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WORLD MARITIME UNIVERSITY

Malmö, Sweden

**A STUDY OF DEVELOPMENT OF THE
COASTAL ZONE OF AQABA-JORDAN**

A Suggested Sustainable Model

By

AL-JAFARI DAUD MOHAMMAD

The Hashemite Kingdom of Jordan

A dissertation submitted to the World Maritime University in partial fulfilment to the
requirement for the award of the degree of

MASTER OF SCIENCE

in

**GENERAL MARITIME ADMINISTRATION AND ENVIRONMENT
PROTECTION**

1995

DECLARATION

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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DEDICATION

*For being there supportive and caring
with patience and understanding
I dedicate this dissertation to
my wife Roopa Al-Jafari
and my children
Raji, Dina, Remah and Sanad
who helped me in making this work
possible*

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ABSTRACT

This dissertation focuses on the need to implement integrated coastal management for sustainable development in the region of Aqaba /Jordan, while proposing methods for doing so.

At the beginning, the integrated management process is studied in detail, highlighting its role in creating a steady sustainable relationship between resources and their users in general.

Aqaba is explored as a case-in-point. The reader is introduced to the region geographically, physically, climatically and with an overview of the development, population, and environmental effects.

The economic and social development of the region is examined in detail and the various administrative offices in the area are defined, along with an explanation of their responsibilities.

The effects of the various development on the environment are discussed at length. Ways and means of improving situation are suggested.

In order to facilitate the choice of a suitable strategy, the various proposed plans for development in the region, are explored. A model is suggested, and methods for making it prompt and cost effective are elaborated.

At the end, the previous chapters are summarized as conclusions of the study. Recommendations for future actions of the management system in the region, are enumerated.

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LIST OF ABBREVIATIONS

AM	Aqaba Municipality
APC	Aqaba Port Corporation
ARA	Aqaba Regional Authority
ATPC	Aqaba Town Planning Committee
DAP	Di-Ammonium Phosphate
EC	European Community
EIA	Environmental Impact Assessment
EPA	Environment Protection Agency
GDP	Gross Domestic Product
GAEAP	Gulf of Aqaba Environmental Action Plan
JCC	Jordan Cement Company
JD	Jordan Dinar
JEA	Jordan Electricity Authority
JPMC	Jordan Phosphate Mine Company
ICAM	Integrated Coastal and Marine Area Management
ICZM	Integrated Coastal Zone Management
NGO	Non- Government Organization
MMREA	Ministry of Municipal, Rural Affairs, and the Environment
MSS	Marine Science Station
MTA	Ministry of Tourism and Antiquities
MWI	Ministry of Water and Irrigation
RSCN	Royal Society for the Conservation of Nature
RSS	Royal Scientific Society
SWOT	Strength, Weakness, opportunities and Threats
WHO	World Health Organization

PREFACE TO THE DISSERTATION

A STUDY OF THE DEVELOPMENT OF THE COASTAL ZONE OF AQABA (JORDAN)

A SUGGESTED SUSTAINABLE MODEL

A. INTRODUCTION.

The coastal zone denotes a land-sea interface. This area is a dynamic system of great economic, social and environmental significance to the country as it provides resources for trade, transport, fisheries, aquaculture, infrastructure, industrial development and tourist recreation. These activities tend to put pressure on the environment of the region, depleting the very resources that are being utilized. All the evidence suggests that coastal zones throughout the world are under intense and increasing pressures.

There is an urgent realization in all regions of the world that development and the environment are inescapably interdependent. This reality necessitates policy integration between environment and development among sectors and nations, if sustainable economic and environmental benefits are to apply to present and future generations.

Thus it is important for countries to implement sustainable development at their coasts if they want to avoid the long term effects of unplanned development which will result in lower resource yields, increasing costs of exploitation or significant environment damage (Ref.13).

The goal of sustainable development is "to meet the needs of the present without compromising the ability of future generations to meet their own needs" (Ref. 22. p.8). It is a continuous process of decision making which emphasises development that is "environmentally appropriate, making proper use (and sometimes non-use) of natural resources and protecting essential ecological processes, life support systems, and biological diversity" (Ref. 4, p. 17).

The coastal town of Aqaba is of great significance to the Hashemite Kingdom of Jordan, being its only outlet to the sea. The topic of this dissertation is a case study of the development in and around the coastal zone of Aqaba and the current extent of its pollution problems.

The intent is to examine the existing methods of overall management of the development in the region, identifying any successes or failures of the current management scheme. The study hopes to suggest a possible model for integrated management of the coastal zone to allow continued sustainable development by the authorities responsible.

The present study of the growth and planning activities of Aqaba has been mostly compiled from land-use planning documents of the area, particularly the Master Plan of Aqaba and other related documents like the Environmental Action Plan and Regional Development Plan. These form a foundation for the preparation of this dissertation.

B. THE PURPOSE OF THE STUDY.

The development of the region of Aqaba until now has been mostly haphazard, due to a lack of co-ordination between the various planning authorities which have been acting sectorially. Thus there has been a disbalance between the actual development plans and regional development to date. It is doubtful whether the natural systems can sustain the future development plans that have been drawn up.

Hence the objectives of the Study are:

1. To formulate an environmental profile of the Aqaba region based on available data.
2. To study the effects of the various management programmes in the region, to date.
3. To assess the environmental impacts of various developmental activities and to establish a sustainable model for the optimum use of coastal resources.
4. To suggest general objectives and guidelines towards long term development which harmonizes with the protection of the ecosystem.

C. STRUCTURE OF THE STUDY.

The Study is divided into five parts.

1. The first chapter deals with the concept of Coastal Zone Management, its working and objectives, plus its requirement in the development of Aqaba.

2. The next three chapters are analytical assessments, dealing with:

a. A general profile of the region, introducing the reader to Aqaba, the port city of Jordan (Chapter 2).

b. A study of the development of Aqaba up to its present status. This deals with economic, infrastructure, population and tourism development (Chapter 3).

c. The various management authorities in the area and their achievements which have affected the region so far (Chapter 4).

3. Chapter 5. pays attention to the environmental impacts of development. In the first section the effects related to land management and human impact in the Aqaba region are discussed. The second section deals with other forms of pollution and attempts to identify the agents responsible for environmental degradation of the area. The last part proposes methods for environmental management.

4. Chapter 6. discusses the important steps and issues related to the implementation and development of an Integrated Coastal and Marine Area Management process suited to the region.

This will deal with the following:

a. Defining the need for integrated coastal area/zone management in Aqaba.

b. The general objectives of sustainable development and environmental protection and a proposal for a possible model of institutional arrangement within the framework of Integrated Coastal Zone Management (ICZM).

c. Designating the responsibility and authority for management planning to a single institution in the region.

d. Recommendation for implementation of environmental planning for sustainable development of the area.

5. Chapter 7 constitutes the overall conclusion to the dissertation, summarizing the findings of the study and the recommendations for actions to be taken for the sustainable development of the region.

At the close of each chapter conclusions are drawn for that chapter in discussion form. These also relate to the basic theme of a model for sustainable development in the region.

The study hopes to provide the reader with a clear understanding of the problems of the region and the urgent need to establish a legal and institutional framework for implementation of environmental management while encouraging sustainable economical growth.

CHAPTER ONE

INTEGRATED COASTAL MANAGEMENT

A. WHY DO WE NEED COASTAL MANAGEMENT?

Most coastal areas of the world face urgent, increasingly severe problems of a rapidly growing human population, deteriorating environmental quality, loss of or reduction in critical biodiversity, and increased risk from natural hazards.

This has caused a continuing deterioration of the ecosystems on which we depend, to sustain life on earth. It is urgent that we change course, improving living standards for all; creating protected ecosystems for a safer, more prosperous future.

This requires simultaneous consideration of all aspects of the environment and social and economic development making optimal use of the land and its resources (Press Summary of Agenda 21, 1992).

The biggest problems faced by the developing regions are:

1. **Poverty.** This needs development programmes providing employment. An improved infrastructure within the guidelines of environment conservation would be required.

2. **Wasteful consumption of resources** produces an environmental stress by the use of more and more energy and raw material without regard for the future.

Educating the public is an important step to combat this by advising developing countries to avoid replicating the wasteful pattern of industrialised countries.

3. **Rapid population growth** (along with consumption and technology) is a major factor in environmental change, producing demands for natural resources, employment, education and social services. The impact of population on environment and development issues must be thoroughly researched at a national level for planning and decision making. (Ref. 22).

Several problems are common to the management of all coastal areas:

1. Growing numbers of coastal resources users and increasing conflicts among them.

2. Limited or inadequate financial and human resources for management activities.

3. Incomplete data, information, and understanding of coastal problems.

4. Public and political expectation that coastal problems have immediate solutions.

5. Multiple-agency authorities and jurisdictions, and little or no co-ordination between levels of government and across agencies within the same level of government.

6. Increasing conflicts among economic development, environmental protection, and natural resource management objectives.

These problems (Ref.16) challenge virtually all institutions responsible for managing coastal areas (public agencies at various levels, the private sector, and the academic community). An integrated, highly participatory management approach (one that involves all of those facing these challenges) is needed, to replace the traditional segmented approach of each institution concentrating on only a part of the coastal picture.

B. WHAT IS "INTEGRATED COASTAL MANAGEMENT" ?

"Management" denotes a set of related activities carried out to achieve desired objectives. Coastal management requires diverse activities such as planning, assessing, implementing, enforcing, monitoring, evaluating and educating.

To be effective, these activities should be integrated and performed continuously (Ref. 5). They should also have information feedback, from monitoring to planning and operations to assessment, built into the continuous management process. The goal is to achieve sustainable development and conservation, of both the inhabitants and the ecosystem.

Integrated Coastal management requires a comprehensive understanding of the relationships between coastal resources, their uses, users in different sectors, and the mutual impacts of development on the economy and on the environment. These relationships need to be understood and expressed not only in physical and environmental terms, but also in economic terms as they are important for planning, policy formulation, implementation and performance evaluation.

C. AIMS OF THE INTEGRATED MANAGEMENT SYSTEM.

Integrated coastal zone management is an adaptive process of resource management for environmentally sound, sustainable development in coastal areas. It is the most

appropriate process to anticipate and respond to long-term concerns and needs while addressing present day challenges and opportunities. It is not a substitute for sectoral planning, rather it focuses on the linkages between sectoral activities more comprehensive goals such as:

- (*) identifying where resources can be harnessed without degradation or depletion;
- (*) renewing or rehabilitating damaged resources for new uses;
- (*) ensuring the integrity of ecosystem biodiversity;
- (*) guiding the level of use to make sure that the carrying capacity of the resource is not exceeded;
- (*) ensuring that the rate of loss of resources does not exceed the rate of replenishment;
- (*) reducing risks to vulnerable resources;
- (*) encouraging complementary rather than competitive activities;
- (*) ensuring that environmental and economic objectives are achieved at tolerable cost to society (Ref.13).

D. OPERATIONAL PROCESS.

There are four basic stages in the process of changing the management policy into an operational management system (Ref.11).

1. The identification of management options.

The first stage requires, a critical assessment of the various activities of the region and their impacts on the water and adjacent coast.

2. The evaluation of the alternatives.

The priorities here, are to evaluate the significance of the issues, identifying those that need to be managed, plus the scale, focusing on the critical issues first.

The practical method for doing this is to formulate a group of "experts" with knowledge of the sea, the coast, the issues encountered, the institution responsibility structure and the technical management measures potentially available, with their strengths, weaknesses, opportunities and threats (SWOT) analyses (Ref.11).

Brain storming sessions with this consultant group should focus on four factors which influence the effectiveness of management processes.

- * natural trends,
- * man-induced trends,
- * existing management obligations and
- * resource considerations.

Once these parameters have been determined, the "strategies" for issue resolution and management policies should be addressed. These would combat both physical bias issues (like congestion on land and water, safety risks, interference, pollution, resources degeneration and disturbance) and management bias issues (like failure to comply with regulations, duplication of responsibility and effort, management divergence, inadequate resources and authority deficits).

After an evaluation of the strategies and options the most effective management scheme is formulated along with its benefits/constraints analysis.

3. Implementation of management strategies.

The next stage is the implementation of the options that have been approved and selected. This involves:

- * a detailed design of the measures approved,
- * efforts to obtain any necessary national statutory approval,
- * a co-ordinated investigation of funding opportunities,
- * the instigation of an education and information programme,

- * the identification and training of manpower requirements, and
- * the construction of associated development.

This stage (Ref.11) does not end at this point. Implementation is a continuous process involved in the day to day operation of the management programme.

The precise details of the various management measures selected, must now be added. Attention must be paid to maximising the effectiveness of the measures, and daily planning of the operation.

4. The evaluation of the management performance.

This is a continuous process through a performance audit programme. Its priorities are to assess the effectiveness of the strategies implemented, along with the identification and rectification of any problems that might deter the successful working of the programme.

Responsibility for this audit could lie with an independent body, or those responsible for the co-ordination and the implementation of the management scheme.

After the initial transitional phase, a formal periodic audit programme should be established with a standard format to allow future temporal comparison of results.

The results and supporting data should be made available to the various interest groups. This encourages communication and co-operation among participants, gaining their support and compliance. It also helps in justifying any amendments found necessary to the management scheme as a result of the audit (Ref.11).

E. REQUIREMENTS OF THE SYSTEM.

From the methodological point of view Integrated coastal management requires (Ref. 13):

1. A multidisciplinary approach;
2. Problem-solving and not problem-transfer;
3. Priority to prevention rather than cure; and
4. A precautionary approach, leaving options open where current knowledge is insufficient.

There are two crucial and mutually related issues which should be strongly emphasized (Ref.22):

1. The first one refers to the need for changing the existing trends of growth and development in the region. This primarily calls for a change in setting the basic goals, strategies and policies of the future long term development, to establish the balance between the social and economic development and the best use of area's limited natural resources. The balance seen from this point of view is not simply a matter of preventing pollution and conserving the natural environment, but an orientation towards sustainable development as a goal of both economic and environmental policies.
2. The second one is that, a full recognition of the pressing problems is not all what it takes. The experience of different coastal regions of the world with similar rates of development, suggests that for achieving a sustainable pattern of development (i.e. to reduce the existing and to prevent future pollution, to conserve the resource base while ensuring a relatively effective economic growth) a largely improved management structure is needed.

F. WHEN IS ICZM NECESSARY?

The need for a coastal state to accelerate the development of capabilities for integrated coastal zone management arises when (Ref.13):

1. Current trends of increasing poverty in coastal communities are resulting in degradation of the coastal zone and the deterioration of the quality of life.
2. Current pressures from development and population are increasing the land-based sources of marine pollution and human intervention with river basins adversely affects coastal processes by accelerating the decline of natural resources or increasing their vulnerability to pollution.

The changes may, in turn, limit options for future development since (Ref. 22):

- * many degraded and threatened coastal resources and ecosystems are in need of rehabilitation and restoration;
- * efforts to develop coastal zone management and implement national programmes may take 10 years or more; and,
- * Implementing strategies for adapting to and mitigating the impacts of global climate changes may take longer periods to reduce the effects.

G. AQABA AS A CASE-IN-POINT.

Aqaba has developed from a small town 20-30 years ago to a busy city with more than 70,000 inhabitants today- and this rapid development is expected to continue. The total seaborne import and export of Jordan, and a substantial part of the trade with its immediate neighbours Syria and Iraq, passes through the port of Aqaba and travels on the roads and railway through the region to and from the north. Along the

coast south of the town, a large power plant and heavy industrial production and storage areas are located (See map 1,2,3).

Substantial tourism has developed along the coast north-west of the town and there are plans for large scale tourism south of Aqaba town. The Aqaba airport north of the town is the second largest in the country and handles both domestic and international traffic.

The main environmental resources and tourist attractions in Aqaba are the clear sea water, the sandy beaches, the unique coral reefs, the mountains and the desert. These are influenced adversely by the effect of development and pollution. The pollution that affects the ecosystem may also affect the health of the population and impede sustainable development which is crucial to maintaining the national economy.

The neighbouring countries which benefit by access to Jordanian port facilities, sea transportation, tourism and industrial development along the coastline are also directly affected by any changes in the management of the region. The challenges faced by any integrated management authority are (Ref.1 & 7).

1. To plan for sustainable development within a sound environmental framework.
2. Conservation of valuable marine resources e.g. coral reefs and fisheries, and,
3. Maintaining the aesthetic qualities of the waters and the Gulf environment.

H. CONCLUSION.

The implementation of Integrated Coastal Zone Management (ICZM) can stimulate and guide the sustainable development of coastal areas; it can minimize the degradation of the natural system, provide a framework for management of multi-sectoral activities and maintain options for future uses of resources.

As coastal states develop the capabilities for implementing integrated management of their coastal resources, they provide local and national benefits including enhancing economic development and improving the quality of life.

These benefits are achieved through the protection of the environment (e.g. water quality, biodiversity, and adaptation to climate change). Thus ICZM contributes to the protection and sustainable use of the earth's coastal resources.

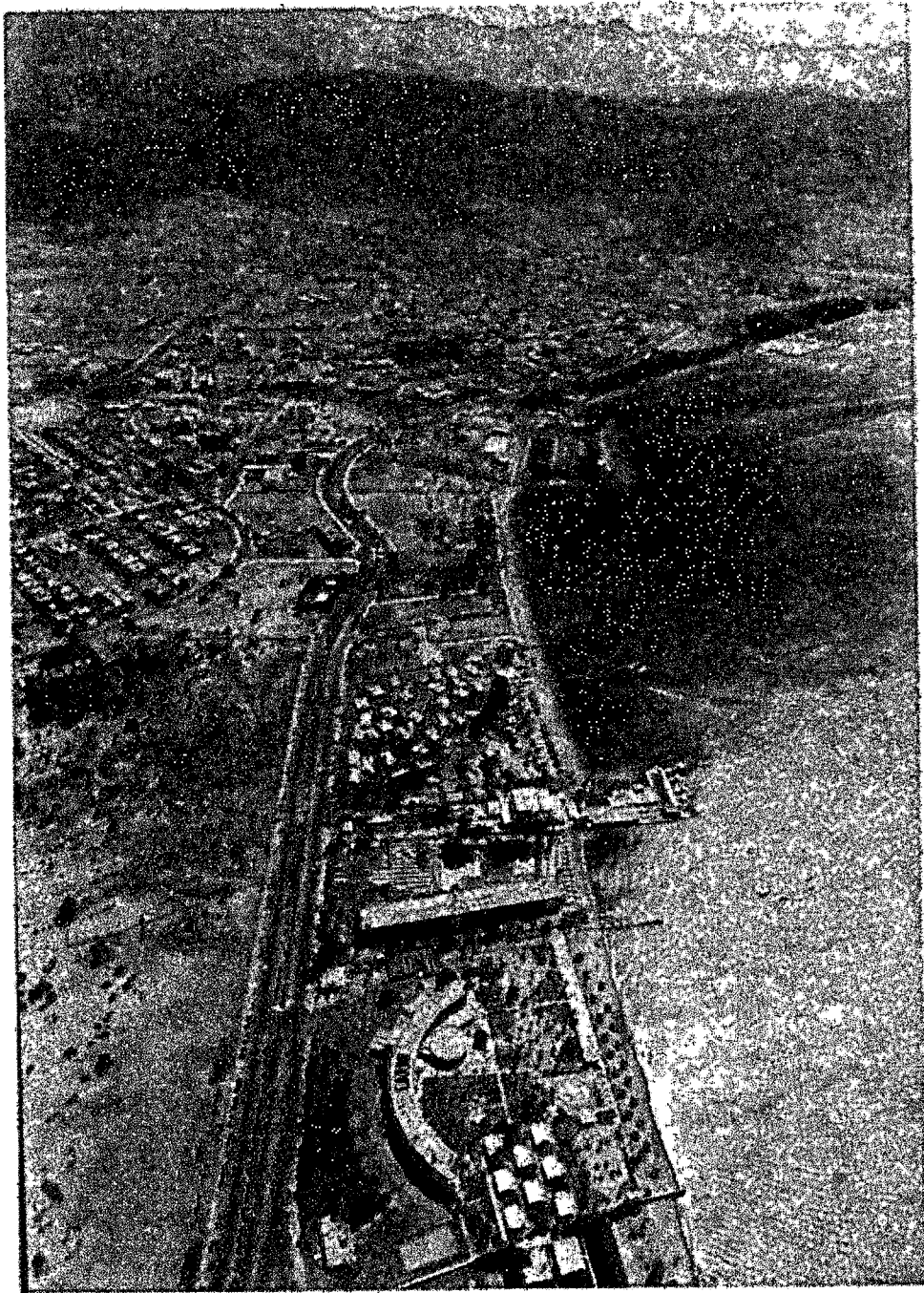


PHOTO PLATE 1. THE NORTHERN TIP OF THE GULF OF AQABA

CHAPTER TWO

INTRODUCING AQABA

A. GEOGRAPHIC LOCATION OF AQABA.

The Hashemite Kingdom of Jordan is an Arabic state in Southwest Asia. Its position is extremely strategic, with Iraq and Saudi Arabia bordering the east and the south respectively. On the west, are Israel (See map 1 on page 22-1) and the occupied West Bank (future state of Palestine). Syria makes up the northern boundary and, to the south and south west, in order (across the sea at the Gulf of Aqaba), lie Egypt and Israel (Ref.10).

