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SINAI DEVELOPMENT STUDY, PHASE I

FINAL REPORT

VOLUME III

AN ECONOMIC DEVELOPMENT AND INVESTMENT PLAN, 1983 TO 2000

SUBMITTED TO:

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FINAL REPORT

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AN ECONOMIC DEVELOPMENT AND INVESTMENT PLAN, 1983 TO 2000

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EXECUTIVE SUMMARY

The economic development program for the Sinai Peninsula has been prepared as an integral part of the Recommended Strategy presented in Volume I. At various times during the process of formulating that Strategy, the development potential of each economic sector was analyzed by sector specialists; especially in the later stages of SDS-I, the economic potential of each of five subregions was assessed. The results of these subregional and sectoral analyses were integrated into several alternative development strategies, each including a different mix in terms of employment, spatial distribution, investment emphasis, and phasing. The Recommended Strategy represents the Study Team's best judgement of the most effective mix to achieve rapid growth; it proposes a realistic path for establishing a self-sustaining economy in Sinai.

The economic development program presented in this volume is in no sense a prediction or a forecast. It is a strategic plan, an integrated set of proposals, a reflection of mutually reinforcing concepts. Sinai's history does not offer the planner very useful "trends" except in subsectors such as animal husbandry and petroleum extraction. Therefore, to a substantial degree, the economic development strategy for Sinai has to be built from scratch in response to perceived potentials and demands, incorporating comprehensive development strategies and concepts that have worked in other parts of Egypt, and elsewhere. Consequently, this economic development program is more than normally subject to questions and uncertainties.

The most fundamental of the questions that many people ask is, "Why does Egypt choose to develop Sinai extensively and rapidly?" The answer to this basic challenge rests on three fundamental considerations:

- Rapid population growth and overcrowding in Nilotic Egypt require that new lands be settled elsewhere
- Rapid economic growth for the country as a whole since 1972 is supported partially by two of Sinai's key resources, petroleum and the Suez Canal
- Sinai is located between the rest of Egypt and the burgeoning economies of the Arabian Gulf; it is located on major world sea and air-travel routes.

Economic objectives

Starting from the premise that Egypt's economy will continue to grow for the rest of this century as it did for the last decade, the SDS team concluded that it would be reasonable for Egypt to plan:

- To settle 4 percent of its forecast population growth for the remainder of this century in Sinai
- To irrigate about 200,000 feddans, mostly with Nile water, using intensive "high tech" agricultural practices
- To build about 5,500 hotel rooms and more than 20,000 villas or more modest domestic tourist accommodation units in Sinai's resort areas

- To invest in industrial plants and mines that would employ roughly 47,255 persons (less than 5 percent of Egypt's projected new industrial employment) and market a wide diversity of products, primarily to other markets in Egypt and to the Middle East.

To support the economic development program outlined in this volume, Egypt would also invest in a modern infrastructure system and encourage migration to Sinai. This program is reasonable from the national point of view because it would move Egypt toward:

- A more export-oriented economy
- A vertically integrated fossil-fuel industry
- A broader, year-round tourist industry
- Establishment of substantial agricultural activities distant from Nilotic soils
- Greater self-sufficiency in food
- More secure frontiers.

Expenditures to achieve these and other objectives are not recommended as investments that will give Egypt the highest possible financial returns during this century, but rather as reasonable expenditures in light of Egypt's national goals, including social and strategic considerations along with those that are purely economic. This Strategy takes into account the need to mitigate problems in Nilotic Egypt and the desirability of opening new windows of opportunity on Egypt's eastern borders.

Volume III can be seen as describing the motor that will drive the Recommended Strategy presented in Volume I. It shares with Volume II, Managing Sinai's Development, a concern with "how" as well as "what" to do. The program presented here is based equally on the research reported in Volumes IV, V, and VI and on the planning processes described in Volume I.

Rapid economic development is necessary to achieve Egypt's objectives for Sinai. A primary issue addressed, therefore, is the level of effort necessary to start such rapid development at the lowest possible cost and as soon as possible. A good start has been made in this direction by the Governorates, the Sinai Development Authority, and other agencies since 1979; the task now is to accelerate the pace of development in production sectors to create well-paid jobs that will not only improve the welfare of existing residents but also attract tens of thousands of new settlers.

Integration of economic sectors

The year 2000 objective of the economic development program is an integrated dynamic economy that complements the national economy by having a greater proportion than the national average of:

- Modern, intensive agriculture
- Export-oriented agriculture and industry
- Domestic tourism
- Private investment in industry and tourism

- Land transportation services to the Middle East.

The path to this objective is plotted through five distinctive subregional economies, initially characterized by:

- Intensive agriculture, light industry, and domestic tourism close to the Suez Canal (Northwest)
- Irrigated agriculture, varied industry, domestic and international beach tourism, and fishing along the Mediterranean coast (Northeast)
- Light industry, transport services, and dispersed agricultural settlements near the new highways to Baghdad and Riyadh (Uplands)
- Heavy industry near major international shipping lanes along the Gulf of Suez and varied tourism (Southwest)
- International beach tourism along the Gulf of Aqabah with some light industry and local agriculture (Southeast).

The economic development strategy proposed for Sinai begins with three poorly integrated economies:

- "Traditional" (grazing and fishing)
- "Modern" (petroleum and international tourism)
- "Mixed" (agriculture and trade near the Mediterranean).

These differences reflect the diversity of climate, uneven distribution of resources, and poor communications systems of Sinai's recent past. Planning and investment are intended to accelerate the integration of these economies.

The Sinai Peninsula has special economic development problems and opportunities. These are described in this volume under appropriate headings. It seems worthwhile to mention a few here as background to the chapters that follow. Problems include:

- Compared to Nilotic Egypt, Sinai is short of skilled manpower and infrastructure (other than transport)
- Sinai is a desert area
- Sinai has poor access to Cairo and Alexandria, which can, however, be remedied by investments already being initiated.

On the positive side:

- The Sinai Peninsula offers excellent opportunities for investment in economic activities that involve trade with the Middle East and Europe, because two-thirds of Sinai's regional borders are bounded by seas and waterways that carry a substantial share of world trade*

*Eighty-two percent, if the Suez Canal (roughly 155 kilometers) is counted in addition to the coasts of the Mediterranean Sea, the Gulf of Suez and the Gulf of Aqabah.

- A new highway from Suez to Ras Taba, with a short ferry connection to Aqaba in Jordan, will move Cairo hours closer to the capital cities of its trading partners (for example, Baghdad and Riyadh)

- Sinai is energy rich and can exploit its diverse sources of energy much more than it has to date

- Sinai has many world-class scenic features in its mountains, along its coasts, and under the seas

- The relatively sparse agricultural soils of Sinai are located in climates that provide a seasonal advantage in the major urban food markets of Egypt, Europe and the Middle East (even when compared to more experienced agricultural exporters in Turkey, Cyprus, and Lebanon)

- Sinai has good and well-distributed sources of building materials.

In the process of preparing an economic development strategy for each of the several alternative development options considered by the Steering Committee, the Study Team divided economic activities into two groups--"leading" and "other". The three leading sectors selected for Sinai are: irrigated agriculture, mining and industry, and tourism; these are areas of economic activity for which Government promotional efforts would be both manageable and most effective. These three leading sectors are described separately. The importance of economic activity, though not the investment requirements, in other "derived" sectors is expected to be at least as great as in these three.

These other or "derived" sectors to some extent reflect the demand for goods and services required by "leading" sectors. Perhaps the most important "other" or supporting sector will be construction. Transportation, particularly road transport to Cairo, Alexandria, and major markets in the Middle East, is another "derived" service that merits priority. Since Sinai is a coastal region of Egypt, close to major world shipping lanes, and already has four major airports, development authorities can also give early priority to establishing trading capacity. Fostering the efficient provision of such services and providing them with local materials and skilled labor deserves early attention. In addition to construction, transport, trade, and similar activities, economic development requires that non-formal technical training be given high priority to provide locally the skills needed for growth. Such training will itself become another significant source of employment and income.

A major feature of this volume is the description of the economy of each of five separate subregions (Chapter 5). It was the team's conclusion that Sinai's diverse landscape and economy would make such subregional profiles useful for future planners and administrators, illustrating how not only economic sectors but also discrete geographical zones are expected to develop as the Recommended Strategy is implemented. Therefore, much of the physical, social and economic data and projections have been aggregated subregionally. Spatial, temporal, and sectoral linkages are examined at the subregional level for each of the three preliminary alternative strategies--Dispersed, Frontier, and All Coasts--as well as for the Recommended Strategy.

Investment requirements

Table ES-1 below summarizes some of the economic targets of the Strategy. These numbers generalize more detailed presentations in the text. The employment targets depend on timely investment, along the lines summarized in the

next section. Investment in production sectors is itself partly dependent on skills being available and on infrastructure operating efficiently. Manpower and skills in turn are dependent on the availability and quality of social amenities, especially education, housing, and other services.

TABLE ES-1
Summary of Economic Development Strategy

(employment, irrigated feddans, tourist accommodations, in thousands)

	By 1992	By 2000
Agriculture		
Employment	56.6	121.3
(Irrigated feddans)	(80)	(200)
Industry and Mining		
Employment	21.6	47.3
Tourism		
Employment	4.3	11.2
(Rooms/villas)	(8)	(26)
Other "Derived" Activities		
Employment	63.5	133.8
Total employment	146.0	313.6

Officials responsible for managing Sinai's development must think of training at least 200,000 craftsmen, farmers, and workers as well as providing housing for 175,000-200,000 families. The training figure is high, because many jobs will be slightly different from those in Nilotic Egypt; moreover, Sinai must plan for high rates of turnover in some employment categories. Housing will be provided mostly by the private sector, including self-help programs, but the Government will need to intervene to ensure that adequate materials and credit are provided.

More than one-third of the jobs foreseen for the year 2000 are in agriculture. The subregional breakdown, however, indicates that in the Southwest industry may be the principal sector, whereas in the Southeast tourism will dominate.

More than half of the impact in employment and population can be expected after 1992. However, about half of the investment may be required before then; training may precede jobs by a smaller margin. We have shown specific targets for jobs in each leading sector, though a range might have been more accurate, given present uncertainties regarding many details such as the types of irrigated agriculture that will do best in Sinai, the specific industries that Government and other investors will establish, and the best mix between high-service international tourism and the perhaps more modest facilities for domestic recreation.

Chapter 6 outlines some of the major investments needed to stimulate economic and social development, and these are listed in Table ES-2. Nile water conveyances, by far the largest and most revolutionary of the proposed investments, are estimated to require total financing of about LE 2,235 million; land preparation and irrigation equipment would cost a further LE 500 million. Combined pipeline, land preparation, and irrigation equipment capital costs per feddan vary from about LE 7,150 to LE 10,000 close to the Suez Canal to about LE 24,150 in Wadi El Bruk and LE 39,125 at the mouth of Wadi Feiran. Some of these differences in capital costs would be counterbalanced

Table ES-2

Summary of Investment Plan, 1983-2000

(LE million)

	Gross investment		
	Total	1983-91/92	1992/93-2000
National System, subtotal	6,816	2,258	4,558
Production sectors, subtotal	3,100	450	2,650
Petrochemical complex	2,500	300	2,200
Other heavy industry	600	150	450
Service sectors, subtotal	3,716	1,808	1,908
Main highways, harbors	185	125	60
Telecommunications	204	54	150
Electricity generation*	1,000	1,000	--
Bulk water conveyances	2,235	585	1,650
University	80	40	40
Parks/nature reserves	12	4	8
Regional System, subtotal	4,452	2,103	2,349
Production sectors, subtotal	2,662	1,335	1,327
Agriculture	912	400	512
Industry and mining**	750	495	255
Tourism	350	140	210
Other production and services	650	300	350
Service sectors, subtotal	1,790	768	1,022
Roads, harbors, airports	110	60	50
Telecommunications	204	49	155
Electricity/gas (mostly distribution)	508	289	219
Higher education***	24	6	18
Hospitals***	291	66	225
Community infrastructure	134	62	72
Housing	519	236	283
Production sectors, subtotal	5,762		
Service sectors, subtotal	5,506		
Grand total	11,268		

* Mostly for distribution west of the Suez Canal

** Excluding petroleum

***Other education and health care are included in community infrastructure

Sources: Volume III, Chapter 6, and Volume VI, Chapter 3.

(and others reinforced) by differences in pumping and other operating expenses. Industrial investment is estimated to require about LE 750 million for activities such as food processing, other light industry, and mining or processing of minerals; an additional LE 3,100 million is recommended for national industries, including a chemicals-and-refinery complex to be located in the Southwest. Tourist hotel, motel, and villa investment would require LE 450 million.

Investments in the petroleum sector are not included in this projection of investment requirements, but the important role of the petroleum industry must be kept constantly in mind when planning Sinai's development.

An investment of LE 5,762 million directly in production sectors to secure more than 313,000 jobs suggests an average investment per job of about LE 18,400 (LE 32,750 per job if all service costs are also included, or LE 25,620* if services other than bulk water conveyances are counted). If only leading sector employment is considered, the direct investment of LE 5,112 produces 179,725 jobs at a cover of about LE 28,450 per job. This high figure can be attributed partly to high investment costs of heavy industry (for example, the petrochemical complex). The investment cost of jobs in other sectors is generally lower, and their growth should be encouraged to the maximum possible extent. Table ES-3 gives more details.

Service or infrastructure investments are projected at a total amount only slightly less than production investments--LE 5,506 million, or about LE 5,660 per Sinai resident in the year 2,000 (LE 4,630 per resident if the LE 1,000 million for the Ayun Musa generating plant is excluded. Roughly 80 percent of this investment is for large complex "hard" systems (Nile water conveyances, electricity, natural gas pipelines, highways, harbors, and airports) and less than 20 percent for housing, education, health, recreation, and other "soft" systems. The hard systems represent, to a degree, the cost of opening up a new land to settlement and integrating Sinai with the rest of Egypt; the soft systems represent the costs of servicing Egypt's population wherever it may settle, costs that will be incurred whether these people are in Sinai or Nilotic Egypt.

Appendix A analyzes the effects on the investment plan of some possible variations in the strategy (for instance, more or less population, and more or less agriculture). The analysis also estimates the net outlays likely to be required if returns on earlier investments are made available to finance some of the costs of later investments. Thus, though a total outlay of approximately LE 11,300 million is foreseen (starting at under LE 100 million per year, but rising to over LE 900 million in the final 2 years of the century), a maximum net outlay of less that LE 3,600 million is required if all returns generated from earlier investments are reinvested in the Recommended Strategy program. Net outlays peak at under LE 700 million a year, early in the second phase; by the late 1990's the program would be "self-financing" under the assumptions of this analysis. (See Table A-2 for details.) The analysis also indicates how total and net investment are affected by considering both higher and lower population targets and different patterns of economic development (for example, less irrigation and more industry). (See Cases 2 through 6, Tables A-6 to A-12.)

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*These calculations exclude LE 1,000 million proposed for investment in a large thermal electric generating station at Ayun Musa; although located in Sinai, this project is designed mainly to serve markets west of the Suez Canal.

TABLE ES-3

Summary of Employment, Investment, and Capital Costs per Job by Sector, Under Various Assumptions

	Cumulative to Year 2000			Cost per Job (thousand LE000)				
	Employment		Investment					
	Percent	No. (000)	(million LE)	A	B	C	D	E
Agriculture I	38.7	121.3	912	7.5	14.8	21.9	N/A	11.4
Agriculture II	38.7	121.3	2,747	22.6	29.9	N/A	29.9	26.5
Agriculture III	38.7	121.3	3,071	25.3	32.6	N/A	N/A	29.2
Industry/mining subtotal	15.1	47.3	3,850	81.4	88.6	95.8	91.8	85.3
Petrochemical complex	2.2	6.8	2,500	367.6	375.0	382.2	386.2	371.6
Other heavy industries	2.8	8.9	600	67.4	74.6	81.6	76.4	71.2
Other industry/ mining	10.1	31.6	750	23.7	31.0	38.1	32.7	27.6
Tourism	3.6	11.2	350	31.3	38.6	45.7	40.3	35.2
Other[b]	42.6	133.8	650	4.9	12.1	19.2	13.8	8.7
Total (Ag. I)	100.0	313.6	5,762	18.4	25.6	32.7	N/A	22.2
Total (Ag. II)	100.0	313.6	7,597	24.2	31.5	N/A	32.7	28.1
Total (Ag III)	100.0	313.6	7,921	25.3	32.5	N/A	N/A	29.1
Total Investment "distributed"[c] (LE million)	N/A	N/A	5,762	5,762.0	8,033.0	10,268.0	10,268.0	6,973.0

Column A: Direct sector investment divided by the number of jobs. Direct sector investment includes the cost of machinery and buildings for manufacturing, construction and furnishing of hotels for tourism, irrigation and other on-farm equipment for agriculture, and other direct capital costs of establishing production, transport and service enterprises in Sinai whether for "leading" or "other" sectors of economic activity.

Column B: Direct sector investment inflated by the costs of all services except water: namely, "utilities" (transport, telecommunications, and electricity/gas), "community infrastructure" (in this case including housing), and "social services" (higher education, hospitals, and parks/nature reserves) whether part of the national or the regional systems. Capital costs of these services are distributed among sectors in the same ratio as jobs.

Column C: Same as B except bulk water conveyance costs are also distributed among sectors in the same ratio as jobs.

Column D: Same as C except LE76 million of bulk water conveyance systems is attributed to the petrochemical complex; 85 percent of the balance is attributed to irrigated agriculture and 15 percent distributed among other sectors in the same rates as jobs.

Column E: Same as B except only "utilities" costs are distributed among sectors.

Many other variations are possible, but these few serve to illustrate the kinds of policy options available to the Government. The rationale for Column A (Agriculture I) is that the cost of bringing Nile water to Sinai is the cost of integrating the peninsula with the rest of Egypt in a way that gives heavy emphasis to permanent agricultural settlements widely dispersed throughout the peninsula; the concept implies that water conveyance costs should be absorbed by the national treasury. Similarly, Concept A argues that the capital costs of other services are costs that Egypt would have to pay for jobs anywhere. In contrast, Column B distributes the capital cost of all services among various sectors (and columns C and D include water-conveyance costs as well as other services). The concept behind Column E is that the capital cost of economic activities in Sinai should include the "special" (high) Sinai cost of "utilities" (including transport), but not the cost of housing, education, and other services that Egyptians would require anywhere. This case also assumes that the cost of bringing Nile water to Sinai should not be included (unless, as in Agriculture II and III, it is attributed mainly to irrigation schemes.) (Agriculture II attributes 85 percent of bulk conveyances to agriculture and Agriculture III attributes 100 percent of such costs to agriculture.)

Agriculture I - Secondary water conveyances, on farm investment, research, etc.

Agriculture II - Agriculture I plus 85 percent of cost of primary conveyances designed mainly for irrigation (LE 1,835 million).

Agriculture III - Agriculture I plus all capital cost of primary conveyances (except system designed mainly for the petrochemical complex (LE 2,159 million).

[a]The proposed LE 1,000 million investment in a power generating plant at Ayun Musa is excluded from these calculations, since the plant is intended primarily to serve demand west of the Canal.

[b]Includes construction, transport, trade, local tourism, government, repair services, etc.

[c]Ag I case

SOURCE: Calculations by Consultant.

Sinai is already absorbing investments at a rate of over LE 100 million a year in a broad range of sectors. The concern about management capacity that some observers express does not seem to be an insuperable constraint as far as the recommended level of investment is concerned.

Early action

An intensive and extensive development program is well underway in Sinai, led by the Sinai Development Authority and the Governorates. It emphasizes infrastructure. Appendix B to Volume I of this Report includes a comprehensive list of projects. The final chapter of Volume III discusses the development actions that need early priority attention in the areas most directly concerned with economic activities, especially in the "leading" sectors. The question is how to create a new economic foundation in each subregion within Sinai and to do so efficiently. A simple summary of a complex set of recommendations is that agriculture should be emphasized in the North and industry and tourism in the South.

As of 1984, the South was already well provided with much of the air and highway transport investment required for the economic activities proposed. However, shortages of water, telephone, electricity, health, and other services (particularly business services) are still hindering development. Both industry and tourism will require sites that have been improved with a reliable, convenient, economical package of services and are protected from incompatible neighboring uses.

The introduction of Nile water to the South for agriculture, as proposed, could follow different paths: from Ismailia, Cairo, Beni Suef, and/or Qena, and under either the Canal or the Gulf, both of which already have pipelines. The best way to bring Nile water to the South needs urgent study.

In the North, the leading economic activity--agriculture--is already being rapidly expanded. The El Salaam Canal is to be extended under the Suez Canal north of El Qantara. Soon adequate supplies of fresh irrigation water will no longer be a constraint. Other infrastructure and services are also better advanced along the coastal plain in the North than in the South or the Uplands. Therefore, the early action programs may take on a different shape.

Recognizing that development begins from different stages of take-off in different subregions, the following are recommended as characteristic, top-priority early actions to encourage the leading economic sectors discussed in this volume:

For agriculture:

- Improve production of olives, dates, livestock, poultry, and forage crops
- Greatly expand agricultural research, including pilot farms to test new farming systems and to introduce new crops
- Increase agricultural extension services, including training
- Activate a greatly expanded agricultural credit program, possibly including an element of crop insurance
- Complete feasibility studies for identified run-off projects, including dams
- Prepare feasibility studies for Nile water irrigation

- Undertake marketing studies, including specification of shipping services and other facilities that may be required

For mining and manufacturing

- Design industrial districts and reserve the sites in El Arish, the Ayun Musa-Ras Sudr plain, Abu Rudeis, and El Qantara
- Establish an industrial development authority
- Establish building materials processing plants in all five subregions
- Expand non-petroleum mineral exploration and production
- Establish an export development bank
- Expand technical training facilities and programs

For tourism

- Set aside the best sites, based on studies in all five subregions
- Improve existing hotels and promote new ones
- Improve infrastructure serving tourist areas
- Open reception centers seasonally at Rafah, Ras Taba, El Qantara, and Ayun Musa
- Build day-trip/week-end facilities at Bitter Lakes, Romana, and Ayun Musa
- Establish and promote tourist circuits with other regions in Egypt and neighboring countries, including Jordan, Saudi Arabia, and the Sudan.

These early actions are not capital-intensive. They are essential to accelerate the pace of Sinai development.

AN ECONOMIC DEVELOPMENT AND INVESTMENT PLAN, 1983 TO 2000

1.0 INTRODUCTION

Sinai today has three economies: the traditional subsistance grazing economy of the Uplands, the modern petroleum and tourism economy of the Southern Sinai Coasts and the mixed agriculturally-based economy of the Mediterranean Coast. Over the next three Five-Year plans the Recommended Strategy suggests an economic program for each of five subregional economies, leading to a single integrated peninsula economy by the turn of the century. Each of the five subregions will have a quite different sectoral emphasis initially. Inter-subregional linkages will be encouraged as the year 2000 approaches. The subregions will then interrelate more and more strongly among themselves, and a self-sustaining regional economy will be established with strong trading links to Egypt and to export markets.

The population of Egypt is expected to grow by 23 to 26 million by the year 2000. Assuming a crude activity rate of 33 percent, this means that 7.5 million jobs have to be created over the next 17 years, an average rate of 450,000 each year.* If Sinai is to have a population of about one million by the year 2000, over 313,000 new jobs will have to be created (an average of about 18,000 each year). This would represent 4 percent of total national job creation.

