGO's working on water management in the Gaza Strip	Site Manager, EQA staff							
	Develop a efficient water use document for the Wadi Gaza awareness campaign (see project 1.5)	Site Manager, EQA staff							
411L	**Garbage collection and processing**								
	No activities planned for this year								
421S	**Plan for income generating activities**								
	Implement income generating plan	Site manager							
422T	**Capacity building for income generation**								
	Conduct training and workshops, and provide facilities to people of the local communities to engage in income generating activities in the site	Staff member for Public awareness program							
423S	**Aquaculture regimes study**								
	Completion of project								
511F	**Reference and baseline data**								
	Completion of project								
512F	**Ringing station**								
	Registering and ringing activities	Bird monitoring staff member							

Table 11 (continued): Work plan for the year 2005

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-05	Mar & Apr-05	May & Jun-05	Jul & Aug-05	Sep & Oct-05	Nov & Dec-05	
521P	**Awareness program for local stakeholders**								
	Conduct planned meetings, public workshops and informative field tours	Staff member for Public awareness program							
522F	**Information center**								
	Implement plan or design to upgrade the information center								
523P	**Wadi Gaza volunteers**								
	Implement periodic special events within Wadi Gaza, in which people can help and participate with management activities	Staff member for Public awareness program							
524F	**Visitor management and facilities**								
	Implement the facilities that are necessary for visitors (e.g. hiking trails, garbage bins, signposts, observation towers etc.).	Site manager, Project staff USAID							
531E	**Environmental awareness school program**								
	Organize a teacher- training program on wetland and water conservation issues	Staff member for Public awareness program							
532F	**Education room**								
	No activities planned for this year								

Table 11 (continued): Work plan for the year 2005

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-05	Mar & Apr-05	May & Jun-05	Jul & Aug-05	Sep & Oct-05	Nov & Dec-05	
541L	**Tourism development plan**								
	Work on a tourism development plan for Wadi Gaza in cooperation with other ministries and non-governmental institutions	Staff member for Public awareness program							
611A	**Team recruitment**								
	Completion of project								
612T	**Staff training**								
	Completion of project								
621A	**Local Management Advisory Committee**								
	Completion of project								
631A	**Vehicles, tools and machinery**								
	Completion of project								

Table 10: Work plan year 2006.

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-06	Mar & Apr-06	May & Jun-06	Jul & Aug-06	Sep & Oct-06	Nov & Dec-06	
111M	**Habitat monitoring**								
	Conduct habitat survey	Fauna & vegetation monitoring staffs					■		
121M	**Bird monitoring**								
	Conduct systematic bird surveys	Fauna monitoring staff	■	■	■	■	■	■	
122S	**Status of threatened birds**								
	Survey the numbers and locations of target species	Fauna monitoring staff	■	■	■	■	■	■	
	Report on threatened species biology in Wadi Gaza	Fauna monitoring staff						■	
123P	**Visitor participation**								
	Update forms that can be filled in by visitors	Fauna monitoring staff	■						
	Update bird monitoring database	Fauna monitoring staff			■			■	
131M	**Vegetation monitoring**								
	Conduct vegetation survey	Vegetation monitoring staff	■	■					
141M	**Fish and Aquatic invertebrate fauna survey**								
	Conduct fish and aquatic invertebrate survey	Local experts fish & aquatic invertebrates				■	■		
151L	**Hunting regulations**								
	Monitor the number of poached animals	Fauna monitoring staff	■	■	■	■	■	■	

Table 12 (continued): Work plan for the year 2006

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-06	Mar & Apr-06	May & Jun-06	Jul & Aug-06	Sep & Oct-06	Nov & Dec-06	
161M	**Soil survey**								
	Completion of project								
171L	**Defining urban growth areas**								
	Completion of project								
172S	**Maximising current urban land use**								
	Completion of project								
173L	**Land use planning and policies in Wadi Gaza**								
	Completion of project								
174L	**Regulations to prevent urban encroachment**								
	Completion of project								
181S	**Alternative agricultural growth areas**								
	Completion of project								
182L	**Regulations to prevent agricultural encroachment**								
	Completion of project								