Jordan's only access to the sea lies at Aqaba, which is a small town (with an area of 250 Km²) in the southernmost part of Jordan along a portion of the Gulf of Aqaba.

The Gulf of Aqaba marks one of the two northern extensions of the Red Sea following the tectonic rift between Africa and Asia (See map 2 & 3). The Gulf joins the Red Sea through the narrow (6 Km wide) Tiran Strait.

Only 180 Km long and 14-16 Km wide, the Gulf is shared by the four countries which border it, namely, Egypt, Israel, Jordan and Saudi Arabia (see map 3). The

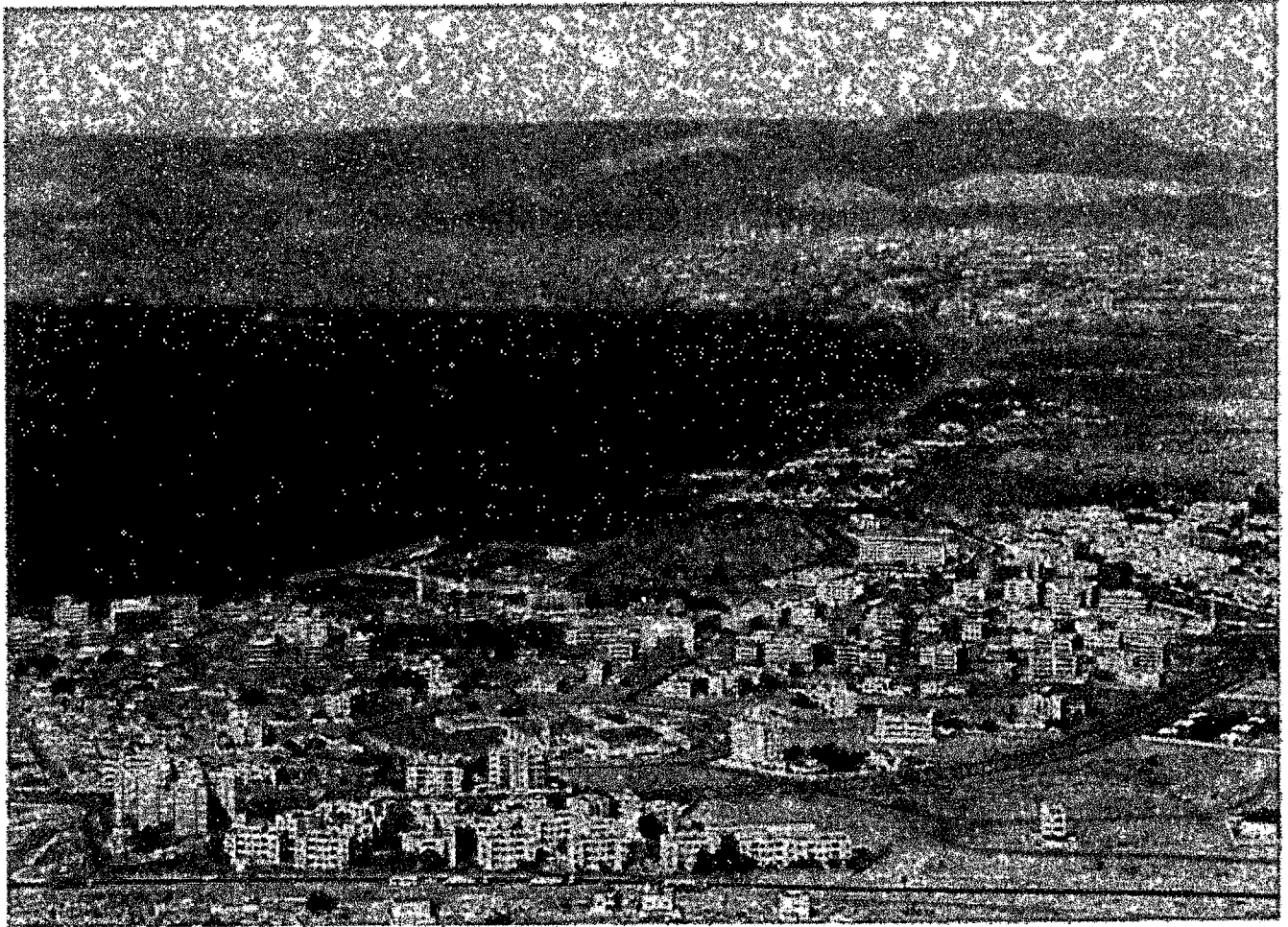


PHOTO PLATE 2. URBAN DEVELOPMENT IN AQABA

Jordanian portion of the Gulf consists of 26.5 Km of shoreline (See photo plate 1,2,3) and 3 miles of territorial waters. The other three countries each claim 12 miles of territorial waters (See map 2).

The total area of Aqaba stretches from an airport at the northern end, to the Saudi Arabian border in the south. It includes the urban town region, the Port areas (see map 4) and the southern coastal strip with the tourist and industrial zones. From west to east, the land extends from the coastal line to high mountain ridges which form the eastern boundary about 5 to 6 Km inland (see photo plate 3).

B. PHYSICAL CONDITIONS (Climate, Wind and Water Quality).

Aqaba is located on a plain area fringed on the east by ridges of granite mountains with elevations up to 1600 M (See photo plates 1, 2, 3). These mountains run parallel to the coastline coming very close to the sea at some points. The mountain ridges are often interrupted by narrow valleys (wadis) that run in east- westerly directions with alluvial deposits of sand and gravel, which become wider as they approach the coastline (Ref.1).

The climate of the region, being of the semi desert type, is very dry and hot, with temperatures ranging from 36 to 45C in midsummer. In winter (December, January, February) the mean temperatures range between 14 to 22 C (Ref.1).

These comparatively high temperatures are coupled with low relative humidity. Rainfall is also very low and occurs mostly in winter.

Winds are significant as they disperse the air pollution in the atmosphere. They are mostly (81% of the time) from the desert in the north and are associated with clear skies, low humidity and dust concentrations from the desert. Southerly winds are less

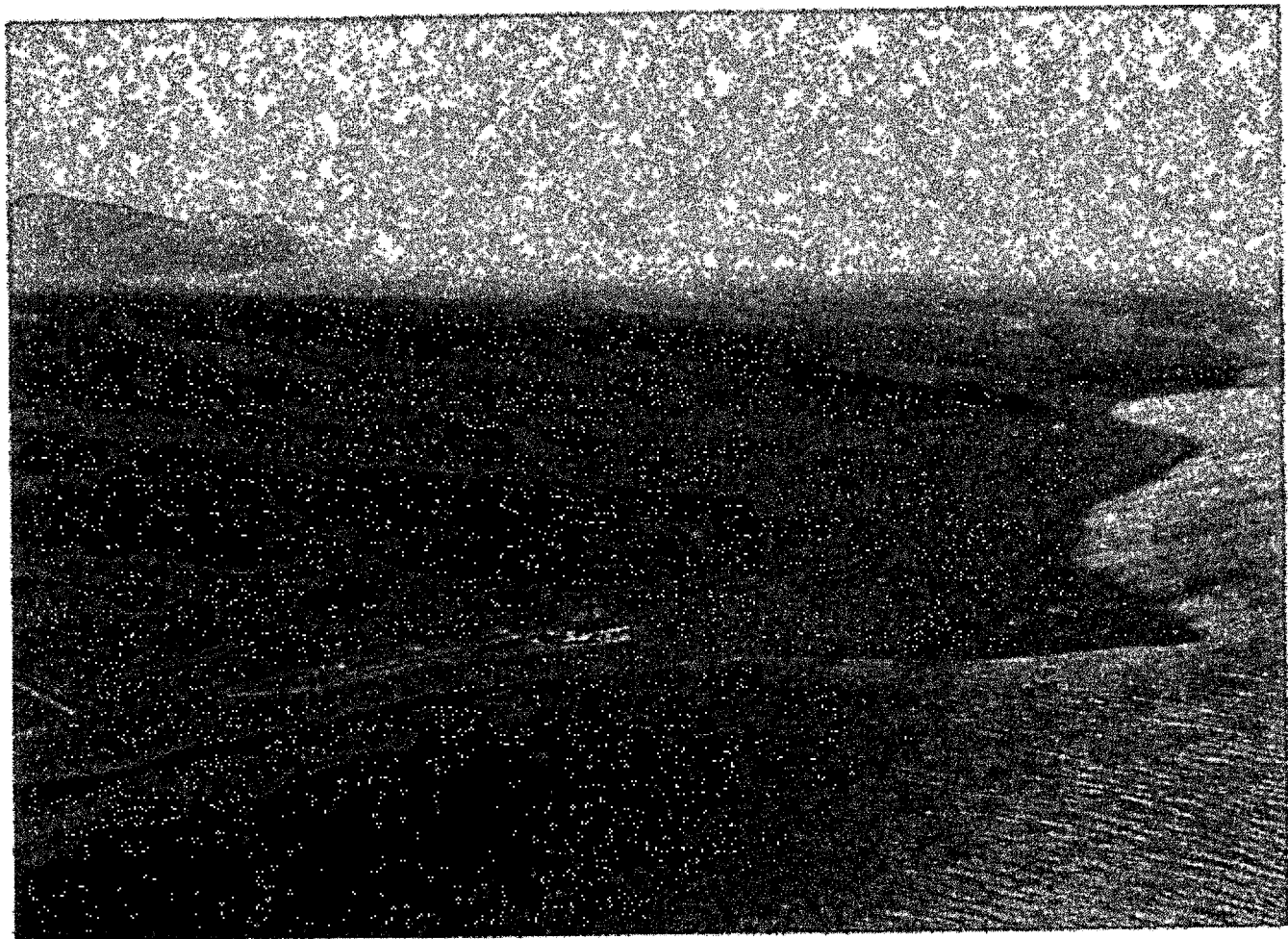


PHOTO PLATE 3. THE SOUTHERN COAST OF THE GULF OF AQABA

frequent (9%) and are often followed by clouds and dust pollution from the port. They seldom last for more than a few days at a time. Calm conditions (wind speed less than 1m/sec) occur 7.2% of the time, and at these occasions dilution and dispersion of dust pollution is poor (Ref.7).

The Gulf of Aqaba represents a marine environment enclosed by arid lands with high temperatures and very low rainfall. There are no permanent rivers emptying into the sea, and there is limited exchange of the water of the Gulf with that of the Red Sea via the Tiran Strait (See map 2, 3).

This has given rise to a lake type circulation of a small size of water body, primarily controlled by evaporation. The waters are thus relatively hypersaline. Water quality is generally excellent due to the very large water depth, practically no fresh water inflow and almost non-existent current effect (Ref.2).

Thus midoceanic water quality and biota prevail. Water temperatures remain in the range of 20 to 26 C all year round. The Gulf of Aqaba has very transparent water with low concentrations of plankton algae and a coral reef of unique biological diversity which has not yet been fully classified (Ref.9).

To date 127 species of coral have been identified with 268 species of fish, seven of which are endemic to the Gulf (Ormond 1978, Ref.20).

Twelve percent of the 80 species of molluscs and an equal portion of echinodermata have been found endemic.

Thus the region has global significance as a unique land-water interface.

C. REGIONAL DEVELOPMENTS (Economical Importance To JORDAN).

Aqaba mirrors the pattern of development in Jordan. In the 1960s the coastline of Aqaba was sparsely populated and unaffected by development activities. The country showed strong economic growth from the period 1973 to 1980 (Ref.1).

During this time many large scale development projects were realized in Aqaba, such as the establishment of potash and fertilizer industries and a number of infrastructural services. As a result, in the next 20 years the Gulf of Aqaba became an increasingly busy shipping route with high economic growth potential (Ref.7).

As Jordan's only access to the sea its 26.5 km of coastline supports a variety of industries closely related with port activities or based on the area's natural resources. The port of Aqaba is the busiest in the Red Sea area after Suez in Egypt and Jeddah in Saudi Arabia. Notable developments along the coast include building of roads, hotels, port and storage facilities, power generation, fertilizer production and tourism (Ref.1).

However, there was a decline in Jordanian economical growth in the 1980s following a Middle East general recession in that period. Aqaba port activities, which were kept vigorous by Iraq's need for transit routes during its war against Iran (1981 to 1988) suffered a set back after a peak in 1988 (Ref.1 & 10).

The set back became worse after 1989 due to the depreciation of the Jordanian Dinar and the Gulf crisis in 1990. In 1991 the embargo against Iraq reduced the regional income through the Port to 1/5th of its 1988 level, compensated only fractional by an increase in domestic import (Ref.7).

Aqaba is the only sea port of Jordan and the major part of the country's population lives in the north. Thus there is a substantial land transport sector linking the port to the rest of the country (See map 5).

A single track railway connects the port with the two major phosphate mines around 200 km to the north. Road transport is represented by two major highways. One serves the eastern sector and the other, on the western side connects the Aqaba port to the Arab Potash Company located in the Dead Sea region (See map 1).

These highways extend to the neighbouring countries. One civil international airport serves Aqaba and is an important tourist connection to the region.

The present and future development potential of Aqaba will be based on developing:

1. Trade and the export of Jordanian industries which is based on the country's natural resources (potash, phosphate and phosphate based fertilizers).
2. The tourism industry, which has been greatly enhanced by the devaluation of the Jordanian Dinar making the region (with its sandy beaches and coral reefs and proximity to historical sites), economically attractive as a tourist destination.
3. The industrial infrastructure (e.g. Fertilizer Complex, Potash Storage, Shiploading Facility, Timber Factory, Power Plant, Container Port etc.) of the region which benefits from the present natural resources.

D. POPULATION.

Associated with economic development, a continuing increase of population in the region has been a main feature in the recent past. The population of Aqaba increased from 10,000 in 1972 to about 57,000 in 1990 reflecting the sudden economic development.

The population has continued to increase rapidly to 60,000 in 1992, 63,000 in 1993. At present the estimate is over 70,000 (reported by the statistical department of Jordan 1994), as compared to the total population of around 4.15 million in the country.

A large share of the population originates from outside the Aqaba region. The highest share of the in-migration of people seeking jobs in the lower income groups, comes mainly from the southern region of Jordan.

The newcomers seek residence in the older parts of the town (around two km away from the coastline), where rent values are lower (See photo plate 2). This process is imposing a large pressure on living conditions due to over crowding, lack of proper sanitation and poor necessary social infrastructure. These substandard conditions are being dealt with through upgrading projects by the various regional authorities listed below.

E. ADMINISTRATION OF AQABA.

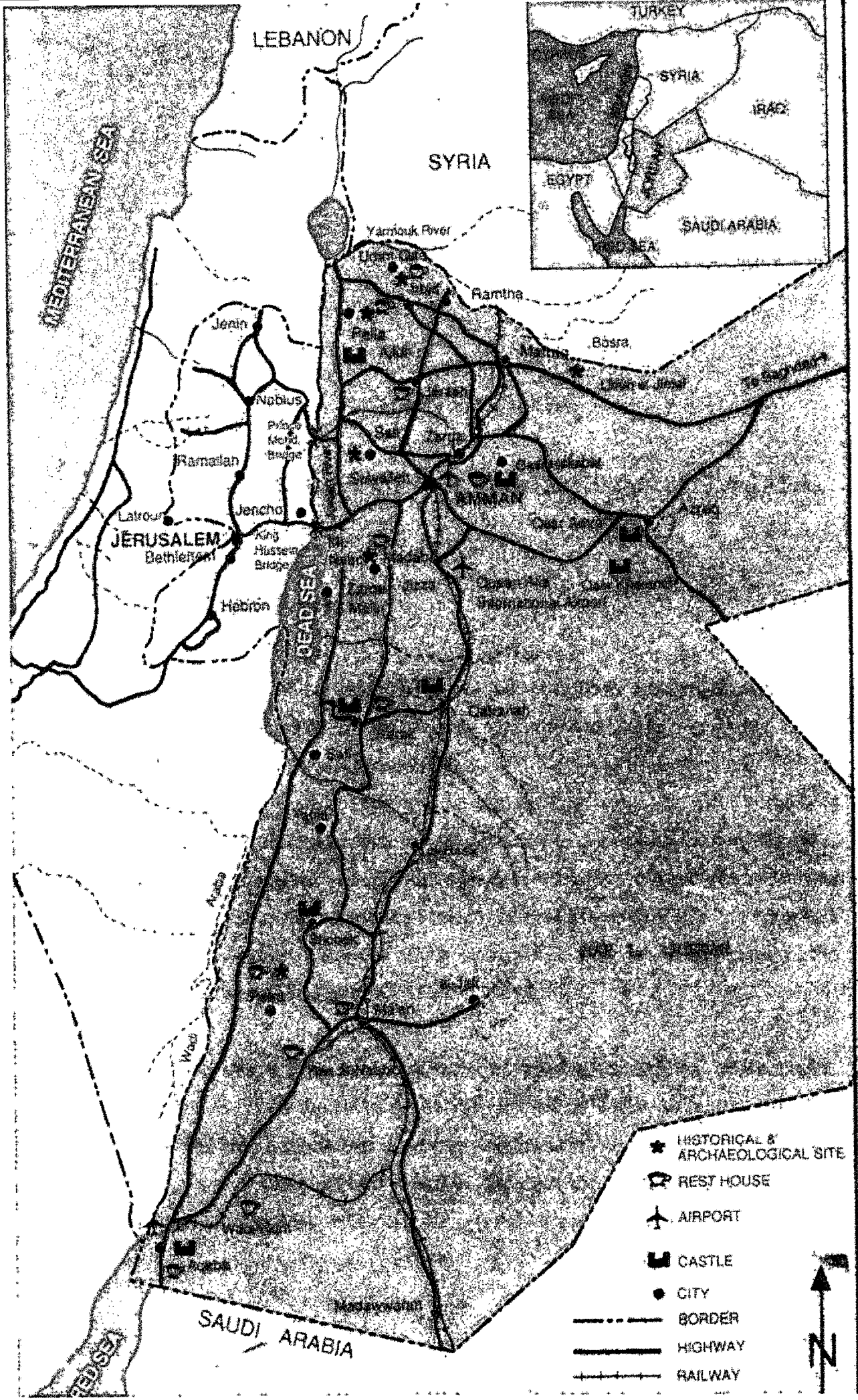
The Aqaba Municipality was first formally introduced for development planning and control in the early 1950's when Aqaba was still a village (Ref.7).

The growing importance of Aqaba, the only sea port of Jordan, caused the establishment of a special planning committee in 1960 to supplement the Aqaba Municipality's efforts in the development of Aqaba. The Aqaba Town Planning Committee (ATPC) was in authority within the town boundaries, while the development of the coastal region was under an ad-hoc committee of the Ministry of Municipal and Rural Affairs which had no technical advisory arm for policy formation (Ref.23).

The need for co-ordinated planning gave rise to the establishment of the Aqaba Regional Authority (ARA) in 1984. The ARA (the legal successor of ATPC) is under the Prime Minister's office and has extended boundaries of jurisdiction.