This volume outlines some of the opportunities for job creation in the key economic sectors, with an emphasis on the potentially "leading" sectors: agriculture and fisheries, industry and mining, and tourism. Given a guaranteed supply of substantial quantities of Nile water to Sinai and the optimum exploitation of ground and surface water potential, areas of the Rafah Strip, Wadi El Arish, northern coast, northwest subregion, Wadi El Bruk, Wadi Sidri Wadi Feiran, and Gulf of Suez and Gulf of Aqabah wadis can be reclaimed for agriculture to supply most local food needs and to provide a substantial surplus of some crops for export to Suez Canal and Nile Valley cities as well as to foreign markets.

Sinai has the natural beauty, culture, climate, beaches, and coral to become a far more important international tourist resort than it is today, while at the same time catering to some of the recreational needs to residents in Cairo and the Delta. Mineral resources, including hydrocarbons, will provide an important impetus to industrial development. Footloose light industries can also be attracted to Sinai by imaginative promotional programs, including banking and administrative support, and will serve growing Sinai and neighboring markets. The expected high level of construction activity in Sinai will give further support to all economic development.

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* Fewer than this now, more in later years.

The purpose of this volume is to describe how the development of economic activities will contribute towards the achievement of national goals for Sinai and to relate the evolving Sinai economy to Egypt's growing and diversifying economy. It describes economic life in five subregions -- Northwest, Northeast, Uplands, Southwest and Southeast (Figure 1.1) -- thus establishing a basis for a more unified Sinai economy to emerge early in the next century.

The national and regional context is outlined in the next chapter, followed by a discussion of the role of economic activities in generating the employment required to support the population and economic viability targets. Chapter 4 discusses agriculture, industry, minerals and tourism activities in terms of sectoral objectives, current activity and potential; this chapter also discusses the trade and construction needs of the promotional or basic sectors, and the potential employment-generation impacts of petroleum sector activities. Chapter 5 brings together economic activities, discusses strategic options and analyzes spatial and inter-sectoral linkages, describing plans to cluster some activities at urban growth centers to maximize agglomeration advantages. Chapter 6 summarizes public and private investment implications of the sectoral projections and itemizes projects, programs, institutional development, and policy decisions required to achieve the proposed levels of economic activity.

This volume reports the economic considerations and options which are the basis for strategic recommendations of Volume I. It also evaluates some alternatives in terms of sector potential. Sector development potential itself is based upon the land capability and water resource analyses of Volumes IV and V and reflects commitment to general employment targets, which were derived from settlement and population goals for Sinai.

Population, settlements, and infrastructure are dealt with separately in Volume VI. The sectoral potential identified in this volume takes advantage of infrastructure capacity now, or soon to be, in place. Volume VI in turn outlines further infrastructure needed to support the projected employment and population. One of the most critical resources is water, dealt with at some length in Volume V. A basic assumption of the proposed development strategy is that the Government of Egypt intends to supply water to Sinai in the quantities required to meet the population target; this has been stated repeatedly and is incorporated in the government's master plans for water and land reclamation prepared in recent years. One purpose of the present volume is to advise on water supply priorities in terms of amounts required for economic activities in various locations and to estimate investment requirements for this essential infrastructure. Some of the action recommendations emerging from the sectoral analysis put emphasis on institutional development, which is discussed in Volume II. Ways of dealing with potentially adverse environmental impacts of development are elaborated in Volume IV.

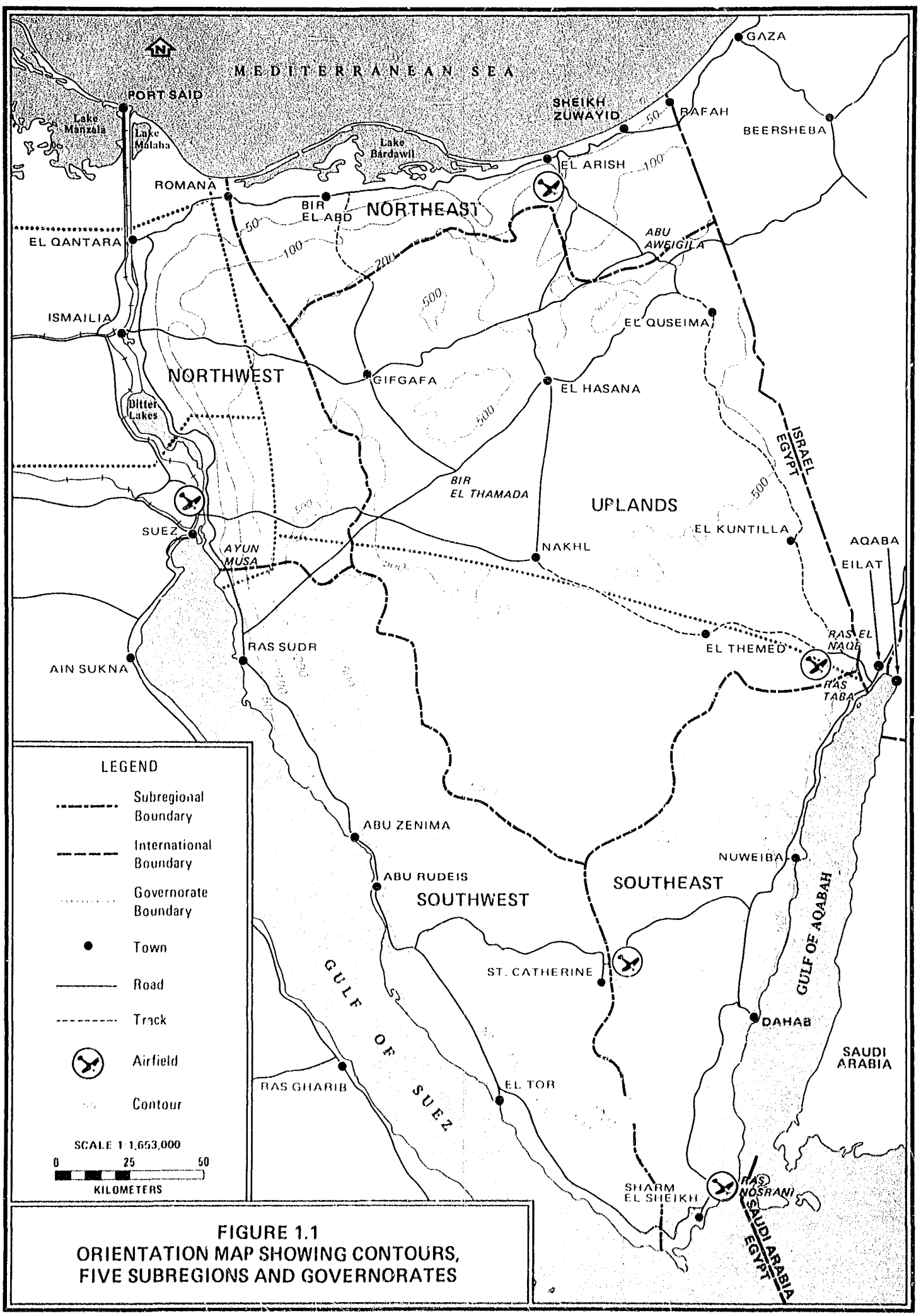

FIGURE 1.1
ORIENTATION MAP SHOWING CONTOURS, FIVE SUBREGIONS AND GOVERNORATES

2.0 NATIONAL ECONOMIC CONTEXT

2.1 NATIONAL ECONOMIC GOALS

Certain general goals for Sinai form the overall framework for development and are summarized in Volume I as follows:

- National integration
- Population absorption
- Resource development
- Attraction and training of manpower
- Economic viability
- Dispersed settlement system
- Improved communications and transport
- Enhanced environment

Three are of particular importance for this Volume: resource development, economic viability, and national integration. However, all the goals have been kept in mind while designing the regional economic plan. A permanent settlement pattern in a region of more than 61,000 square kilometers, capable of supporting a million or more people, needs a stable economic base.

The National 1982/83 - 1986/87 Social and Economic Development Plan* begins with a series of goals to lay the basis for national progress: to improve the standard and quality of life for all; to slow population growth; to improve the productivity of labor; and to increase self-reliance. These national purposes, which are reflected in the goals set for Sinai, are discussed in this section.

2.1.1 Improve the Standard and Quality of Life for All

During the period of 1978-81, real Gross National Product (GNP) rose by 8 or 9 percent per annum, compared with 3.6 percent during the war years of 1967 to 1973. Gross domestic investment grew by an annual average of 16.9 percent between 1975 and 1979, and gross savings increased by an average of 35.2 percent a year. In the same period the value of exports of goods rose by an annual average of 6.5 percent, and imports rose by 5 percent.

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* ARE, Ministry of Planning, The Social and Economic Development Plan, 1982/1983 - 86/87, Part One, Basic Components of the Plan, May 1982 English translation. This will be referred to below as "the Plan."

This outstanding economic performance was attributed partly to a surge in foreign exchange earnings -- a strong petroleum sector with an export surplus, workers' remittances from abroad, net long-term capital inflows, and revenues from the re-opened and now enlarged Suez Canal. These four items together grew by an average of 40 percent/annum in real terms in the years up to 1981.

A recent survey has indicated that all social and occupational groups benefitted from this growth in GNP except management and executives employed by government. High level government professionals suffered a real income loss of 6.5 percent annually between 1978 and 1981. This contrasts with 17.5 percent real income gain for unskilled workers in the private sector.* Ministry of Agriculture data indicate that farm worker earnings have also risen at a rate in excess of the rate of inflation. Sinai will need to offer terms of employment which are attractive to both government officials of the very highest calibre and to private workers.

Recent data show the extent to which Egypt is suffering from the world-wide recession. Low oil prices are cutting into export revenues, estimated to have been $2.3 billion for 1982, compared with $3 billion projected earlier. Suez Canal traffic, remittances from abroad and tourism earnings are also down. The budget deficit is estimated to be LE 4 billion.**

To improve the quality of life for Egypt's current 44 million and the projected additional 23-26 million by the year 2000, the Government plans to increase the development effort and devote a higher proportion of the national income to investment. During the past few years that percentage has ranged from 20 to 23 percent. Total investment planned for the 1982/3-1986/7 period is LE 35.5 billion, of which 77 percent is in the public sector.

The Plan favors long-term growth over immediate consumption and intends that private consumption will grow by less than GDP (5.4 percent, compared with 8.5 percent). Assumptions underlying this allocation to consumption include a 2.8 percent population growth rate and considerable productivity improvement.

Housing deficiencies are singled out in the Plan. The aim is to construct 300,000 units in 5 years, including 72,000 for low income groups.

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* Middle East Advisory Group, Survey of Personnel Policies and Salaries in Egypt.

** The source of much of the data in this section is the Ministry of Planning (official reports and informal discussions).

The Plan aims to correct current internal structural defects by favoring the commodity sector over other sectors.

Sector	Current Structure	Planned Growth Rate
Commodity production	54.3	9.8
Production services	26.8	6.1
Social services	18.9	8.5
GDP	100.0	8.5

To achieve the stated goal to "increase the efficiency and productivity of the factors of production", the intention is to avoid the "horizontal development" of the past which, the Plan says, ignored the efficient exploitation of financial, human and natural resources.

Within the commodity sector, industry is favored; 25 percent of public sector investment is allocated to industry, compared with 10 percent for agriculture.

The industrial and mining sector is highlighted as having great potential in terms of employment generation and likely future economic growth. It is a sector around which growth in other sectors will build, has good factor substitution prospects for increasing labor usage, generally high domestic income elasticities, and export potential. From 1971 to 1980 about 22 percent of the new jobs were found in manufacturing, second to services, which grew by 38 percent (mainly due to increases in government administrative employment; its share has risen by 26 percent over the past 10 years).* Industry and mining have absorbed between 25 and 35 percent of gross fixed investment for the past 20 years, and in 1980 provided about 15 percent of total employment. The current Plan projects an industrial growth rate of only slightly more than the increase in GDP. Among the industrial investment priorities in the current Plan are projects in food processing, clothing and those based on raw materials produced locally (e.g., cement, gypsum, stone). A number of chemical industries will be established for the first time.**

Although the Open Door policy encouraged industrial and private sector development (private domestic and foreign investment grew more rapidly than public investment in the post-1976 period), the public sector remains in a preferred position in a number of important areas. Entry into production by the private sector is difficult, especially in areas that might compete with existing or planned public sector production.

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* CAPMAS, Annual Labor Force Sample Surveys.

** Minister of Industry and Mineral Resources, Egyptian Mail, Feb. 19, 1983.

The public sector purpose has generally been to produce essential goods at affordable prices, not to seek export markets. It is noteworthy that Egypt has been attractive to foreign capital (investment growing 56 percent annually from a low base in 1976 to 1981), and some of the more effective applications of external capital have been industry and mining.

2.1.2 Slower Population Growth and Higher Labor Productivity

The Plan expresses concern over the rate of population growth. The current rate is 2.8 percent. Even if that rate fell to 2.4 percent by the year 2000, Egypt's population will exceed 70 million. This rapidly growing population will have rising economic expectations as well as basic needs.

High rural birth rates together with weakened agricultural price incentives have encouraged migration to the urban areas, particularly to Cairo and Alexandria. The GOE would like to divert population growth from Cairo and Alexandria: to new towns such as Sadat City, to the Canal Zone, to secondary cities, and to the newly reclaimed land on the edge of the Delta, in the New Valley and in Sinai.

Migration is an important potential source of population for Sinai. Two types of Egyptian migratory movements are observed--internal, three-fourths of which is from rural to urban areas, and international, mainly to higher paying jobs or new settlement opportunities abroad. In 1970 there were some 9,380 Egyptian emigrants on secondment or contracts overseas, 90 percent in Arab countries. By 1978 the number had risen to 101,464, 98 percent in Arab countries.* The 1976 census reported that 1,425,000 persons, or 3.7 percent of Egypt's total population, were living abroad. The trend seems to have accelerated in more recent years. Thus, there is a tradition of long-distance migration when the incentives are high enough to compensate for the discomforts and disadvantages of being uprooted.

The rural-to-urban migration within Egypt has been on an even greater scale. The figures below show the growth in the percentage of Egypt's population living in urban areas.**

- 1907 - 19 percent
- 1937 - 28 percent
- 1960 - 37 percent
- 1976 - 44 percent

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* Economic Bulletin, Vol. XXXII, No. 3-4 (Cairo: National Bank of Egypt, 1979).

** CAPMAS defines urban areas as the "urban governorates" and the markaz capitals in the other governorates.

From 1966 to 1976, approximately 0.5 percent of the rural population moved each year to the major cities.

The net increase in rural population was 1.9 percent/annum, while that of the urban population was nearly 3.5 percent/annum. About two-thirds of the urban growth rate was due to natural increase, while the remaining one-third was due to immigration from rural areas. Internal migration has been responsible for the redistribution of nearly 25 percent of the Egyptian population.*

Cairo and Alexandria attract most of the migrants. It has been estimated that 30 percent of Cairo's population in 1970 was made up of migrants -- 40 percent from the southern governorates, 60 percent from the Delta. Slightly over 20 percent of Alexandria's population is estimated to be immigrants.

One of the Plan's objectives is stated as the "better use of the human factor", referred to as the "spinal cord of development". The Plan recognizes that growth in several countries has been achieved with increases in labor productivity. The Plan also urges reducing construction periods in major projects and raising the output per feddan. There are nearly 400,000 new entrants to the labor force each year. The economy is characterized by oversupply in some sectors and shortages in others. The Plan aims to encourage the redirection of labor into the high productivity sectors, including manufacturing and construction.

2.1.3 Increase in Self-Reliance

Export growth and import substitution are urged in the Plan, as is a reduction in the foreign components of projects (almost half the previous Plan's projects required foreign assistance). It is hoped that the LE 2 billion 1981/82 balance of payments deficit will fall to LE 1.6 billion, and that its ratio to GDP will decrease from 9.8 percent to 7 percent. Imports of consumer goods as a proportion of total national consumption will fall slightly; imports of finished goods as a proportion of total imports will fall considerably, being offset by a rise in the imports of intermediate goods in accordance with the overall national investment strategy.

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* Ibrahim, Saad Eddin, Internal Migration in Egypt: a Critical Review (Cairo: PFPB, Jan.1980). The recent CAPMAS Internal Migration Survey has confirmed these trends and findings, although recently there has also been an increase in rural-to-rural migration.

Food security is a particular target. On average, Egyptian families spend 50 to 60 percent of their incomes on food.* In 1980 nearly one-half of Egyptian food requirements was imported. Egypt is said to be one of very few countries in the world which produces less food per capita now than it did in 1970.**

Partly because so much food has to be imported, Egypt has the most trade dependent food economy of all the developing countries with a population over 20 million. A recent survey among senior government officials*** found food security to be the top ranking national objective and priority for investment.

Agriculture, which accounts for about 35 percent of employment but only about 20 percent of GDP, has an employment growth rate of less than 1 percent per annum. Its output contribution to GDP grew less than any other commodity or distribution sector between 1974 and 1979. Industry's employment growth is 5 times as fast as agriculture's. Agricultural value added per worker is just over one-half of the value added of all sectors taken together, and one-third of industry's.

In defense of agriculture's performance, it is often pointed out that the maintenance of low food prices both discourages farmers and subsidizes industry. Sinai's agricultural projects need to be designed with very high labor productivity so that they will generate incomes attractive to immigrants and be competitive with industrial employment.

The 1982/83 - 1986/87 Plan expects the agricultural share of GDP to fall. Growth will continue to be slower in agriculture than in other sectors, with a rate of growth approximately the same as the rate achieved over the past three years. Investment will be channeled to increase productivity by: (a) providing better drainage and (b) making research and extension services more widely available; the latter is a particularly urgent need in Sinai. The focus is to be on higher yields within a short period of time from land currently under cultivation or already reclaimed; land reclamation will also continue at a high rate and is targeted to realize 150,000 additional feddans per year, export-oriented, high-value crops have priority, and the 1 million feddans already reclaimed are being distributed both to small farmers and to fairly capital-intensive joint ventures with experienced foreign partners. There is also to be

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* Food expenditure represented about 62.4 percent of total consumption expenditure in urban areas (50.8 percent in rural areas) in the 1974-75 Family Budget Survey of Egypt.

** IBRD: World Development Report, 1981.

*** Investment Opportunities in Egypt: Project Listing and Profiles. A.D. Little & Co., Cairo, Egypt, 1981.

a focus on increasing poultry, egg and fish production.* All these national programs can find promising opportunities for development in Sinai.

The Plan points out that in 1955 there were 0.25 feddans of agricultural land for each Egyptian and that this figure has now fallen to 0.15. At least 20,000 feddans are lost to urbanization each year. To maintain the rate of 0.15 feddans per person, reclamation needs to take place at approximately 200,000 feddans per annum. The so-called vertical improvements are favored to increase output/feddan.** It is also thought that the policy of improving the output of current agriculture is more likely to keep people in villages. This policy is also related to the higher labor productivity goal outlined in the previous section.

A recent Minister of Agriculture claimed that the intensity of use of old land could be increased by 2 percent/annum, in effect increasing the amount of cropped land by 120,000 feddans/annum. Many of the recent new lands projects have involved the rehabilitation of "old new lands" which have never achieved full production. The area supplied by the Ismailia Canal is to be increased to serve 692,000 (not 392,000) feddans, and an additional 162,000 feddans of west Delta lands. Larger, truly new projects include the completion of work already under way at Salhia and proposals for Sinai and the New Valley. Many observers argue that pricing policy will be an important instrument to stimulate the optional use of productive capacity on both old and new lands.

The most widely debated element of agriculture policy is subsidies. One study showed that the 1980 farmgate price for wheat was LE 76.50/ton, compared to the consumer price of LE 41.20, and an international price of LE 133. For rice the figures are LE 75, LE 50 and LE 320.*** In other words, the farmer receives about the same price for both rice and wheat, yet the border price of one is 2.4 times the other. The need for implementing economic reforms concerning food subsidies was urged by the Deputy Prime Minister (later Prime Minister) in a speech before the People's Assembly in December, 1981.**** The Plan refers to the establishment of a "sound price system" and to "restoring real prices."

Changes in food price policy will be difficult, since it is estimated that a total elimination of food subsidies would reduce the living standards of the lower 80 percent of the population by between 20 and 28 percent; the impact would be

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* Al Ahram, December 28, 1981, The Cropping Pattern in Egypt.

** Vertical improvements hold land constant and vary capital and labor to increase output. Horizontal improvements apply the same technology to more land.

*** Institute of Agricultural Economics Research, Ministry of Agriculture; World Bank, Commodity Trade and Policy Trends, August 1980; CAPMAS, Bulletin of Foreign Trade.

**** See Al Ahram, December 25, 1981.

only 12 percent on the top 20 percent. Moves in this direction will, however, greatly assist the achievement of the Plan's food security goal by giving appropriate incentive price signals to current and potential farmers, while at the same time encouraging conservation among consumers.

A change in energy policy will also assist the accomplishment of this goal. Generally, domestic prices average one-fifth of their international price equivalent and are low relative to other prices in Egypt. These low energy prices have fed price signals into the economy which have promoted energy intensity in production, consumption and investment.*

Subsidies on energy add 20 to 23 percent to the living standards of all income groups: the top 20 percent drive cars; the bottom 25 percent consume other energy-intensive products and services. The energy subsidy has been estimated to have been LE 1.9 billion in 1979 (fuel and electricity sales at less than international prices plus net real value of fuel and electricity as intermediate inputs to other sectors). The domestic consumption of petroleum is currently rising by 10 to 11 percent/annum. Oil, which might more advantageously be exported or remain part of the strategic reserve, is being consumed domestically.

The GOE plans to substitute gas for oil in many areas of domestic consumption. Egypt may have gas reserves of as much as 40 trillion cubic feet.** Associated and non-associated gas has much lower opportunity costs for domestic uses than oil. The Ras Shukayr pipeline, the Port Said pipeline, the Cairo Gas Distribution Project and the Abuqir projects are manifestations of this new policy, which will make the achievement of the improved-balance-of-trade goal easier to realize.

2.1.4 Conclusion

The implications of these national economic goals for development in Sinai are summarized in Table 2-1. As the resource assessment of this Study shows, Sinai has the potential to play an important role in contributing to the achievement of purposes emphasized in the Nation's Plan.

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* For example, in 1983 the domestic sale price for diesel fuel was 14 percent of the international price; for butane gas, 23 percent; and for electricity, 18 percent. Only gasoline came close -- 63 percent for regular, 72 percent for premium. EGPC sources.

** A figure frequently quoted informally in petroleum sector circles. The official reserve is 9.75 TCF. Personal communication.

Table 2-1

National Economic Goals and Opportunities for Sinai

1982/83-1986/87 5-Year Plan Economic Goals	Opportunities for Sinai
1. Improved standard and quality of life for all:	
- All to benefit from growth.	- Development funds available for remote areas.
- Industry and mining to continue as fast growing sectors.	- Considerable mineral potential in Sinai. Plenty of space for industry. Location particularly well suited for energy-intensive industry and exports to the Middle East.
- Emphasis on food processing, clothing and local raw materials.	- Processing of Sinai's agricultural output encouraged. Clothing is good example of "footloose" industry recommended in Sinai.
	- Industry generally a modest water user compared to agriculture.
- New chemical industries.	- Sinai has ample feedstock, plenty of land, can use seawater for some cooling.
2. Slower population growth and increased labor productivity:	
- Reduce migration to major cities.	- Development of Sinai will offer alternative destinations outside congested Delta.
	- Agricultural and industrial communities in Sinai will attract surplus rural population, otherwise destined for major cities.
	- Sinai can provide alternative to emigration to Arab countries and attract back to Egypt some who went abroad earlier.
3. Increase in self-reliance:	
- Reduce dependency on imports.	- Irrigated agriculture on Sinai's better soils will produce food for domestic consumption and exports.