Table 12 (continued): Work plan for the year 2006

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-06	Mar & Apr-06	May & Jun-06	Jul & Aug-06	Sep & Oct-06	Nov & Dec-06	
211L	**regulations for the natural flow of Wadi Gaza**								
	Completion of project								
212S	**Restoration of natural flow**								
	Completion of project								
221C	**Restoration of vegetation diversity**								
	Planting of nursery seedlings	Site staff / warden							
	Control the encroachment of dominating species	Site staff / warden							
222C	**Rehabilitation of saline and brackish habitats**								
	Implement plan to restore saline and brackish conditions								
223C	**Impact and control of alien plants**								
	Cutting of alien plants where necessary								
231L	**Wastewater treatment and infrastructure**								
	Completion of project								
232M	**Hydrology and water quality monitoring**								
	Collection of water quality data								
233S	**Best use of fertilizers in agriculture**								
	Completion of project								

Table 12 (continued): Work plan for the year 2006

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-06	Mar & Apr-06	May & Jun-06	Jul & Aug-06	Sep & Oct-06	Nov & Dec-06	
241S	**Techniques for mosquito control**								
	Apply these alternative techniques in the site	Site Manager & EQA staff							
	Monitor the effects of these techniques on the mosquito larvae and the site as a whole	Site Manager, municipalities & EQA staff							
242L	**Mosquito control regulations and enforcement**								
	Completion of project								
251L	**Prevention of dumping**								
	Completion of project								
261S	**Technical solutions for the re-establishment of animal migration**								
	Study migratory routes of terrestrial animals	Fauna monitoring staff							
	Study to restore (of ground bound) animal migration	Fauna monitoring staff Fauna expert							
	Report results of the studies	Fauna monitoring staff Fauna expert							
	Submit the report to the relevant authorities	Site manager							
262L	**Plan for the restoration of terrestrial animal migration**								
	Study international agreements concerning natural reserves and parks in the Middle East								
	Report the international legal obligations concerning nature reserves								
	Submit this report to the responsible authorities								

Table 12 (continued): Work plan for the year 2006

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-06	Mar & Apr-06	May & Jun-06	Jul & Aug-06	Sep & Oct-06	Nov & Dec-06	
311C	**Sustainable grazing management**								
	Completion of project								
312C	**Regulations for woodcutting**								
	Completion of project								
313C	**Regulations for sand and stone quarrying**								
	Completion of project								
321L	**Reduction of groundwater extraction**								
	Lobby with the PWA, EQA and MOPIC to implement these regulations	Site Manager, EQA staff							
411L	**Garbage collection and processing**								
	Completion of project								
421S	**Plan for income generating activities**								
	Implement income generating plan	Site manager							
422T	**Capacity building for income generation**								
	Completion of project								
423S	**Aquaculture regimes study**								
	Completion of project								
511F	**Reference and baseline data**								

	Completion of project								

Table 12 (continued): Work plan for the year 2006

Project code	Project Title & Activities	Responsibility	Period						Budget ($)
			Jan & Feb-06	Mar & Apr-06	May & Jun-06	Jul & Aug-06	Sep & Oct-06	Nov & Dec-06	
512F	**Ringing station**								
	Registering and ringing activities								
521P	**Awareness program for local stakeholders**								
	Conduct planned meetings, public workshops and informative field tours	Staff member for Public awareness program							
522F	**Information center**								
	Implement plan or design to upgrade the information center	Site manager							
523P	**Wadi Gaza volunteers**								
	Implement periodic special events within Wadi Gaza, in which people can help and participate with management activities	Staff member for Public awareness program							
524F	**Visitor management and facilities**								
	Completion of project								
531E	**Environmental awareness school program**								
	Organize a teacher- training program on wetland and water conservation issues	Staff member for Public awareness program							

Table 12 (continued): Work plan for the year 2006

Project code	**Project Title & Activities**	**Responsibility**	**Period**						Budget ($)
			Jan & Feb-06	Mar & Apr-06	May & Jun-06	Jul & Aug-06	Sep & Oct-06	Nov & Dec-06	
532F	**Education room**								
	Design a room in the visitors center dedicated to educational purposes.	Staff member for Public awareness program							
	Develop a room in the visitors center dedicated to educational purposes.	Staff member for Public awareness program							
541L	**Tourism development plan**								
	Work on a tourism development plan for Wadi Gaza in cooperation with other ministries and non-governmental institutions								
611A	**Team recruitment**								
	Completion of project								
612T	**Staff training**								
	Completion of project								
621A	**Local Management Advisory Committee**								
	Completion of project								
631A	**Vehicles, tools and machinery**								
	Completion of project								

5. REVIEW

5.1 The annual review – progress towards objectives

The annual review will take place during the last 2 months of each year of the management plan. The annual review will be the responsibility of the site manager. Figure 15 shows the process for the annual review.