In addition there are various concerned government agencies which also take part in the planning of the regional development. These are the Ports Corporation, Department of Health, Department of Agriculture, Water Authority, Free Zone Corporation, Royal Scientific Society, Ministry of Tourism and Antiquities, Civil Defence, Aqaba Marine Science Station (MSS), Royal Society for Conservation of Nature (RSCN) and the Aqaba Municipality (Ref.7).

A detailed overview of the interaction of the various institutions and NGOs is given in chapter 4.



LEBANON

SYRIA

TURKEY

SYRIA

IRAQ

EGYPT

SAUDI ARABIA

MEDITERRANEAN SEA

Yarmouk River

Lidnani

Ramtha

Jenin

Bosra

Nabliis

Ramallah

JERUSALEM
Bethlehem

Hebron

Amman

Wadi

SAUDI ARABIA

- * HISTORICAL & ARCHAEOLOGICAL SITE
- ☞ REST HOUSE
- ✈ AIRPORT
- 🏰 CASTLE
- CITY
- BORDER
- == HIGHWAY
- +--- RAILWAY



CHAPTER THREE

AN ASSESSMENT OF THE DEVELOPMENT OF AQABA .

A. INTRODUCTION.

The development of any region is a process of growth and transformation; "a movement through which society changes, takes the decision to change and carries out this change itself" (Ben Mady Ref.3).

When studying development one has to assess the in depth modification that takes place in its economic and even physical aspects as a transfer from one step to the next in the process of its expansion. In the words of H.W.Singer (Ref.12) "Development is growth plus change; change in turn is social and cultural as well as economic, and qualitative as well as quantitative".

Aqaba illustrates a case in the dilemma of development of the whole region. Modernisation in the Jordanian portion of the Gulf of Aqaba, as in the rest of the country, has been a recent and rapid phenomenon in the last twenty years. This has transformed the entire 26.5km coastline from its natural state by a variety of developments associated with economic growth. These include the construction of

buildings, hotels, roads, port and storage facilities, power generation and fertiliser production industries. The coastline has also been put into various uses by the development of tourism. The economic development has also increased the population of the town six fold in this period.

These developments have had significant impacts on the environment of the Gulf of Ababa, the health of industrial workers, the integrity of the coastline and desert ecosystem (which bring 40 million JD per annum in tourism).

These effects are observed in chapter 6 of this study. The assessment of development to date forms a foundation for the discussion of its impact and the formation of a future development model addressing existing problems and future threats in a sustainable manner. The information presented below has been obtained by pertinent documents outlined in references.

B. ECONOMIC TRANSFORMATION.

The coast of Aqaba has been subjected to a variety of changes during the last 30 years. In 1960 the coastline was only 9.5 km long. Aqaba itself was a village, sparsely populated and unaffected by development.

In the late 60s after losing contact with Haifa and Gaff in the West Bank of Jordan, the potential of the region was realised as Jordan's only outlet to the sea. The coastline was increased by moving the southern border of Jordan 17 km further to the south, giving Ababa a coastline of 26.5 km.

Following this, Aqaba continued to grow and change reflecting the economic uplift of Jordan from the mid 70s to mid 80s. This growth was underpinned by foreign aid and the remittance from more than 300,000 Jordanians working abroad . In 1984 Jordan had one of the highest growth rates in the world, averaging annually a growth rate of

more than 8%. The rate of inflation fell from 12% in 1981 to 7.4 % in 1982, 5.5 % in 1983. 3.9 % in 1984, 3.0 % in 1985 and zero in 1986 (Ref.19).

During this phase the port of Aqaba was rapidly modernised. It changed from a local faculty servicing Jordan to a regional port dealing with export and import of materials like oil, grain, minerals, sulphur and fertilisers. A high increase in shipping activities made the port the busiest in the area after Suez (Egypt) and Jeddah (Saudi Arabia).

In accordance with this development, Aqaba itself was transformed into a bustling modern town. Sandy beaches were developed to the north of the coast as tourist and private resorts. To the east and south east there was extensive industrial expansion with phosphate and fertiliser plants, power stations, wood industries, industrial jetties and piers.(see map 3&4).

At about the end of the 80s there was an economic regression in the Middle East. Jordan's development accordingly slackened. Aqaba port facilities however, continued to show a vigorous turnover due to Iraq's demand for alternative transit routes during the Iraq-Iran war.

Aid from Iraq helped to develop the land route system leading to Aqaba. The infrastructure of the region continued to expand with the public sector borrowing heavily at high commercial terms creating a large external public debt.

Economic difficulties gave rise to structural imbalances which grew worse. By 1989 Jordan was unable to service its external debts and repayment commitments. Between 1987 and 1990 The Jordanian dinar was devaluated to half its price as compared to US dollars.

This gave rise to inflation, recession and a decline in output by more than 5 % in 1990.

Table 3.1 Shows that since 1987, the real GDP growth was even unable to keep up with population growth.

Table 3.1: GDP Development Market Price (1985-1991).

Years	1985	1986	1987	1988	1989	1990	1991
GDP current price	1898	2040	2089	2201	2841	2567	2805
GDP constant price	1898	2072	2144	2170	2047	1931	1950
Real Growth (p.a.)	--	9.02%	3.5%	1.2%	-5.7%	-5.6%	1.0%
Real Growth (p.c.)	--	5.3%	-0.1%	-2.4%	-8.7%	-16%	-4.4%

□ IMF Estimate.

Source: Statistical Year Book - Table (21/5, 21/6). Current Report 1992.

The next year showed a small growth in economy. This was due to the 300,000 Jordanians who returned from the Gulf States during the 1990-91 Gulf War, bringing their wealth with them and easing the monetary situation a little.

However, soon unemployment increased and after 1992 Jordan's financial state suffered from the lack of previous inflow of remittances from abroad. That year Jordan was forced to reschedule a 800 million US\$ debt with its 14 creditors (See Table 3.2 for falling Dinar value).

Table 3.2: Development of Exchange Rate In (1985-1993).

Years	1985	1986	1987	1988	1989	1990	1991	1992	1993
JD/DEM	.135	.162	.189	.214	.306	.412	.420	.432	.450
JD/USD	.395	.350	.339	.372	.570	.664	.641	.692	.704

Source: Statistical Year Book. Country Report 1993

The present perspective for development in Aqaba seem mixed and dependent on three factors:

- 1) Transit transport to Iraq,
- 2) The country's general economic level,
- 3) The activity level and exports of industrial products (Ref.18).

C. INDUSTRIAL DEVELOPMENT.

The industrial sector of Aqaba is divided into many parts which are studied individually:

Jordan's major industries are based on the country's natural resources located mainly in the south of the country. Potash extraction from the Dead Sea and Phosphate from mines at Al-Hasa, Wadi Al-Abiad and Al-Shadiah. Together with phosphate based fertiliser production, these account for around 50% of Jordan total exports (Ref.1).

Employment surveys in 1990 showed that total employment in Aqaba due to these industries was 1700 with 1000 in the fertiliser plant (Ref.1).

C.1 Phosphate Exports.

Jordan started exporting phosphate full scale by 1960 after the completion of a deep dock with conveyer belt and ship loader, phosphate stores and sheds. On the completion of a treaty with Saudi Arabia and the extension of the coastline by 10 km, the facilities were further extended to double capacity.

The table below shows the pattern of phosphate export from 1985 to 1991. Rising prices on the world market boosted production after 1987 showing a peak in 1989.

Since then market condition have been difficult due to the collapse of East European economies (Ref.25).

Table 3.3: Phosphate World Market for the Years (1985-1994).

Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Export in m/t	4.6	5.1	5.5	5.8	6.4	4.9	4.2	4.3	3.7	3.6
Exchange in USD	N.A	192 \square	180	206	257	209	181	209	180	191
World Share % Export	10.8%	11.8%	12.6%	14.5%	13.2%	13.1%	12.8%	11.2%	11.2%	11.5%

Table 3.3 : Key Indication for Jordan's Phosphate Industry (1985-1991).

Source: EIU: Jordan country Profile P.30. Jordan phosphate Mining Company (JPMC), Annual Report 1991. M = million , t = tonne, \square Million USD.

The present perspective for the industry seems to be mixed. Future export seems dependent on world market conditions. Since Jordan's share accounts for 13% of the world's export of raw phosphate, expansion in this trade might affect the world market. Further projects include an increase of phosphate supply to the East which forms a favourably located large potential market .

C.2 Fertilizer Industry.

The fertiliser industry located in Aqaba, is run by the Jordan Phosphate Mining Company. Yearly production which was about 600,000 tonnes per year in 1991, has now increased to 740,000 tonnes. Production uses potassium chloride supplied by the Potash Company from the Dead Sea Complex (See Table 3.4).

Table 3.4: Fertilizer Exports (1988-1995 α).

Years	1988	1989	1990	1991	1992	1993	1994	1995 α
Export in m/t	.600	.573	.668	.663	.547	.412	.517	.276

Source: APC Year Book 1995. α Export in 1995 till June End.

C. 3 Potash Export.

The Arab potash company which started commercial production in 1993 increased export until APC accounted for 3.1% of the world potash production in 1991. Production is expected to increase to about 1.8 million tonnes (See Table 3.5).

Table 3.5: Arab Potash Corporation's Export in (1986-1995 α).

Years	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995 α
Export in m/t	1.1	1.2	1.31	1.32	1.4	1.36	1.23	1.45	1.5	.75

Source: APC Annual Report (1992-1995). α Potash Export in 1995 till June End.

C. 4 Cement Export.

The Cement Industry began production in the mid 60s. However, Jordan started exporting cement to neighbouring countries in the early 1980. Export amounts rose rapidly due to which the company built a new berth in Aqaba for bulk cement exporting in 1992. The table (3.6) below shows yearly export of cement through Aqaba.

Table 3.6: Export of Cement (1988-1995). Through the Port of Aqaba.

Years	1988	1989	1990	1991	1992 α	1993	1994	1995
Cement Ex.in m/t	1.25	1.37	1.37	1.3	1.05	.695	.516	.108

Source: APC Year Book (1993-1995).

α The Decline in export of cement is due to increase in export of clinker after 1992.

Source: Personal knowledge, statistics not available.

C. 5 Transport Sector.

The Iraq Iran war gave rise to extensive transit from the Aqaba Port to Iraq. Seventy five per cent of the total volume of import through the port was to Iraq. During this time the port capacity was increased greatly and some JD 65 million invested in expansion projects. Traffic through the port grew from 1.6 million tonnes in 1975 to 20.7 million tonnes in 1988 Source: APC Year Book (1994-1995). (See Table 5.5 chapter 5 for Port Traffic Development).

However, the decline in the value of the Dinar, the Gulf War and the following sanctions against Iraq has brought the present traffic to about a quarter of the value in 1988. During the so called "years of prosperity", the port of Aqaba was developed in every way including administration, institution, tariffs, regulations, staff and labour (consisting mostly of non Jordanians). These earned Aqaba the reputation of one of the most organised ports in the Middle East.

The fact that Jordan needs to export to bring in revenue for the country, means that it will continue to rely very heavily on its only sea port. Thus in spite of the present slump in economic output, the Port of Aqaba is viewed as one with high development potential.

C. 6 Land Transport.

Aqaba being situated in the south, and the greater share of the Jordanian population living in the north of the country, induces a very substantial land transport sector to all the industries based in Aqaba.

There is a single track railway serving the phosphate transport from the region in Al-Hassa (200 km to the north) to Aqaba port. Road haulage accounts for another 50 % of the phosphate transport.

Together with other commodities transported to and from the port , the fertiliser industry and other industries in the region, there is very heavy trucking to and from Aqaba, a figure reaching an estimated 1200 vehicles a day. In addition a large number of buses transport passengers to and from the passenger terminal south of the port. Employment surveys in 1990 showed that the transport sector represents more than 50% of the total employment in Aqaba with the port being the largest employer having more than 5000 employees (Ref.25).

D. TOURISM.

Aqaba is very strategically located in the immediate vicinity of historical sites and tourist regions of Jordan, like Petra and Wadi Rum. This has made Aqaba with its proximity to Israel and Egypt, its clear sea, unique coral reefs and wide beaches, an important tourist destination.

Before the devaluation of the Dinar, Aqaba was relatively expensive as compared to other tourist centres in the region. The lower value of the Dinar has now enhanced Aqaba as an attractive tourist site to visit.

Tourism in the Aqaba region grew from 1987 to 1989. After a recession due to Gulf Crisis in 1990 tourism has started a to recover showing a 42 % increase from 1992 onwards, accounting to figures issued by the Department of Statistics in Jordan Times 1993.

In 1987 an ambitious master plan was published by the Aqaba Regional Authority (ARA) with a proposal for a large tourist village 10 km south of the city, aiming at both international and domestic tourism with a capacity of about 2000 hotel beds and 1000 chalets (Ref.7). The present hotel capacity in the area is about 1700 rooms.

During the early years of tourism development all the major hotels were built at or around the sea front in the north where beaches were developed for swimming and recreational

activities. Further hotels came up in the town area. The master plan for the tourist village aimed at providing secluded areas for tourist activities never got underway due to the reluctance of private enterprises to shift to a region far off from the local amenities of the town.

Nevertheless, after signing of the peace treaty with Israel in 1994, the number of international tourists to Aqaba has increased due to the offer of a package deal (south Egypt, Israel and Jordan) to foreign visitors. Therefore the master plan may be carried out in the near future to absorb the influx of visitors due to lack of space for expansion in the northern part of the coastline (See photo plate 1, 2, and 3 in annex 1).

E. POPULATION.

In accordance with the expansion and development of the region, the population of Aqaba increased from a mere 10,000 in the early 70s to about 62,000 in 1992, with present estimate of over 70,000 inhabitants, showing an annual growth rate of about 3.6 per cent (Source: Jordanian Statistics Department 1994).

A large section of the population originated in the 80s by the transfer of Jordanians seeking jobs from the north. They were mostly employed in the port and other industrial concerns. Based on survey conducted by the ARA on the labour force in 1990, it is noticed that more than 80 % of the workers are in the "lower wages" groups with less than 12 years of schooling. This indicates that the lower income jobs which mainly employed foreign labour in the early 80s are being filled in by Jordanians, a positive influence of the rising inflation in the country.

Most of the incoming Jordanians seek housing in the older part of the town, 2 km away from the coastline (See photo plate 2) because it is conveniently located and has lower rent values. This has given rise to a replacement process where original inhabitants are moving out to new and better residential areas and renting their old houses to the new comers.

Living conditions in the old part of the town are at best substandard, with a lack of proper sanitary infrastructure, sewage systems or proper roads. Overcrowding by migrants has worsened the condition in the area by increasing residential density (100-340 inhabitants per hectare in 1986).

The various administrative authorities are trying to upgrade living conditions and health services in the region. But the problem still seems an uphill task which requires an integrated approach with proper financing, planning with sustainable development in mind and education of the masses.

F) DISCUSSION AND FUTURE DEVELOPMENT.

This over view discussed development in Aqaba during the last 30 years and studied its impact on the

- a. Economy,**
- b. Industries,**
- c. Tourism and**
- d. Population .**

The overall picture shows that development in Aqaba started slowly in the late 60s and then suddenly picked up momentum in the early 80s, peaking in all fields around 1988, transforming Aqaba into a modern, busy port town with industrial infrastructure development to the south and south east of the area.

After this there was a sudden fall in development in all sectors except in population (and housing). Due to the economic regression in the country, Jordan has to rely very heavily on increasing future export of its industrial products, and on increased traffic with the neighbouring regions for the recovery of its financial status. Thus Ababa continues to

hold great potential for the future growth, industrial development and even crowding of the region in the future.

Already plans have been formulated and leases requested for industrial development in the southern zone of Aqaba. These include industries concerned with the processing, storage and transshipment of various chemical products, spare parts manufacturing, textile industries and stock feed production.

Power plant capacity of the power generated at present is expected to increase 100 fold in the next two years, taking into account that Aqaba is the only place where cooling water is freely available for industrial purposes like energy generation.

Oil storage and refiner facilities and free zone services may be considered with an increase of truck transport in the area.

Estimated annual revenues by some of the major activities taking place in Aqaba include:

1. Port activity	JD 35-50 million
2. Tourism	JD 40 million
3. Fertilizer and Phosphate production	JD 210 million

Long term development are ambitious and include:

1. Land Transport enhancement.
 - A. Road linkage among Egypt, Israel and Jordan in the south.
 - B. A western road connection between Aqaba and Syria through Wadi Araba.
 - C. A transport linkage with Saudi Arabia in the east as an extension of the desert high way (See map 1) from Al-Jafr.
2. A sea canal linking of the Red Sea with Dead Sea providing hydro-electricity and a navigational channel.
3. Allocation of a free zone area in the southern part of Aqaba, close to the industrial

sites (See map 4).

4. Building of a new multipurpose terminal at the industrial sites for handling all types of exports.
5. Building of an extra passenger berth for ferry services between Aqaba and Nuweibeh (Egypt).
6. Enlargement and development of Aqaba Airport.
7. A technical centre for personnel training.

In addition, the productivity of the port of Aqaba must be improved. This involves the formation of a master plan dealing with issues related to operation and management of activities such as cargo handling, cargo storage, maintenance of cargo handling machines/equipment, computerisation and training programmes.

The list of short term and long term development plans shows a tendency among policy makers to rush headlong into expensive modernization programmes without differentiating between the ideal and the attainable.

How far such ambitious goals as those given above are sustainable or even feasible in a region with a coastline of only 26.5 km, remains to be seen unless the planning council study the problems and their effects on the environment, and the shaping of social life.

It is imperative, in this context, that an integrated master plan be formulated, addressing all the issues in both short and long term development plans, studying their effect on other developing countries in the world, realising which would be feasible and useful to our region and discarding those that are detrimental in the present or the future.

With such an object in mind, the next chapter discuss the position of the various administrative bodies in the region while the chapter succeeding that studies the effects of development (past, present and future) on the Environment

CHAPTER FOUR

INSTITUTIONAL RESPONSIBILITY FOR ADMINISTRATION OF AQABA

A. INTRODUCTION.

In the preceding chapters it has been stressed that:

- 1) Aqaba is singularly important to the Jordanian economy as its only port and its only point of export and import through the sea.
- 2) Considering its value, the size of the place is extremely small, with territorial waters of three nautical miles and a coastal strip length of 26.5 km only.
- 3) The growth of Aqaba from a diminutive fishing village to a modern coastal town complete with port, tourist and industrial infrastructure, has been fairly rapid and in this short period the population has increased enormously.

4) All signs point to further development and modernization if Jordan has to obtain maximum benefit from the strategic position and aesthetic qualities of this region. The ambitious plans for future economic progress have been outlined in the last chapter. It is important in this context that there be set up a proper planning strategy which, fully conversant with the ecological problems, encourages sustainable development of the region.

Proper planning is a procedure to spot and solve development problems by defining and understanding the intrinsic relations of these problems with environmental resources (Ref.14. p.4).

Setting up a model for devising a planning system with its complexity and dynamics, requires a preliminary investigation of all the administrative bodies that have been actively instrumental in the development of the region up to the present.

Such an investigation provides a panoramic view of the various administrative councils, which have the power to make changes in the region. It hopes to thus form the basis on which to structure a model for future sustainable development.

B. ADMINISTRATIVE BODIES OF AQABA.

Administration in the region could be divided into two categories (Ref. 1):

1. Comprehensive Administration.

This is responsible for the governing and development of the region as a whole. In this category there are three main administrative agencies.

1.a. The Aqaba Governorate.

1.b. The Aqaba Municipality

1.c. The Aqaba Regional Authority.

Brief details are given below, to define these offices, their formation, activities, responsibilities and their roles in the development of the region.

2. Sectoral Administration.

This category is made up of a number of agencies representing national ministries in the region (Ref.1). They have certain authorities over the subject issues of development and environmental management within the limits of their jurisdictional areas. These agencies report directly to their head offices in the national ministries in the capital. Each agency is dealt with separately, below.

1. Comprehensive Administration.

1.a. The Aqaba Governorate.

Until the middle of 1994, Aqaba was a subdistrict belonging to the province (governorate) of Ma'an (see Map 4.1).

The Aqaba subdistrict was then headed by a governor who used to report to the governor of Ma'an and thence to the Ministry of the Interior. The governor was aided by an executive council consisting of his deputy, the chief of the Aqaba police, and all the directors of the local administrative agencies representing national ministries in the Aqaba area.