1982/83-1986/87 5-Year Plan Economic Goals	Opportunities for Sinai
3. Increase in self-reliance: (Cont.)	
- Increased poultry, eggs and fish production.	- Active fishing industry in Sinai is eager to expand as "port" facilities improve, credit is made available and export markets develop.
	- Governorate programs aim at self-sufficiency in eggs, broilers, small livestock. Sheep/goat grazing can improve to increase exports.
- More intensive agriculture.	- Sinai can play pioneering role in Egypt by emphasizing water-conserving irrigation technologies; also, Sinai has large areas suitable for aquaculture and mariculture.
	- Poultry and egg production need little water.
	- Very high yields per unit of water and land have been achieved for various parts of Sinai and similar desert areas.
- Increased oil sector revenue.	- Gulf of Suez has much of Egypt's known oil.
- High value agricultural exports.	- Occupation years gave Sinai some experience in exporting high-value agricultural products.
- Substitution of gas for oil in domestic consumption.	- Sinai is thought to have substantial gas deposits in addition to large fields already discovered.
- Import substitution.	Sinai could produce substantial food surpluses if recommended irrigation program is implemented.

3.0 ROLE OF ECONOMIC ACTIVITIES IN MEETING NATIONAL GOALS FOR SINAI

Capital investment in leading economic sector activities and their support activities will transform the economic ambiance of traditional pastoral and service activities into a more commercial mode with about 200,000 feddans of irrigated agriculture, varied manufacturing industries, processing facilities for minerals and foodstuffs, aquaculture, and beach tourism. As well as mirroring the national economy by having higher proportions of non-agricultural employment than is now the case, by the year 2000 Sinai could lead the nation in chemical and refining activities, desert agriculture and recreational tourism, while supplying many of Egypt's mineral requirements. These tasks will be made easier by the fact that many members of the existing Sinai community already have some experience of non-traditional activities.*

This chapter discusses current government programs and outlines the need for public sector support for job creation in order to reach a target of over 313,000 jobs by the year 2000.

3.1 CURRENT GOVERNMENT PROGRAMS

A major reconstruction program is under way for Sinai.** High proportions of the Regional budget in 1980/81, 1981/82 and 1982/83 were allocated to irrigation, power, construction, transport, communications, housing, utilities and other services. The level of investment is also high: the 1980-84 National Plan allocated 1.1 percent of the national investment total to Sinai; compared to a current population of only 0.4 percent. Sinai received allocations of LE 55 million in 1980/81, LE 53 million in 1981/82, and LE 84 million for 1982/83. These programs aim to ensure that Sinai has good roads, working airports, adequate settlement services, reliable power supply, good telecommunications and much improved access to the rest of Egypt across the Suez Canal.

The 1982/83 - 86/87 Plan proposes total government expenditure of LE 441.1 million in North and South Sinai.*** Although almost every Ministry and public agency has some involvement in Sinai, as shown in Table 3-1, almost 60 percent of the investment will be channeled through two sources: the Ministry of Development and the Governorates.

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* See, for example, Glassner, M. in the Geographical Review, No. 64, 1974, The Bedouin of Southern Sinai. Surveys show that over half had had experience of non-traditional activities.

** See Ali Abou Zeid, Rehabilitation of Sinai, Sinai Symposium, May 1982.

*** It was not possible to obtain from the Ministry of Planning, a breakout of the Canal Governorates' Sinai figures.

The North and South Sinai Governorates themselves have been allocated more than any other governorates in Egypt apart from Cairo and Alexandria.* Table 3-2 summarizes North and South Sinai's 1982/83 budget allocation by sector. Almost all is for infrastructure and housing. Among the economic activity projects are dairy farms (LE 1.1 million), olive processing (LE 1.2 million), sheep fodder, chicken farms, fruit and vegetable farming, ice factories, and brick manufacture.

Within the infrastructure theme, there is an emphasis on the completion of projects which appeared in the previous plan. For example, less than one quarter of the Ministry of Development's projects under the new Plan are for completely new projects.

Table 3-1

Budgets for North and South Sinai by Ministry Summary
1982/1983 - 86/87 Plan

Ministry	Number of Projects	Budgeted LE Amount Million	Percent
TOTAL**	268	441.1	100.0
Agriculture	15	6.5	1.5
Industry and Mining	8	46.7	10.6
Petroleum	3	34.1	7.7
Electricity and Energy	3	23.8	5.4
Supply	10	24.4	5.5
Development	75	168.8	38.3
Education	2	13.0	3.0
Civil Aviation and Tourism	4	10.4	2.4
Health	12	6.1	1.4
Governorates	88	88.1	20.0
Others (12 Ministries or Agencies***)	48	19.2	4.2

* One-quarter of Cairo's total; only slightly less than Alexandria's
** Of which 135 projects, valued at LE 237.8 million, are in North Sinai and 133 projects (LE 203.3 million) in South Sinai.
*** Each with less than 1 percent of the total budget.

SOURCE: Ministry of Planning, February 1983. These figures had not been approved by the National Assembly when this report was written.

Table 3-2

Allocation of Sinai Development Expenditures by Sector, Summary 1982/83 Budget

Sector	Amount (LE Million)	Percent Distribution
TOTAL	93.3	100.0
Agriculture	2.8	3.0
Irrigation	4.4	4.7
Industry	8.1	8.7
Petroleum	5.0	5.3
Electricity	9.8	10.5
Transport	24.2	26.0
Utilities	16.7	17.9
Services	8.2	8.8
Housing	13.3*	14.2
Others	0.8	0.9

* Includes LE 9.5 million in housing loans.
SOURCE: Ministry of Planning, February 1983.

In the Five-Year Plan for Sinai as a whole seven times as much money has been allocated to the Ministry of Industry than to the Ministry of Agriculture, presumably because the particular projects (mainly mining and minerals processing) can be initiated more quickly. The Ministry of Tourism has been allocated less than one percent; it would appear that its full program for Sinai is still to be incorporated in the Plan. South Sinai will continue to receive almost 46 percent of the total allocated to North and South Sinai taken together. Twenty-eight percent of its allocation is through the Ministries of Industry and Petroleum, 36 percent through the Ministry of Development. It is also interesting to compare Tables 3.1 and 3.2, although the two tables are not comparable row by row. Tourism, which is allocated between five and ten percent of investment in the Recommended Strategy, receives less than one percent in either table.

While the Ministry of Agriculture has only 1.5 percent of budgets summarized in Table 3.1, the agriculture irrigation sector receives a more reasonable 7.7 percent in Table 3-2, apparently because of projects carried in the Ministry of Development and Governorates' budgets. Electricity shifts from 5.4 percent to 10.5 percent for similar reasons.

3.2 EMPLOYMENT GENERATION

As the basic infrastructure networks are completed, more and more attention will have to be given to the creation of over 313,000 jobs

estimated as required to support a population of 1 million by the year 2000. Infrastructure, especially pipelines to carry Nile water, is a necessary but not sufficient vehicle for the achievement of this ambitious employment target.

Sinai is an example of what the regional economic literature refers to as a 'lagging region.'* It is possible to distinguish four stages of development for such regions. In the first there is a deficiency of social overhead capital, little economic overhead capital, and not much directly productive activity. In the second stage there is an excess of social overhead capital (ample government services, schools, housing, and medical services, for example); shortages and other difficulties of economic overhead capital begin to be overcome in this stage. In the case of a remote region such as Sinai, there is a third stage when economic as well as social overhead capital is in excess supply (when the roads have been upgraded and the first massive Nile water pipelines constructed), and job creation receives increasing attention. Balanced growth of social and economic overhead capital on the one hand and directly productive activities on the other characterize the fourth final stage.**

The achievement of this fourth stage of balanced, self-sustaining growth is a major economic objective for the year 2000. Development managers can now take full advantage of the situation in which economic overhead capital is in oversupply and encourage the rapid growth of productive activities. Consistent with this scenario, an imbalance among sectors may be expected initially, when programs press for improvement in key sectors rather than on all fronts.

Some of these key sectors can be referred to as "basic" activities: in terms of regional economic theory these would include production which has the potential to sell outside the region. These activities bring income into the region and, especially important in the case of Sinai, reduce its dependence on the national economy. Other sectors are "key" in the sense that they are initiators of the development process. The housing and construction sectors are in this category, since they most easily attract investment in a relatively underdeveloped region where population is expected to increase and infrastructure is needed. Military service and petroleum activities are in the same "key" category, especially if they encourage the permanent settlement of staff.

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* Many speakers at the Sinai Symposium, sponsored by the National Academy of Sciences in May, 1982, referred to Sinai as a neglected region, or international buffer zone, which had been deliberately left underdeveloped.

** See N. Hansen, "Unbalanced Growth and Regional Development," Western Economic Journal Vol. 4, 1964, also R. Looney and P. Fredericksen, "The Regional Impact of Infrastructure Investment in Mexico", Regional Studies Vol. 15, No. 4, 1981.

The simple injection of cash or other direct government subsidies to households in a lagging region such as Sinai will have a very limited constructive impact on the level and nature of permanent economic activity. Thus, the early 1980s practice of providing quarterly nutritional supplements to one-third of Sinai's inhabitants, although necessary in the short-run, was unlikely to contribute much to long-term self-reliance.

Direct intervention to generate economic activity is required. The GOE is already beginning to invest in the exploitation of Sinai's natural resources, including coal mining at Gebel El Maghara, ferromanganese extraction and smelting in the Umm Bugma and Abu Zenima areas, petroleum activities in the Gulf of Suez, land reclamation in New Mit Abul Kom and El Arish, salt extraction at Lake Bardawil, and tourism along the Gulf of Aqabah. There are also plans for large-scale land reclamation in the Northwest and along the northern coastal road.*

The encouragement of activities which are not determined by the particular conditions of the locational environment will free the Sinai economy from some of its harsher physical constraints. These activities will seek out new markets and base themselves on new technologies. Sinai promises to be a new frontier to Egypt in this respect. Drip irrigation relaxes some of the constraints of poor quality soil in an arid land and is very thrifty in its use of water. Intensive vegetable, fruit and flower production can be directed towards the "off-season" penetration of new overseas markets. More generally, it can be noted that according to recent studies in more advanced economies, small, modern footloose activities have continued to grow rapidly** even while manufacturing employment as a whole was falling during the recent recessions.

The innovator/adapter is likely to be more valuable to Sinai than the inventor. Techniques exist to grow barley even with sea water. Research and demonstration projects are needed to make such techniques an economic reality leading to widespread effective application. Since the diffusion of these innovations will tend to take place down the spatial hierarchy (for example, from agricultural research stations at growth centers), the creation of the higher level centers where these activities tend to cluster will assist this form of development.

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* The Ministry of Land Reclamation initially planned to reclaim at least 281,200 feddans in Sinai between 1983 and 1987, according to Ali Abu Zeid, The Rehabilitation of Sinai, Sinai Symposium, National Academy, May 1982. Also see Section 4 below.

** R. P. Oakley, A. T. Thwaites, P. A. Nash, in a University of Newcastle upon Tyne publication, 1979. They quote U. K., German and Scandinavian studies.

The generation of high-income jobs will keep people from leaving Sinai, encourage in-migration, and reduce the need for public subsidies. This tends to mean relatively capital-intensive activities:* for example, plastic shelter agriculture, high technology manufacturing, minerals processing, petrochemicals, and high-quality processed foodstuffs. These activities are also characterized by high investment in labor skills. Labor-intensive, high technology activities are among the fastest growing worldwide. Given the high cost of supplying water to Sinai, agriculture also has to be both capital- and labor-intensive per unit of water. In this context drip irrigation systems substitute on-farm investment and labor intensity for off-farm investment. In general, relatively high levels of investment per job are to be expected in all economic sectors in Sinai.

Direct public-sector intervention should concentrate on economic activities with extensive multiplier effects.** This could involve direct public participation in operations requiring large amounts of investment: mining, heavy industry, large-scale industry and land reclamation. Linkages would be created from agriculture to food processing, heavy industry to agricultural inputs and manufacturing; these, in turn, lead to increased demand for trade (including transport) and construction services, which increase local incomes further and would therefore also increase the demand for food, clothing, and other consumer products.

Public intervention will also take the form of developing the institutions necessary to encourage the private sector: a development bank to seek out and support new investment ideas; training centers to work with manufacturers and other enterpreneurs to mitigate the skilled labor constraint; migration agencies to locate potential migrants and to assist them in finding support, accommodation and employment on arrival in Sinai.

High levels of investment require high levels of saving. One 1982/83 - 86/87 Plan objective is to "increase local finance from real savings and avoid inflationary financing". National savings comprise 16.6 percent of GDP. The Plan urges the removal of impediments to the inflow of Arab and other foreign funds. Discussions with governors, other community leaders and businessmen indicate that many businessmen from outside Sinai have shown serious interest in investing there, and that there is already much "informal" finance in Sinai itself, outside the official banking system, particularly in North Sinai. Egyptian savings,

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* Relatively capital-intensive methods will tend to bid up the price of labor. Labor can of course also obtain a high return if the activity as a whole is very profitable; and those very profits will in turn attract capital and bid up the price of labor.

** By standard Keynesian analysis, government expenditure on investment goods "goes further" where there is no lack of demand for the product. Where there is a lack of demand, the focus should be on stimulating consumption. In this volume generally, we assume that demand exists for the products of the activities described and that this study has to specify the steps to be taken to meet that demand. The 1 million population target, a partial basis for that demand, is an input to the study.

particularly remittances from abroad, tend to go into land and real property, since historically these instruments have proved to be less risky investments than farming or manufacturing industry. A development bank helps reduce the current risk to individuals and corporations inherent in "productive" investment as it faces the unavoidable uncertainty of markets.

The essence of multiplier effects is that they cause growth to increase over time. Development will accelerate as intersectoral and spatial linkages are established. The clustering of activities around growth centers will encourage rapid and mutually-supported growth there. The small-scale formal sector will expand, increase its scale, and move into larger markets; the informal sector will grow and become formalized. Markets will expand and attract outside investors. Not all of these linkages can be predicted. Nevertheless, if industry is given infrastructure and services support, it will almost certainly create its own dynamics with many unexpected linkages, as has happened in all the development success stories elsewhere in the world.* (Linkages are dealt with in more detail in Chapter 5.)

Rapid development tends to be associated with industrialization, although this need not divert attention from rural as well as urban growth potential. Industry is a fairly economic user of Sinai's most scarce resource, water. Irrigated agriculture could require 50-100 times as much water per job as most industry. Nevertheless, agriculture will also have a major role in employment generation in Sinai and will also assist in achieving the dispersed pattern of permanent settlements to which the Strategy is committed. This will require full exploitation of groundwater and a large allocation of Nile water. Sinai's irrigated agriculture will have many of the characteristics of a manufacturing activity; it will be capital and energy intensive, use skilled labor, and tend toward integration of growing, processing, and marketing activities. Sinai agriculture will use less water than most irrigated cropping, be conducted in a controlled environment (e.g., windbreaks and cloches); employ highly qualified management; minimize production and marketing risks; produce standardized products; and operate year-round.

3.3 TRANSFORMATION OF THE SINAI ECONOMY

The economy of the region is now mainly traditional, but partially modern, as the left-hand side of Table 3-3 shows.

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* Invariably, it seems, characterized by even fewer natural resources than Sinai, although with more water: e.g., Hong Kong, Japan, Singapore, South Korea.

Table 3-3

Key Elements of The Sinai Economy 1983 and 2000

1983	2000
Traditional economy	Traditional economy
- pastoral activities	- pastoral activities
- nomadic population	- range management
- rainfed agriculture	- rainfed agriculture
- dependence on nutritional supplements	- surface runoff conservation
- low activity rates	- local handicraft production
- high dependency ratios	Modern economy
- urban centers focus on distribution activities	- manufacturing industry
- labor-intensive methods	- irrigated agriculture
- informal finance	- large-scale land reclamation
	- exports
	- food self-sufficiency
- high illiteracy levels	- private domestic and international investment
Modern economy	- commercial banking
- petroleum exploration	- large-scale domestic and international tourism
- petroleum extraction	- high accessibility
- imported labor, without families	- urbanization
- cultural tourism	- balanced rural communities
- beach tourism	- plentiful power supply
- air travel	- exploitation of many minerals
- intensive agriculture	- intra-subregional linkages
- drip irrigation	- inter-subregional linkages
- sprinkler irrigation	- sophisticated transportation services
- capital-intensive methods	- reliable potable and irrigation water supply
- widespread primary education	- permanent settlement of all labor, with families
	- high literacy levels
	- advanced education
	- management and vocational training
	- sophisticated medical services
	- technology- and capital-intensive agriculture
	- marketing networks

However, some of the modern portion of the economy is outside the mainstream of Sinai activity. Much of the income generated by petroleum exploration and extraction, international tourism, and by imported skilled and manual labor leaves the region. Furthermore, the poorer members of the community remain highly dependent on welfare support from outside the region to provide their basic human needs.

The creation of a wider range of modern economic activities will support a dispersed pattern of permanent settlement and make Sinai a full partner in Egyptian development--indeed, a leading edge in some instances, such as desert agriculture. Over the next 17 years the economy will aspire to the characteristics of a more mature modern economy, as shown on the right-hand column of Table 3-3.

4.0 ECONOMIC SECTORS

This chapter deals with the three leading sectors separately. Each section states sector objectives, describes current activities, and summarizes potential. Linkages among the sectors are dealt with geographically, by subregions (and zones within subregions), in Chapter 5.

4.1 AGRICULTURE AND FISHERIES

4.1.1 Objectives

Regional development objectives for agriculture include:

- Rapidly expand agricultural production to make Sinai largely self-sufficient in food, with initial emphasis on perishables such as vegetables, poultry, fish, dairy products and meat
- Rehabilitate and expand the livestock sector on an ecologically sound and sustainable basis
- Strengthen Sinai-based agricultural research and extension to assist in raising the productivity of present agriculturalists by increasing the output of traditional crops and introducing new ones, and to serve new settlers, especially those seeking high incomes from irrigated agriculture
- Create export-oriented production facilities to provide both employment opportunities and foreign exchange earnings
- Introduce Nile water to Sinai on a large scale principally to expand agriculture production
- Encourage construction of spreader dikes, small dams, and other structures as required for irrigation, to assist agricultural production, especially in isolated locations.

An immediate objective is to make current agriculture more productive and so reduce the dependence of Sinai on imported food and to find better marketing for current surpluses.

The Ministry of Land Reclamation plans to reclaim 28,200 feddans in Sinai under the current Five-Year Plan. The proposed phasing of these plans was described by Dr. Ali Abu Zeid,* who heads the Sinai Development Authority, as follows:

Location	Feddans Already Reclaimed	Feddans Included in the Plan of the Ministry of Development					
		Total	82/83	83/84	84/85	85/86	86/87
TOTAL	11,450	28,200	10,000	2,700	1,500	2,500	11,500
Wadi El Arish	550	1,000	-	-	-	1,000	-
Rawfah Dam	-	2,000	-	-	-	1,000	1,000
East of El Arish	-	3,000	1,000	1,000	1,000	-	-
Wadis Sudr, Feiran and El Qaa	400	1,500	-	-	500	500	500
East of the Bitter Lakes	10,500	10,700	9,000	1,700	-	-	-
El Tina Plain	-	10,000	-	-	-	-	10,000

4.1.2 Current Situation

(a) Agriculture

Following relatively high rainfall early in 1983, there were many thousands of feddans of rainfed agriculture. Sparse rainfall supports about one million date palms. The most common crop is barley grown in small areas under intermittent cultivation in scattered wadi beds, as shown in Table 4-1. Watermelon and castor beans are also grown in the traditional agricultural economy. The cash value of these crops is not as high as for other fruit and vegetables, but they are low-risk crops and are readily absorbed by the subsistence Bedouin economy.

There are about 12,600 feddans of irrigated agriculture, mainly olives and vegetables, but also barley, alfalfa, peanuts, sorghum, beans, sunflower, clover, berseem and fruit. Over half the irrigated agricultural land is in the El Arish-Rafah area

* Rehabilitation of Sinai, Sinai Symposium, May 1982.

Table 4-1

(A) Rainfed Crops in Sinai

Crop	Quantity	Location	Comments
Date Palm	350,000 trees yielding 10,500 tonnes	North Coast	Nutritious, storable Bedouin food; consumed locally
	650,000 trees	Elsewhere in Sinai	
Barley	Variable according to rainfall. Includes: 1,700 feddans Sheikh Zuwayid; 6,000 near Rafah; 1,200 near Hasana and Nakhl; 1,000 south of El Arish; 100 in Wadi Sudr	Rafah Strip North Coast. Upland Hasana and Nakhl	Local grain and fodder
Berseem Alfalfa	Variable according to rainfall	Scattered wadi beds	Traditional methods of cultivation. Component of transhumant system
Watermelon	Variable according to rainfall. Includes: 1,500 feddans near Hasana and Nakhl; 1,400 near Bir El Abd	El Arish and elsewhere along North Coast. Uplands Hasana and Nakhl	Human and animal food
Castor Beans	Variable according to rainfall	El Arish and elsewhere along Coast	Used for oil

Table 4-1 (cont'd)

(B) Irrigated Crops in Sinai

Crop	Quantity (Feddans)	Location	Comments
Olives	700	El Arish, Ein Guderat near El Quseima	Used for pickling and oil. Traditional low density planting (40 trees/feddan). Young trees intercropped. Basin irrigation. Groundwater.
Vegetables	400	El Arish	Local consumption. Tomato, marrow, cucumber, peppers, okra, eggplant, potatoes. Drip irrigation. Groundwater.
Vegetables	320	El Arish	Local consumption. Farmers cooperative. A variety of vegetables; also olive trees and figs at cooperative. Drip irrigation. Groundwater.
Mixed	200	El Arish	Local consumption. Olives, apricots, apples, guava, grape-vines. Mostly olives. Drip irrigation. Groundwater.
Vegetables, Fruit	2,850	Sheikh Zuwayid	Local consumption, surplus for export. Mainly vegetables under plastic cloches. Drip irrigation. Groundwater.
Olives, citrus, guava, almonds, peas, grapes, vegetables	3,630	Rafah	Local consumption, surplus for export. Drip irrigation. Groundwater.
Grain, berseem, clover vegetables, fruit	3,000 (6,000 by 1984)	Hero Village, Bitter Lakes	Export to Canal Zone. Sprinkler irrigation, mainly center pivot. Nile water.
Vegetables, olives	500	Youth Farm, Bitter Lakes	Export to Canal Zone. Originally over 1,000 feddans. Nile water.
Barley, alfalfa, peanuts, sorghum, beans, sunflower	1,000 (5,000 by 1984)	New Mit Abul Kom	Export to Canal Zone. First phase of 11,000 feddan land reclamation scheme. Center pivot and drip irrigation. Nile water.

and depends upon groundwater; most of the rest is in the very early years of development east of Bitter Lakes and is based upon Nile water syphoned under the Canal. A further 1,150 feddans is being reclaimed in the El Arish area, bringing El Arish and the Rafah Strip close to self-sufficiency in vegetables and many tree crops.