The annual review will assess progress in the projects outlined in **Chapter 4.3**. The review will check whether the performance indicators have been met and the work, resources and time taken to do it. Difficulties in completing tasks, starting tasks and other delays will also be recorded. The site manager* is required to bring difficulties and other matters promptly to the attention of the Local Management Advisory Committee (LMAC) and other associated institutions such as the Environmental Quality Authority (EQA).

An annual project review sheet has been devised to standardize and systematically record the results of the review. Difficulties in completing tasks can be logged under the heading "Remarks". An example of the annual project review sheet is given in Annex 4 of this plan.

Comments, complaints and suggestions made by visitors, the Local Management Advisory Committee or others associated with the site should also be logged and incorporated in the annual review.

The review will act as a record of project performances and difficulties in completing tasks, and allow the quantity and quality of the work done to be evaluated in relation to the resources available (in finances and manpower). The value of this approach is that a re-evaluation of resources can be made and presented to the Local Management Advisory Committee (LMAC) or others associated with the site and seeking feedback.

The results, including feedback from the review, can be used to fine-tune planning for the following year including, if necessary, a revision or modification of targets, times and resources in the work plan to address shortcomings, incomplete tasks and changes in priority or needs.

*The annual review is an excellent tool for providing feedback to the various bodies and stakeholders about the implementation and progress of management. Management is, however, a continuous process and **the site manager**, especially, should be aware at all times of the targets, timetable and measures to keep the management plan on track. The manager should also show a degree of flexibility, particularly in face of challenges or obstacles which may crop up unexpectedly and require a rapid response.

Figure 16: Annual review process

5.2 The four-year review of the management plan

The duration of this, the first Wadi Gaza management plan has been set at four years. The choice of four years is because of the rapidly changing political, social, economic and ecological forces which affect the site. It is both appropriate and essential to know to what extent the objectives have been met. The four-year review is therefore objective based and assesses whether they have been or are being achieved. The review also gives the opportunity to assess other aspects such as costs and benefits. The four-year review will be initiated at the beginning of the fourth year. As with the annual reviews, the four-year review will the responsibility of the site manager.

The four-year review follows the same process as the annual reviews. However, as the four-year review is objective based, it will be done according to the list of objectives in **Chapter 3.5**. The review will assess the extent to which each objective has been achieved, what resources were used and the benefits accruing – both to the environment and the local people. This assessment can draw on and will be helped by the previous annual reviews. Difficulties in achieving objectives should be raised by the site manager with the Local Management Advisory Committee (LMAC) and other associated institutions such as the Environmental Quality Authority (EQA).

After the review of the objectives has been completed, the quantity and quality of the work done can be measured against the resources that have been used (financial and manpower). The results of the four-year review will be presented to the Local Management Advisory Committee (LMAC) and as a feedback mechanism for stakeholders and other bodies associated with the site.

The feedback from the Local Management Advisory Committee (LMAC) and stakeholders as a result of the review, can be used alongside the review to guide preparation of the next management plan. It will be an essential tool in determining the shape of the second management plan; in identifying changes or revisions to the objectives; and in determining the implementation measures to be applied from year 5. To meet this timetable, the revision of the first management plan should take place during the second half of the fourth year, prior to its end.

Figure 17: Process four-year review

ANNEX 1: References

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ANNEX 2: Glossary

AMSL: above mean sea level.
- **aquiclude**: a virtually impermeable layer above or below the aquifer.
- **aquifer**: groundwater reservoir; water-holding rock body or layer.
- **check dams**: water retaining dams, i.e. dams constructed for the purpose of intercepting and retaining water.

CMS: Convention on the Conservation of Migratory Species of Wild Animals (sometimes shortened to *Convention on Migratory Species*).
- **conglomerates**: coarse-grained sedimentary rocks composed of pebbles set in a finer textured matrix.