This office had the power and responsibility, by law, to maintain security, encourage public education, agriculture, tree planting and manufacturing. It could establish public markets, organize community centres, opening of rural roads, supply of water and electricity to villages and towns and public health centres. These tasks however, were poorly managed due to the lack of properly trained staff and a lack of funds.

The efforts of this office were thus usually more focused on security through the police and public health through the health directorate (Ref.23).

Hierarchy presented a problem in those days, such as lack of cooperation from other governing agencies who had more power than the governor's office. These led to public demands for change by the representatives of this office in the parliament house. The central government responded by raising the level of administrative representation of the region to that of an independent province (governorate).

The post of governor has been assigned to the president of the Aqaba Regional Authority (ARA) who holds the rank of a minister and thus is the highest in the hierarchy. This has been done to eliminate the division of power among different government agencies and centralize the decision making capacity in one governing body (Ref.1).

This office has now set up two councils. The first is formed out of all government administrative offices in the area. They meet periodically to discuss issues concerning the development and welfare of the area.

The second council consists of representatives of the commercial sector who deal with the economic issues and plan any action needed to be taken in business and industrial matters.

1.b. The Aqaba Municipality.

The Aqaba Municipality was the first department for the control of planning and development in Aqaba. It was set up in the early 1950s when Aqaba was still a village with a coastline of 9.5 km (Ref.23).

The Municipality is a branch of the Ministry of Municipal, Rural Affairs and Environment (MMRAE). The municipality is responsible for the issuance of commercial licenses; sewage and waste water collection and transportation to the treatment plant; solid waste collection and disposal; cleanup of coastline and public land; monitoring of slaughter houses and landscaping of public spaces; town sanitation and cleanness, and some maintenance work of roads and other public facilities.

The town mayor is the head of this office, and he is also a member of the ARA board. He is chosen by local elections. Up to date this office has ranked as a weak spot in the administration of the region due to a lack of efficient and trained staff and funds at hand.

1.c. The Aqaba Regional Authority (ARA).

The ARA is the replacement of the Aqaba Town Planning Committee (ATPC), which was established in 1960 (Ref.1) to supplement the Aqaba Municipality in the development of Aqaba. The ATPC was placed in charge of all development within the town boundaries. When the southern boundary of Aqaba was extended by 17 km, an ad-hoc committee headed by the MMRAE was created for the development of the newly annexed south coast.

The MMRAE was authorised (Ref.23), by definition, to handle all municipal and regional affairs relating to the national level. However, a legal basis which demands the elaboration of regional development plans, did not exist in Jordan at that time. The MMRAE had no technical arm to give advice on policy formulation, development control and physical planning for the area under their jurisdiction.

As a result there were many unbalanced decisions which led to the development of industrial and port sites on the south coast, without planning. In fact all the large infrastructural development on the south coast (the fertilizer complex, potash storage,

shiploading facility, timber factory, power plant and container port) are results of such unplanned decisions.

In addition to this, the division of power between the ATPC and MMRAE created conflicts between the two committees, resulting in a lack of co-ordination in the development policies adopted by them. Such a situation led to the formation of the Aqaba Regional Authority (ARA), in 1984, as the sole body responsible for planning and development in both the Aqaba town and the south coast.

The ARA is the legal successor of ATPC, but with extended boundaries of jurisdiction (Ref.7). It is an autonomous government institution with unique competence in Jordan.

It has complete charge of comprehensive socio-economic development in the Aqaba region, with a total area of about 8300 km², forming 10 % of the total area of the country (Source: Summary of the ARA structure 1994, supplied by ARA office).

The ARA is headed by a president who is the chairman of the board of directors. He is also presently the acting governor of the province of Aqaba, holding the capacity of a minister and directly answerable to the prime minister.

The ARA is responsible (by law No. 7 of 1987) for the planning and co-ordination of social and economic development of the region and the formulation of necessary policies, plans, regulations and programs in collaboration with the concerned public and private agencies (Ref. 1 & 2).

The Area's responsibilities include:

- i. Design and execution of industrial, tourist, agricultural and infrastructure development projects in the region.
- ii. Planning and design of other projects related to ARA objectives, and supervision of the execution of works carried out by the concerned public and private agencies in accordance with the responsibilities entrusted to them.
- iii. Control and modification of the unbalanced growth of Aqaba town.
- iv. Ensuring the Aqaba Region's ability to absorb large investments and permit optimal use of resources in a variety of fields including: air, road and sea transportation; transit, free zone and services activities; medium and large scale industries; and local, regional and international tourism (Ref.7. p 34).

2. Sectoral Administration.

There are various concerned government agencies which are directly or indirectly responsible along with the ARA for the development and environment protection in Aqaba. These are outlined below:

2.a. The Ports Corporation of Aqaba (PCA).

The Port of Aqaba and its facilities form the most important source of income in the region as well as in the country. The PCA has always been and still is, the largest employer of human labour and as such has been the sole agency responsible for the growth and development of Aqaba from the status of a village, to a modern town (Ref.25).

While providing housing for its employees, transportation for goods and labourers, and having sole authority over the maritime administration and development of the coastline (by royal decree in the year of its inception-1953), the port has had more power than any administrative body set up by various ministries.

In fact, until 1984 (when ARA was formed), the port director was also the chairman of ATPC, and as such made all the decisions on town development. Having the largest amount of funds at its disposal, the port has always taken its own decisions on development within its jurisdictional area (which comprises a large portion of the town), independent of any other planning authority (Ref.23).

Having proper know-how and a trained technical staff, the port decisions on development of the region (housing colonies, public gardens, clubs, beaches etc.) have been environment friendly and an enhancement to the area. It is the practice of other planning councils to turn to the PCA for funding and technical help in most of their projects.

Legally the port at present is responsible for operation of the port facilities. It has authority over some of the environmental impacts of shipping activities and maritime administration of the coastal area.

The PCA Director has the capacity of a deputy minister and is member of the ARA board (Ref.7).

2.b. The Ministry of Tourism and Antiquities (MTA).

The office of the MTA is responsible for the coordination of operations in the historical tourist sites such as the museum and archaeological sites of Aqaba and the surrounding area. The MTA is represented at the board of ARA. Most of the responsibility of developing tourism in Aqaba has been allocated to ARA who have

developed all the tourist sites in the region (Ref.7). The boost in tourism in Aqaba can be attributed to the combined efforts of ARA, the Royal Jordanian Airlines (who offer package tours to the region) and the private sector (the hotels which organize recreational activities like scuba-diving and water skiing).

2.c. The Ministry of Health (MH).

Although not represented on the board of ARA, the MH is directly concerned with environment protection. Its responsibilities include monitoring of environmental health conditions like water quality and sewage treatment plant effluent. In Aqaba they are mostly concerned with domestic pest control and hygiene inspection of public premises used for handling food (Ref.1).

2.d. The Water Authority (Ministry of Water and Irrigation (MWI)).

This Ministry is not represented on the board of the ARA. It is responsible for the supply of drinking water, the operation and maintenance of sewage treatment plants and, in Aqaba, the supply of wastewater effluent for irrigation (Ref.7).

2.e. The Aqaba Marine Science Station (MSS).

The MSS was established in the early 1980s for monitoring coral reef ecological trends and providing facilities for training and research (Source: personal communications). It is run jointly by the Universities of Jordan and Yarmouk. It is well placed to serve as a base of operations for baseline research and monitoring of water and air quality and critical biological indicators.

2.f. The Royal Society for Conservation of Nature (RSCN).

This is an NGO established in 1982. It maintains and operates a patrol boat which, with the assistance of the Coast Guard, undertakes twice daily inspection patrols of the port area and the coastline in order to ensure shipping compliance with PCA regulations prohibiting marine pollution. Part of its mandate includes the promotion of

environmental awareness, educating the public on the need to protect coral reefs. As the organization is responsible for the maintenance of protected areas throughout Jordan, the RSCN along with the ARA, MTA and local communities will prepare and implement integrated conservation management plans for a proposed Aqaba marine reserve and for Wadi Rum (personal communication).

2.g. The Royal Scientific Society (RSS).

Although the RSS has no offices in Aqaba, its mandate includes responsibilities relevant to the environmental management of Aqaba and can be contacted by ARA on a case by case basis, to investigate environmental issues related to waste water and industrial emission (Ref.7).

C. Discussion and conclusion.

An interaction diagram (Fig.4.1) below shows the relationship of ARA with other institutions concerned with environmental management in the region. Table 4.1 summarizes the activities in environmental issues, of the above organizations. It is evident that there is a considerable overlap in the distribution of their responsibilities.

Without a mechanism to unite the functions of all these associations, there could be many unbalanced decisions leading to chaos as happened before in the early 80s. In the absence of adequate planning and control, future development could cause substantial hazards to health and to the natural resources (See Chapter 5), which in many cases are already suffering substantial increases in pollution levels.

At the present, the ARA is the institution with the highest authority in planning and development in the region. As regards the environment, the ARA has co-ordinated construction of the sewage treatment plant (with the participation of MWI and MMRAE), created a back road to divert heavy traffic away from the town (though

ARA INTERACTION DIAGRAM *

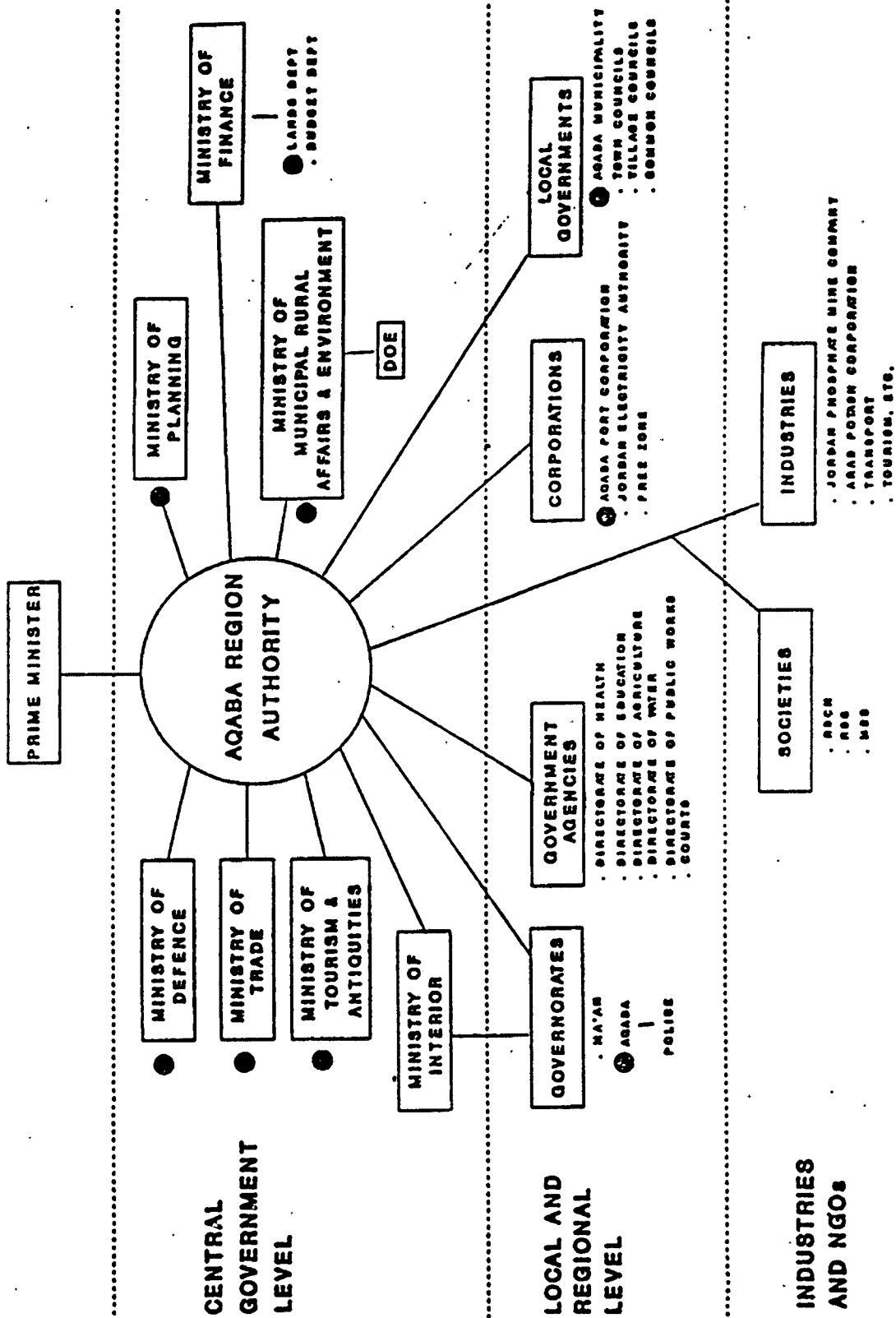


FIG. 4.1 PAGE 45-1

Represented on the ARA Board of Management.

* Based on the Interaction Diagram of the Aqaba Study Report

Source: Gulf of Aqaba Environment Action Plan (with permission).

TABLE 4.1 OVERLAP IN AGENCY RESPONSIBILITY FOR ENVIRONMENTAL ISSUES

AGENCY	AREA OF RESPONSIBILITY						
	Urban/Regional Planning	Waste Water Process	Solid waste Disposal	Drinking Water quality	Other Environ. Monitoring	Nature & Cultural Resource Protection	Environmental Standards
NATIONAL MINISTRIES							
MMRAE							
MOH							
MW&I							
MOA							
MIT							
MTA							
LOCAL GOVERNMENT BODIES							
ARA							
AM							
APC							
OTHER ORGANIZATIONS							
HCEP							
MSS							
RSCN							
RSS							

- AM - Aqaba Municipality
- APC - Aqaba Port Corporation
- HCEP - Higher Council for Environmental Protection
- MOA - Ministry of Agriculture
- MOH - Ministry of Health
- MIT - Ministry of Industry and Trade
- MMRAE - Ministry of Municipal, Rural Affairs and Environment
- MSS - Marine Scientific Station
- MTA - Ministry of Tourism and Antiquities
- MW&I - Ministry of Water and Irrigation
- RSCN - Royal Society for the Conservation of Nature
- RSS - Royal Scientific Society

Source: Gulf of Aqaba Environment Action Plan (with permission).

the road is presently unsafe for use), upgraded cleanliness of the port (with the help of PCA), identified three coral reserves (with the MSS) and established a diving centre.

In reality until now, most of the decisions on development and upgrading activities have been taken up by the various sectoral administrative bodies, with the ARA doing little more than endorsement of the decisions.

The ARA has established an environmental committee with top level administration and a working body of which the author is a member.

However there are no formal mechanisms or specific assignments of staff to handle environmental matters. In addition, the "Law of the Aqaba Region Authority" of 1987 contains no requirements for environmental safeguards.

In the absence of any legal authority for enforcement of its programs the ability of the ARA is extremely limited (Ref.1 & 7).

It is evident that any model for a future development plan must include an environmental unit with administrative and enforcement powers (See Chapter 6 for details).

CHAPTER FIVE

DEVELOPMENT-ENVIRONMENT INTERACTION

1. INTRODUCTION.

According to the Gaia (The Greek goddess of the earth) hypothesis, "the evolution of the species of living organisms is so closely coupled with the evolution of their physical and chemical environment that together they constitute a single and indivisible evolutionary process

(Ref.12 p.33).

The environment and development are interlinked. Any development process affects the earth and the earth in turn affects the people. As the world prepares to face the 21st century, environmental management has become a matter of unquestioned priority in the list of global concerns. It has become the fundamental task of all to accomplish the objectives of socio-economic development. This can be done through "sustainable development"- a policy that meets the needs of people today without destroying the resources that will be needed in the future (Ref. 24 p.54).

The protection of the environment and the promotion of economic development are closely interrelated goals if we are to achieve a state of development that is continuous and profitable both to the community and the natural resources which support it .

The first step in achieving sustainable development based on long-term planning is to recognize the current environmental situation, to try and remedy any reparable damages that have occurred, and to build a future plan of development which maintains and enhances a healthy environment for all members of the ecosystem.

The marine environment is a complex system controlled by various physical, chemical and biological processes. Understanding these processes is a prerequisite to any consideration of past, present, or future human impacts on the sea (Ref. 15 P. 25).

The marine systems and the organisms within it are constantly adjusting to stresses and changes. It thus has a certain capacity to absorb stresses and tolerate management. To determine this capacity of the Gulf of Aqaba ecosystem, it is necessary to identify the targets most at risk from pollution.

Based on the results of these studies, suitable protection standards must be formulated and acted upon. Nations sharing the Gulf of Aqaba must thereafter ensure that the rate of exposure of targets does not exceed the established standards.

This chapter attempts to pin-point the various present pollutants, their targets, the level of pollution and a prospective analysis of future threats concurrent with imminent development projects, hoping to ensure the sustainability of future development of the region (Ref. 14 p. 3-4).

While discussing the major pollutants of the region it is important to keep in mind that:

- 1) Aqaba represents Jordan's only access to the sea and is as such, vital to the national economy.
- 2) The coastline of Aqaba is only 26.5 km long and supports a variety of activities including the port, hotels, tourist sites (beaches etc.), and industrial infrastructure.
- 3) The Gulf of Aqaba has an enclosed type of marine environment with very little water circulation for dispersion of pollutants, so most pollution effects are confined to localised points and will accumulate with time.
- 4) The Gulf has characteristic rich and diverse habitats with extensive sand and rocky outcroppings, coastal lagoons, coral reefs and seagrass beds. These reefs form a coastal barrier against wave action and erosion and are valuable for tourism, since they have a unique diversity. A large number of fish, echinoderms and molluscs are endemic to the area (Ref. 20), making preservation of the marine diversity of the region a matter of global importance.
- 5) The winds are mostly northerly, from the desert carrying dust and also contributing to the aerial dispersion of pollutants.
- 6) The water of the Gulf (as well as the shoreline) are shared by the four neighbouring countries (namely Egypt, Israel, Jordan and Saudi Arabia) which surround it. Any environmental mishap would automatically affect the whole region and thus the four countries should cooperate and combat any environmental threats on a regional basis unconfined by national boundaries.

2. RECOGNIZING EXISTING AND POTENTIAL POLLUTANT THREATS.

There are two main sources of pollution at the coastal level.

A. Land based sources. B. Sea based sources.

A. Land Based Sources:

These are the most varied kind and have two types of impact.

A.1. The Physical Impact.

A.2. The Chemical and Biological Impact.

A.1. The Physical Impact.

Physical impacts are caused mainly by:

A.1.1. Construction activities.

Construction activities when building a port or berth may cover or destroy the natural sea bottom. Large hotel constructions and structuring of beaches north of the Aqaba port are examples of this impact. Urbanization often entails extensive construction which affects shore zones and nearshore waters due to increased sediment loading and infilling of sea areas.

The settling out onto the sea bed of significant quantities of sand and other materials put into suspension by various agents including human activities is probably the chief cause of damage to marine habitats in the Gulf of Aqaba. In addition to the direct destruction of corals and intertidal habitats, the construction of solid jetties causes down-current areas to become stagnant, and this in turn may result in an increase of the effects of local discharges of pollutants in the sea in that area (Ref.15).

A.1.2. Tourism.

Recreational activities like swimming, snorkelling, camping and other tourist activities have the potential to do extensive environment damage. Tourism is important to Jordan because of the nation's need for foreign exchange earnings. During 1989, around 470,000 tourists arrived in Aqaba by sea and air. Tourism may both directly and indirectly affect coastal resources.

The uncontrolled use of these resources can itself cause serious impacts. Loss of diversity and degradation of reefs are predictable results of spearfishing, garbage proliferation and coral damage by swimmers and divers.

The delicate coral reef systems of the area have been affected by these as well as by vandalism and littering, though no accurate figures are available (Ref. 7).

A.1.3. Solid waste (Garbage).

Approximately 90 tons of garbage are generated daily by the town and the port of Aqaba together. The Aqaba Municipality holds the responsibility for garbage collection and disposal.

The municipal rubbish dump is located at an unfenced, open desert area, 1-2 km off the desert highway bypass back road (which is relatively unused), 18 km away from Aqaba town. An unnecessarily large area is given over to extremely haphazard dumping. The rubbish is continually burned openly with no hygienic incinerators present (Ref.7).