The livestock sector has traditionally been very important for Sinai. Goats, camels and sheep produce milk, meat, fibre, hides, and, in the case of camels, provide means of transportation. There are smaller numbers of donkeys, very few horses and less than 100 beef cattle. An estimate of the livestock population of Sinai is given in Table 4-2. There are also many pigeons and rabbits as well as a nascent poultry industry. A small fresian dairy herd was recently established in El Arish.

Table 4-2

Estimated Livestock Population in North & South Sinai Governorates

1981

	Sheep	Goats	Camels	Donkeys	Horses
North Sinai	25,159	75,713	3,766	1,230	-
El Arish Markaz	6,052	21,227	539	157	-
Bir El Abd Markaz	11,114	35,924	1,654	107	-
El Hasana, Nakhl	7,993	18,562	1,573	966	-
South Sinai	12,698	44,917	16,282	5,092	302
TOTAL	37,857	120,630	20,048	6,322	302

Source: Ministry of Agriculture, 1981.

The livestock sector has considerable potential for improvement. Range resources are meagre and the communal use of land has led to overgrazing close to the point of eliminating some of the better forage and browse species. The condition of the stock is in general poor. Lambing percentages are poor, partly due to the great distances stock travel. Several diseases are endemic. There are a few signs of the introduction of breeds from outside Sinai; sheep show characteristics of Awassi, Baluchi and Merino. There is little trade in livestock products beyond Sinai, although camel wool, for example, could be very valuable.

Agricultural organizations active in Sinai are listed in Table 4-3; they provide the basis for improved productivity and growth and include: farmers' cooperatives, the governorates' agricultural directorates (which operate extension services, including demonstration projects), the Green Revolution Society (which has drilled wells), PBDAC, large scale agricultural companies, and ISMAMEX (an export marketing company). Bedouin have been resettled on 5-feddan farms near El Arish by the Green Revolution Society.

The Governorate of Ismailia has settled graduates in the East Bitter Lakes area giving them 15-year loans: 10 percent down, 4 years' grace, without interest. This land tenure situation is less than satisfactory. The present ownership certificate, given when farmers initially settle, does not give full title to the land. Farmers cannot use the land as collateral for loans from PBDAC. However, it is possible for cooperatives to obtain small loans guaranteed by the Ministry of Development's General Organization of Land Reclamation Cooperatives.

In the recent past many of the fruits and vegetables consumed in, or distributed from, El Arish came from Ismalia and Sharkia Governorates shipped in 1- to 5-ton trucks. The net inflow is likely to be reversed in the near future when the Rafah Strip production is added. Official wholesale prices are generally respected, which is an indication that supply and demand are roughly in balance. Olive oil used to be sold to Palestinians living west of the Jordan River and is thought to be too acidic at the moment to redirect to other export channels. Pickled olives find a ready marke+ elsewhere in Egypt.

The East Bitter Lakes and the El Arish-Rafah Strip areas represent two different aspects of Sinai's agricultural future.

New Mit Abul Kom and the Youth Farms are based upon Nile water and combine sprinkler irrigated field crop cultivation with drip irrigated vegetable production. Farmers there are immigrants to Sinai, some of them young, pioneering graduates. Their produce is exported from the region.

Apart from rainfed barley, watermelon and castor, the agriculture of El Arish and the Rafah Strip is drip-irrigated and intensive. Close to the shore between Sheikh Zuwayid and Rafah about 6,500 feddans are farmed by local families in 5-feddan parcels of land sited between the dunes. Some are based upon wellwater, some on capturing water which runs through the dunes, just below the surface. Plastic cloches over tomatoes, cucumber, and okra, together with the drip irrigation and careful on-site family attention, help to establish a semi-controlled environment.

Table 4-3

Agricultural Organizations in Northern Sinai, 1981

Organizations	Size and Functions
Wadi El Arish Agricultural Cooperative	350 member-families cultivate 3,600 feddans. Distributes animal feed, fertilizers, insecticides. Markets dates and olives.
Agricultural Cooperative for Vegetable & Fruit Production	400 members (some also in above cooperative). Seasonal activities - auctions of dates and olives, olive oil.
Bir El Abd Cooperative	Sells dates.
El Salaam Cooperative	344 feddans.
Agricultural Directorate - North Sinai Governorate	Agricultural extension, veterinary services. land tenure, legal affairs, statistics, pest control. Field offices El Arish, Bir El Abd, El Hasana, Nakhl, Sheikh Zuwayid, Rafah, 100 staff.
- Agricultural Extension Service	10 feddan demonstration farm: vegetables, seeds, nurseries. Approves fertilizer requests. Supervises pest control.
- Animal Production Dept.	Construction, management of poultry farms and livestock feed lots.
- Green Revolution Authority	Drills wells, provides technical assistance, distributes seedlings. 200 staff in El Arish.
- Principal Bank for Development and Agricultural Credit (PBDAC)	Loans for livestock, poultry, and fishing operations, tractors and trucks; warehousing; distribution of fertilizers; maintenance of irrigation systems.
Akkaria Company	Operates Hero Village reclamation site.
Arab Contractors	Operates New Mit Abul Kom reclamation site.
Governorate of Ismailia	Supports the Youth Farms in East Bitter Lakes.
ISMAMEX	Exports fruit and vegetables from Ismailia Governorate; branch at Sarabium.

Whereas the East Bitter Lakes produce has a guaranteed market west of the Canal, the Rafah Strip is in a more precarious position, although purchase of the orange crop has been arranged. The area served markets to the east in the recent past, as far afield as Jordan. Since rainfall is far higher in this area than anywhere else in Egypt and sufficient to support semi-permanent agriculture where groundwater is not available; even where there is no irrigation, more reliable marketing arrangements would encourage the substitution of cash crops, such as fruit and vegetables, for much lower-value subsistence crops such as barley. Therefore, the existing farmers' most immediate need is reliable long-term market outlets. This will permit farmers to raise production sufficiently to accommodate population growth prior to the arrival of Nile water in the late 1980s or early 1990s, when more extensive agriculture catering more to distant export markets should be possible.

(b) Fisheries

The Gulf of Suez and the eastern Mediterranean are generally fished to the limits of their potential. However, yields and incomes can be improved by improving storage, distribution and marketing methods. Substantial increases in the level of output of valuable fish products can also be achieved by extension of Egypt's aquacultural experience into Sinai, around the margins of lakes and in ponds on clayey soil, possibly in association with agriculture.

In 1978 Egypt landed 37,000 tons of fish from coastal Mediterranean waters, and 16,000 tons from the Red Sea (almost all from the Gulf of Suez). The Sinai Mediterranean coastal portion is estimated to be between 10,000 and 20,000 tons. Almost all of the Red Sea fishing is conducted out of the Port of Suez by 3,000 fishermen in 80 purse seiners, 68 trawlers, and 61 handliners. Lake Bardawil can produce a substantial sustainable catch of at least 2,500 tons per annum.

Mediterranean catches have been falling since the mid-1960s, due to falling levels of enrichment from the Nile and overfishing. Two to three thousand fishermen operating out of El Arish use small craft from the beach and catch only 1 or 2 tons/person/annum. Harbour facilities are under construction for El Arish, including a breakwater for all-weather protection and a depth alongside piers of at least 3 meters. Some improvement of Lake Bardawil facilities is also underway.

Lake Bardawil covers 156,000 feddans, with a maximum depth of only 4 meters. Commercial fishing began in 1955 with the dredging of inlets (to control the salinity level of the lake and the migration of fish). A large portion of the catch used to be sold abroad for high prices (e.g., to Italy). The lake supports about 1,500 fishermen. Water circulation is a problem in the lake, and if the fish catch is to be sustained, regular dredging is required to keep the inlets open.

Sardinella, Indian mackerel, and little tuna make up the bulk of Gulf of Suez catch landed at the Port of Suez. Catches are highly variable according to seasons and phases of the moon; half the catch is made between October and December, one-third is made from January to March. Trends in catches indicate that the maximum level of yield has probably been reached. Improvements in vessel servicing and fish-handling facilities at the Port of Suez have been recommended to save labor and improve quality. With appropriate port facilities, vessels operating out of El Tor could fish the southern part of the Gulf, with a great saving in time and fuel. A fishing pier has been proposed for El Tor.

Small craft operate from the Gulf of Aqabah coastline. No fishery similar to that in the Gulf of Suez is possible because the water is mostly very deep, and there is little upwelling to enrich the waters. There is some potential to introduce mariculture in the coral reef areas of both the gulfs for both fish and shellfish. El Tor and Sharm El Sheikh are both well located for fleets to fish the Red Sea from Ras Mohammad to Aden.

A major opportunity to increase Egyptian fish production lies in aquaculture. Aquaculture has been practiced in Egypt for many years, mainly near the edges of the northern Delta lakes, where portions of the lakes have been diked off to raise carp, mullet, and tilapia.

Four major aquaculture programs are now underway:

- At Mariut, a program was started in 1979, and the first crop is expected in 1984--5,000 feddans have been diked to raise fish, and the program will be expanded eventually to total 30,000 feddans.

- At El Zawaya, a program with 1,000 feddans was started in 1977.

- Near Abassa, a project jointly funded by the Government and USAID will eventually include 50,000 feddans of fish farms for carp and mullet fry. Training and research facilities are included.

- A private venture near Tal El Kebir now has 350 feddans in use and is expected to increase to 1,300.

These kinds of projects are well suited to Sinai conditions and are recommended for replication there.

4.1.3 Potential

4.1.3.1 Field and Horticultural Crop Potential

The agricultural land capability analysis, based upon the interpretation of satellite imagery, reports by the Desert Institute, REGWA, and Enterprise for Applied Physics, and other field studies, was undertaken to advance the process of identifying areas in each subregion of Sinai which would be suitable for irrigated agriculture. Land Resource Units were identified by combining information on topography, landforms, geology, soils, water and vegetation. Land Resource Units with very severe limitations (such as exposed bedrock, mobile dunes, extremely saline soil) were excluded from further consideration. Units with five or more "less-severe" limitations (such as prone to flooding, steep slope, surface stones, coarse texture, high calcium carbonate, high exchangeable sodium) were also set aside. Units with fewer than five such limitations were identified as the most suitable candidates for further study in order to find sites that are most promising for irrigated agriculture (Figure 4.1).

Nine Land Resource Units covering about 16,400 square kilometers were identified as most likely to have soils suitable for agriculture. However, about 6,780 kilometers of those units are in component landforms judged unsuitable for irrigation, leaving approximately 9,620 square kilometers where suitable soils are most likely to be found. Using a rule-of-thumb that 50 percent of the land in these areas will in fact have usable soils and that 60 percent of those soils can actually be irrigated (for instance, are in sufficiently contiguous tracts to make irrigation economical), 2,885 square kilometers (say 704,000 feddans) were identified as most promising for further investigation.

The agricultural land capability assessment is summarized in Table 4-4 for the nine Land Resource Units with four or fewer soil limitations. Seventy-two percent of the potentially cultivable soil is in Land Resource Units A and C, which includes much of middle and upper parts of Wadi El Arish and Wadi El Bruk. These are among the cultivable Land Resource Units most remote from the Nile in terms of pumping height, as well as distance.

Rainfall in Sinai, which only rises above a mean of 60 mm per annum in the northeast corner near the Mediterranean Sea, is sufficient to support semi-permanent agriculture between Sheikh Zuwayid and Rafah only. Soils there, which are in Land Resource Units H and D, are among the best in Sinai.

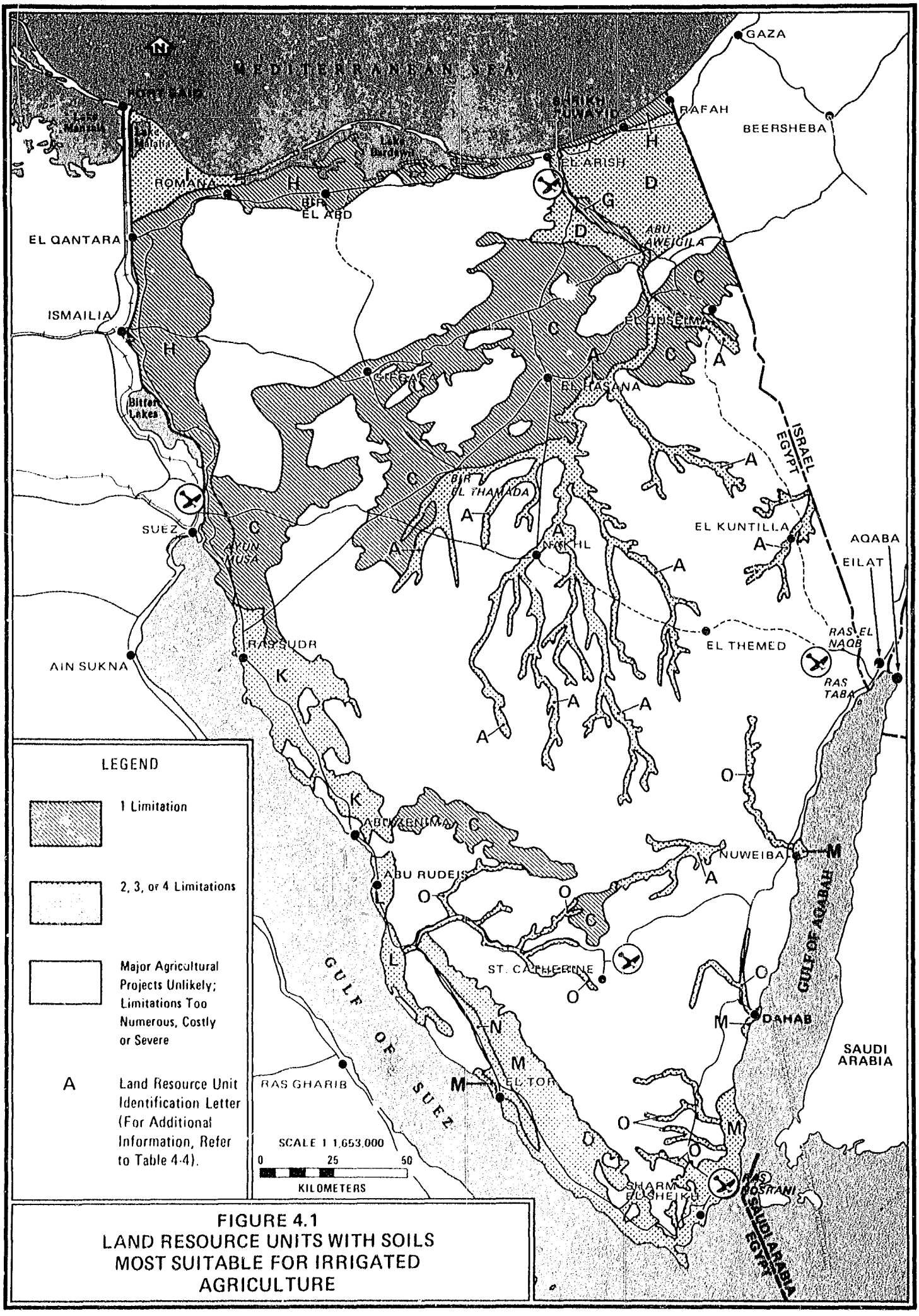


FIGURE 4.1
LAND RESOURCE UNITS WITH SOILS MOST SUITABLE FOR IRRIGATED AGRICULTURE

Table 4-4

IRRIGATED AGRICULTURE POTENTIAL BASED UPON RECONNAISSANCE STUDIES

Land Resource Unit	Landform Component	Candidate Area for Cultivation (feddans) (000)	Limitations	Prime Crops	Preferred Method of Irrigation
A. Higher elevation wadis, including El Bruk, El Arish, El Gayifa, and El Gerafi	Flood plain	139	High salinity	Olives, almonds, grapes, dates, pomegranates, figs, kale, tomatoes, peppers, spinach	Drip
	Active wadi beds	35	High $CaCO_3$	Barley, cotton	Sprinkler
	Active wadi beds	35	High $CaCO_3$	Barley, cotton	Sprinkler
C. Upland plains, including Ramlet Himeiyir and parts of middle Wadi El Arish	Sandsheet	210	Coarse	Figs, olives, citrus, tomatoes, carrots, beets, onions	Drip
	Active wadi beds	105	Steep slopes Flood risk	Deciduous fruits, nuts, avocado, beans	Drip
D. Northeast corner, south of Rafah Strip; part of Lower Wadi El Arish	Alluvial sand	59	High $CaCO_3$	Olives, grapes, almonds	Drip
	Active wadi bed	22	High $CaCO_3$ Flood risk Stoney	As above, especially on margins	Drip
G. Part of Lower Wadi El Arish	Alluvial soil on lower terraces	4	High salinity	Dates, vegetables, figs, olives	Drip
				Barley, cotton, wheat, sorghum, alfalfa, berseem	Sprinkler
H. East of Suez Canal, North Coast west of El Arish	Aeolian Sandsheet	66	Coarse	Vegetables	Drip
I. El Tina Plain (between Port Said and El Qantara)	Deltaic and lacustrous deposits	29	Salinity High water table	Wheat, rice, vegetables, fodder, root crops	Drip
L. Abu Rudeis; mouth of Wadi Feiran	Alluvial plain and active wadi bed	15	Coarse, High sodium Stoney Flood risk	Tomatoes, beets	Drip
N. El Qaa Plain	Alluvial plain	7	Coarse Gravel High salinity High sodium	Dates, figs, olives, pomegranates	Drip
	Playa	7	High salinity High sodium Shallow	Dates, figs, olives, beets, pomegranates, tomatoes, peppers	Drip
	Active wadi bed	2	Coarse High salinity High sodium Flood risk	Wheat, cotton, alfalfa, barley, tomatoes, beets	Sprinkler and Drip
O. Aqabah Wadis	Terraces	4	High salinity Shallow	Figs, pomegranates, olives, tomatoes, peppers, beets	Drip
TOTAL		704			

SOURCE: Calculations by Dames & Moore. Further detail is in Volume IV, see especially Chapter 3, Table 3-8, and Appendices A, B, and C.

Runoff recapture potential, which depends upon the drainage density of a basin and the incidence of heavy storms, is highest on land with a relatively low slope and little stone cover.* There are many small areas throughout Sinai with surface runoff potential, and preliminary estimates suggest that a total of about 4,750 feddans of cultivable soil could be reclaimed in this manner. About 18,000 additional feddans could be cropped under extensive, non-irrigated agriculture using spreader techniques, runoff farms and conduit collection. However, much more conservative targets (2,000-6,000 feddans) are proposed for the Recommended Strategy. Areas of better potential include the wadis of the Southeast subregion, the northern part of the Southwest subregion, and the Uplands subregion (Figure 4.2).

A supply of about 192,000 m^3/day of groundwater is estimated to be directly below or close to the candidate cultivable soils. Depending upon salinity and the irrigation methods used, this groundwater could support up to 14,000 feddans of irrigated agriculture. Several candidate Land Resource Units have suitable land, and an initial target of 10,900 feddans is incorporated in the Recommended Strategy. About half of the soils recommended for agriculture using groundwater are in the Southwest subregion, as summarized in Table 4-5, and additional soils can probably be developed with groundwater in the Uplands once hydrological studies have been completed there.

Table 4-5

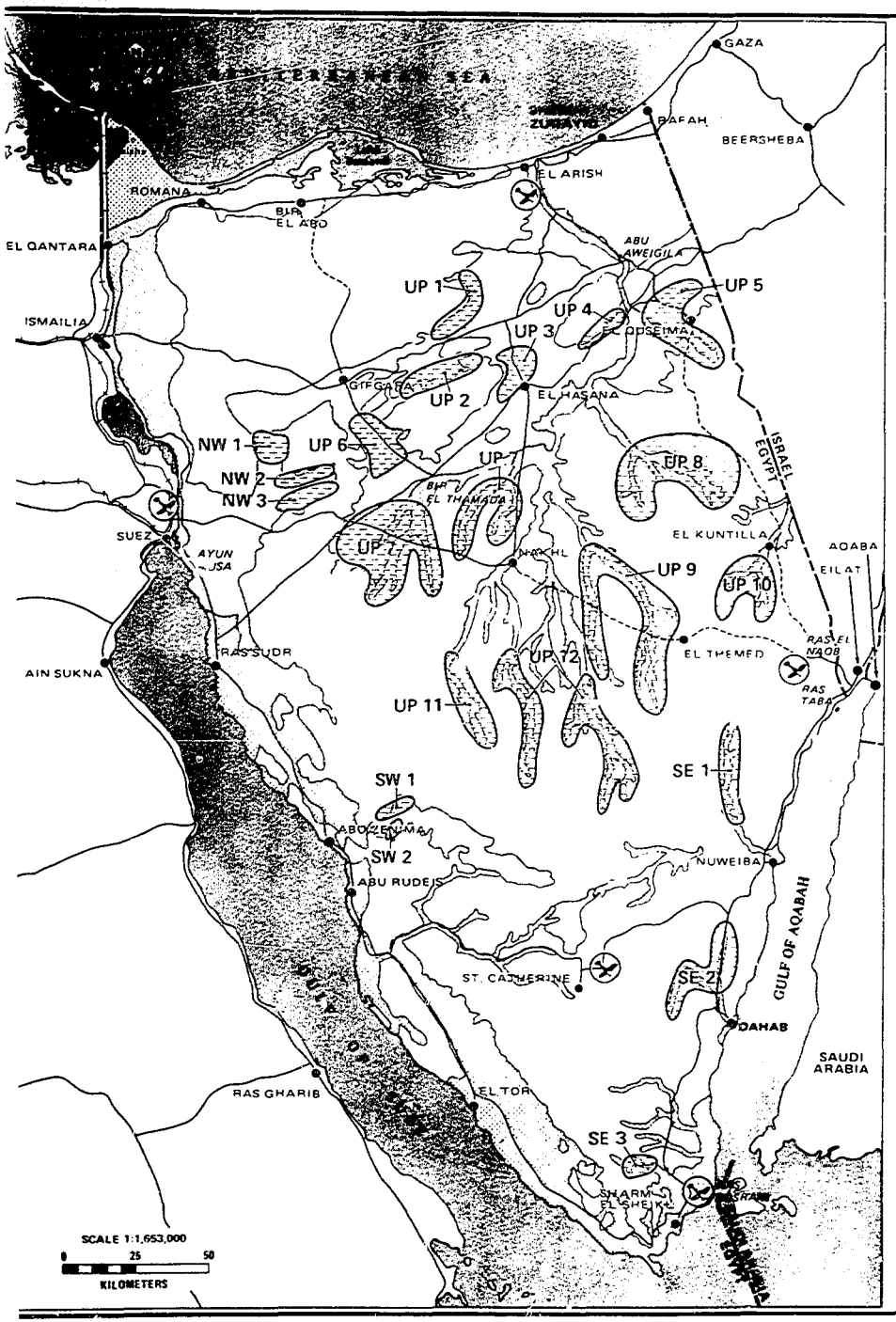
PHASING OF IRRIGATION DEVELOPMENT WITH GROUNDWATER
(Feddans)

Subregion	Phase I	Phase II	Phase III	Total	Estimated Water Duty (million m^3/yr)
TOTAL	2,400	4,800	3,700	10,900	82.5
Northeast	2,000	1,700	300	4,000	20.0
Uplands	50	600	250	900*	7.2
Southwest	300	2,200	1,800	4,300	44.2
Southeast	50	300	1,350	1,700	11.1

*In addition an initial target of 2,000 feddans is recommended for cultivation using "managed runoff" (estimated water duty, 8 million m^3/yr).