ECD-GE: European Commission Directorate-General Environment.
EEC: European Economic Community.
EEA: European Environment Agency.
- **eolian**: sediments deposited by the wind.

EQA: Environmental Quality Authority.
EU: European Union.
- **halophyte**: a plant of salt rich soils.
- **halophytic**: pertaining to plants of salt rich soils.
- **hectare**: a metric measurement of area; one hectare equals 10,000 square meters (100,000 dunums).
- **Holocene**: a geological term. The most recent geological epoch – spanning the last 10,000 years.

IBA: Important Bird Area (a *BirdLife International* designation for sites of international importance for birds).
IUCN: International Union for the Conservation of Nature.
- **legume**: a member of a large plant family which produces generally large seeds in distinct, elongated pods. The family includes such well known agricultural crops as peas and beans.
- **loess**: a wind-blown loamy deposit found in river valleys.
- **MenA:** Ministry of Environmental Affairs
- **metapopulation**:
- **Miocene**: a geological term. An epoch in the Tertiary period, 26 million to 7 million years before present
- **MOAG**: Ministry of Agriculture.
- **MOLG**: Ministry of Local Government.
- **monoculture**: an extensive patch of vegetation solely composed of a single species.
- **MOJ**: Ministry of Justice.
- **MOPIC**: Ministry of Planning and International Cooperation.
- **MOPWH**: Ministry of Public Works and Housing.
- **MOTA**: Ministry of Tourism and Antiquities.
- **MWC**: MedWetCoast.
- **NGO**: Non governmental organization.
- **PARC**: Palestinian Agricultural Relief Committees.
- **PEPA**: Palestinian Environmental Protection Agency.
- **phreatic**: relating to the water table/groundwater.
- **Pleistocene**: a geological term. An epoch in the Quaternary period, c2 million to 10,000 years before present.
- **Pliocene**: a geological term. An epoch in the Tertiary period, 7 million to 2 million years before present.
- **PNA**: Palestine National Authority
- **PRA**: Participatory Rapid Appraisal (a socio-economic survey technique)
- **Quaternary**: the most recent geological period from about 2 million years ago to the present, and incorporating the Pleistocene and Pliocene epochs.
- **RAMSAR Convention**: name of an international convention established in the town of Ramsar (Iran) in 1971. Country signatories to the Convention undertake to include their wetland sites of International Importance on a "Ramsar site list" and to protect and conserve these sites.
- **Tertiary**: the geological period preceding the Quartenary; from about 65 million to about 2 million years ago.
- **USAID**: United States Agency for International Development.
- **UNDP/PAPP**: United Nations Development Program/Program of Assistance to the Palestinian People.
- **waders**: small to medium sized birds with long legs, belonging to the Charadriidae family. They are normally associated with the water's edge and use their long legs to wade into the water.
- **waqf land**:

Annex 3. The MedWetCoast Initiative

MedWetCoast is a **Med**iterrean **Wet**lands **coast**al initiative. Its full title is ***Conservation of Wetland Coastal Ecosystems in the Mediterranean Region*** (MedWetCoast). The project was created by the ***United National Development Programme*** (UNDP) and the ***United Nations Office for Project Services*** (UNOPS), and is funded by the ***Global Environment Facility*** (GEF) with co-funding from the ***Fond Français pour l'Environnement Mondial*** (FFEM). Its main aim is to conserve coastal and wetland biodiversity of global and regional importance in the Mediterranean basin. The pilot sites for the project are 15 key wetlands in six countries/authority: Albania, Egypt, Lebanon, Morocco, Palestinian Authority (Wadi Gaza) and Tunisia.

The project is based upon three distinct and complementary actions.

1. At local level:
   a) Implementing sustainable management at the 15 pilot sites. Involving local stakeholders through local intersectoral management committee in support of that process.

2. At national level:
   a) Developing an innovative legal framework for removing the causes of biodiversity degradation.
   b) Reinforcing the institutions involved in the management of natural resources and promoting coordinated policies.

3. At regional level:
   a) Strengthening capacities through training and technical assistance.
   b) Developing and sharing the Mediterranean experience through networking.