Recycling of garbage is rudimentary, and light materials such as paper and plastic bags are picked up by the wind and blown throughout a wide area of desert. Many beaches, much of the coastal seabed and some urban areas in Aqaba, and Wadi Rum desert

receive are thus littered with domestic refuse. If this trend is not curbed, the resulting environmental degradation will be harmful to the corals, hamper tourism and may affect public health. There is urgent need for an environment action plan which will improve garbage collection and disposal systems (Ref.7 p. 24).

A.1.4. Sewage.

Most of the town of Aqaba has adequate sewage service with main outfalls, lift stations and force mains. Before 1993, there was inadequate provision of collection lines, so that about 60 % of the town population was not connected to the town sewage system. At present most of these services have been completed. The areas which have yet to be connected are a portion of the old town, the low income areas, and the south coast. In the absence of sufficiently serviced septic tank facilities, contaminated waste water is entering the ground water table. The effects of this on the hygiene of the urban environment, or the marine environment of the Gulf waters needs to be studied (Ref. 7 p. 22).

A.1.5. Wastewater.

The capacity of the existing plant for oxidation treatment of wastewater is adequate at present and for future handling increased loads. However the lining of the concrete sedimentation ponds are not sealed, and about 1700 m³ of water is lost daily by seepage. A further 1300-1600 m³ per day is lost by evaporation. Samples from ground water wells in the vicinity of the plant are not tested by local plant operators. An increase in the ground water level has been recorded in the area (Ref. 7 p. 23).

This loss of water represents a lost opportunity for increased irrigation which would reduce the demand on fresh water stocks currently used for irrigation. Sludge removal is limited to surface skimming of scum which is buried near by, rather than recycled for agriculture. The quality of effluent however, is reportedly (periodically monitored

by treatment plant laboratory) above standards for water resources used in semi-restricted irrigation (Ref.15).

A proper plan for improved irrigation methods, proper water recycling and wastewater purification would increase the availability of water for effluent-irrigated agriculture. If such a plan is not drawn up soon seepage and contamination of the water table could pose the same threats to human health and the marine environment, as outlined for sewage above (Ref. 7 p. 24).

A.2. Chemical and Biological Impacts.

These kinds of environmental problems are primarily caused by industries and associated transport activities resulting in air, soil, groundwater and marine pollution, such as air pollution by traffic, spillage of phosphate dust at port loading facilities and the production of sulphurous and nitrogenous emission from the fertiliser and power plants

(See Table 1). Other marine pollution sources include oil spills from shipping or road haulage activities, organic matter (e.g. grain) or dangerous cargo material spillage during bulk handling operations (Ref.7 p. 9).

Table 5.1 : Major Air Pollution Sources.

Sources	Activities	Principal Pollutants
1. Traffic	Lorries, buses and cars. Engine exhaust, tire wear and road dust.	Dust, CO ₂ , NO Hydrocarbon, odour
2. Main Port	Handling and loading of Phosphate.	Dust (phosphate)
3. Other Ports	Handling and loading of cement, clinker and rice	Dust
4. Power Plant	Burning of Oil	Sulphur dioxide, Nitrogen oxides, soot
5. Fertilizer Company	Handling of bulk Materials.	Dust (phosphate) Dust (fertilizer), Fluoride.
6. Potash Co.	Handling of bulk materials	Dust (potash)

Source: Aq. Co. Env. Man. St. In. Jordan. (1993).

In the case of Aqaba there is an overall lack of environmental baseline data necessary to assess environmental impacts. Sporadic monitoring of water and air quality undertaken by the Marine Science Station (MSS) and Royal Scientific Society (RSS) have yielded estimated data presented in the tables supplied. The sources of pollution have however been identified and are described below.

A.2.1. Pollution from Phosphate Transport.

The phosphate reserves of Jordan are the third largest in the world (after the US and Morocco). The exports of Jordan Phosphate Mines Company (JPMC) generate around 50% of the country's foreign exchange earnings. The company exports raw phosphate and also has a large phosphate based fertilizer producing plant. But phosphate rock export (about 6 million tons annually) accounts for the major portion of the income. This phosphate is exported by sea through a special loading terminal at the port of Aqaba (also see chapter 3).

Phosphate arrives at the shipping terminal by rail and road (trucks). On arrival, phosphate rock is off loaded into storing sheds from where it is transferred into freighter vessels by semi enclosed conveyor belts. According to an estimate in 1993, 12-15 tons of phosphate was lost each day during this process, most of it as dust (Ref.1 p. 3.22-3.25). Phosphate dust was emitted in three phases: (1) During off loading of phosphate; (2) during movement of the material up the conveyor belts, and mostly; (3) during loading into the ship's hold, (around 80 % of dust generated during loading, resulted from the practice of dropping the rock from the top of the conveyor belt into the bottom of the ship's hold). Along with being a source of pollution this loss of material was an economic loss to the company (Ref. 7 p.10).

Phosphate dust settles on all surfaces in the loading terminal and immediate environment. Due to the northerly winds, most of it is blown into the sea where it sinks, settling on the sea bed and coral reef communities where its effects cause great environmental concern.

Phosphate dust settling on the polyps of the coral reef ecosystems inhibits metabolite exchange and blocks out light, either killing or altering them (Ref. 8 p. 613).

This dust causes intensive water turbidity which prevents nutrition for the coral polyps. The phosphate dust also acts as a fertilizer and causes eutropication, by increasing algae growth which covers the whole reef flat, killing species of coral by shading and accumulating sediments. As a result of this algae growth there is a conspicuous increase of herbivorous sea urchin and fish populations, an effect studied in the northern Red Sea more than a hundred years ago, by Klunzinger (1872) (in Ref. 8).

In addition to this, the air and water pollution caused, have a visible detrimental impact on the aesthetic value of the region as a tourist destination. (Ref.7 p.11, Ref.15).

When the winds are southerly and strong, phosphate dust is blown northwards into the town, constituting a definite hazard to the residents of Aqaba. Separate air monitoring studies undertaken by the Royal Scientific Society and the EC (Ref.7) in 1993 indicated that the maximum peak concentrations of phosphate dust in residential areas were significantly higher than WHO standards (RSS studies showed maximum 24 hr concentrations around 900 micrograms per cubic meter which is 7.5 times the WHO standard). Phosphate dust with a high silica content (around 18 %) has been found to be the cause of a high incidence of restrictive lung disease (by the Ministry of Health) mainly pneumoconiosis and silicosis in phosphate workers at Aqaba (Ref.7 p 10, Ref.1. p 3.24).

Apart from this, phosphate dust is also blown southwards by the northerly winds, creating similar effects far south of the harbour distant from the loading site.

Remedial Action.

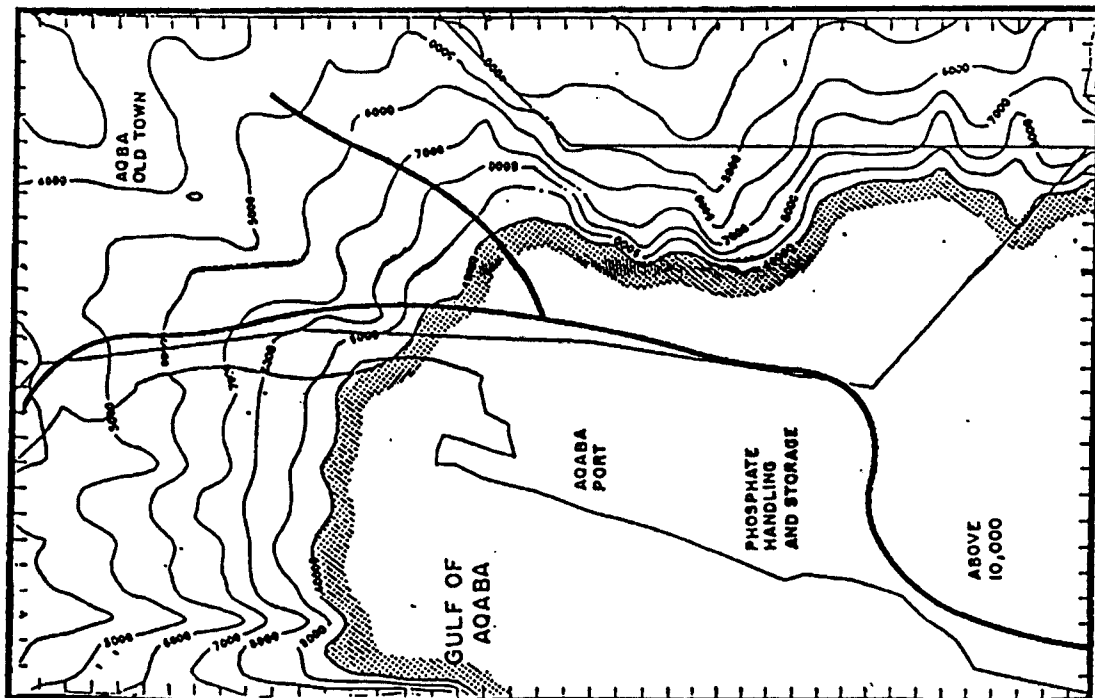
It is urgent that phosphate dust emission be contained at all the fugitive dust sources at the main port including,

1. lorry and rail wagon unloading facilities,
2. the entire passage through the 53 conveyor belts and
3. at the loading terminals where the highest amount of dust is emitted.

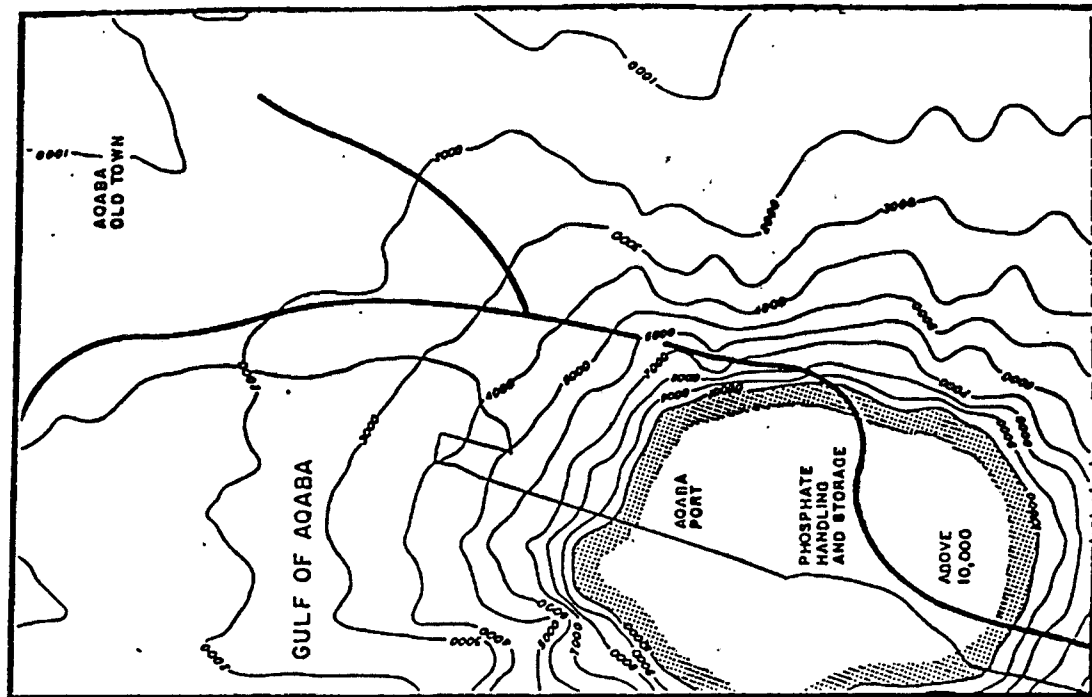
In July 1993, the Port Corporation installed two choke feeders at a cost of .75 million US\$ (these are extended tubes down which the rock is dropped from the end of the conveyor into a spring loaded hopper which periodically drops the material from this much decreased height into the bottom of the ship hold, thus reducing blow back) (Ref.1).

This has reduced the total dust emission by 80 % at present (See Fig.5.1). However, dust concentrations in the urban region still significantly exceed WHO standards.

This calls for a comprehensive dust collection system (at all points mentioned above), which is estimated locally to cost about US\$ 6 million (Ref.18) and is therefore prohibitively expensive at the present. There are plans to install dust collection units at various points of the conveyor system to reduce emission along the belts. Further assessments are required through an audit in accordance with EC procedures and careful periodical monitoring.



PAST SITUATION



PRESENT SITUATION WITH CHOKE FEEDERS

FIGURE 5.1 PHOSPHATE DUST CONCENTRATIONS AROUND AQABA PORT.
MAXIMUM HOURLY CONCENTRATIONS IN MICROGRAM/M2

A.2.2. Pollution from Road Transports.

Road transport in Aqaba creates pollution in the form of exhaust gases and dust from trucks, tires and engine oil. The port of Aqaba receives around 1200 haulage vehicles every day.

Heavy trucks pass through the town and tourist section of Aqaba, carrying phosphate, potash, cement, sulphur, fertilizer, oil and general cargo (See Table 5.2).

Table 5.2: Total Number of Trucks per Year Visiting Aqaba Port (1985-1991)

1985	1986	1987	1988	1989	1990	1991
404561	422608	518529	477374	388908	362283	302481

Source: Port Corporation, Monthly Statistics 1987-1991.

In the absence of monitoring data for the level of exhaust gases and dust, visual observations and preliminary modelling results show high pollution concentrations and noise levels in the urban areas adjacent to truck routes. This leads to health impacts for the people living in these areas (Ref.7 p.13).

As a remedy, an alternative bypass back route was completed in 1993 and truck traffic was redirected through it, bypassing all urban sectors of the town. But the gradient and the length of the slope of the back road are high and conducive to accidents. Hence this route is currently unused. Precautions to prevent accidents are under way and require trucks to use cylinder spring braking systems to be fitted to all heavy vehicles travelling to and from Aqaba.

At present, there are no proper facilities for the parking and basic maintenance of these vehicles which use unsealed sandy areas along the approach to Aqaba and occasionally, the beach (See map 4). These create visible environmental issues:

1. **Truck Tires:** There are approximately 72,000 truck tires discarded throughout Jordan each year, of which about 20% are dumped at Aqaba creating an eyesore. At present 150,000 discarded truck tires in Aqaba require disposal (Ref.7 p 14).

It has been suggested that a solution to the problem would be the use of these tires as fuel for firing in cement kilns providing an oil equivalent annual fuel value of JD 500,000 per year. To establish this it would be required to modify the present cement kiln fuel feeding system and formulate a system of tire collection (Ref. 7. p. 14, Ref.1). Large numbers of used truck tires are discarded at these parking areas. Although this is not a chemical pollutant, it is discussed here because the same sources (trucks) also cause chemical pollution concerns.

2. **Used engine oil** is dumped directly onto the ground at these sites. In beach areas this oil reaches the marine environment.

2. **Oil Dumping :** Used engine oil is dumped directly onto the ground at these sites. In beach areas this oil reaches the marine environment. With regard to the oil dumping problem a special truck parking area has been leased to the Unified Company. This would serve two purposes.

i) The oil pollution problem would be restricted. Companies leasing truck parking area would be required by lease agreement, to provide facilities for used engine oil collection and other waste disposal.

ii) The lease contract would also require the company to collect the used tires and supply them to the cement company for a fee.

In addition to these, there is an urgent need for enforcing coastal zone regulations against truck parking on the beach.

A monitoring study of the environmental and health effects of vehicle pollution (for air and noise) will allow establishment and enforcement of exhaust standards for the vehicles.

A.2.3. Pollution from the Fertilizer Plant.

The fertilizer plant is jointly owned by (JPMC) and Aqaba fertilizer Company. It currently produces about 740,000 tons of Di-ammonium phosphate (DAP) and 270,000 tons of Phosphoric acid annually. Sulphuric acid used in the process is produced on site from elemental sulphur. More than a thousand people are employed by the plant (Ref.7. p. 17).

Conscientious management contains most aspects of the production process which could be harmful to the environment. For instance, all process water is recycled. Reject water is kept in evaporation ponds. Monthly monitoring evaluates stack emission from different production units. All stack gases are treated and the emissions are in compliance with US Environmental Protection Agency (EPA) standards. 25,000 cubic meters of cooling water is used per hour and the temperature of the thermal effluent is cooled by passing it through holding ponds before pumping into the sea at a distance of 140 meters from the shore at a depth of 25 meters (Ref.7. p. 11).

The environmental concerns are primarily related to:

- i) The disposal of large quantities of gypsum which is produced as a by-product of the production of DAP and Phosphoric acid.
- ii) The possible effect of thermal effluent and anti-fouling chemicals on the marine ecosystems.
- iii) Maintenance of gaseous and vaporous pollutants in stack emission at EPA acceptable levels.
- iv) Control of seepage or escape of toxic process chemicals from evaporation ponds.
- v) Dust control (Ref.7. p.12).

The gypsum by-product is currently transported by conveyors to a valley above the plant where it is dumped. The resulting mountain of gypsum (about 2 million tons per year) is the most visible environmental impact of the fertilizer plant.

A runoff or land slide during flooding by rains could have disastrous effects on the coral reef due to siltation and the presence of toxic by-products generated during the production process. An overview of land-based pollution is given in the form of two consecutive tables (3 & 4).

Table 5.3: Estimated Quantities of Organic Matter, Nitrogen and Phosphorous Discharged Directly to the Gulf Of Aqaba.

Pollution Source	BOD t/y	Nitrogen t/y	Phosphorous t/y
Storm water, Aqaba town	10	2	0.5
Sewage, Seepage from Aqaba	a small quantity is observed.		
Sewage, Arab Potash Company	0.5	0.4	0.1
Sewage, Container Port	0.9	0.2	0.05
Sewage, Passenger Terminal & Ferries	5.8	1.2	0.35
Employees at Ferries and Terminal	0.9	0.2	0.05
Harbour Spills (1991) Raw Phosphate	Raw Phosphate to the sea 10,000 t/y 14% P		1400
Chemical Fertilizer	0.01% of 14 663,000 DAP /y		15.5
Grains (Main Port)	230	16	2.3
Rice	38	2.7	0.38
Total	286	36.7	1420

Source: Aq. Cos. Res. Env. Man St. In Jor. 1993. BOD= Biological Oxygen Demand.

Table 5.4: Estimated Nitrogenous Emissions to the Atmosphere from Jordan (tons per year).

Pollution Source	Calculation Assumption	Nitrogen t/y
JEA Power Plant	7200 t/y of Nox to Atmosphere or approximately 2200 t N/y	2200 t/y
Jordan Phosphate Mines Company	To Atmosphere NH ₃ : 1995 t N/y P ₂ O ₅ : 1.9 t P/y Nox : 122 t/y = 37 t N/y	2030
Total to the Atmosphere	Ton /year	4230

Source: Aq. Cos. Res. Env. Man. St. In Jor. 1993.

B. Sea Based Pollution:

This kind of pollution mainly occurs through shipping and fisheries.

B.1. Impact from Shipping.

Aqaba is a prominent shipping port. Between 1985 and 1991 annual shipping traffic to the port was about 2500 vessels handling about 13-20 million tons of cargo per year (See table 5 p 64).

While political circumstances have resulted in a temporary reduction, the amount of cargo handled by the port is expected to increase over the next few years(See table 5.6).

Table 5.6: A Comparison between Total Export and Import in 1991 and 1994 to show the main items of traffic to the port. Source: APC Four Decades of Changes.

Exports (in 000 tons)			Imports (in 000 tons)		
Items	1991	1994	Items	1991	1994
Fertilizer	660	518	Vegetable oil	141	244
Potash	1,265	1,500	Mineral oil	500	7
Rock Phosphate	4,300	3,825	Ammonia	174	354 □
Cement / Clinker	1,200	516	Sulphur	55	N.A
Other	190	131	Food, Consumer goods	3,100	3,450

□ This number shows import amount in 1994 for both ammonia and Sulphur.

There are three categories of pollution from shipping which include:

- (i) Deliberate or negligent dumping of oil or other hazardous material and garbage disposal.
- (ii) Pollutants contained in discharged ballast and bilge water.
- (iii) Pollution resulting from collisions or other shipping disasters (Ref.7).