SOURCE: Calculations by Dames & Moore.

NOTE: Areas in each subregion are those which could be irrigated by groundwater up to a limit of 6,000 TDS mg/l (assumed for the purposes of this Study to be the lowest water quality which would permit cultivation). It was also assumed that only groundwater directly beneath or fairly close to cultivable soils would be utilized. Three of the largest areas suggested for reclamation with groundwater are the El Qaa Plain (initially 4,000 feddans until more is known about groundwater), the deltaic portion of Wadi El Arish (2,000) The Rafah Strip (2,000) and El Kuntilla (600) as well as several wadis in the Southeast subregion.



CANDIDATE AREAS FOR AGRICULTURE BASED ON WATER-SPREADING SYSTEMS

LEGEND

–MAP UNITS–

SE 3 — CANDIDATE AREAS FOR AGRICULTURE BASED ON WATER-SPREADING SYSTEMS*

–SUITABILITY OF SOILS FOR CROP CULTIVATION–

1 LIMITATION

2, 3, OR 4 LIMITATIONS

MAJOR AGRICULTURAL PROJECTS UNLIKELY; LIMITATIONS TOO NUMEROUS, COSTLY OR SEVERE

*Groundwater may be used to supplement run-off in some areas.

–KEY TO NUMBERED MAP UNITS–

–NORTHWEST–

NUMBER	WADI OR TRIBUTARY AREA[a]
NW 1	Umm Khisheib
NW 2	El Giddi
NW 3	El Hagg

–UPLANDS–

NUMBER	WADI OR TRIBUTARY AREA[a]
UP 1	Draining Gebel El Maghara
UP 2	Draining Gebel Yelleq
UP 3	El Hasana
UP 4	Draining Gebel El Halal
UP 5	El Gayifa
UP 6	El Hegayib
UP 7	El Bruk
UP 8	Geraia
UP 9	El Aqabah
UP 10	Gerafi
UP 11	Upper Wadi El Arish
UP 12	El Ruaq

–KEY TO NUMBERED MAP UNITS–

–SOUTHWEST–

NUMBER	WADI OR TRIBUTARY AREA[a]
SW 1	Tayiba and El Hommur
SW 2	Baba

–SOUTHEAST–

NUMBER	WADI OR TRIBUTARY AREA[a]
SE 1	Watir
SE 2	Dahab
SE 3	Lithi

[a]Sites suitable for agriculture based on water-spreading systems are most likely to be found in the upper reaches and tributary areas of listed wadis; candidate areas most suited for early investigation and development are shown.

FIGURE 4.2
CANDIDATE AREAS FOR AGRICULTURE BASED ON WATER-SPREADING SYSTEMS

On the basis of these estimates, it appears that indigenous water resources will not support even 15,000 feddans of permanent irrigated agriculture in accessible locations and perhaps a little more extensive, non-irrigated agriculture. A much larger development of irrigated agriculture is possible, however, using water imported from the Nile.

Within the 704,000 feddans in candidate areas (Table 4-4), the study team estimates that about 327,000 feddans in four subregions will be found suitable for intensive development, once more detailed soils and feasibility studies are completed, provided sufficient water can be imported to them.* The general locations of these potential sites are shown on Figure 4.3 and listed in Table 4-6. Estimates of feddanage take into account field conditions observed by the team and the probability of finding contiguous tracts suitable for large-scale reclamation. When the Recommended Strategy was prepared, after discussions with the Steering Committee, some of the more remote of these areas were deferred for development after the year 2000; these otherwise-promising areas (namely, the eastern two-thirds of the Uplands Zone, the high Ramlet Himeiyir Plain, and the El Qaa Plain) are relatively distant from proposed Nile water conveyances. The Consultant recommends that in the interim portions of these areas (for example, 4,000 feddans in the El Qaa Plain and smaller feddanage near El Kuntilla, El Quseima, Nakhl and Wadi Feiran) be irrigated with local groundwater, if at all possible, and that the wadis in the Southeast also be developed as intensively as possible with local groundwater.

The total area to be reclaimed using Nile water under the Recommended Strategy is about 189,000 feddans, including an initial 20,000 feddans in the El Tina Plain, where proximity to markets and Nile water is found to outweigh the disadvantages of salinity and a high water table. This program is estimated to require about 1,500 million cubic meters of water annually by the year 2000.

4.1.3.2 Livestock

This sector's potential can be maximized if producers are persuaded to cooperate to conserve what is a very limited grazing potential. Animal health and breeding programs can be carried out simultaneously with improvement in the management of range resources. An improved marketing system can also be introduced to encourage producers to sell less productive animals, so that more forage remains for the producing herds. In Bedouin society the animals a man keeps are his insurance against disaster. If the risks he faces are reduced, he will have greater incentive to act in a manner which is in his own long-term interest as well as that of fellow pastoralists. Livestock associations are recommended to permit commercial decisions on grazing reserves, improving range conditions, establishing animal health clinics, livestock markets, and relocation of goat, sheep and camel stations where improved breeding stock are produced.

Certain areas have been identified under the Recommended Strategy for intensive grazing and rangeland development. Selection was made on the basis of the current livestock population in the area, the potential for improving rangeland and water resources, proximity to markets and services, and absence of more promising alternative land uses. The largest such area is in the Uplands and includes places like Middle and Upper Wadi El Arish,*

*As noted earlier, additional land in small parcels at scattered locations can be developed with local groundwater and managed runoff.

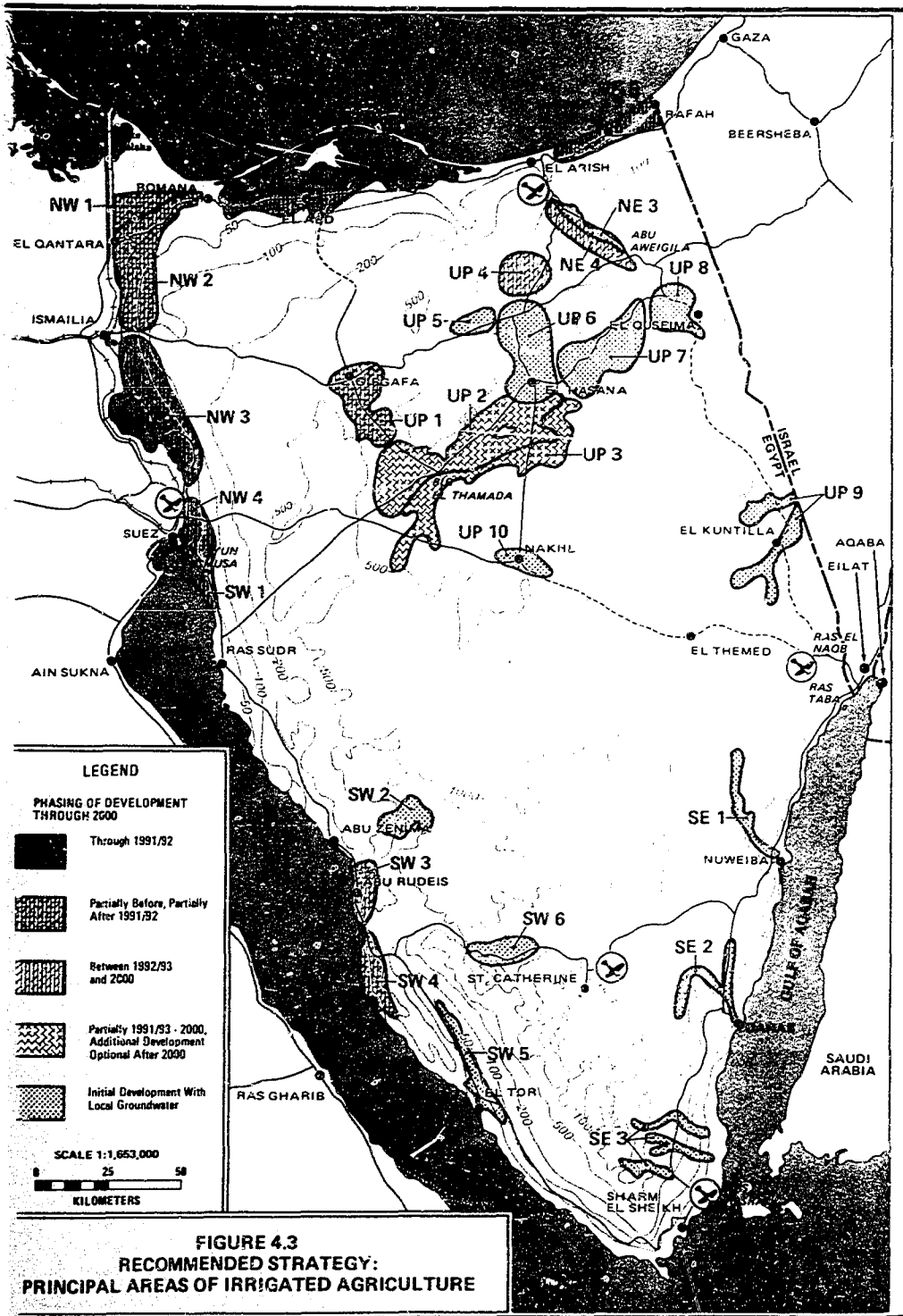


FIGURE 4.3
RECOMMENDED STRATEGY:
PRINCIPAL AREAS OF IRRIGATED AGRICULTURE

–PRINCIPAL WATER SOURCE FORSEEN FOR INDIVIDUAL AREAS OF IRRIGATED AGRICULTURE–

(Areas are keyed to map by identification numbers, and the water source is listed for each area as forseen in the recommended strategy and three alternatives.[a])

NUMBER	AREA	PRINCIPAL WATER SOURCE, BY STRATEGY (Refer to Key to Principal Water Sources for descriptions.) RECOMMENDED	FRONTIER	DISPERSED	ALL COASTS
	–NORTHWEST SUBREGION–				
NW 1	El Tina Plain	NP-11	—	NI	—
NW 2	El Qantara-Baloza	NP-2	NI	NI	NI
NW 3	East Bitterlakes	NP-E	NI	NI	NI
NW 4	East of Suez (joins SW 1)	NP-1	NI	NI	NI
	–NORTHEAST SUBREGION–				
NE 1	Romana - El Mazar	NP-3	NI	NI	NI
NE 2	Sheikh Zuwayid - Rafah	NP-4	NI	NI	NI
NE 3	Lower Wadi El Arish: LRU* G	NP-5	NI	NI	NI
NE 4	Lower Wadi El Arish: LRU* D	NP-5	NI	NI	NI
	–UPLANDS SUBREGION–				
UP 1	Gifgafa	NP-9	NI	NI	GW
UP 2	Wadi El Bruk: LRU* C	NP-10	NI	NI	GW
UP 3	Wadi El Bruk: LRU* A	NP-10	NI	NI	GW
UP 4	El Sirr Plain	NP-6	—	NI	NI
UP 5	Wadi El Hema	OE-9	—	—	—
UP 6	El Hasana	OE 10	NI	NI	GW
UP 7	Middle Wadi El Arish	OE-10	NI	NI	GW
UP 8	Wadi El Gayifa/El Quseima	OE-10	NI	GW	GW
UP 9	Wadi El Gerafi/El Kuntilla	GW	—	GW	—
UP 10	Nakhl (Research Station)	GW	—	—	—
— —	Gebels El Maghara, Yelleq and El Hallal	MR/GW	—	—	—
	–SOUTHWEST SUBREGION–				
SW 1	East of Suez (joins NW 4)	NP-1	NI	NI	NI
SW 2	Hosh El Bagar/Ramlet Himeiyir Plain	OE-8	—	NI	—
SW 3	Abu Rudeis	NP-7	GW	NI	NI
SW 4	Wadi Feiran Delta	NP-8	—	NI	NI
SW 5	El Qaa Plain	OE-8	GW	NI	NI
SW 6	Wadi Feiran Upstream	GW	GW	GW	GW
— —	Industrial Area North of Ras Sudr	NP-12	—	—	NI
	–SOUTHEAST SUBREGION–				
SE 1	Wadi Watir (northwest from Nuweiba)	GW	GW	GW	GW
SE 2	Wadis El Ghaib and Masb (north and west of Dahab)	GW	GW	GW	GW
SE 3	Three Wadis West of Nebq	GW	GW	GW	GW

[a]The Recommended Strategy is summarized in Volume I of this report. It represents a synthesis and refinement of concepts and proposals considered earlier in the planning process. The Frontier, Dispersed and All Coasts alternative strategies were prepared in less detail earlier in the planning cycle as one basis for further analysis of Sinai's development potential and for discussion with the Steering Committee. The strategies differ not only with respect to the principal sources of water recommended for each area of irrigated agriculture (for instance, as this table shows, the "Frontier" alternative proposed much less Nile water for the Southwest and substantially more for the Uplands than the Recommended Strategy) but also in the number of feddans proposed for irrigation (as described elsewhere in this volume and Volume III). Strategies are fairly similar with respect to their recommendations for Northwest, Northeast and Southeast subregions and differ mainly in their treatment of agricultural potentials in the Uplands and the Southwest.

*Land Resource Unit, as defined in Volume IV. See also Figure 4.1 and Table 4-4 in this volume.

–KEY TO PRINCIPAL WATER SOURCES–

NP-11	Nile water conveyance systems, probably mainly by pipeline. In some of these areas groundwater will also be used for agriculture to the extent sustainable supplies of appropriate quality are available, but transfers through Nile systems are expected to be the principal source of irrigation water once the Recommended Strategy is implemented. (For additional information on water conveyance systems, refer to Figure 6.1 and Tables 6-2 and 6-5).
NP-E	Existing Nile water siphons serving the East Bitter Lakes area.
NI	Nile water conveyance systems. Specific proposals (for example, capacities and routings) have been superseded by the Recommended Strategy.
OE-9	Optional extensions of Nile water conveyance systems. Initial development with local groundwater is strongly recommended as soon as aquifers are tested.
GW	Development mainly with local groundwater to the extent sustainable supplies are available.
MR/GW	Managed runoff, supplemented by any available groundwater.

TABLE 4-6

Potential Reclamation Areas, Using Mainly Nile Water, and Estimated Water Duty

Subregion/reclamation area	Candidate Area[a] (000 Feddans)	Recommended Strategy Feddans (000)	Recommended Strategy Water Duty[b] (Million m^3/Year)
Northwest, Subtotal	71.0	71.0	544.8
1. El Tina	20.0	20.0	
2. Qantara-Baloza	16.0	16.0	
3. East Bitter Lakes[c]	30.0	30.0	
4. East of Suez (Joins SW-1)	5.0	5.0	
Northeast, Subtotal	52.0	52.0	372.8
1. Romana-El Mazar	20.0	20.0	
2. Sheikh Zuwayid-Rafah	15.0	15.0	
3. & 4. Lower Wadi El Arish	17.0	17.0	
Uplands, Subtotal	156.0	51.0	411.3
1. Gifgafa	16.0	16.0	
2. & 3. Wadi El Bruk	68.0	25.0	
4. El Sirr Plain	10.0	10.0	
5. Wadi El Hema	5.0	[d]	
6. El Hasana	20.0	[d]	
7. Middle Wadi El Arish	25.0	[d]	
8. Wadi El Gayifa/El Quseima	5.0	[d]	
9. Wadi El Gerafi/El Kuntilla	7.0	[d]	
Southwest, Subtotal	48.0	15.0	170.6
1. East of Suez (Joins NW-4)	1.0	1.0	
2. Ramlet Himeiyir Plain	8.0	[d]	
3. Abu Rudeis	6.0	6.0	
4. Wadi Feiran Delta	8.0	8.0	
5. El Qaa Plain	25.0	[d]	
Southeast, Subtotal	[d]	[d]	-
TOTAL	327.0	189.0[e]	1,499.5[e]

[a] The precise number and location of feddans most suitable for major reclamation and irrigation projects will be more clearly defined when REGWA soil surveys (now in progress) and detailed feasibility studies have been completed

[b] Calculations assume a combination of irrigation methods appropriate to each area and estimated evapotranspiration rates based on climatic data for each area. Imported (Nile) water only; groundwater usage (and feddanage) shown above on Table 4-5.

[c] Includes 14,000 feddans already under development.

[d] Development to be initiated with local groundwater and "managed" runoff.

[e] An additional 10,900 feddans are recommended as the initial target for irrigation with groundwater, including 1,700 feddans in the Southeast subregion. Another 2,000 feddans will be cultivated with "managed runoff", mainly in the Uplands. The total water duty for these 12,900 feddans is estimated at 90.5 million cubic meters per year. (See Table A-8, Volume V.)

SOURCE: Calculations by the Consultant. See also the land capability analysis, summarized in Volume IV, The Land and Environment of Sinai (especially Chapter 3), and the water resources analysis in Volume V, Water Supplies and Costs (especially Table A-8).

Wadis El Bruk, El Aqaba, El Gayifa and El Gerafi. This area generally contains high quality soils, including Land Resource Units A and C. There may be groundwater in the lower cretaceous sandstone aquifers several hundred feet below the surface. Surface water potential is excellent due to low gradients and high drainage densities. Spreader dikes and terraces will enhance revegetation and rangeland improvement efforts, and a system of dams and reservoirs will assist in the provision of water for livestock (Figure 4.4).

Other candidate enhanced grazing areas include: south of Bir El Abd, where current livestock production is high; Wadi Sudr and Wadi Wardan, close to Suez Canal markets; Umm Bugma and parts of the El Tih Plateau, with good soil and surface runoff potential, and reasonably close to Abu Rudeis/Abu Zenima; and Wadi Feiran and St. Catherine.

Modern livestock production is almost an industrial activity with low water usage, capital intensive methods of production, modest land requirements, and many intermediate inputs. A successful dairy cattle enterprise is already in operation in El Arish, as well as some chicken farms. Candidate areas for such farms are the centers of population where fodder is readily accessible: El Arish and the Rafah Strip, east of Suez, Qantara, Abu Rudeis and the Wadi Feiran Delta, and El Sirr. Smaller scale facilities could be operated near Nakhl, El Themed, El Quseima and El Kuntilla.

4.2 INDUSTRY AND MINING

4.2.1 Objectives

Productive employment opportunities are needed to bring about the full employment of Sinai's current labor force, to attract new settlers and to process the minerals from mines and the produce from farms. The rapid economic development of Sinai's known mineral resources will be planned and promoted. New mineral resources will be explored and, where feasible, developed both to replace depleted resources and as a contingency against changing domestic and international market conditions.

An administrative, legal, and financial environment will be created which will be conducive to the growth and economic well-being of industry. The private sector will be encouraged, particularly since so many of the industrial opportunities in Sinai are in the kinds of ventures that the private sector has successfully developed throughout Egypt. As a coastal region, Sinai's industry can be export-oriented from the start.

4.2.2 Mineral-Related Activities

The petroleum sector is the most lucrative in Sinai. Its wealth has much more impact on the national than on the regional economy. Sinai has numerous areas of known mineral potential.

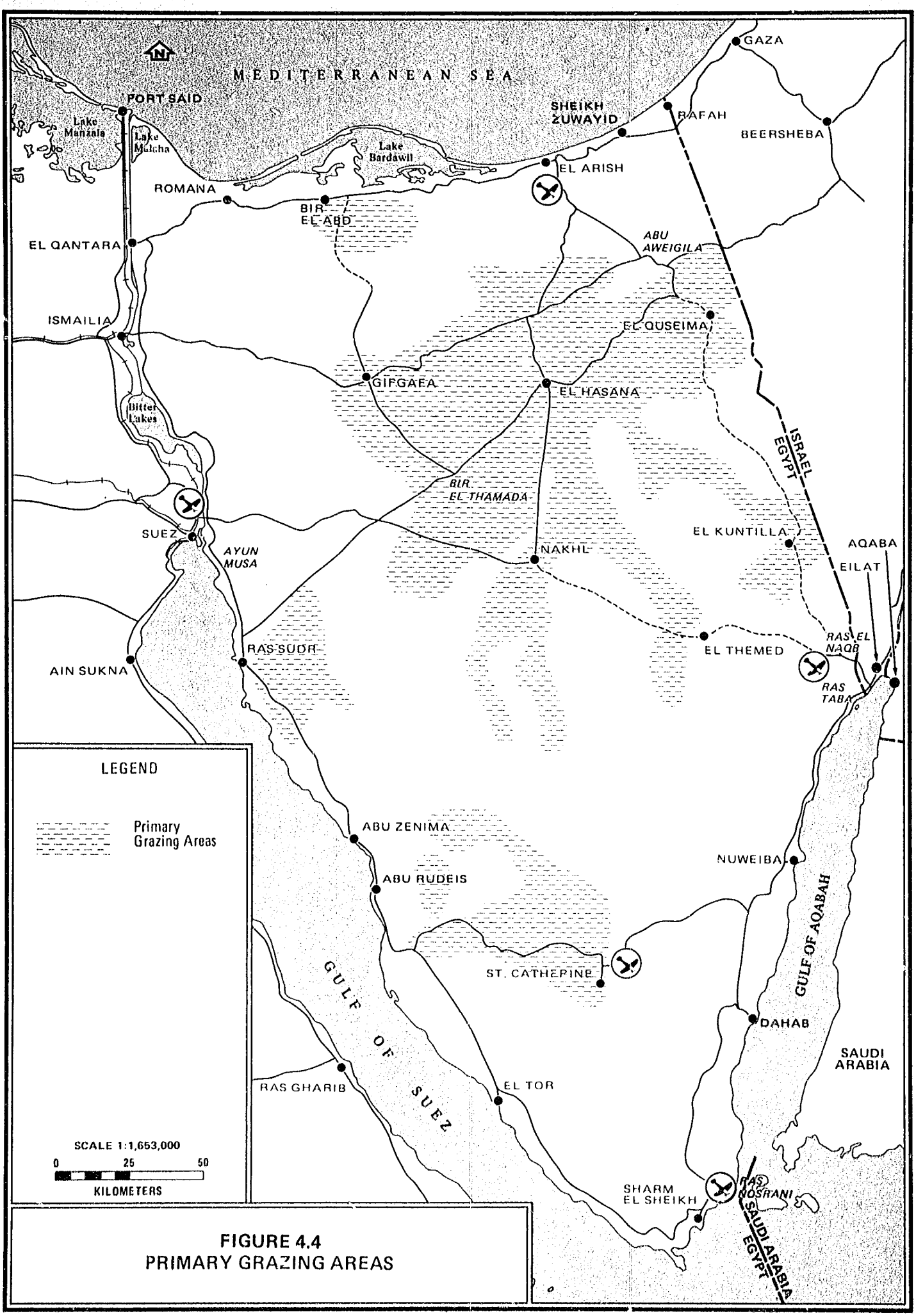


FIGURE 4.4
PRIMARY GRAZING AREAS

Figure 4.5 shows sites where the most important mineral deposits have been reported. Among the better prospects are:

- Kaolin, to the east of Abu Zenima and Abu Rudeis, also near Umm Bugma
- Manganese, at Umm Bugma
- Copper, in South Sinai--comparable deposits elsewhere have supported economic mining operations
- High silica glass sand, at El Khabouba and Wadi Budra
- Turquoise, historically mined near Umm Bugma
- Gold and tin-tantalum-niobium, in South Sinai
- Salt, at Lake Bardawil, Ayun Musa, Lake Malaha, and other locations
- Coal, at El Maghara and near Umm Bugma
- Iron, at Gebel El Halal
- Gypsum, at Ras Malaab

The Precambrian crystalline rocks of South Sinai are similar in character to those containing economic deposits of uranium in other parts of the world.