The Regional Facilitation Unit

Methodological support for the project is provided by the Regional Facilitation Unit (RFU), hosted by France at the Tour du Valat Biological Station, in the Camargue - itself a major Mediterranean wetland. The RFU provides national institutions with various methods and tools that have been developed and validated during MedWet projects. In addition, other specific tools have been developed specially for the project with the support of international experts. This has allowed a unified approach across the region, based on uniform terms of reference for the ***site diagnosis*** studies and an international standard framework for the ***management plans***.

Site diagnosis. The first active stage at Wadi Gaza was the collection of data, past and present, on the circumstances and values of the site. This extended beyond environmental issues alone to take into account the socio-economic situation of the local people, including their aspirations for the future. The outcome was a series of surveys and investigations which were analysed and presented in a Site Diagnosis report.
Management plan. The results of the site diagnosis, and the recommendations from it, form the basis of the management plan which appears here.

In addition to the methodological guidelines, ***international experts*** support the national components in implementing the field activities related to the site diagnosis and to the development of management plans. A series of regional technical meetings have also been organised as further support and as capacity building excercises. These meetings not only contribute to strengthen technical aspects but also facilitate a greater exchange of experience among the project partners and recognised Mediterranean wetland technical experts.

The ***international expert*** called upon to support the site diagnosis studies for Wadi Gaza was Christian Pérennou. Christian is Project Leader at the Tour du Valat Biological Station, Camargue, France, and has considerable and wide ranging experience in wetland issues. International support at the management plan drafting stage was provided by Nick Riddiford, head of The Albufera International Biodiversity Group (TAIB) and Principal Investigator of a long-running study into biodiversity, environmental change and their implications for management at a major wetland and protected area in Mallorca, Spain.

Regional meetings are organised to consolidate the working principles at national and regional level. The regional component of the project fulfils the following objectives:

- To strengthening the capacities and experience of MedWetCoast Project participants;
- To constitute an operational network between the actors in the different countries.

Strengthening Capacity

The capacity strengthening objective is achieved through training and technical assistance.

Training: training is an essential tool within the framework of this project for strengthening national and local capacities of site managers. Emphasis has been placed on developing and implementing training plans which respond to specific project needs in each country as well as at regional level. Identifying training requirements enables training courses to be constructed that respond precisely to the project challenges. The French environmental training specialists, Atelier Technique des Espaces Naturels (ATEN) has taken a lead in this, conducting missions to all participating countries to analyse training requirements. A regional training programme has been devised and national training plans proposed for the partners in each country. Each year, several regional training sessions are held in support of the various development phases of the project.

Networking

Networking is achieved in a series of ways. The RFU has harnessed Mediterranean wetland expertise in the form of a team of international experts. These specialists advise and support the national units on a one-to-one basis through communications, meetings, site visits and fieldwork training. National and regional meetings and training courses bring experts and participants together as a wider group and optimises exchange of experience among project partners within the Mediterranean basin as a whole.

Incorporating socio-economic issues and the ***concept of sustainability*** into the management process widens the group even further. A common approach to the site diagnoses, through adherence to the MWC terms of reference, lends regional comparability to the results; and the same applies to the management plans through adherence to a logical framework approach (ATEN) and to an international standard

management plan process and format (Eurosite). The implementation of a uniform, unified approach strengthens the value and the power of the results over the entire network.

Concept of sustainability. Sustainability is at the heart of the MedWetCoast project and central to the process of management planning. The management plans for MedWetCoast wetland sites are designed to take this into account and seek to establish corridors of communication to all stakeholders. Their inclusion opens the door to the constitution of operational networks at site and national levels. Civil servants, local authorities, NGOs, scientists, representatives of populations are all drawn into the implementation stage, thus establishing further exchanges and partnerships. MedWetCoast provides a regional dimension, assisting national and local components by facilitating the transfer and the optimisation of experiences among the project partners within the Mediterranean basin as a whole.