While examining the sea based pollution in the Gulf of Aqaba it is important to remember that the waters of the narrow Gulf are shared by four neighbouring countries. Thus, pollution caused by a ship sailing in its own territorial waters may impact the marine environment of neighbouring countries (Ref.7).

(i) Dumping, in general, is not much of a problem in the Gulf of Aqaba. In fact the high efficiency of garbage collection from vessels in the Gulf is a source of pride to the PCA efforts. However spilling of material during bulk handling at the port presents problems which have been discussed above.

(ii) With high concentration of tar and other oil residues, ballast water discharges into the sea can be extremely damaging to marine habitats. While modern tankers are equipped with segregated ballast tanks or have special oil separators, older and smaller ships lack such facilities. Installations for receiving, separating and recycling oil contaminated ballast waters are a standard requirement for ports. Among the four countries surrounding the Gulf, only Israel has de-ballasting facilities at its port. The port of Aqaba does not possess facilities for the treatment of ballast or bilge water. It is important that such facilities be set up as soon as possible, since it can eventually become a cost-effective investment (e.g. in Israel, 25,000 ton of oil are retrieved annually from de-ballasting facilities at three ports). (Ref 7 p 19).

(iii) Oil spills are the most acute form of pollution threats from maritime vessels visiting the Gulf. Apart from polluting the water and beaches, oil spills (small or large scale) constitute a danger to coral reef ecosystems.

B.1.1.1. Small scale oil spills.

Monitoring for oil spills from shipping at Aqaba is under taken by the PCA and voluntarily by the RSCN which operates one vessel for daily inspection of the Gulf waters. In addition, the PCA has an inspection team of eight men which is maintained

on call, around the clock. This staff patrols vessels anchored offshore, investigates spills and if necessary, takes the ship operator to court for violations on a "polluter pays" basis. In 1990, there were 22 reported oil spills in the Gulf (Ref.15.). Most of these were attributed to vessels visiting the Israeli port of Eilat.

B.1.1.2. Large scale oil spills.

These are mainly caused by mishaps at sea. One large oil spill resulting from an accident or collision, could permanently damage the coral reef reserve as well the beaches along the coast. It would be sure to also have adverse effects on the neighbouring countries. Although shipping traffic control is very strict in the whole region (no mishap has occurred so far), there is always the imminent danger of such an occurrence (Ref.7 p 18).

The PCA is not equipped to deal with medium or large scale spills, nor are any of the neighbouring countries. Since the matter is one of regional concern, as well as being highly expensive to set up, it is advisable for the four countries to cooperate in setting up a single emergency response capability for the Gulf (Ref. 15).

B.1.2. Impact from Fisheries.

Commercial fishing in Aqaba, started sketchily in the early 1970s with the development of a local market among restaurants and hotels catering to tourists. Although more than 140 families in Aqaba have economic dependence on commercial fisheries, the yield is almost insignificant. The total saleable catch is only around 105 tons per year, netting approximately JD 315,000 to the fishing community. The amount of fish imported for consumption yearly in Jordan, is over 100 times this

amount, making Jordan a fish importing country (Source: APC yearly records 1993-1994).

After a ban was imposed on Jordanian boats fishing in Egyptian and Saudi-Arabian waters in 1982, almost all fishing in Aqaba is conducted by small boats in the coastal area (Ref 7. p 31-32).

The Gulf of Aqaba is a semi-enclosed sea, with a small body of hyper-saline water, and almost no water interchange with the Red Sea. Thus the amount and variety of edible fish is very small.

Fishing is mainly centred on the biodiversity and productivity of the coral reef systems. Common fishing techniques include cage traps, hand drawn nets and hand lining with baited hooks and lures. The most successful is the cage trap, which is also the most harmful since they catch most species of reef fish both edible and inedible, regardless of size, and all the fish caught are killed.

Lately there has been a marked reduction in the abundance and diversity of coral reef populations. This is chiefly due to cage trap fishing. Other environmental issues are: damage to coral reefs by anchors, discarded nets, lines and traps.

Having limited marine resources, the Gulf of Aqaba is susceptible to damage by unplanned exploitation of the fisheries. No effective regulations control the number of boats engaged in fishing, fishing techniques, size or content of the catch, or areas to be fished in Aqaba's limited marine region (Ref 7. p 32).

The Gulf of Aqaba has no potential for commercial fisheries. Judging by the yearly haul, economic returns and environmental impacts, the fishing industry would not only damage the fishery itself (Source: Personal Communications with Sec. Aq. Fish.

Assoc.), but also threaten the future of the lucrative tourist industry which depends on the presence of unspoiled natural coral reef ecosystems.

D. DISCUSSION AND CONCLUSIONS.

The previous chapter (ch. 4), discussed the various authorities responsible for environmental protection in Aqaba. It was seen that, in the absence of a single controlling authority, many different departments bear this responsibility often leading to overlaps in their fields of jurisdiction.

The various sources of environmental impact which have been outlined in this chapter demonstrate the need for a coordinated approach to planning. A coordinated approach to planning minimize problems created by lapping jurisdictions.

By and large, environmental issues in countries with developing economies have little importance to administrators who are interested in development policies which stress quick results with high yields.

The environmental impacts of these schemes are not examined closely. The common populace has little knowledge of what environmental protection entails, or even means.

There is an urgent need for public awareness, creating participation and involvement at all levels so that local information and knowledge are incorporated into making environmental policies effective.

This is even more significant in light of the intense growth and development taking place in the Gulf of Aqaba (Annex 2 gives an overview of future development projects and their impact on the Gulf of Aqaba).

Without environmental protection, there will be no basis for sustainable development in the Gulf of Aqaba. Both the government and the people share the responsibility for protecting the Gulf of Aqaba from the effects of development, to sustain development itself.

Table 5.5: Development of Aqaba Port Traffic (1985-1995).

Year	Total/ton	Export t/y	Import t/y	No. Of Ships
1985	14,547,711	8,177,707	6,370,104	2,671
1986	16,850,628	9,697,388	7,153,240	2,677
1987	20,015,371	11,271,622	8,743,749	2,555
1988	20,096,138	10,952,973	9,143,165	2,583
1989	18,680,649	9,985,974	8,694,675	2,446
1990	15,036,456	8,871,857	6,164,599	2,222
1991	13,225,468	7,677,470	5,547,998	2,075
1992	13,281,014	7,259,311	6,021,703	2,430
1993	11,633,870	6,381,181	5,252,689	2,491
1994	10,572,280	6,648,377	3,923,903	2,485
1995 □	5,542,022	3,096,867	2,445,155	1,130

□ These figures represent the port traffic till June 30th, 1995

Source: APC 1994-1995

CHAPTER SIX

STRATEGY FOR ENVIRONMENTAL PROTECTION

A. INTRODUCTION.

"For better or for worse, our physical environment is a near-perfect diagrammatic representation of our collective living and working habits" (Peter Droege in "To Live in Harmony With The Sea, "Coastal Management, Vol. 20. Jan-Mar 1992).

The previous chapters have attempted to depict a contemporary diagram in the case of the Gulf of Aqaba; a diagram which makes it apparent that the pattern of development and life in the region to date has been denigrating and undervaluing to the sea and its fragile resources.

Development in the Jordanian portion of the Gulf of Aqaba has been a recent and rapid phenomenon, spanning two decades, transforming the entire coastline from its natural state by a variety of developments associated with economic growth (chapter 4), a growing number of tourists and an estimated sixfold increase in population in the town of Aqaba.

These developments have had a negative impact (chapter 5) on the environment of the Gulf, the health of industrial workers, and the integrity of the coastline, coral reef, and adjacent desert ecosystems (which in themselves constitute a resource for the US\$ 40 million per annum tourist industry).

Consequently the establishment of curative and preventive measures to protect the Gulf's natural resources is an issue of critical importance to the region. Without the establishment of a preventive framework, the environment of the Gulf of Aqaba is exposed to the threat of irreversible damage which is likely to increase in future.

Therefore, effective environmental management and pollution control programmes are needed to protect the Gulf's natural resources while allowing for development of the region's trade, industry and tourism. In other words, the programme should provide orientation towards sustainable development, conserving the resource base while ensuring a relatively effective economic growth, which will require a significantly improved management structure.

Consequently it is advisable for the area of Aqaba to adopt an integrated management system usually referred to as Integrated Coastal Zone Management (ICZM), or the closely related Integrated Coastal and Marine Area Management (ICAM). (Ref .2).

The principles and methodology of the integrated management system have been reviewed in chapter 2.

B. OBJECTIVES OF THE INTEGRATED MANAGEMENT SYSTEM IN AQABA.

When determining a suitable management programme for the Gulf of Aqaba one can refer to a number of similar plans drawn up for different regions of the world (Ref.15, Ref.6).

Considering the physical aspects of the Gulf, a management programme for the region should combine two existing practices: the management of semi-enclosed seas and the management of coastal zones. The division between the two systems of management has been bridged in recent years. Governments now acknowledge that both the coastal zone and the ocean realm, especially in semi-enclosed seas like the Gulf of Aqaba, are interdependent systems.

As coastal resources are used simultaneously by different economic and social sectors, integrated management can only be accomplished when all these uses (of the coastal resources), users and their relationships are clearly understood. This approach is consistent with the objectives for integrated management and sustainable development of coastal areas and marine environment, established at the UN Conference on Environment and Development, held in Rio de Janeiro in 1992 (Earth Summit).

The primary aims of any management system should be:

- * to secure the long-term sustainable use of the coastal zone, the sea and the sea bed;
- * to secure the reproductive capacity and health of the living resources of the coastal zone, the sea and the sea bed;
- * to secure the long-term use of the renewable resources of the coastal zone and the sea;
- * to secure or conserve the natural land/seascape; and
- * to provide mechanisms for resolving conflicts between competing uses of the coastal zone (Ref 16).

These aims can be achieved by the following mechanisms:

1. Encouraging the generation of monitoring information by

- * evaluating the present state of the environment,
- * renewing or rehabilitating damaged resources.

2. Assisting the reduction of impacts from point source pollution by

- * identifying how development can continue without degradation of the natural resources.

3. Ensuring the integrity of the ecosystem's biodiversity by guiding the level of use so that the carrying capacity of the resource base is not exceeded. This can be done by

- * ensuring that the rate of loss does not exceed the rate of replenishment,
- * reducing risks to vulnerable resources.

4. Developing and implementing a regional citizen education and participation programme by

- * encouraging environmental awareness in individual members of society,
- * encouraging complementary rather than competitive activities,
- * ensuring that the environmental and economical objectives are achieved at tolerable cost to society (Ref.6 & 16).

And thus, promoting the protection, restoration and enhancement of the marine and land environment in the Gulf.

C. DEVELOPMENT STRATEGY CONCERNS.

There are several points of concern that need to be considered before formulating a viable strategy and policy for future sustainable development in the Aqaba area.

These are mainly based on the determination that the existing trends of development must be changed or slowed down by adopting a selective model of development with consistent implementation of environmental conservation and recovery methods. Any proposed development plan should be based on the following facts (Ref.7):

1. Development of Aqaba has reached such a stage when direct benefits of the industrial development are being shadowed by costs of environmental degradation.
2. Persistence of the existing trends of growth will cause two problems:
 - a. Further resource depletion by encroachment on the remaining coastal resources, and
 - b. Deteriorated quality of life due to pollution.

Characteristically any management programme must be

- i. cost effective, using machinery which is largely in place already and which is not overburdened;
- ii. able to facilitate the accumulation of specialist knowledge and sources of advice;
- iii. capable of dealing with large-scale developments;
- iv. adaptable, to address specific issues raised by individual development proposals;
- v. capable of recognising and dealing with the potential impacts of developments in the rights and interests of the neighbouring states (Ref.16).

D. ORGANIZATIONAL ARRANGEMENT FOR PLANNING.

The Gulf of Aqaba drainage basin and the waters of the Gulf are shared among the four nations which border it. Because the Gulf's small and highly sensitive ecosystem is affected by the activities of all the four nations, no single country can ensure its protection.

Environment protection schemes must cross political barriers and work outside their own borders to achieve long term protection of the Gulf (Fig. 6.1).

Logically all the four nations should be represented in the organisational arrangement for the preparation and implementation of a management programme, as suggested by Jens Sorensen in "A Strategy for Preparing and Implementing a Coastal Zone Management Program for the Gulf of Aqaba" (Ref.15. p 159).

According to the author, there should be a joint management programme involving scientific and policy making panels made up of representatives from the four nations. An efficient and well defined model has been proposed, as shown in (Fig. 6.2).

Practically however, such a representation would probably be inconvenient for geopolitical reasons. It is argued that (Ref.17. p.301), "the Gulf of Aqaba is probably not a good context in which to try something radically different. There are sufficient sources of tension and uncertainty in the region that the parties are advised to try to avoid the unforeseen difficulties that will arise from a new approach within the treaty" (M. Gelpe in Ref.17). Moreover, the planning area defined, would be too large to achieve the objectives of the management plan efficiently and harmoniously.

The four nations could however, cooperate in sharing of data and suggestions for the formation of suitable administrative arrangements in each region. While the expertise and financial support of international organisations and other nations can play a role in furthering such regional efforts, it is the local authorities themselves, who through mutual co-operation, offer greatest potential for designing co-operative solutions appropriate to the region.

	EGYPT	ISRAEL	JORDAN	SAUDI ARABIA
Domestic sewage, pollution, and degradation of coral communities	X	X	X	
Industrial operations (particularly phosphate loading), pollution, and degradation of coral reef communities		X	X	
Oil pollution and degradation of coral reef communities from shipping and transfer operations	X	X	X	
Coral reef degradation from recreation and tourism activities such as sport fishing, coral collection, boat anchors, and discharge of wastes from boats	X	X	X	
Adverse impacts of imported sand for tourist beaches on coral reef communities	X	X		
Degradation of the quality of tourism beaches from various pollution inputs	X	X		
Tourism development and the degradation of the landscape's visual attractions	X	X	X	
Exploitation of fishery stocks in excess of maximum sustainable yield (grouper, lobster)	X		X	X
Utilization of fishery stocks below maximum sustainable yield	X			X
Dynamite fishing	X			X
Decrease in the populations of rare and endangered wildlife (particularly birds, marine mammals, and turtles)	X	X	X	X
Loss and degradation of rare wetland habitats (particularly mangroves)	X			

Potential Issues Motivating the Initiation of a Gulf of Aqaba Action Plan.

Protection of the Gulf of Aqaba therefore, heavily depends on continued support from the general public and from government and private sectors and NGOs on national and regional levels (Ref.7).

As suggested by Sorensen (Ref. 15), and depicted in (Fig.6.1), a suitable administrative arrangement should be divided between a policy committee and a technical committee.

The policy committee is the executive institution that makes the final decisions, controls the budget, and confirms appointments to all other committees, panels or groups needed to prepare the management programme. It should be made up of official government representatives.

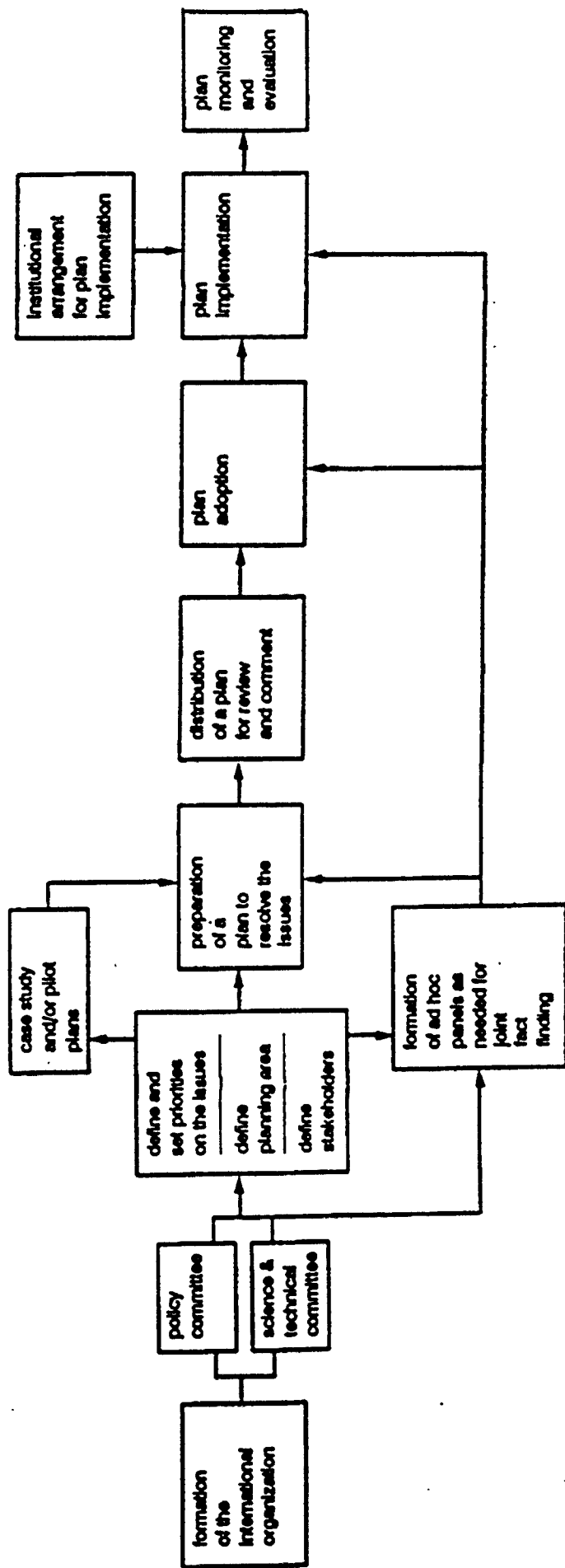
The scientific and technical committee should consist of experts from government, universities and NGOs who are particularly knowledgeable about technical issues related to the programme, and would direct information collection and analysis, including fact-finding efforts.

In short, the policy committee would focus on the value-driven aspects of the issues under consideration. The scientific and technical committee would concentrate on the facts, i.e., on the collection and analysis of data. Both committees should have an adequate planning staff and implementation staff to conduct the necessary day to day work (Ref.15).

E. OPERATIONAL MANAGEMENT TECHNIQUES.

The four key stages in the translation of policy into operational management techniques "on the ground" are (Ref.11):

- a. The identification of management options.



A process for preparing and implementing a management program for the Gulf of Aqaba.

- b. The evaluation of options.
- c. The implementation of management strategies.
- d. The evaluation of management performance.

These four have been clarified in chapter 2. These stages guide the process of strategy implementation and subsequent evaluation of the management process in a systematic manner.

A variety of technical measures, both voluntary and statutory are available to the coastal managers. Various approaches to the development and maintenance of the marine state have been advocated. In fact coastal management is not a new issue in the region. Out of the four Gulf-bordering countries, Egypt and Israel have initiated coastal management programme over the last 22 years (Ref.15, pp.159-175).

The Government of Jordan is very much aware of the importance of comprehensive land use and developmental planning. However, mechanisms for managing the marine estate have evolved slowly and in an ad-hoc manner due to the low priority given to sustainable marine development in the past (Ref.1).

Environmental studies were carried out sporadically, in the late seventies, by scientific organizations like the Royal Society for the Conservation of Nature (RSCN) and the Marine Science Station (MSS).

Private corporations like the Phosphate Company had their own laboratories for monitoring pollution levels. Their reports were mostly haphazard due to lack of interest (Ref. 2).

Regional development plans were drawn up as far back as 1982 (Ref.23), which gave importance to environment protection.

Further surveys were carried out in the 90s, (Ref.1, 2, 7 & 25) in collaboration with foreign consultants, who all endorsed the importance of sustainable development in the region.

F. INSTITUTIONAL RESPONSIBILITY.

The problem is not so much a lack of awareness for the need of environment protection as an agreed plan on environmental action, and a lack of cohesive co-operation among the various governing bodies. Responsibility for environmental protection in Aqaba is shared by too many departments of state and other bodies. This has led to a lack of co-ordination in development efforts (Ref. 7).

A fundamental issue is the nature of the machinery that should be used. The choice lies between the adoption of a developed approach based on assigning marine responsibilities to bodies already involved in the planning processes for the landward side of the coast, or delegation of an over-arching body responsible for all aspects of marine planning and management.