Prior to 1967, manganese ore deposits in Sinai had been mined for some time and, just prior to the Israeli occupation, the complex at Abu Zenima had been developed for smelting the ore to produce ferro-manganese. However, the new Plan has allocated only LE 2.3 million to the project and has postponed a further LE 36 million until after 1987.* The Sinai Manganese Company plans to develop the high quality (97½ percent pure hydrated) gypsum at Ras Malaab. LE 11 million will be invested by 1987; a further LE 12 million thereafter. A tender for equipment has been issued. The company also plans to reactivate the kaolin mines in Western Sinai; the Egyptian Company for Refractories has recommended another small mining activity east of Abu Zenima.

An agreement has been reached with Japan and the United Kingdom to construct a 600 megawatt thermal power station at or near Ayun Musa including desalinization capacity. This plant will use El Maghara coal as part of its energy source. It will be expandable to 1200 megawatts. This plant can be a bellwether to heavy industry on the East of Suez/Ras Sudr coastal plain.

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* Ministry of Industry and Mines, private communication.

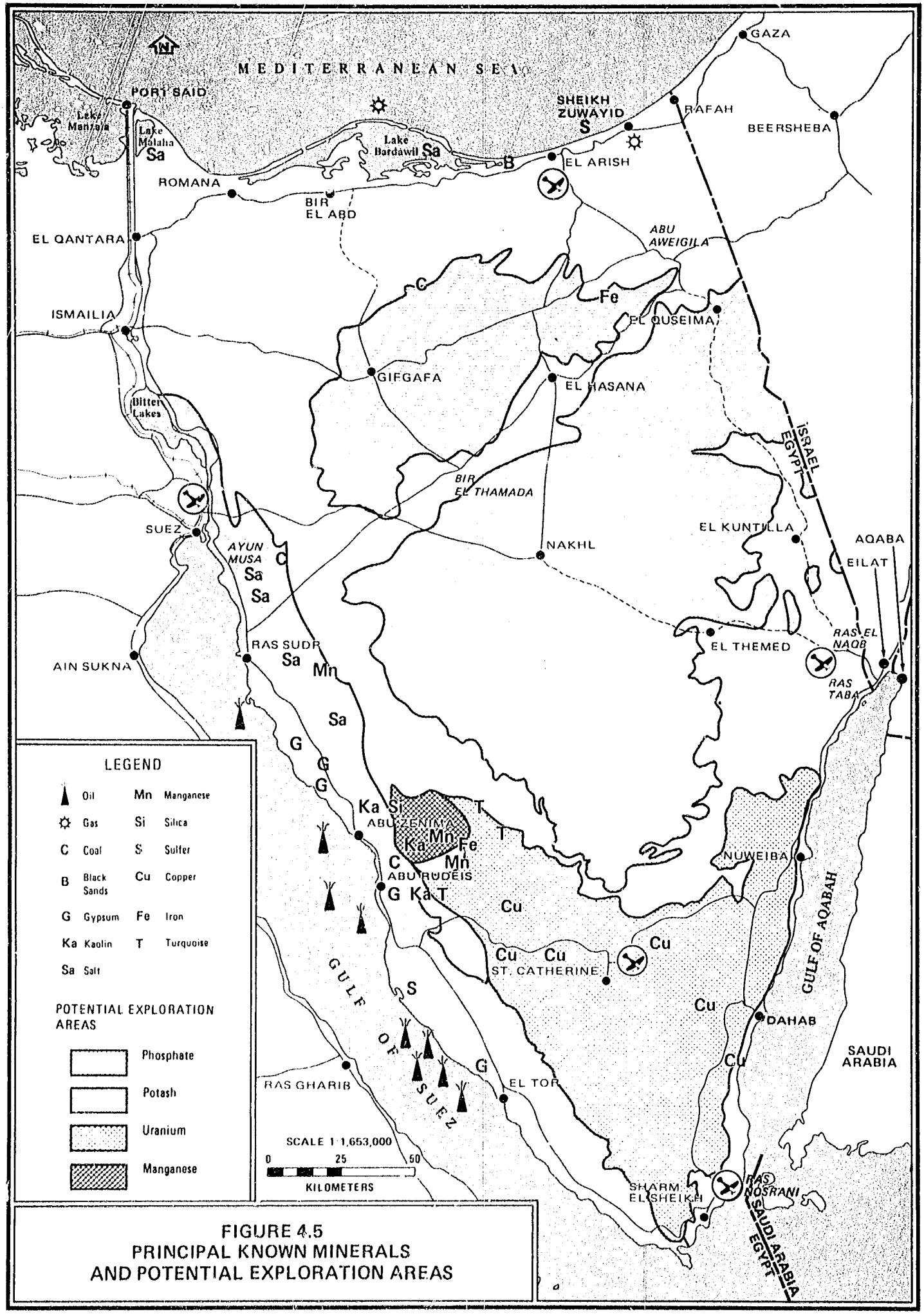

FIGURE 4.5
PRINCIPAL KNOWN MINERALS
AND POTENTIAL EXPLORATION AREAS

Twenty-one million pounds is being invested in the salt project at the eastern end of Lake Bardawil and LE 3 million in the glass sands project in the Southwest subregion.

4.2.3 Economic Activities in El Arish and Other Towns

In 1981 a special study was carried out regarding economic activities in El Arish, Sinai's largest city. Table 4-7 indicates that fully 70 percent of the licensed businesses (not including a large number of smaller units in the informal/unlicensed sector) provide retail goods and services. About 10 percent can be defined as manufacturing or wholesale. Not surprisingly during a time of rapid growth, construction is a strong 20 percent.

Table 4-7

Licensed Businesses in El Arish, in 1981

	Number	Percent
Manufacturing	17	1.6
Wholesale/warehousing	86	8.3
Construction	199	19.3
Retail goods/services	699	67.8
Hotels/restaurants	31	3.0
TOTAL	1,032	100.0

SOURCE: Dames & Moore Settlement Survey, 1981; see Working Paper 14.

More information on a sampling of businesses in El Arish is provided in Table 4-8. Most of these businesses are small; the largest employs 35 people, and there is only one reporting investment over LE 100,000. Many of the businesses rely on markets outside of El Arish, even as far away as Cairo. Wages do not appear to be much higher than those in Cairo. Prices, however, are higher. A car repair firm reports its prices to be 15 percent higher than in Cairo: the hardware store has to add a per-ton transportation surcharge of LE 15; and the cement and iron bars wholesaler has a similar surcharge. Those higher price levels are themselves an incentive to some local businessmen.

Similar data for 12 establishments in other areas of Sinai are listed in Table 4-9. Handicrafts produced in Negila and El Arish are primarily marketed in Cairo. The larger businesses are contractors. A large proportion of unskilled and semi-skilled employees come from outside of Sinai.

Table 4-8

Data on Some Businesses in El Arish - 1982

Type of Business	Market	Investment (LE)	Staff	Wages
Car repair[a]	All of North Sinai	30,000	5	% profit on repairs
Hardware store[b]	All of North Sinai	24,000	6	LE 40/mo
Olive oil production[b]	All of North Sinai	120,000	9[c]	LE 2-3/day
Transport[d] company	50% local 50% Cairo & Suez Canal	65,000 (1 truck)	2	LE 60/mo
Tile/brick manufacturing/ contracting[e]	75% El Arish 25% North Sinai	40,000 (Manufr) 100,000 (contr)	35	LE 30/mo unskilled LE 40-100/mo tilemakers, LE 100/mo brickmakers
Clothing manufacturing[b, f]	25% El Arish 75% Cairo & Suez Canal	50,000	31	LE 28/mo assistant tailor, LE 120/mo manager
Farm (vegetables, fruit)	Local	2,500	14	LE 1-5/day unskilled, LE 8/day skilled
Needlework program	Cairo	5,000	3	LE 55/mo or LE 1/piece
Hotel/ restaurant[g]	Local (visitors)	10,000 (restaurant) 7,000 (hotel)	7	LE 15-40/mo unskilled (plus tips), LE 200-400/mo skilled

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a/ Using some labor from Nile Valley.

b/ All local labor.

c/ October to December only.

d/ Annual sales of LE 3,000 to 3,500.

e/ 50 percent of labor from Upper Egypt.

f/ Annual sales of LE 58,000.

g/ 80 percent of labor from Cairo.

SOURCE: Dames & Moore Settlement Survey, 1981; see Working Paper 14.

Table 4-9

Data on Businesses in Seven Sinai Locations, 1981

Location and Type of Business	Market	Investment (LE)	Staff	Wages
NORTHEAST				
Bir El Abd				
Transport Company	All of North Sinai, Cairo	31,000	3	LE 50-100/mo
General contractor/ distributor	Local	25,000	30[a]	LE 3/day unskilled, LE 5/day skilled
Food distributor	Local	--	2	LE 15/mo
Chicken farm[b]	Within 30 km	5,000	3	LE 30/mo unskilled, LE 75/mo skilled
General contractor	All of North Sinai. Ismailia	1,000,000	75[c]	LE 2-10/day
Rabaa				
Wood products	All of North Sinai, excluding El Arish	10,000	4	(d)
Negila				
Handicrafts	Cairo	[e]	17	LE 3-7/piece
SOUTHWEST				
Ras Sudr				
Farm	Local	[f]	7	--
Feiran Oasis				
Farm	Subsistence	[g]	6	Percent of crop value
St. Catherine				
Hotel	Local (visitors)	1,000[i]	30[h]	LE 100-300/mo
General store[j]	Local	--	3	LE 8/mo
El Tor				
Poultry farm[k]	All of South Sinai	20,000	3	--

[a] Most labor from Upper Egypt.
[b] Annual sales of LE 3,500.
[c] Many from the Delta and Upper Egypt.
[d] Shared annual sales of LE 3,000.
[e] 32-m^2 building.
[f] 30 feddans - vegetables, oranges, grapes, wheat, and maize.
[g] 5 feddans - dates, olives, vegetables, turkeys, sugar.
[h] 50 percent of labor from Cairo and Alexandria.
[i] Annual rental payment.
[j] Annual sales of LE 2,000.
[k] Annual sales of LE 15,000.

SOURCE: Dames & Moore Settlement Survey, 1981; see Working Paper 14.

In summary there is experience in a wide range of industrial activities in Sinai, but as yet there are almost no large, indigenous enterprises. Some businesses are already generating cash for the region by selling their products in Cairo, Alexandria, Ismailia and overseas.

4.2.4 Industrial Potential

The potential for industry in Sinai will depend largely on the following factors:

- Considerable mineral wealth, including oil, gas and other sources of energy
- Ready access to major markets in the Canal Governorates, the Delta, and neighboring countries, by highway, and to more distant markets by air or by ship
- Strength and dynamism of the peninsular economy and its administrative and political leadership
- Resources and demands of the national and international economies
- Markets resulting from rapid population growth and a peninsular orientation among the local inhabitants
- Planned development of agriculture, based largely on a supply of Nile water to Sinai.

The following paragraphs relate this potential to industrial land capability in Sinai and describe a range of the industrial activities suitable for the peninsula.

4.2.4.1 Land Capability

Three types of industry can be distinguished:

- Physical resource-based
- Market-oriented
- Footloose.

The activities currently included in the Five-Year Plan are all physical resource-based. The location of employment in this category is determined by the sources of the major natural resource inputs, while the viability of mining and processing has to take account of market demand and access to the market. When the products of some resource-based

industries are very bulky (low value-to-volume ratio), accessibility to markets is a particularly important consideration. Many Sinai minerals have this characteristic. For example, since El Maghara's coal is of low quality, the transportation costs of delivering each Btu to Ayun Musa or Helwan will be high.* Australian coal is thought to be cheap per Btu delivered to Egypt. Some minerals are so bulky that major processing takes place nearby, as proposed for ferromanganese and glass sands. High-value products, such as copper and some of the rarer minerals, can bear much higher levels of transportation costs. Since energy-intensive activities are best located close to the source of energy, the southwest coast between Ras Sudr and Suez is particularly suitable for a chemicals and refinery complex.

Physical resource-based activities frequently require large areas of flat land with good foundation conditions. Coastal sites are frequently favored for processing activities. There is no scarcity of such sites in Sinai, except in the Southeast, although high land restricts coastal sites in some locations. Bulky inputs from outside the area (such as Australian coal) will be imported by the means of transport with the lowest unit cost (sea), and the processed outputs, which are less bulky, can be conveyed to their markets by the same means (if the market is distant) or by road. Bulky inputs include the heavy machinery and construction parts, typical of these capital-intensive projects.

The northern zone of the Southwest subregion is a good location for profitable minerals processing, since the sources of the minerals are on or close to the coast and therefore have ready access to cheap transportation. This zone is also close to major agricultural and urban markets in the Canal Region, Cairo and the Middle East.

Although all economic activities have to be market-oriented, some manufacturing businesses tend to be located in or close to the market itself. These include assembly activities which increase rather then reduce bulk. Examples include furniture, washing machines, prefabricated construction parts, and metal products. Because of economies of scale, assembly tends to take place at a small number of larger urban centers in preference to a larger number of local settlements. Location close to air or sea ports is important when assembly is for export. Sinai is particularly well endowed with airports, and the Northwest, Northeast, and Southwest subregions are close to major, international seaways and to the major Egyptian sea ports.

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* These include the cost of constructing a railroad or upgrading and maintaining the roads, and the cost of acquiring and maintaining road or rail vehicles.

In the case of processing activities which only slightly "alter" the raw material for intermediate or final consumption, there is a trade-off between the cost of transporting the bulky raw material from many origins to a central location and the cost of transporting final products. For example, the packaging of some agricultural products can begin near the farm. However, other products are best prepared in the service centers which handle cleaning, grading, and further packaging before final consumption in the towns. Packaging for export and processing which involves canning or changing the physical form of the produce (for example, olive oil or soap) will tend to take place at larger centers.

Therefore, many industrial activities aiming to serve a Sinai market are most likely to take place in the Peninsula's existing and planned urban centers. Those same locations may also be the best export outlets, since good air, road and sea transportation services are either already in place or planned.

The third category, footloose industry, does not need to be in, or close to, a local market or close to a source of raw materials. Since footloose industry is generally free from the raw material locational constraint, there is nothing to be lost and something to be gained by locating such activities close to major local markets.* Footloose activities sometimes also involve assembly. The extreme footloose activity is one which produces such high-value items (high value per unit of weight and volume) that the costs of transporting the materials to the production center and the product to the market form a very small proportion of the final selling price. Silicon chips are a prominent example. Clothing and pharmaceuticals for export are also in this category. Such products are often exported by air. Indeed, some are so "perishable" that they need to reach their markets quickly. Other products are of such high value that they have to be moved to the market quickly to avoid high inventory costs; examples include optical goods and many non-metallic minerals.**

Footloose activities are often characterized by the need for strict quality control and at least some highly skilled labor. They are attracted to urban areas because such areas have a larger labor pool from which to select high-quality staff, have more training facilities, and provide appealing residential amenities for the top management which will come from outside, at least at first.

Footloose activities will, therefore, tend to be attracted to urban locations in a fashion similar to market-oriented activities. Both these types of industrial activities enjoy agglomeration economies. The businesses which assemble consumer durables will also attract the manufacturers of parts and the suppliers of the service. Managers and workers will benefit from interaction with others in similar activities, as well as from access to training and banking facilities. Modern transportation services, with their own economies of scale, will most easily be attracted to clusters of industrial activity, which also provide the basis for sharing the cost of providing high-quality infrastructure.

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* There are exceptions: high security facilities, for example.

** P. S. Smith, Air Freight, Faber and Faber, London, 1974.

Industrial land uses are generally not expected to be in serious conflict with tourism and agriculture. There are some exceptions. Care will have to be taken in these particular situations, several of which are discussed further in Volume IV. For instance, the Abu Rudeis area industrial and oil-related facilities should not be sited on the land which may also be suitable for agriculture. Some of the land, which is already under cultivation, near the airport to the south of El Arish will also appeal to industrial developers. The land across the Canal from Suez and Ismailia has agricultural as well as urban spillover potential. However, in each such case, there is sufficient land to accommodate both activities, provided adequate plans and controls are developed during the next few years.

Mineral activities are the ones most likely to have adverse environmental impacts, and feasibility studies for each large-scale mining project should be carried out in a way that indicates ways to handle environmental impact, ensuring that potential conflict with other land uses, particularly tourism, is mitigated or eliminated.

4.2.4.2 Industrial Activities for Sinai

The industrial profile for Sinai includes a high proportion of labor intensive activities (which also tend to use water sparingly), assumes the full development of anticipated but not yet economically proven mineral resources, and favors mineral activities already established elsewhere in Egypt. Phasing by subregion appears in the next chapter. Table 4-10 lists the activities and products discussed below.*

(a) Foods, beverages and oils

The extended growing season and availability of soil suitable for irrigated agriculture offer the potential of significant high value agriculture and associated agro-industry once adequate water becomes available in the appropriate areas. Some enterprises in this category are already being initiated by the public sector. Under the new Plan, the Governorate of North Sinai will invest in olive processing (LE 1.2 million), ice factories (LE 0.4 million), automatic bakeries (LE 0.6 million) and slaughter houses (LE 0.4 million). The East Delta Milling Company, a Ministry of Supply agency, will build a flour mill in El Arish.

Olives do well in Sinai and sell well in the rest of Egypt, which currently imports both olive oil and pickled olives. An olive enhancement program is among the high-priority programs of the Ministry of Agriculture, and is expected to provide better returns to farmers and to promote new plantings for future production. Olives are now processed in several factories dispersed around El Arish; the general quality level of processing could be improved considerably, especially when production expands. Careful controls are required during the pickling cycle. The later pressings in olive oil processing could also provide the basis for industrial uses, such as soap manufacture.

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* See also a similar list in GOFI, Proposals for the Establishment of Light and Medium Industrial Projects in Areas of Population Concentration in the Governorate of North Sinai, Sinai Symposium, National Academy of Sciences, May 1982. More detail is available in Working Paper No. 36, Industry, in the SDS-I project files.

Table 4-10

Proposed Industrial Activities in Sinai

Industrial Category		
Food, beverages, oils	Olive oil	Dairy/beef
	Pickled olives	Bees/honey
	Dates	Ice
	Peanut butter	Cold storage
	Vegetable oil	Fish processing
	Flour milling	Beverages
	Bakeries	
Building materials	Sand, aggregates	Metal doors, fittings
	Cement	Steel fabrication
	Concrete products	Sheet metal products
	Clay, brick, tile	Paint
	Wood, sash, doors	
Mining, processing of minerals	Manganese, iron	Calcined gypsum
	Ferromanganese	Refractions
	Glass sand	Lake salt
	Flat glass	Coal
		Seabed minerals
Clothing, accessories	Ready-made garments	Leather garments, sundries
	Cloth, canvas products	Footwear (leather or plastic)
Durable goods, furniture	Agricultural implements	Solar water heating
	Wood furniture	
	Metal furniture	
Refinery, chemical	Fertilizer complex: Ammonia, urea, nitric acid, calcium ammonium nitrate	Caustic soda, chlorine
		Soda ash
		Oil refinery
		Petrochemical complex

Similarly, a date enhancement program has been undertaken at the national level and is strongly recommended in Sinai. The soft Sinai dates, although more difficult to process, are preferred by many consumers. High-quality peanuts are grown in Egypt. In addition to marketing the crop as whole peanuts, peanut butter could be manufactured by joint ventures with foreign companies which have access to the process technology.

Castor beans, which are being grown in the Rafah Strip and south of El Arish, could provide the basis for the production of vegetable oils. The Egyptian internal market is expanding and substantial quantities are now imported. Vegetable oils, therefore, have import substitution as well as export potential.

There is a program to set up flour mills and bakeries throughout Sinai. Investment requirements for local bakeries are so small, the technology so simple, and demand so predictable that private sector participation could easily be encouraged.

Other suggested activities include honey bees, fish processing, beverages and soft drinks, and ice production and cold storage, which is a necessity for efficient distribution.

(b) Clothing and accessories

This category of industry is labor-intensive and so represents one of the principal hopes for generating employment in Sinai to manufacture a product that can be traded outside the region. It offers the combined advantages of an easily transferred technology, low capital investment per employee, labor-intensive operations, and a high value-to-weight ratio in both raw materials and end products. There is considerable export potential, as long as high quality and production cost advantages can be sustained. There is abundant experience elsewhere in Egypt to assist the development of this industry in Sinai. It is an opportunity that favors the private sector. Such companies will need to be oriented to international opportunities and to seek joint ventures and distributional arrangements for export to other countries in the Middle East and Europe. Free zone facilities would assist such arrangements by sheltering foreign investors in local ventures and encouraging the use of high quality foreign source raw materials.

This sector includes ready-made garments, cloth and canvas products, leather garments and sundries, and footwear, made from both leather and plastic. In the recent past, ready-made garments were exported to London from El Arish; currently, the Bedouin handicrafts program employs 300 women and sells its products through a number of outlets in Cairo. Its main current handicaps are poor-quality raw materials and the need to redesign local products to increase their appeal to high-income Egyptians and tourists. For example, the very attractive Bedouin dresses are made from heavy materials in order to last a lifetime. Lighter materials are required for Cairo and overseas markets.

(c) Building Materials

A very small building industry already exists in El Arish. Increases in demand will make larger operations advantageous and profitable. Association between small businesses in Sinai and larger companies elsewhere with access to capital and know-how would make possible more rapid growth. Although many building materials are now imported into Sinai from the rest of Egypt, the peninsula has most of the necessary raw materials to support the ambitious construction program which has been projected for the next 20 years.

The sand and aggregates used in highway and building construction in North Sinai are of generally poor quality. The development of higher quality sources should be possible, particularly with the introduction of efficient equipment for collecting and classifying material. Egypt is expected to reach self-sufficiency in cement production in the near future. An additional plant some time in the 1990's might profitably be constructed to the southeast of Suez, close to energy sources, limestone and other raw materials, water supplies and a rapidly growing market. Technology also now favors small cement factories. The GOE is thinking in terms of one for each governorate, a measure which would relieve the pressure on the highways of large trucks carrying cement long distances. Sinai could work with governorates less well-endowed with raw materials to produce not only for its own needs but also for export to other nearby communities.

Other building materials which could be manufactured in Sinai include:

- Concrete products
- Bricks and tiles
- Doors, door and window frames and related hardware
- Steel fabrication
- Sheet metal products
- Paint.

(d) Durable goods and furniture

Furniture-making is well established in Egypt and is ideal for small private sector operations, since capital investment is low, involving mainly light shop equipment. These bulky products will tend to be supplied to local rather than distant markets. There are also proposals to expand the existing solar water heating workshop. The repair, assembly and manufacture of agricultural implements, including parts for drip and sprinkler irrigation equipment, will serve Sinai's farmers.

(e) Mining and mineral processing

Mineral potential will be among the first to be realized in Sinai. As stated earlier, a number of projects are close to implementation.

GOE plans for ferromanganese, glass sand, gypsum, salt, and coal have already been mentioned. Although there is no allocation in the Plan to exploit the resource, the known kaolin deposits in the southwest are of such exceptional quality for refractories, being high in aluminum content and low in critical impurities, that such a project might be added and will almost certainly attract private investors. Some of the key characteristics of the promising mineral projects, including investment, employment and phasing, are outlined in Table 4-11.