Expanding the network

This networking can extend further. The MedWetCoast project aims to catalyse a sustainable mechanism for the conservation of wetlands and coastal areas throughout the Mediterranean basin. At the international level it works in close collaboration with existing regional activities, and in particular the MedWet Initiative, the Ramsar Convention and the Mediterranean Action Plan (the Barcelona Convention). It is also forging operational links with the Mediterranean programmes of organizations such as the IUCN and the WWF. This form of networking allows the results and experiences of the MedWetCoast project to be disseminated widely and to be built upon in future - as well as mobilizing the extensive potential of knowledge, skills and action that exist within the different organizations. Returning to the national and site level, the experience and skills gained by the six countries involved in the MWC project form the foundations for effective dissemination to sites and countries nearby and throughout the region.

MedWetCoast, closing the circle

In a part of the world where biodiversity is at the same time among the richest and the most threatened, the MedWetCoast project will thus actively contribute to conserve biodiversity and to “close the Mediterranean circle”.

News about the MWC program, Wadi Gaza and the other sites involved in the project, can be found on the MedWetCoast website: www.medwetcoast.com

ANNEX 3: Annual review sheet

Project annual review sheet				
Project name:				
Operational objective:				
Outputs:				
Indicators:	**Have the indicators been met?**	**Description**		
List of activities:	**Work done?**	**Resources used?**	**Time taken?**	**Remarks:**

ANNEX 4: Provisional Health and Safety Schedule for Wadi Gaza Nature Reserve

List of Health and Safety issues	**Applying to:**	
Description	*Visitors*	*Staff*
Unless by boat or floating craft, entry in the estuary lake will be forbidden because of the unpredictable depth of the mud layer	Yes	Yes
Visitors and staff should be warned not to drink water from the wetland or to use it for washing their hands or other parts of their bodies	Yes	Yes
Establish a drinking water station at the entrance of the site for visitors and staff	Yes	Yes
Staff should be aware of the potential risks of poisonous or hazardous animals or plants in the site	Advice from staff	Yes
Dead animals may only be handled by staff wearing protective gloves	Advice from staff	Yes
Staff members who capture animals for ringing or other purposes must be vaccinated against Tetanus and Rabies (bats)		Yes
Staff members who capture animals for ringing or other purposes must work in teams of two or more people		Yes
The observation towers must be checked weekly for defects or other hazards that could pose a health risk		Yes
The hiking trail and roads in the site must be checked every two weeks for hazards that could pose a health risk, like exposed boulders or deep pits		Yes
All wooden structures, e.g. the observation towers, must contain a fire extinguisher		Yes
All wooden structures, e.g. the observation towers, must be checked weekly for splinters		Yes
Staff members who find defects or other potential health risks must arrange the repair of these defects as soon as possible		Yes
Small fences must be placed alongside roads and trails that run past steep unstable slopes in the site		Yes
Warning signs and information boards must be placed around deep pits, including construction pits and those caused by flash floods	Advising visitors	Yes
At least one first aid kit must be available in one of the facilities on site	Advice from staff	Yes
Ladders and hand-rails need to be placed on steep ascents or descents, e.g. to observation towers		Yes
The site must be closed to visitors during flash floods	Advice from staff	Yes
Visitors and staff should wear protective head-wear and carry a minimum 1.5 liters of water per person during the hotter months of the year	Yes	Yes
A leaflet needs to be drawn up for visitors indicating the do's and don'ts in the site and where staff members can be found in case of an emergency	Yes	
At least one staff member on site must have done a first aid course in case of emergencies		Yes
Develop and maintain an effective program of collection, compilation and analysis of visitors and occupational safety and health statistics		Yes
Organise information programs on the importance of and proper use of adequate safety and health equipment		Yes
Education and training of employers and employees in the recognition,		