Between the two, the second seems the more advisable method.

Future management would best be conducted within the framework of an overall plan that is the responsibility of one central council which would direct a single course of action, establishing standards and procedures adoptable at a national level, and provide an opportunity to initiate regional co-operation in managing the impacts of development throughout the Gulf of Aqaba.

Such a council would come directly under the authority of the central government. Countries with extensive coastlines benefit from large government bodies like a Ministry of the Sea (Ref. 16), but the size of the coastline and the town of Aqaba, favours a sectoral approach under a department or Ministry of Environmental Protection.

This administrative council would necessarily have more authority, being much higher than all present offices in the bureaucratic hierarchy of the area.

However, taking all aspects into consideration, it is obvious that setting up an independent department for environmental protection in Aqaba would be prohibitively expensive at the present stage (See table 6.1 for cost estimates).

Table 6.1 A Summary of Estimated Costs of the Implementation of the Environmental Plan (Ref.7, p. 66).

ACTION	COST (in 000 USD)
Preparation of a legislative & regulatory framework	300
Strengthening ARA to manage environmental issues	1,300
Industrial pollution control and prevention □	1,480
Marine pollution control and prevention	2,080
Water and wastewater control and management □□	30,280
Solid waste management	470
Protected area management	900
Fisheries management	150
Monitoring and applied research	4,200
Public awareness and environmental education	,100
Total.....	41,260

□ To be Covered by Polluter □□ 99% investment

It appears, that the best policy would be to authorize an administration office already present and functioning, as the supreme governing body responsible for all environmental policies, regulations and development plans in the region.

During the years 1992-1993 the Aqaba Region Authority (ARA) conducted a comprehensive environmental management study of the Aqaba coastal resources with the collaboration of the "COWIconsult" group which is a delegation of the Commission of the European Community (Ref.1). A proposed environmental model

was set up by them (See Fig. 6.3), giving absolute authority for environment management to the ARA.

Another model was proposed in the same year by the Gulf of Aqaba Environmental Action Plan (GAEAP), from the environmental division of the World Bank (Ref.7). This closely resembles the plan by the COWIconsult group (See fig. 4.1 page 42-1). Both studies have allocated the responsibility for environmental planning to the ARA.

The reasons for this (Ref. 7) are:

1. It is an autonomous government institution under direct control of the prime minister's office.
2. It is the only government institution in charge of comprehensive socio-economic planning and development over the Aqaba region, which consists of both the Aqaba town and the south coast (see Chapter 4).
3. It has, in co-ordination with the concerned agencies, worked for environmental protection (e.g. it has constructed a sewage treatment plant and a back road to divert heavy truck traffic away from coastal and town areas, upgraded town cleanliness and identified three coral reserves).

The arguments against giving complete authority to ARA are manifold (Source: Personal Communications with Gen. Sec. of ARA).

1. Although the ARA has some legal instruments through law, to ensure environmentally sound development of the Aqaba area, it does not seem to be in satisfactory control of this vital aspect of development.
2. The ARA is insufficiently staffed in the field of environmental control and monitoring tasks. In fact there is no official body responsible for this area and no knowledgeable staff, assignments or mechanisms to handle environmental matters.

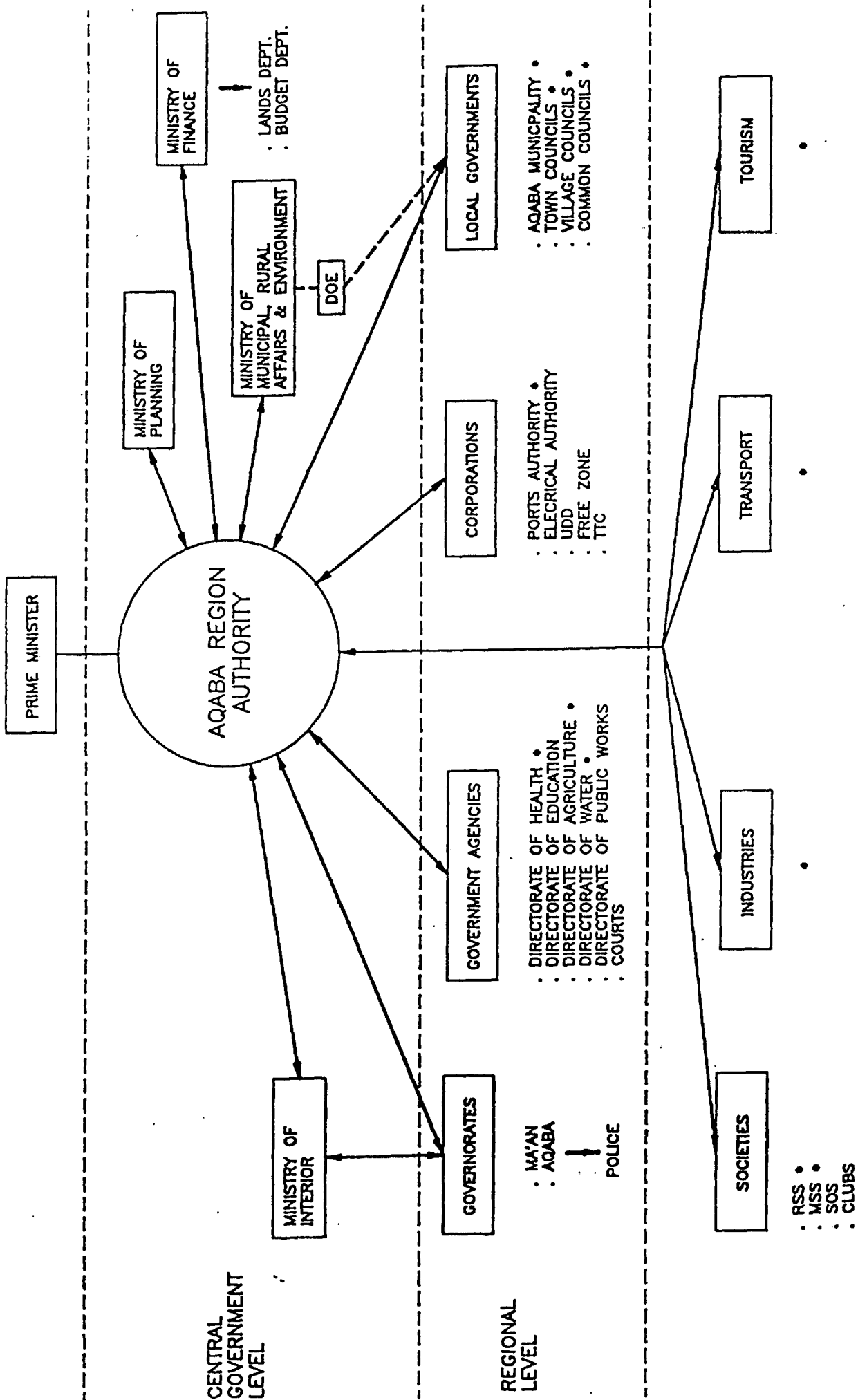


FIG. 6.3 PAGE 77-1

FIGURE 6.3: ARA INTERACTION DIAGRAM BY COWiconsult GROUP

• ENVIRONMENTAL RELATION EXISTS

Source: Aqaba Coastal Resources Environmental Management Study (Ref.1).

3. There is insufficient environmental protection legislation in Jordan. In addition, the Law of the Aqaba Regional Authority" of 1987, contains no requirement for environmental safeguards.

4. There is a competition among the various concerned government agencies to exercise environmental control tasks empowered in them by law, their ranking, and their standing.. Examples of these agencies are: The Ports Corporation, Department of Agriculture, Free Zone Corporation, Royal Scientific Society, Civil Defence, Water Authority, and the Aqaba Municipality.

Although the activities of these groups have led to a fair amount of environment protection to date, the work accomplished has mostly been as a result of ad-hoc decision making and temporary curative action.

If the ARA has to be designated as the over-arching body exercising absolute control over all planning processes to ensure sustainability of future development, it is necessary to expand the jurisdictional power of the office. In fact there are four important elements to be considered.

1. The Institutional Strengthening of the ARA.

In the present set up of the ARA, the president is the chairman of a council made up of top level administrators representing various ministries of defence, trade, interior, transport, industries, tourism, planning, finance, and education. This council however, meets sporadically, and their efforts at co-operative decision-making are more a matter of formality than anything else.

To strengthen the ARA's role of authority, it is important:

- i. To change the name of the ARA council to "Board for Strategic Planning of the Aqaba Region".

- ii. The board meetings should be periodical (say once a month) and attendance and active participation must be mandatory.

- iii. Each representative of the board must have a special consultant office in his organization to supply him with a monthly picture of the achievements with statistical data. This, along with a list of future requirements should reach him before the monthly ARA board meeting. This will give him an account of the strengths and weaknesses in his organization and offer a view of the environmental threats and development opportunities.

- iv. The board should review all the input of data from the various sources. These should be stored, thus forming an information pool for statistical surveys and strategic planning of the region.

- v. Strategic planning must be a co-operative effort with all the members participating positively, to ensure overall rather than sectoral development.

- vi. The presence of consultants from the environmental unit (See below), must be mandatory at the meetings.

2. The inclusion of a powerful environmental unit endowed with administrative and enforcement capabilities.

Through the establishment and operation of an environment unit, ARA would be equipped to manage and maintain the environment integrity of the Gulf of Aqaba. The unit would be provided with adequate authority, staffing and equipment to accomplish its new mandate.

The unit should establish permanent links with all environmental offices in the region to allow sound environmental principles to be maintained.

3. The establishment and enforcement of a legislative and regulatory framework for the Aqaba region. This would include:

i. The establishment and enforcement of regulations to control impacts due to development and other activities throughout the coastal (terrestrial and marine) area of the Gulf (e.g. building, dredging and landfill activities).

ii. Development and implementation of an "Environmental Impacts Assessment" (EIA) system and development and industrial permit procedures.

iii. The establishment and enforcement of discharge standards controlling air and water pollution from ships, industries, port and tourist activities.

iv. Legal provision for protecting significant sensitive terrestrial and marine ecosystems, habitats and species (Ref. 7, p.50).

4. Investments and technical assistance activities.

Working on a limited budget, the board of ARA should establish a priority list of the development and issues for the region.

A detailed budget is required for equipment and training for the establishment of the environmental unit (See table 6.1 for cost estimates).

G. PUBLIC AWARENESS AND ENVIRONMENTAL EDUCATION.

Effective conservation of the coastal reserve and the maintenance of a clean, litter-free environment, can only be possible with full support of the general public, both resident and visiting. Consequently the ARA in partnership with appropriate local

NGOs, would design and implement environmental awareness programmes aimed primarily at local residents (including fishermen), tourists and commercial visitors.

These would also be directed at policy and decision makers. Planned activities would include the establishment of educational field centres at reserves, and the provision of specialist support to the Ministry of Education for improving the environmental content of all formal Jordanian education curricula.

H. DISCUSSION AND CONCLUSIONS.

The plan outlined in this chapter would address environmental policies, institutional-related and investment needs, and identify priorities for action. Policy aspects including the creation of the necessary regulations would strengthen the coastal zone management capabilities needed for implementation of the recommendations of the plan. This would lead to the stimulation of investments in environmental clean up and prevention measures, highlighting the economic advantages of an environmental programme.

Introduction of standards and regulations should be accompanied by (Ref.7):

- a. development of economic instruments including charges (service and emission charges, user fees, product taxes);
- b. provision of a system of incentives for not polluting (tax allowances);
- c. creation of a deposit refund system to ensure the collection of reusable materials;
- d. design of practical enforcement mechanisms; and

e. delegation of clear enforcement responsibilities, along with adequate authority and staffing to enable enforcement.

While some of the benefits of the plan above (e.g. reduction of point source pollution and the clean up of beaches) would soon be visible, the greatest value of the plan would be in establishing a permanent local capability to prevent, contain or manage the detrimental environment consequences of development while facilitating sustainable economic growth.

It would also facilitate options for regional co-operation necessary, in order to resolve trans-boundary environmental problems.

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION.

" Then we entered the Gulf of Aqaba, the most desolate sea in the world. There is hardly any maritime plain in the south, while in the central section, black and red mountains rise sheer from the water. Beside this majestic wildness, the desolation of the Gulf of Suez is a mild and smiling landscape. No ships visit these waters, the only sign of there having been life on the sea is the wreck of a Turkish gunboat on a reef at the entrance to the Gulf. Yet, strange to say, at intervals are clumps of stunted palms around a brackish well, scarcely to be called oases, where a few Arabs live, partly upon their goats and camels and partly by fishing".

These words, written about the Aqaba Gulf by Crossland in 1939, certainly do not describe the busy waterway bordered in the north by industrial areas (of Jordan and Israel) of today.

The preceding chapters have tried to illustrate the effect of development in the Aqaba region and thus provide an overview of the environment-development interaction in the area.

B. OBSERVATION AND FINDINGS.

The major conclusions of the study are summarized below:

1. In the space of the past twenty five years Aqaba has changed from a sparsely populated, quiet fishing village to a busy modern port and popular tourist destination.

2. Associated with this, a variety of developments modified the coastline of Aqaba during the period of economic growth of Jordan (from the mid 70s to the mid 80s). These have had adverse impacts on the environment, the most prominent of which are:

a) air pollution, resulting from industrial activities like phosphate and cement loading, power plants and heavy vehicles of the transport sector; and

b) coral reef degradation, from construction activities and dredging, tourist use of the beaches and coral reefs (bathing, snorkelling etc) and pollution by littering.

3. Concurrent with this development, the population of Aqaba has increased from 10,000 in the early seventies to about 70,000 at present. This was caused mostly by a transfer of people from other parts of the country seeking jobs (created by the economic boom) and residence in the area.

This sudden expansion in the population in the early 80s caused over-crowding and housing problems in the urban area. The town authorities tried to cope with the on-

rush by speeding up urban development with scant regard for its effect on the natural resources.

4. The present state of the Gulf is a result of this dynamic expansion, both in industrial development and urban growth within the limited space of the Aqaba area.

5. When discussing development programmes in the region, it is necessary to keep in mind that the Gulf of Aqaba is a small, narrow body of hyper saline water, nearly cut off from the open sea, having very little circulation of its waters. Therefore pollutants are not widely dispersed, but remain localized, giving long-term effects by accumulation.

Realizing this, and knowing of the various developments (Chapter 4) in the region to date and their effects on the land and sea environment (Chapter 6), as well as future proposals for large scale planned development in the area, it becomes evident that the environmental impact will increase further unless steps are taken to control the pollution effectively.

6. It is evident here that the surest method of conserving the natural state of the environment is to harness and slow down both development and population growth.

7. However, the development of Aqaba is crucial to the presently weakened Jordanian economy. Estimated revenues brought in by some of the activities in the region are:

Port activities	= JD 35-40 million,
Fertilizer & Phosphate Export	= JD 210 million,
Tourism	= JD 40 million.

(Ref. GAEAP 1993).

In addition Aqaba provides storage and free-zone services and is the only place in Jordan where cooling water is available for energy generation in industrial processes.

In fact the government of Jordan views Aqaba as a region with high economic potential and plans further development of trade, industry and tourism in the area.

8. What is actually needed then, is to establish a balance between social and economic needs, and the best use of the area's limited natural resources in a way that will protect and enhance those resources for the future, by providing a comprehensive legal and administrative framework for environmental protection and pollution control.

9. The existing legislation is largely insufficient as a legal basis for intervention or action against serious pollution. The responsibility for environmental planning, pollution control and enforcement in Aqaba is, at present, taken up by several government agencies (namely: the Aqaba Regional Authority, the Governorate of Aqaba, the Municipality of Aqaba, the Ports Corporation and the Water Authority of Jordan) and regional scientific societies. This has resulted in poor co-ordination among agencies, duplication of work and gaps in environmental protection.

10. It is imperative to implement strict legal measures of environment control in every development plan, to avoid further depletion of resources and a deteriorated quality of life due to pollution.

Such measures can only be taken if the responsibility for environmental improvement is given to a single umbrella organisation that would have the responsibility of making regular environmental impact assessments of the environmental effects of each project, and the power to enforce standards and regulations for environmental protection in the area.

11. It was recommended in the previous chapter, that to be cost effective and prompt, such authorisation should be given to an office already involved in the administration and development of the region, rather than go into the expense and delay involved in

creating a separate governing body. The Aqaba Regional Authority (ARA), in spite of its many weaknesses (lack of clear legal mandate and inadequate resources for environmental protection), was seen to be the office most suited for the purpose.

C. RECOMMENDATIONS.

Ways of strengthening the ARA by giving it higher legal authority and the creation of a fully operational "Environment Unit" were discussed in chapter 6.

The following recommendations have been outlined for strengthening the ARA:

1. Increased Power.

The ARA should be endowed with administrative and enforcement capabilities (see chapter 6) by giving it the necessary legal and administrative authority.

2. Coordination Capabilities.

The planning department should co-ordinate all significant environmental protection activities with other relevant organizations in the area (namely: Ports Corporation, Ministries of Water, Irrigation and Health, Royal Scientific Society, Royal Society for Conservation of Nature and the Marine Science Station).

This would ensure the integration of environmental management within regional development planning.

3. Adoption of a Clear Strategy for Development.

A balanced growth strategy should be adopted, defining the environmental and developmental goals for the Aqaba region.

Four areas require careful consideration and planning:

- 3.a. Industrial development.**
- 3.b. Tourism enhancement.**
- 3.c. Urban area upgrading.**
- 3.d. Regulation of fishing activities.**

4. Updating of Environmental Protection Legislation.

After a scrutiny of proposed developments and their likely impact on the environment, environmental protection regulation must be updated, as required. This can be done by:

- 4.a. Ensuring the enforcement of environmental criteria, standards and regulations for each specific terrestrial and marine zone;**
- 4.b. Implementing Environmental Impact Assessment (EIA) procedures for all development projects before permit issuance;**
- 4.c. Enforcing environmental monitoring studies to be conducted regularly by all large industries in the area, identifying point and non-point sources of pollutants and nutrients, and including a monitoring of the results of pollution control measures applied;**
- 4.d. Establishing revenue generating mechanisms (like assessment or impact fees on new constructions, solid waste emissions service and user taxes and concessions for tourist activities), to provide sufficient long term funding for the environmental unit, plus cover costs of maintenance of coral reef reserves and beaches;**
- 4.e. Ensuring the implementation of water and air quality monitoring programs and preparation of a sea-water quality management strategy with the co-operation of**

concerned scientific organisations like the Marine Science Station, the Royal Scientific Society and The Royal Society for Conservation of Nature;

4.f. Ensuring the provision of equipment, facilities and training to enable the setting up of a Marine Pollution Disaster Contingency capable of taking immediate action to protect the coastline and marine ecosystems in the event of pollution through marine hazards.

4.g. Prohibition of construction on coastal and marine areas which are ecologically sensitive. The requirement of the shore act should be adhered to by confining all construction of touristic infrastructure at 100 to 200 meters from the highest tide line.

4.h. Prohibition of sewage or effluent discharge near the coast or in shallow waters (above a depth of 20 meters).

4.i. Implementation of a solid waste management plan for upgrading collection and disposal of garbage from the town, the port, the beaches, reefs and desert areas. The plan should also review methods for recycling of garbage.

4.j. Industrial pollution must be contained by careful monitoring and remedial action for industrial effluents and by products (e.g. gypsum, stack emissions, chemical by products and thermal effluent from the fertilizer plant, and dust from the phosphate loading).

5. Public Awareness.

Public awareness should be increased by providing full information on the status of the Aqaba environment, including the diversity of the coral reef ecosystems and air and water quality.

This can be effected by public awareness initiatives to prioritise environmental problems. These should be undertaken by local organizations, ad-hoc committees, campaigns, and inclusion of environment protection studies in school curriculum.

D. THE BENEFITS OF INTEGRATED MANAGEMENT.

Integrated management of coastal resources is widely accepted as the necessary approach to achieve sustainable development of a nation's marine environment (Source: Handout on Strategic Planning at WMU. Prof. T. Sampson). Although this would be a difficult task for the sectoral administrative authority, its future benefits would be significant.