At a later stage, following surveys and feasibility studies, it might be possible to develop some of the other minerals listed in Section 4.2.2. The Plan has an allocation of LE 3.4 million for geological surveys in Sinai. It is essential to start such surveys now, since there is much fragmentary knowledge about Sinai's minerals which needs to be developed more fully, and project gestation periods are typically long.

(f) Refinery and chemicals

The establishment of a refinery and chemicals complex based upon Sinai's abundant energy resources could generate over 6,800 jobs, provide exports from the region, and support other Sinai-based activities. This industrial development, summarized in Table 4-12, would require investment in excess of LE 2.5 billion. It is projected for Phase III, by which time it is anticipated that a large supply of natural gas will be available, and conversion of this raw material into high-value fertilizers for Sinai as well as other Egyptian and world markets will be profitable and beneficial to the agricultural economy.

The suggested plant would produce high analysis nitrogen fertilizers (urea and calcium ammonium nitrate). The plant could also produce phosphatic or complex fertilizers if economic deposits are discovered in Sinai or other phosphate supplies are shipped to Sinai for processing.

A caustic-chlorine plant is also suggested, using sodium chloride from Lake Bardawil and producing chlorine for making polyvinyl chloride plastics in the petrochemical complex. The Lake Bardawil salt plant would also provide inputs to a soda ash plant, which could use local limestone as an input. The largest end-user would be in glass-making, which is expected to increase steadily in Egypt given the growing demand for flat glass and containers and the ready supply of raw materials and energy. A flat glass plant is recommended for Sinai in the 1990's.

An oil refinery with a capacity of 100,000/150,000 barrels per day is suggested. It is assumed that around 75 percent of production would be in the fuels most heavily consumed in Egypt today--gasoline, kerosene, gas oil, fuel oil and butagas. The balance of the output would be supplied to the adjacent petrochemical complex in the form of light distillate hydrocarbons and aromatics.

Table 4-11

Recommended Mineral, Mining and Processing Prospects

Industry Location	Annual Capacity (000 tons)	Startup Phase*	Employees	Power (KW)	Water (m^3/day)	Investment (LE 000) Foreign	Local
Manganese-iron mine							
Umm Bugma	70	II	100	--	8	3,000	2,000
Ferromanganese Smelter							
Abu Zenima	50	II	900	20,000	1,700	10,000	6,000
Glass sand mine							
Southwest	60	I	30	70	50	500	3,000
Northwest	12	II	60	140	100	1,000	6,000
Flat glass							
Abu Rudeis	100	II	900	4,000	700	70,000	42,000
Gypsum mine							
Ras Malaab	300	I	120	--	5	900	900
Ras Malaab	300	II	120	--	5	900	900
Calcined gypsum							
Ras Malaab	210	I	280	5,000	17	5,000	3,800
Ras Malaab	210	II	280	5,000	17	5,000	3,800
Kaolin mines, Southwest							
No. 1	50	I	50	700	250	4,000	1,000
No. 2	50	I	50	700	250	4,000	1,000
No. 3	50	II	50	700	250	4,000	1,000
No. 4	50	III	50	700	250	4,000	1,000
Refractories							
Abu Rudeis	54	II	200	600	15	2,000	1,500
Salt							
Lake Bardawil	2,000	I	240	1,000	12	3,300	17,300
Coal mine							
Gebel El Maghara, Uplands	600	II*	1,000	4,300	800	60,000	34,000
TOTAL			4,430	42,910	4,429	177,600	125,200

* Phase I - 1983 to 1987; Phase II - 1988 to 1992; Phase III - 1993 to 2000.
SOURCE: Estimates by Dames & Moore.

Table 4-12

Recommended Refinery and Chemical Products Development in the Southwest Subregion

Industry (Feddans)	Annual Capacity (000 Tons)	Startup Phase	Jobs	Power (KW)	Water (m^3/Day)	Investment Foreign (LE 000)	Investment Local (LE 000)
Fertilizer Complex:							
Ammonia (14)	660	II	60	2,440	20,000	80,000	25,000
Urea (10)	825	II	60	5,000	17,280	55,000	25,000
Nitric Acid (10)	230	II	50	4,000	3,000	16,000	9,000
CAN[a/] (14)	330	II	100	3,000	1,500	22,000	23,000
Support Facilities (30)	--	II	300	1,000	15	8,000	23,000
Caustic Soda, Chlorine (60)	240	II	120	96,000	7,000	70,000	30,000
Soda Ash (60)	100	II	200	3,000	1,200	45,000	35,000
Oil Refinery (650)	5,000	II	550	20,000	9,600	225,000	75,000
Petrochemical Complex:							
Initial (700)	400	II	1,250	54,000	45,000	320,000	170,000
Expansion (1,800)	800	II	4,100	256,000	105,000	780,000	480,000
		TOTAL	6,790	444,440	209,595	1,621,000	895,000

a/ Calcium ammonium nitrate.

SOURCE: Estimates by Dames & Moore.

A portion of the petrochemical complex's feedstock could be supplied by natural gas, which should be available in sizeable quantities in the 1990s. It is assumed that this complex will be built in two stages. In the first stage the end-products would be polyethylene and PVC plastic resins and detergents of the standard alkybenzene sulfonate type. The second stage expansion would enlarge the complex to three times the initial production capacity and increase the number of product groups four-fold. This stage would add plastics of differing properties and end uses -- polystyrene, polypropylene, ABS resins, SBR synthetic rubber, and a number of widely used organic chemicals. The products of this complex would be widely distributed in Egypt and would also generate downstream consuming industries locally in Sinai, such as plastic processing. Products might include plastic pipe and tubing, packaging films and sheeting, plastic bottles and containers, electrical fixtures, and molded items. Paint and rubber product industries would also be directly simulated.

This large project could be sited in a number of locations in Egypt -- for example, on the energy rich western coast of the Gulf of Suez or to the west of Alexandria close to the Abu Qir gas field. Sinai has the necessary large areas of flat land, plentiful energy and proximity to major transportation networks. The petrochemical complex could be a very important project for Sinai since location between Suez and Ras Sudr would place it on international shipping routes and at a "hinge" between northern and southern Sinai. A decision to locate Egypt's petrochemical complex in Sinai would certainly help accomplish the Government's goals of settling people on the peninsula and establishing a dispersed pattern of settlements; conversely, a decision to ignore Sinai's very tangible advantages as a site for the complex would make the accomplishment of other objectives more difficult.

4.3 TOURISM

4.3.1 Objectives

Tourism objectives for the next 20 years include:

- Establishing major international beach tourist resorts along the Gulf of Aqabah and near El Arish
- Constructing holiday villages on the coasts of the Gulf of Suez, Bitter Lakes and the mediterranean, catering mainly to Egyptians
- Setting up tourist circuits for religious, cultural, and sightseeing visitors
- Building facilities for day-trippers and weekenders from Cairo, The Delta, and Canal cities
- Accommodating the specialized but growing coral reef, wildlife and health tourist markets.

The types of tourism with the best potential for generating significant employment and income and establishing a permanent population are warm water beach, regional beach and domestic tourism. Warm water beach tourists are expected to come to South Sinai's coasts mainly from Europe, particularly in the winter; regional beach tourists from Europe, Egypt, and adjacent Arab countries will visit Sinai's northern and western coasts mainly in the summer; and domestic tourists will travel from the Delta to resorts in the Northwest, Northeast, and Southwest Subregions. Successful development of the first two, highly competitive types of international tourism is expected to be large-scale and very quality-conscious. Large, high-quality hotels and associated beach services, restaurants, and shops are recommended in order to justify inclusion in tour operators' brochures and to compete with Spain, the Canary Islands, Yugoslavia, Greece, and many other attractive destinations. There would be fewer risks involved in promoting the much smaller, specialist markets; but the rewards, particularly in terms of jobs, would be correspondingly modest.

International beach tourism is prone to weak local multiplier effects, due to widespread use of imported construction materials, food, management and staff. Particular care, therefore is recommended to link this sector with others -- high quality fresh food production, ample labor supply through careful selection and training, full utilization of plentiful local building materials, the local production of handicrafts and beachwear, good water supply and sewerage, etc. Domestic tourism has stronger local multiplier effects with less conscious effort; market penetration is also less of a problem.

The physical environment is important to tourism: Sinai's unique beauty, as well as its climate, is likely to be the main attraction to tourists from abroad and from elsewhere in Egypt, once good travel and hotel services are established; however, tourists are also a threat to the environment. A major effort is recommended to protect the natural environment as well as the culture and heritage of the indigenous population.*

The National Plan for 1982/83 - 86/87 has earmarked LE 378 million for direct tourism investment throughout Egypt. It is expected that most tourist development will be financed by the private sector. Private sector investment will grow from LE 30 million in 1982/83 to an expected LE 50 million in 1986/87. The target is to receive 5 million tourists in 1985, earning for Egypt a projected LE 2 billion. Coastal resorts are among the activities given high priority, and Sinai is among the areas identified for early development; with Gulf of Aqabah locations being named as the principal Sinai sites. The Ministry estimates current capacity in the whole of Sinai to be 450 rooms and aims to add another 400.

Since the hotels at Nuweiba and Dahab were severely underutilized in 1982, an immediate objective is to restore the market for facilities already existing along the Gulf of Aqabah.

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* The Gulf of Aqabah road was constructed to run inland from Sharm El Sheikh, Dahab, Nebq, and Nuweiba in a series of loops precisely to limit access to the unique coast and to protect its natural beauty. It is reported that this tripled the cost of building that road and increased travel times to coastal villages; but the extra costs were judged worthwhile to protect the coastline aesthetically and ecologically.

4.3.2 Current and Recent Activity

The main concentration of current tourist capacity is in the Southeast subregion along the Gulf of Aqabah (Sharm El Sheikh, Marsa El Atī, Dahab and Nuweiba) and at El Arish. There are Ministry of Tourism and Governorate plans for new accommodations along the Gulf of Suez coast in the Southwest subregion and in the Northwest subregion at Great Bitter Lake and Ayun Musa. Only the Gulf of Aqabah settlements have ever achieved the status of tourist resorts--an estimated 200,000 visitor nights in 1980/81, of which about 60 percent were Europeans arriving via Israel. St. Catherine, with limited overnight resources, received about 50,000 visitors in the year prior to the Israeli withdrawal; there are now three flights a week from Cairo and from Israel, plus bus tours. Desert trek tourism operated out of Israel and accounted for 10,000 to 20,000 visitor-days annually in the late 1970s. An increasing number of Egyptian visitors reach Sinai by car and bus.

The few years represented a period of readjustment for Sinai tourism, occurring at a time when Egyptian tourism as a whole suffered from global recession.* Therefore, recent annual visitor rates are far lower than those given above. Sinai businesses have also suffered from the loss of the Israeli visitors to the Aqabah coastal area.

4.3.3 Potential

Physical potential in terms of tourism land capability is described in Volume IV. Given the climatic conditions, the beaches, coral, and unique scenery, and the archaeological, historical, military, natural and religious sites on one hand and the need to generate high levels of well-paid employment on the other hand, two major international resort markets have been identified. Market potential is summarized below.**

The first market, Warm Water Beach Tourism, consists of relatively high income Western European tourists seeking water and beaches suitable for swimming during all or most of the year, including the winter months. Both the Gulf of Suez and the Gulf of Aqabah fulfill the climatic requirements. However, only the latter offers a combination of other physical advantages--clear, unpolluted waters; sandy beaches free of rocks and obstructive vegetation; a smooth sandy bottom; control of sharks, jellyfish and other hazards; and freedom from high surf. In addition, the Southeast boasts coral reefs which are of special interest.

This is the fastest growing tourist market. Although it is difficult to define such a market statistically, one recent study estimated 200 million holiday trips originating from the top eight European markets.***

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* Egyptian tourism earnings fell by 26 percent between October, 1981, and October, 1982. The number of tourists actually increased, but the number of tourist nights fell, according to the Central Bank of Egypt (personal communication).

** More detailed discussions are available in memoranda in SDS-I project files.

*** European Tourism Demand Study (Frankfurt: Steigenberger Consultants, 1980).

South Sinai's competitors include the Canary Islands (which have 40 to 50 percent of the entire market), Florida, the Caribbean, the Gambia, Kenya, the Seychelles, Sri Lanka, Pattiya (Thailand), Penang (Malaysia) and Bali. All except the Canary Islands are farther from West Germany, the U.K. and Scandinavia, the largest potential market. Although this is a less price-elastic market than some others, the travel cost saving (which itself increases at a decreasing rate with distance) could give Sinai an edge over its competitors. The Governorate of South Sinai is already well provided with airfields, namely, at Sharm El Sheikh, Nuweiba, Dahab, St. Catherine and Ras Naqb.

Until detailed market studies are completed, it would be somewhat speculative to estimate what proportion of this market Sinai can expect to capture. To take an extreme case, few would have predicted 30 years ago that the Canary Islands, which then had only a few thousand arrivals, would have 1.7 million in 1978. European tour operators contacted during this study indicated that a target of 4 to 6 percent market share by 1990 is reasonable -- reasonable in the sense that it could be achieved if Sinai were marketed well, if the facilities were constructed in a timely manner and efficiently operated, and if overall market trends were as currently anticipated.* To err on the side of conservatism, a smaller market share has been assumed here.

Estimates of visitor days and hotel room requirements in accordance with the Recommended Strategy are summarized in Table 4-13. Annual variability tends not to be great for this kind of tourism: 90 percent December to April hotel occupancies and 40 to 70 percent during the rest of the year are typical.

The second market has been labeled Regional Beach Tourism. Every year tens of millions of Europeans of all income groups, from unreliable climatic zones, purchase package vacations to enjoy warmth and sunshine on Mediterranean beaches, especially during the summer months. In 1980 this market was said to total about 300 million visitor days. In 1975 Spain captured 65 percent of this market, Italy 10 percent. In recent years Portugal, Greece, Yugoslavia, Turkey, Morocco, Tunisia and Bulgaria have been eroding Spain's market share, but the proportions travelling to these destinations remain small. The market is quite price sensitive; rapid price increases in Spain in 1982, for example, were one reason some traffic shifted to Portugal and Italy.

El Arish and other locations along Sinai's Mediterranean coastline have the warm summers and superb beaches required to serve this market; a good airport is also available. It is, however, farther from the market than almost all the main competitors, especially Spain (Costa Brava and Majorca). However, the airfare penalty might not be too great (an estimated 17 percent penalty on the total package from London when compared with Tunisia, for example) as long as Sinai can successfully promote its unique attractions and achieve a reputation for high quality service.

* Recent Economist statistics indicate that European tourism is fairly recession proof. This is particularly the case with the higher income groups.

Table 4-13

Ranges of Potential Visitor Days and Hotel Rooms for Various Sinai Tourism Markets

Market	1990		2000	
	Visitor Days (Million)	Hotel Rooms	Visitor Days (Million)	Hotel Rooms
Warm Water Beach - Southern Sinai	0.6 - 1.7	1,120 - 3,480	1.0 - 3.7	2,000 - 7,420
Regional Beach - Northern Sinai	0.8 - 2.7	1,640 - 5,370	1.5 - 5.9	3,090 -11,690
Domestic Beach	0.5 - 1.0	980 - 1,970	0.8 - 1.7	1,660 - 3,335
Middle Eastern	0.3 - 0.5	500 - 1,000	0.4 - 0.8	830 - 1,660
Cultural Tourism	0.3 - 0.7	568 - 1,408	0.5 - 1.2	972 - 2,336
Coral/Scuba	0.2	330	0.3	530

SOURCE: Estimates by Dames & Moore.

Recent Economist Intelligence Unit (EIU) studies indicate that price and income elasticity are equally important in forecasting long-term demand; in other words, that a resort is likely to gain as much from higher incomes in the originating countries as it may lose by being marginally more expensive. What is even more important is that the constant term in this equation (representing fashion, promotional effort, etc.) tends to be far larger than either of these elasticities.

Again, a precise quantitative estimate of the market share to which Sinai might aspire is highly speculative. A target of 1.5 million visitor days and 3,090 hotel rooms has been proposed for the year 2000. This represents a very low (three-tenths of one percent) share of the market.

A portion of the visitors to the El Arish and Aqabah international resorts will be Egyptians. Residents of Cairo, the Delta and Canal cities will make the half-to-one-day journey by road (less by air) to these resorts, and to Romana, Great Bitter Lakes, the beaches of Ras Misalla and Ayun Musa, the ancient ruins of Pelusium and Sarabit El Khadim, the hot springs of Hamman Faraun, the cooler highlands of the Mitla Pass and Gebel El Maghara, the wildlife conservation areas of Lake Bardawil, the mangroves and coral of Ras Mohammad, and many other unique attractions. They can also be expected to build villas and buy and rent beach flats in Sinai, just as they do at Alexandria and Damietta.

Particularly between now and 1992, it is expected that tourist centers in the Northwest, Northeast and Southwest will be dominated by domestic tourists staying in tourist villages, hotels and villas. There will be 7,500 tourist flats in the Northwest and 1,900 in the Southwest, mainly on or near beaches. Four hundred and twenty-five hotel rooms will be constructed in the Northwest mainly for domestic tourists, 50 in the Uplands zone, and 610 in the Southwest. El Arish will have 850 rooms by the end of Phase II, many of which will be occupied by domestic tourists. El Arish will grow as an international resort, mainly in Phase III.

The issue for both beach and tourism markets is not so much the size of the market, but rather which actions do the promoters of Sinai's potential have to take to supply services which are clearly in very large demand. There was no beach tourism market of any kind before the 1950's and yet the current market is very large and continues to grow despite worldwide recession. The rate of Sinai's achievement of the potential shown in Table 4-13 will depend on the efficiency of tourist facility construction programs and the rate at which Sinai's tourist services can establish an outstanding reputation. Nevertheless, since it is already an international resort and has a 'price' edge over competitors in a fairly stable market, South Sinai can be expected to progress towards its potential more quickly than North Sinai.

Of the nearly 1.4 million tourists visiting Egypt in 1981, almost as many came from Arab countries as from OECD countries (579,000 compared with 665,000) with Saudi Arabia a slightly more common origin than the United States.* Tourist-night proportions were similar. Between 1981 and 1990 the Arab market is expected to grow by 29 percent, the OECD by only 16 percent.** Arabs from Saudi Arabia, Jordan, Kuwait and other locations might well feel more at home in Sinai's resort locations, within easy reach of open spaces, than in Cairo or Alexandria. About one-third of the Middle Eastern visitors to Egypt stay at or near Alexandria (about 112 million visitor nights annually); many can be diverted to Sinai's cleaner and often closer beach resorts, as might some of the half million or so Arabs who visit other parts of Egypt each year.

Cultural tourism is an established Egyptian market, but a small one. Some tourists now make day trips to Sinai; others stay 1 to 3 nights in the vicinity of St. Catherine's Monastery. Sinai will increasingly be added to the Cairo-Luxor-Giza circuit. Some beach tourists will also wish to visit St. Catherine and make other side trips to places such as those listed earlier as attractions mainly for local Egyptian daytrippers.

The outstanding coral reefs along the Gulf of Aqabah and at Ras Mohammad have attracted divers and snorkelers from around the world for some years. These tourists have made Sinai known to the tourist world and will continue to lead the way for some years. Reef tourism probably accounted for about 100,000 visitor days at Sharm El Sheikh, Dahab and Nuweiba in 1980. Estimates for 1990 and 2000 appear in Table 4-13;

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* France, West Germany, Britain, the Benelux countries, Switzerland, and Scandinavia together account for about twice as many tourists as the United States.

** SOURCE: Ministry of Tourism.

they assume a 5 percent annual growth rate. Many of the other visitors to these resorts will be introduced to snorkeling and scuba diving, although they come originally merely to sunbathe. Each resort has a diving school. Several Egyptian and foreign tourist groups are considering health tourist activity based on the hot springs at Hammam Faraun and Hammam Saidna Musa. The Arab Sinai Company has begun developing a tourist village in nearby Ras Misalla. These facilities are expected to prove especially attractive to Egyptian and Arab tourists.

Tourists and businessmen travelling from Cairo and Alexandria to Israel, Jordan and beyond will be encouraged to visit Sinai en route for some sightseeing and perhaps a restful night or two and a few days on the beach. Other small markets can be found among the desert-trek and wildlife enthusiasts.

4.3.4 Concluding Observation

The actual size of Sinai's tourist industry in the year 2000 will be determined by many factors in the next 15 years. However, it is already clear that tourism represents a very large opportunity for Sinai in terms of jobs and income. Precise markets, effective promotional campaigns, and specific investment partners remain to be determined, partly with the aid of detailed market planning and feasibility studies during the next few years. Nevertheless, it is the judgement of experts, including experts who assisted in the early stages of preparing this Report, that there was more of a risk from thinking "small" at this stage than from thinking "large". It is recommended that plans for Sinai keep open the possibility that very large scale tourism will develop, particularly beach tourism catering to international as well as domestic markets. A corollary to that recommendation is that specific resorts be planned on a large enough scale and with sufficient aesthetic vision to command a position of high respect in a market which is notoriously competitive; to plan for less than the best could mean a short-term advantage but would not be in the best long-term interest of Egypt, especially when the contribution of tourism to a dispersed pattern of permanent settlements is one important objective of the government's overall development strategy for Sinai.

4.4 SUPPORTING ECONOMIC SECTORS

Construction and trade services (wholesaling and transportation) are the most active sectors in Sinai. Table 4-7 above shows the dominance of these sectors in El Arish: 76 percent of establishments are in the retail and wholesale sectors, 20 percent in construction (including the storage and transportation of construction materials). The largest businesses in Bir El Abd are general contractors.

Despite the large numbers of such businesses in Sinai, major capital works and most transportation are now carried out by companies from elsewhere in Egypt, which means that much of the income generated by these activities leaves the regional economy. The settlement survey in 1981 indicated that some of the construction labor employed in Sinai, even in locations where there is high unemployment, came from outside the peninsula.

A tile and brick manufacturer in El Arish reported that he had been compelled to recruit half his workforce of 35 from Upper Egypt. Ninety-five percent of a Bir El Abd general contractor's staff of 30 came from Upper Egypt. Another Bir El Abd contractor had managed to recruit only seven locally, out of a labor force of 75.

Other inputs to these supporting sectors also now tend to come from outside Sinai. Large quantities of aggregate, bricks, cement, window frames, wood and other construction materials as well as air conditioners and electrical parts can be seen moving across the Canal into Sinai on virtually every ferry.* The whole Southwest Subregion and much of the Uplands can have good access to sand, gravel, limestone, dolomite and gypsum once local resources are developed.

The achievement of Sinai's ambitious growth and capital works targets can be greatly assisted if early encouragement is given to the creation of a construction materials industry and an indigenous construction workforce. If the development authorities guarantee a steady flow of work (throughout the year, and taking one year with another), give access to finance for the acquisition of materials and capital equipment (working and long term capital), and provide training facilities, viable, locally based, private sector enterprises would tend to emerge and expand appropriately.**

Similar observations are made about the house construction subsector. It easily attracts private, individual savings and is highly responsive to local demand. Almost all dwelling units in Egypt are constructed by the private sector, most by very small enterprises. Given proper support, this sector can be expected to provide much more employment in Sinai than at present and to encourage other related activities.