avoidance and prevention of unsafe or unhealthy working conditions		Yes

ANNEX 5: Ground photographic coverage

Table: Description of ground photographic source material for Wadi Gaza

Number:	Description:	Year:
1	Cleaning Activities USAID project 2001	2001
2	Cleaning Activities USAID project 2001	2001
3	Cleaning Activities USAID project 2001	2001
4	Cleaning Activities USAID project 2001	2001
5	Cleaning Activities USAID project 2001	2001
6	Cleaning Activities USAID project 2001	2001
7	Cleaning Activities USAID project 2001	2001
8	Cleaning Activities USAID project 2001	2001
9	Cleaning Activities USAID project 2001	2001
10	Cleaning Activities USAID project 2001	2001
11	Cleaning Activities USAID project 2001	2001
12	Cleaning Activities USAID project 2001	2001
13	Cleaning Activities USAID project 2001	2001
14	Cleaning Activities USAID project 2001	2001
15	Construction Debris removal USAID project 2001	2001
16	Construction Debris removal USAID project 2001	2001
17	Construction Debris removal USAID project 2001	2001
18	Cleaning Activities USAID project 2001	2001
19	Cleaning Activities USAID project 2001	2001
20	Cleaning Activities USAID project 2001	2001
21	Cleaning Activities USAID project 2001	2001
22	Cleaning Activities USAID project 2001	2001
23	Cleaning Activities USAID project 2001	2001
24	Cleaning Activities USAID project 2001	2001
25	Cleaning Activities USAID project 2001	2001
26	Cleaning Activities USAID project 2001	2001
27	Cleaning Activities USAID project 2001	2001
28	Cleaning Activities USAID project 2001	2001
29	Cleaning Activities USAID project 2001	2001
30	Project plate, visibility	2001
31	Cleaning Activities USAID project 2001	2001
32	Cleaning Activities USAID project 2001	2001

Number:	Description:	Year:
33	Cleaning Activities USAID project 2001	2001
34	Cleaning Activities USAID project 2001	2001
35	Pollution in Wadi Gaza	2002
36	Pollution in Wadi Gaza, sewage	2002
37	Pollution in Wadi Gaza	2002

38	Pollution in Wadi Gaza	2002
39	Pollution in Wadi Gaza	2002
40	Pollution in Wadi Gaza	2002
41	Pollution in Wadi Gaza	2002
42	Pollution in Wadi Gaza	2002
43	Pollution in Wadi Gaza	2002
44	Pollution in Wadi Gaza	2002
45	Pollution in Wadi Gaza	2002
46	Pollution in Wadi Gaza	2002
47	Pollution in Wadi Gaza	2002
48	Pollution in Wadi Gaza	2002
49	Cleaned areas in Wadi Gaza	2001
50	Cleaned areas in Wadi Gaza	2001
51	Cleaned areas in Wadi Gaza	2001
52	Cleaned areas in Wadi Gaza	2001
53	Cleaned areas in Wadi Gaza	2001
54	Cleaned areas in Wadi Gaza	2001
55	Cleaned areas in Wadi Gaza	2001
56	Cleaned areas in Wadi Gaza	2001
57	Cleaned areas in Wadi Gaza	2001
58	Cleaned areas in Wadi Gaza	2001
59	Cleaned areas in Wadi Gaza	2001
60	Cleaned areas in Wadi Gaza	2001
61	Cleaned areas in Wadi Gaza	2001
62	Cleaned areas in Wadi Gaza	2001
63	Project staff member	2001
64	Information center	2001
65	Information center	2001
66	Cleaned areas in Wadi Gaza	2001
67	Cleaned areas in Wadi Gaza	2001
68	Cleaned areas in Wadi Gaza	2001
69	Cleaned areas in Wadi Gaza	2001
70	Meeting with representatives of local community	2001
71	Meeting with representatives of local community	2001
72	Meeting with representatives of local community	2001
73	Wadi Gaza Project Logo	2002
74	Wadi Gaza Poster	2002
75	Wadi Gaza Poster	2002
76	Wadi Gaza Poster	2002
77	tel-esakan excavation	2001
78	Awareness tour & meeting	2001
79	Awareness tour & meeting	2001
80	Awareness tour & meeting	2001
81	Awareness tour & meeting	2001
82	Awareness tour & meeting	2001

Number:	**Description:**	**Year:**
83	Cleaning Activities USAID project 2001	2001
84	Cleaning Activities USAID project 2001	2001
85	Cleaning Activities USAID project 2001	2001
86	Cleaning Activities USAID project 2001	2001
87	Cleaning Activities USAID project 2001	2001