1. A long term preventive perspective would curtail further environmental degradation and marine pollution.
2. Clean up of marine, littoral and desert areas, enhancing the aesthetic value of the region's tourist resources.
3. Management of pollution at specific sources would help in reduction of pollutants at source.
4. The ecological balance of valuable reef and marine ecosystem would be maintained.
5. Recycling of waste water for irrigation would ease the impending problem of water shortage in the area.
6. It would establish standards and procedures to be adopted at the national level in the future.

7. It would increase Jordan's value as a trading and tourist destination.

8. It would enable the authorities, to provide in prompt response to any marine accident in the Gulf.

9. It would provide an opportunity for regional co-operation in encouraging sustainable development throughout the Gulf of Ababa.

In this way, by participating in the resolution of trans-boundary environmental problems, it would promote peace and co-operation in the region.

E.CONCLUSION.

Aqaba's problems are neither unique in this world, nor in the region itself. Governments of developing countries are often short sighted due to an ignorance of the issues at stake. They tend to look for immediate solution to immediate problems, exploiting people and nature in the name of development, leaving the side effects to accumulate into future disasters.

Due to the proximity of the states surrounding the Gulf of Aqaba, local disasters have far reaching effects, ultimately influencing the entire Gulf. Local environmental problem therefore, need to be studied as regional crises with all the neighbouring countries involved in the implementation of a joint environment action plan.

It is hoped that the formation of an integrated coastal management system in Aqaba would be a step in the right direction and by participating in the resolutions of trans-boundaries environmental problem, it would promote peace and co-operation in the region.

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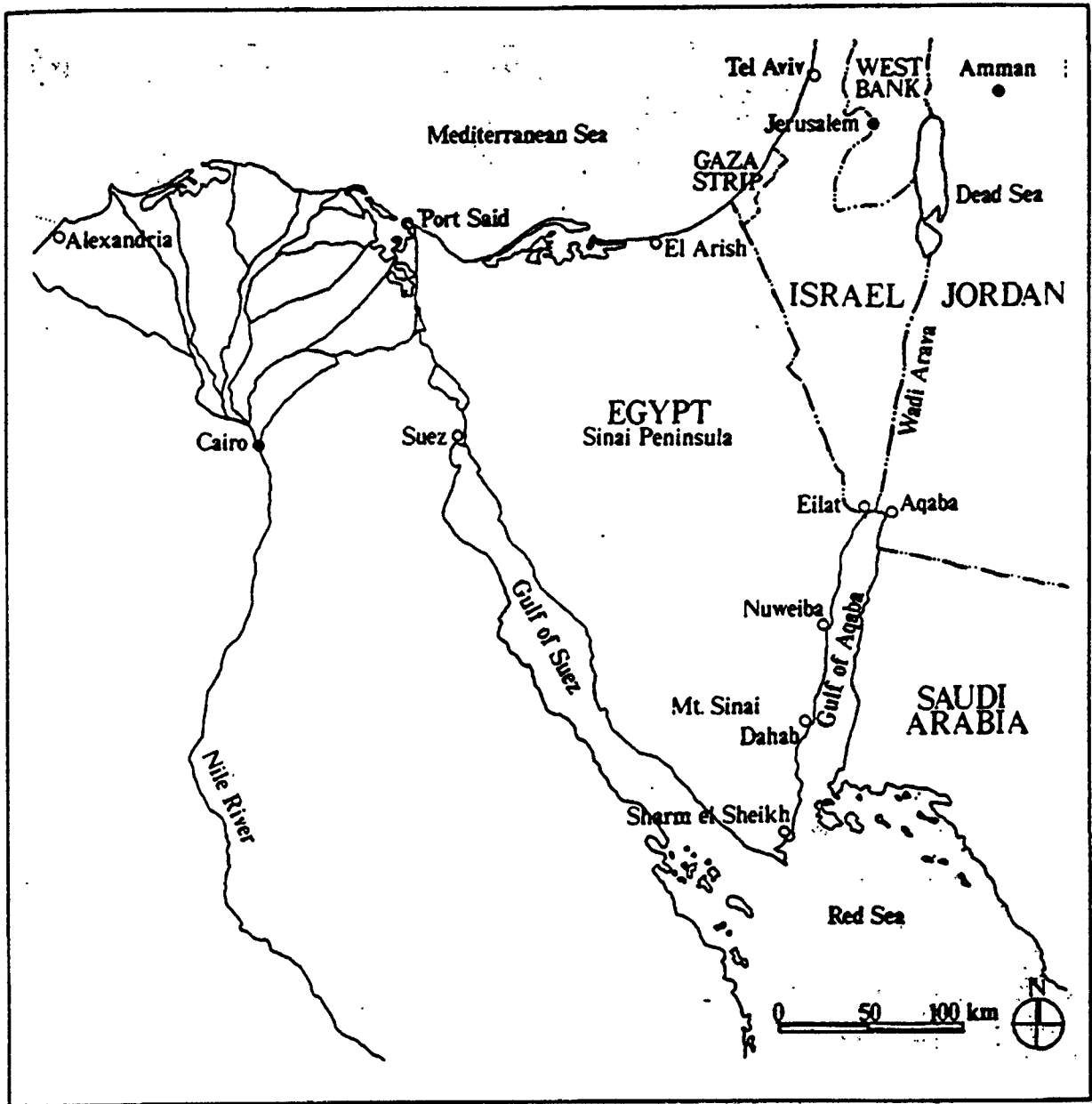
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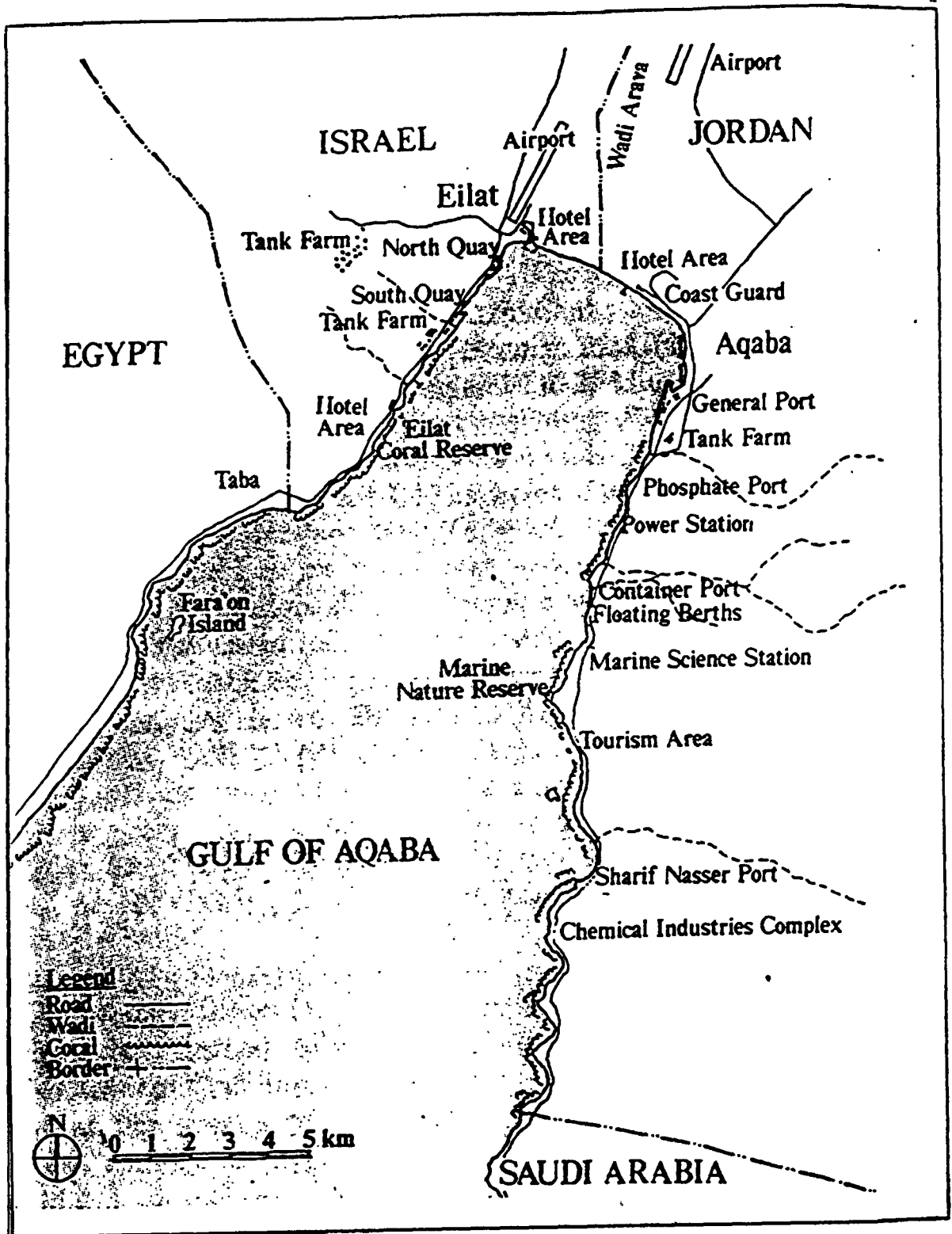
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ANNEX 1

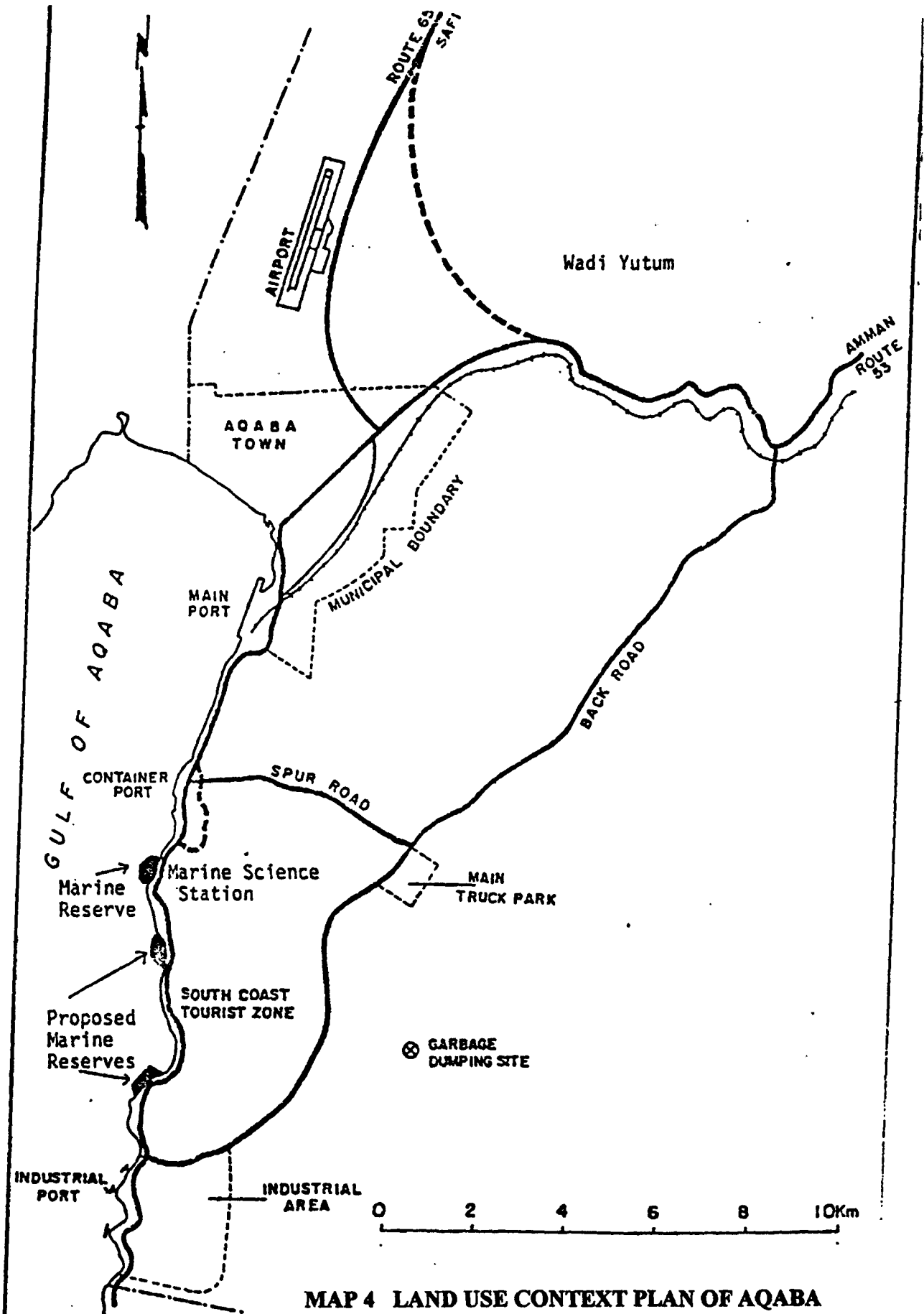
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MAP 2 THE NORTHERN EXTENSION OF THE RED SEA

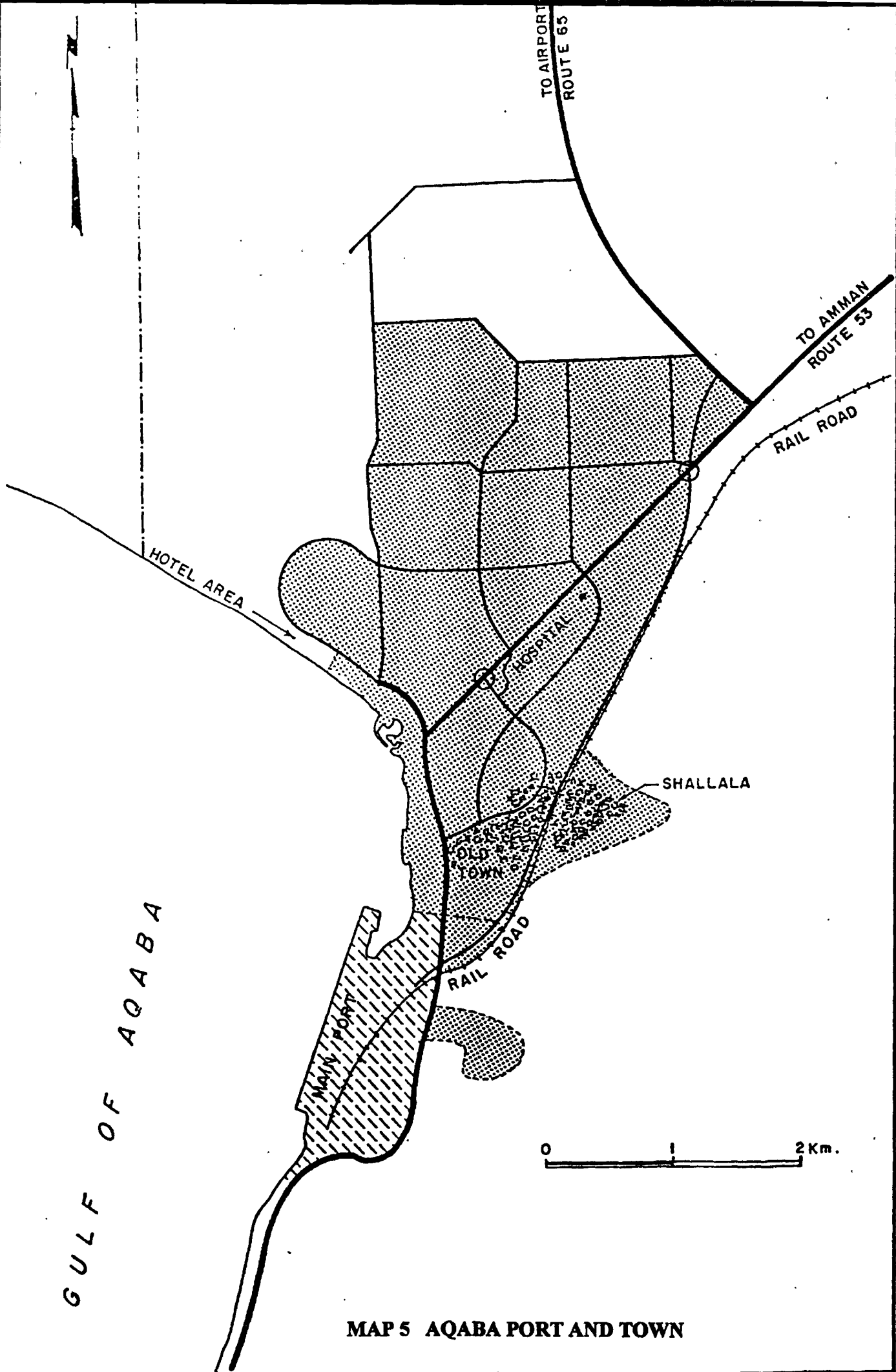


MAP 3 THE NORTHERN END OF THE GULF OF AQABA



MAP 4 LAND USE CONTEXT PLAN OF AQABA

Source: Aqaba Coastal Resources Management Study in Jordan



MAP 5 AQABA PORT AND TOWN

Source: Aqaba Regional Authority.

ANNEX 2

**PLANNED PROJECTS AND PROBLEM IMPACT IN THE
AQABA COASTAL ZONE**

Planned Projects and Probable Impact in the Aqaba Coastal Zone

Project	Sector	Probability	Timing	Impacts			Environment
				Production	Employment	Resources	
1. JPMC expansion	industry	100%	end 1993	112,000 t/yr	none	same as existing	
2. DAP	industry	100%	end 1993	160,000 t/yr	none	same as existing	
3. Add. raw phosphate storage expansion	industry	+ 2	b 2000	400,000 t/yr	100	need new bulk jetty	dust
4. APC Potash expansion	industry						
5. APC Sodium Chloride	industry						
6. NPK	industry	100%	1995	300,000 t/yr	100	60 dunums inland 300,000 m ² /yr wat.	
7. Phosphate storage in main port	industry	+ 2	2000	200,000 t storage 3.0 mn t/yr export			dust
8. APC Bromine	industry						
9. APC Potassium Sulphate	industry						
10. Meat Processing	industry			600,000 sheep/yr 6000 cows/yr	260	US\$700,000	wastewater t.p.
11. Steel Factory	industry						
12. Petrol Tank Farm	industry	100%	1995	180,000 m ³	50		spill of voc
13. Liquid Ammonia	industry						

Project	Sector	Probability	Timing	Impacts			Environment
				Production	Employment	Resources	
14. Liquid Chemicals Storage	industry						
15. Vegetable Oil Storage	industry						
16. Power Line to Egypt	industry		pending				
17. Holiday Village (Quaboo)	tourism		pending	2180 beds		54 ha, water supply	sewage
18. Net tours Hotel	tourism		pending				
19. International Hotel group 1	tourism		pending	500 + 250 beds		20 ha, water supply	sewage
20. International Hotel group 2	tourism		pending	1000 beds		33 ha, water supply	sewage
21. Water Theme Park	tourism		pending				
22. Coral reserves, Marine park	tourism		pending				
23. Port expansion	transp.						
24. Truck Terminal	transp.						
25. Restart Timber Factory	industry	100%		higher production			
26. Multipurpose Berth - general cargo	transp.	depends on other projects		7500t vessel 3.0 min t/yr bulk 1.0 min t/yr cargo		300 m coastline	

Project	Sector	Probability	Timing	Impacts			
				Production	Employment	Resources	Environment
27. Bulk Berth	transp.				50	200 m coastline	
28. Passenger Terminal Berth	transp.				no change	150 m coastline	
29. Power Plant Second Stage	industry	+ 2	1995-97	260 MW	1000	0.3 cu. m/yr of water	as existing plant
30. Expansion of Sulfuric Acid	industry	+ 2	b 2000	0.3 mn t/yr	none		as existing plant
31. Desalination Plant	industry	+ 2	b 2000	2.0 mn cu. m/yr	none	less water consump.	
32. Phosphoric Acid Storage P205	industry	+ 2	1995	storage 10,000 t export 200,000 t/yr	15-20	60 dunums inland	

Source: Aqaba Coastal Resources Environmental Management Study in Jordan-EC-COWIconsult and CEB, 1993

Sector: industry, transport or tourism.

Probability: 100%; very high + 2.

Time aspects: year of completion or before 1995/2000/2005.

Economic sector impact: production in physical terms; employment in number of persons; resources - land, water, coastline, etc.; environment-emission types and amount.