88	Cleaning Activities USAID project 2001	2001
89	Cleaning Activities USAID project 2001	2001
90	Cleaning Activities USAID project 2001	2001
91	Cleaning Activities USAID project 2001	2001
92	Construction Debris removal USAID project 2001	2001
93	Construction Debris removal USAID project 2001	2001
94	Construction Debris removal USAID project 2001	2001
95	Construction Debris removal USAID project 2001	2001
96	Construction Debris removal USAID project 2001	2001
97	Construction Debris removal USAID project 2001	2001
98	Planting of tree and shrub seedlings USAID project 2002	2001
99	Planting of tree and shrub seedlings USAID project 2002	2001
100	Planting of tree and shrub seedlings USAID project 2002	2001
101	Planting of tree and shrub seedlings USAID project 2002	2001
102	Planting of tree and shrub seedlings USAID project 2002	2001
103	Planting of tree and shrub seedlings USAID project 2002	2001
104	Planting of tree and shrub seedlings USAID project 2002	2001
105	Construction of Waterharvesting ponds	2002
106	Construction of Waterharvesting ponds	2002
107	Construction of Waterharvesting ponds	2002
108	Construction of Waterharvesting ponds	2002
109	Construction of Waterharvesting ponds	2002
110	Construction of Waterharvesting ponds	2002
111	Construction of Waterharvesting ponds	2002
112	Construction of Waterharvesting ponds	2002
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114	Construction of Waterharvesting ponds	2002
115	Construction of Waterharvesting ponds	2002
116	Construction of Waterharvesting ponds	2002
117	Construction of Waterharvesting ponds	2002
118	Construction of Waterharvesting ponds	2002
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125	Construction of Waterharvesting ponds	2002
126	Construction of Waterharvesting ponds	2002
127	Construction of Waterharvesting ponds	2002
128	Construction of Waterharvesting ponds	2002
129	Construction of Waterharvesting ponds	2002
130	Construction of Waterharvesting ponds	2002
131	Agricultural road	2003
132	Agricultural road	2003

Number:	**Description:**	**Year:**
133	Agricultural road	2003
134	Agricultural road	2003
135	Agricultural road	2003
136	Agricultural road	2003
137	Agricultural road	2003

138	Agricultural road	2003
139	Agricultural road	2003
140	Agricultural road	2003
141	Agricultural road	2003
142	Agricultural road	2003
143	Agricultural road	2003
144	Agricultural road	2003
145	Agricultural road	2003
146	Agricultural road	2003
147	Agricultural road	2003
148	Olive tree plantings	2003
149	Olive tree plantings	2003
150	Water harvesting pond construction	2003
151	Agricultural road	2003
152	Irrigation from WH ponds	2003
153	Water harvesting pond construction	2003
154	Agricultural road	2003
155	Irrigation from WH ponds	2003
156	Wood cutting in the site	2003
157	Tree plantings	2003
158	Tree plantings	2003
159	Planted tree species	2003
160	Planted tree species	2003
161	Sewage outlet at the beach	2002
162	Little egrets in Wadi Gaza	2002
163	Sewage outlet from Al Nusseirat refugee camp	2002
164	Aquatic invertebrates in the freshwater pond of Wadi Gaza	2002
165	Wadi Gaza view	2002
166	Wadi Gaza view	2002
167	Wadi Gaza view	2002
168	Wadi Gaza Flora	2003
169	Wadi Gaza Flora	2003
170	Wadi Gaza Flora	2003
171	Wadi Gaza Flora	2003
172	Wadi Gaza Flora	2003
173	Wadi Gaza Flora	2003
174	Wadi Gaza Flora	2003
175	Wadi Gaza Flora	2003
176	Wadi Gaza Flora	2003
177	Wadi Gaza Flora	2003
178	Wadi Gaza Flora	2003
179	Wadi Gaza Flora	2003
180	Wadi Gaza Flora	2003
181	Wadi Gaza Flora	2003
182	Wadi Gaza Flora	2003

Number:	**Description:**	**Year:**
183	Wadi Gaza Flora	2003
184	Wadi Gaza Flora	2003
185	Wadi Gaza Flora	2003
186	Wadi Gaza Flora	2003
187	Wadi Gaza Flora	2003

188	Wadi Gaza Flora	2003
189	Wadi Gaza Flora	2003
190	Wadi Gaza habitats	2003
191	Wadi Gaza habitats	2003
192	Wadi Gaza habitats	2003
193	Wadi Gaza habitats	2003
194	Wadi Gaza habitats	2003
195	Wadi Gaza habitats	2003
196	Wadi Gaza habitats	2003
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206	Wadi Gaza habitats	2003