The transport sector is also characterized throughout most of the world by small-scale, private operators. No Sinai transport company has more than a few vehicles; most have only one, and almost all their trucks are small although very large vehicles loaded west of the Canal can be seen hauling heavy cargoes throughout Sinai. Plans for agriculture envisage large numbers of refrigerated trucks carrying perishables to Cairo, Alexandria, elsewhere in the Middle East and to ports for export to Europe. The plans for industry provide the basis for deliveries of chemical products to many parts of Egypt, wearing apparel to Western Europe, cement to the main Sinai settlements, and processed minerals from the west coast to the rest of Egypt. The tourist industry will require bus operators to carry holidaymakers from airports to resorts, and to arrange tours of the region. A freight forwarding industry (including airfreight) will be required to consolidate loads for distant destinations. Sinai's planners, possibly through the development bank, can be expected to guide Sinai's businessmen into these ventures and also to attract businessmen from the rest of Egypt already active in providing such services.

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* By far the largest tonnage crossing the Canal at the time of the Traffic Survey in 1981 was building materials. The next two items were perishable food and petroleum products. All were travelling eastbound.

** The responsiveness of the construction sector to new demands is documented in the Construction Industry Study (Cairo: World Bank and GOHPR, 1981) and the Informal Housing Study (Cairo: Abt Associates, Dames & Moore, and GOHPR for USAID, 1982). Further discussion of the prospects for a construction materials industry can also be found in the SDS-I files.

4.5 ALTERNATIVE STRATEGIES AND ECONOMIC PERFORMANCE

All Coasts and Frontier strategies perform best in terms of economic objectives, with All Coasts having a slight advantage in terms of an industrial rather than agricultural emphasis in a region where water conservation, including more jobs per unit of water used, will always be important.

However, a dispersed pattern of settlement is a very important overall objective, and the Dispersed Strategy was specifically designed to present one variant of that pattern. The Recommended Strategy, presented at the subregional level in the next chapter, is partly a synthesis of these three alternative strategies and includes inputs from the many analyses to be found in the project Working Papers and insights gained from meetings with the Steering Committee.

5.0 SPATIAL, SECTORAL AND TEMPORAL LINKAGES

5.1 SPATIAL DEVELOPMENT THEORY APPLIED TO SINAI

In central place theory, generally attributed to W. Cristaller,* spatial patterns are thought to be hierarchical, with higher order places offering more functions than lower order places, although it is now generally agreed that all higher order centers do not necessarily have all lower order functions. This is related to the spread-backwash concepts of G. Myrdal,** further developed by Hoselitz and Hirschman -- a circular and cumulative causation similar to the "trickle down" concept. Hoselitz refers to cities as being "generative" after a "parasitic" phase.

F. Perroux suggested the identification of growth poles as development centers at which investment should be concentrated to the benefit of the surrounding region, including lower level settlements.*** Some experts feel that Perroux's concept of growth foci is not too applicable to the developing countries, which are characterized by dual economies and a weak diffusion of technological advance. John Friedman, once the main American proponent of Perroux's ideas, is now the most articulate opponent of "trickle down," proposing instead an "agripolitan" development.**** However, even decentralized-agripolitan development theories rely on identifying growth points in rural areas.

Much of the economic planning methodology of this Study has been based on a class of planning models rooted in central place theory. Given an ambitious population-settlement target, it is particularly important that the primary long-term emphasis be on employment creation, especially on employment in activities which contribute positively to the region's balance of trade. The logical flow of the Lowry-type of model***** begins with basic sector employment creation and moves on to service employment. Sector specialists and other team members sought out employment potentials throughout the peninsula, taking into account the region's land capability. The Lowry model then moves on from the locational allocation of employment and population to a specification of service and infrastructure needs. There is an important feedback from service provision to employment generation, for instance, the construction of the Nile water pipelines and upgrading of roads will encourage businesses to establish in Sinai. The Lowry model, linked to central place theory, suggests that a hierarchical settlement structure will develop through scale economies in the clustering of employment and by the achievement of the threshold population levels needed to justify infrastructure with lower unit costs (for example, water supply and wastewater treatment).

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* Die Zentralen Orte in Suddeutschland (Central Places in Southern Germany), 1933.

** Economic Theory and the Underdeveloped Region, 1957.

*** See "Note sur la nation de pole de croissance", Economic Appliquee, 1953.

**** See the exchange between Friedman and Niles Hansen, reported in The Proceedings of the Seminar on Industrialization Strategies and the Growth Pole Approach to Regional Planning and Development - The Asian Experience, Nagoya, Japan, 1975.

***** I.S. Lowry, Rand Corporation, RM-4035-RC, Santa Monica, 1964.

5.2 EGYPTIAN SPATIAL DEVELOPMENT

The National Urban Policy Study (NUPS) is the most recent analysis of settlement systems in Egypt.* The study classified urban settlements in a number of ways--namely: gross population density, population size, physical expansion options, economic growth potential, and population absorption capacity.

NUPS considered Sinai one of the "remote areas", others being Matruh, New Valley and Red Sea governorates. It is a major objective of the Sinai Development Study - Phase I (SDS-I) to prepare plans to make Sinai less remote and to integrate the Peninsula with the Nile Delta, the Nile Valley, and neighboring markets. The NUPS analysis of policy options, which focuses on feasible levels of decentralization from the primate cities of Cairo and Alexandria, implies a hierarchical ordering of settlements at this meso-regional scale:

Cairo
Alexandria
Canal cities
Delta
North Upper Egypt
South Upper Egypt
Remote areas

The Government objective is to decentralize development down that hierarchy, or to be precise, away from Cairo, Alexandria and the Delta:

> "During 1975 the Ministry of Housing and Reconstruction was given major responsibility for the implementation of the rapid urbanization of Egypt away from Cairo and the Nile Valley."**

Sinai is one such region of new settlement. One purpose of SDS-I is to move from the NUPS meso-regional scale and urban emphasis into a more detailed spatial analysis of the potential of Sinai, given its special strategic importance.

It is foreseen that Sinai's development will spring from five foci of growth over the next 25 years, one each in the Northeast, Southwest and Southeast Subregions, two from across the Canal in the Northwest. These generators of growth are shown in Figure 5.1 along with the major transportation corridors which connect them.

- The Ras Taba-Nuweiba area, an "entry growth center" under the Recommended Strategy, will become part of a larger urban area at the northern end of the Gulf of Aqabah (including the city of Aqaba), which will be Sinai's gateway to Jordan, Iraq, Saudi Arabia and the Gulf.

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* PADCO, with ECG and Sherif El Hakim & Associates, National Urban Policy Study, Final Report, 1983.

** H. E. Eng. Soliman Abdul Hai, Planning Consultancy in the Developing World, Third World Review, Vol. 3, 1981.

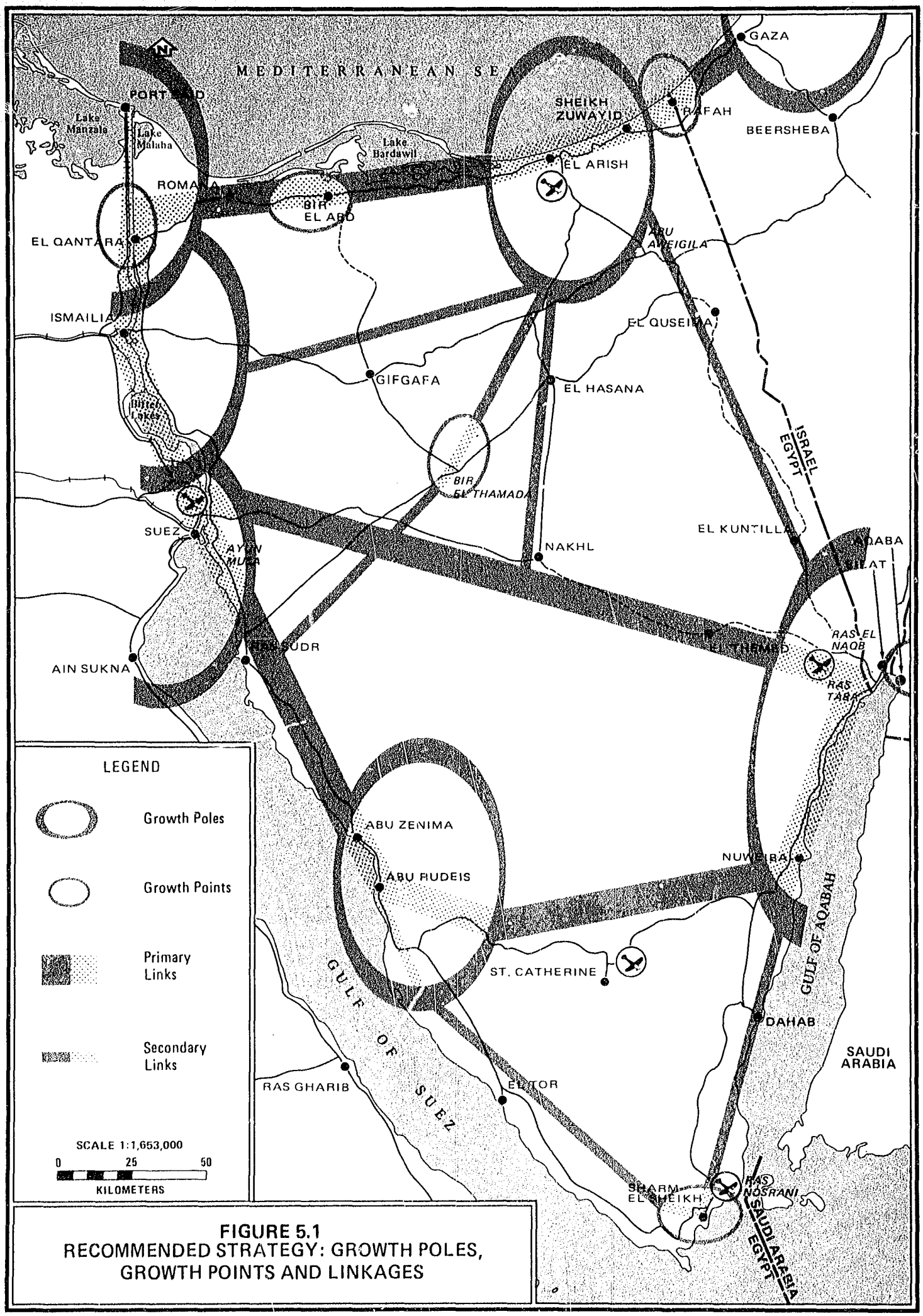

FIGURE 5.1
RECOMMENDED STRATEGY: GROWTH POLES, GROWTH POINTS AND LINKAGES

- The Abu Rudeis growth pole will continue to expand rapidly on the basis of its hydrocarbons, other mineral resources, agriculture, tourism, and higher education.

- The Suez growth pole includes the area between the Hamdi Tunnel to the north and Ayun Musa/El Shatt to the east and Ayun Sukna to the southwest. Beyond 2000, it may grow to over a million.

- The Ismailia/Qantara growth pole links together a series of towns dominated by Ismailia and Port Said. These and other towns along the northern coastal road will service the agricultural and tourist potential of the northern part of the Northwest Subregion and western part of the Northeast Subregion.

- The coastal area from El Arish eastwards, including the Gaza Strip, already has over half a million people; the El Arish growth pole will service the land with the best agricultural potential in Sinai and also develop activities in light manufacturing, industry and tourism.

Economic development around these five major areas of urban growth is discussed in the sections that follow.

5.3 PHASED DEVELOPMENT OF SINAI'S SUBREGIONS

5.3.1 Summary of Employment under the Recommended Strategy

This section describes the phased development of Sinai's subregions mainly in terms of the leading economic sectors. After analyzing alternatives and reviewing them with the Steering Committee, a Recommended Strategy was prepared. This strategy includes some portions of the Dispersed Strategy's spatial settlement pattern and agricultural emphasis, the Frontier Strategy's focus on entry points (Rafah Strip, Ras Taba, Suez, El Quseima), and the All Coasts Strategy's stress on industrial activity.

Population and settlement are unevenly dispersed throughout Sinai. The more populous settlements are along the coasts, in particular in the northeast corner. The general strategic objective is to achieve a dispersed pattern of permanent settlements as economically as possible. The several strategic options discussed here emphasize dispersion and economic viability in varying degrees.

The Recommended Strategy takes advantage of the development dynamics of the existing spatial pattern while dispersing the population more widely throughout all five subregions. About two-thirds of the current civilian population lives in the Northeast Subregion, mostly in El Arish and the Rafah strip; however, only two-fifths of Sinai's additional jobs will be created in that Subregion by 2000. The most rapid growth is to take place in the Northwest, now largely vacant; the shares of population in the Southwest will also increase. This redistribution of population represents a substantial movement in the direction of achieving the goal of a dispersed settlement pattern, without a great sacrifice of economic efficiency. The more intense settlement in the Northwest serves to integrate Sinai with the Delta. (Table 5-1 projects the phased growth of employment in "leading sections" for each subregion.)

Table 5-1

Projected Additional Employment in Leading Sectors, by Phase and Subregion

(Increments, each Phase)

Subregion	I			II			III			Total (leading sectors)			
	Agr	Ind	Tou	Agr	Ind	Tou	Agr	Ind	Tou	Agr	Ind	Tou	Total
NW	5,700	500	0	10,200	2,615	350	11,200	5,880	500	27,100	8,995	850	36,945
NE	1,650	3,550	400	28,950	8,850	1,300	16,800	10,100	2,800	47,400	22,500	4,500	74,400
UP	100	50	0	6,300	1,100	100	25,700	200	0	32,100	1,350	100	33,550
SW	600	690	220	2,400	3,740	400	9,300	8,670	600	12,300	13,100	1,220	26,620
SE	100	0	0	600	480	1,500	1,700	830	3,000	2,400	1,310	4,500	8,210
Total	8,150	4,790	620	48,450	16,785	3,650	64,700	25,680	6,900	121,300	47,255	11,170	179,725
All three sectors		13,560			68,885			97,280			179,725		

(Cumulative)

NW	5,700	500	0	15,900	3,115	350	27,100	8,995	850
NE	1,650	3,550	400	30,600	12,400	1,700	47,400	22,500	4,500
UP	100	50	0	6,400	11,150	100	32,100	1,350	100
SW	600	690	220	3,000	4,430	620	12,300	13,100	1,220
SE	100	0	0	700	480	1,500	2,400	1,310	4,500
Total	8,150	4,790	620	56,600	21,575	4,270	121,300	47,255	1,170
All three sectors		13,560			82,445			179,725	

Source: Projections by Consultant.

Each subregion has been subdivided into two or three planning zones. Each current and potential future settlement has been placed in a 4-level spatial hierarchy, ranging from growth pole (city, over 50,000 population) to growth point (large town, 25,000-50,000) to service center (small town, 5,000-25,000) or market center (under 5,000). As a general principle, each zone has one growth pole or one growth point (one zone has both). These hierarchies have been related to axes of development in a series of subregional sketch maps.* Economic interaction will tend to take place along these axes, which connect related settlements. It is this linking of activities along axes, as well within major settlements, that provides one basis for the regional multiplier effects referred to in Chapter 3.

Major employment characteristics of zones and economic linkages within and between zones are described here. The three "leading sectors" are defined to be agriculture (especially intensive irrigated agriculture), industry (which includes mining and is divided into a number of subsectors), and tourism (both domestic and international).**

The impact of the leading sector activities on other employment will vary by type of activity and location. Industrial activities, generally located in urban areas, will have the greatest local multiplier effects, particularly in the early years when the private savings of the informal sector are invested in new business ventures. The more intensive agriculture around the main settlements will have similar multiplier effects. The greenhouses, cultivation under plastic, and dairy and chicken farms have economic characteristics closer to factories than to traditional Egyptian farms. Technology- and capital-intensive agriculture will also generate many local jobs in equipment repair, assembly and servicing. Pastoral activities in the more remote areas and the largely subsistence agriculture around wells in the interior will require the support of only a few local services and will not have many strong linkages with other businesses.

The tendency of international tourism to import food, labor, and hotel equipment can be counteracted by explicit efforts to cultivate high quality fruit and vegetables locally, to produce beef and dairy products, to provide training and to develop high quality construction services; services for Egyptian tourists will naturally have local multiplier effects.

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* Many reviewers of Sinai's prospects like to think in terms of development axes. See, for example, Gen. Mohammed Abdel Fattah Mohsen's Global View: Strategic Development of Sinai and Mohammed Fag el Nour's Toward a Comprehensive, Long Term Strategy for Sinai, both papers presented at the National Academy of Sciences' Sinai Symposium in May 1982.

** This is not to say that other sectors such as construction, trade, housing, education and government are not "basic" to the development of Sinai. They will however tend to be led by the three "productive sectors" which have most export and import-substitution potential and which consist of many enterprise units that are expected to have long-term economic viability and thus provide the basis in permanent economic activity to support other services, government and so forth.

In agricultural areas the strategy is to maximize local business development and multi-sectoral communities. The literature records many instances where the income elasticity of demand for non-food goods and services is often quite high in rural areas.* Similarly, there is a high elasticity of demand for non-food goods and services with respect to the agricultural sector: tools, repair and supply services, buildings, processing, transport and marketing. Frequently, all but the more complex equipment and supplies, such as tractors and fertilizers, are provided locally. Smallholders are more likely than large scale techno-agriculture to rely on local supplies and services.**

Under the Recommended Strategy Sinai will have an economy which resembles the national one in terms of employment mix. For example, agricultural employment forms over 38 percent of the Sinai total in the year 2000; at the moment the national proportion is about 34 percent. Nationally, the ratio of basic sector (leading sector) jobs to other jobs is about 1:1. Other regional planning studies have used such a ratio.*** To estimate sub-regional and zonal population for the Recommended Strategy this ratio has been varied slightly to account for varying sectoral composition, ranging from 1:05 in remote rural areas to 1:1 in the most complex urban areas such as El Arish and Abu Rudeis. On average each "leading sector" job in Sinai is projected to create 0.75 jobs (three-quarters of a job) in supporting sectors. In other words, for each 1,000 jobs generated in leading sectors another 750 jobs are created "indirectly". (For further discussion, see Appendix B.)

Employment trends are summarized in Tables 5-1 to 5-3. About two-thirds of the total leading sector jobs are in agriculture (including fisheries, mainly aquaculture), and over one-quarter in industry (which includes agricultural processing and mining).

Touristic hotel employment amounts to four percent of the total. The addition of about 121,300 agricultural jobs, many in intensive irrigated agriculture with two jobs per feddan, is predicated on the reclamation of about 200,000 feddans by the year 2000. As discussed below, it is proposed that a further 100,000 feddans or more, mainly in El Qaa, Wadi El Bruk, around El Hasana and in the Middle Wadi El Arish, may be reclaimed when Nile water pipelines are extended to these areas after the year 2000.

Major land reclamation before the year 2000 will be in the Northwest Subregion, including El Tina Plain, along the north coast from Romana to Rafah, a short distance up the Wadi El Arish, and in the Southwest as far as Wadi Feiran. There will also be about 13,000 feddans of intensive agriculture based on groundwater and surface runoff recapture, mainly in Uplands and Southeastern locations and on the El Qaa Plain. Much of the industrial development is projected to be in El Arish, in the Abu Rudeis growth pole, and in the Northwest Subregion, (at El Qantara and El Shatt) and on the coastal plain north of Ras Sudr.

*For example, see Sharing in Development: A Programme of Employment, Equity, and Growth for the Philippines (Geneva, ILO, 1974).

**Dennis Anderson and Mark W. Lierserson, Rural Non-Farm Employment, World Bank.

***See, for example, The Suez Canal Regional Study.

Table 5-2

Projected Growth in Total Employment, by Subregion
Current Employment Compared to Year 2000

Subregion	Estimated Current Employment	Projected Year 2000 Employment	Incremental Coefficient
Northwest	4,925	63,791	13.0
Northeast	26,612	137,040	5.1
Uplands	5,697	50,760	8.9
Southwest	6,592	47,906	7.3
Southeast	1,117	14,058	12.6
TOTAL	44,943	313,555	7.0

SOURCE: Current employment estimated by Consultant from 1982 Census Reports of CAPMAS; projected by Consultant.

Table 5-3

Percent Distribution of Additional Leading Sector Employment

A. Distribution Among Sectors, by Subregion, in the Year 2000

Subregion	Agr	Ind	Tour
	(percent distribution)		
Northwest	74	24	2
Northeast	64	30	6
Uplands	96	4	*
Southwest	46	49	5
Southeast	29	16	55

B. Percent Gain in Jobs within Leading Sectors, by Phase

Sector	To 1986/87	1987/88-91/92	1992/3-2000
		(percent gain)	
Agriculture (inc. fisheries but not grazing)	7	40	53
Industry (including mining)	10	36	54
Tourism	6	33	61

* Less than one percent.

SOURCE: Projections by Consultant.

Each subregion is expected to have some tourist facilities. International tourists will be mainly attracted to beach resorts in the Southeast and Northeast. Domestic tourism will be important in the Northwest (Bitter Lakes, Ayun Musa) and the areas closest to the Suez Canal in the Northeast (Romana) and Southwest (from Ras Misalla to Abu Rudeis).

About half the employment growth is expected to take place in Phase III--that is to say, after 1992. The Northeast is the only region to have more growth in Phase II than in Phase III, reflecting the early arrival of major Nile water pipelines. Development in the Northwest, closest to Nile water also begins quickly. The Southeast and Southwest have most of their growth during the 1990's (third phase).

The five distinct subregional economies can be summarized as follows:

- NW Agricultural, with considerable industry
- NE Agriculture leads, with strong industry support
- UP Agriculture, extensive rural development and substantial growth in irrigated agriculture
- SW Most balanced, industry leads
- SE Tourism dominates, supported by agriculture.

Sectoral emphasis does not vary greatly by phase, except that industrial growth is almost as important as agricultural growth in Phase I.

This presentation of the Recommended Strategy (built on earlier analysis of three alternatives) includes the possibility of two major spatial, sectoral and phasing options:

- The Frontier and Dispersed Strategies proposed the reclamation of substantial parts of the Wadi El Bruk and Wadi El Arish in the Uplands. This reclamation and its impact on employment and population growth are described below. However, some of the potential in the central and eastern Uplands is recommended for the post-2000 period.

  The Recommended Strategy for the period prior to the year 2000 includes enhanced grazing programs (in part through a return to the "hema" system) for this whole central part of the Peninsula. This, the initial phase of irrigation with Nile water, plus a variety of groundwater and surface runoff management schemes will support substantial population growth in the area.

- The Southwest Subregion is projected to attain a population not far short of the Northwest by the year 2000. These estimates for the Southwest do not include land reclamation in the high Ramlet Himeiyir plateau and include only limited initial reclamation in the El Qaa plain (based on groundwater). Much of the growth in the Southwest is based upon a refinery and chemicals complex and minerals processing.

The refinery and chemicals development, which is projected to employ about 6,800 people, would require LE 2.5 billion of investment; it is therefore costly in terms of jobs created and population supported per LE of investment. Such major projects are national in scope, will be costly wherever they are located in Egypt, and are not likely to be significantly more costly in Sinai based on the preliminary evidence available at this time. National projects of this magnitude can make a significant contribution to development in Sinai; it is recommended that a coastal location in Sinai near international shipping routes be one major alternative carefully costed when the feasibility of such a project is studied in detail.

5.3.2 The Northwest Subregion

The Northwest Subregion's three zones are illustrated in Figure 5.2. The Northern Zone is associated with the Governorate of Port Said; the Central, Ismailia; and the Southern Zone with Suez Governorate. As is the case with Southeast and Southwest Subregions, the spatial form is essentially linear, following the road along the east bank of the Canal; the main gas pipelines will also follow this road. There will be a triangle of agricultural activities in the El Tina Plain, once part of the Nile Delta.

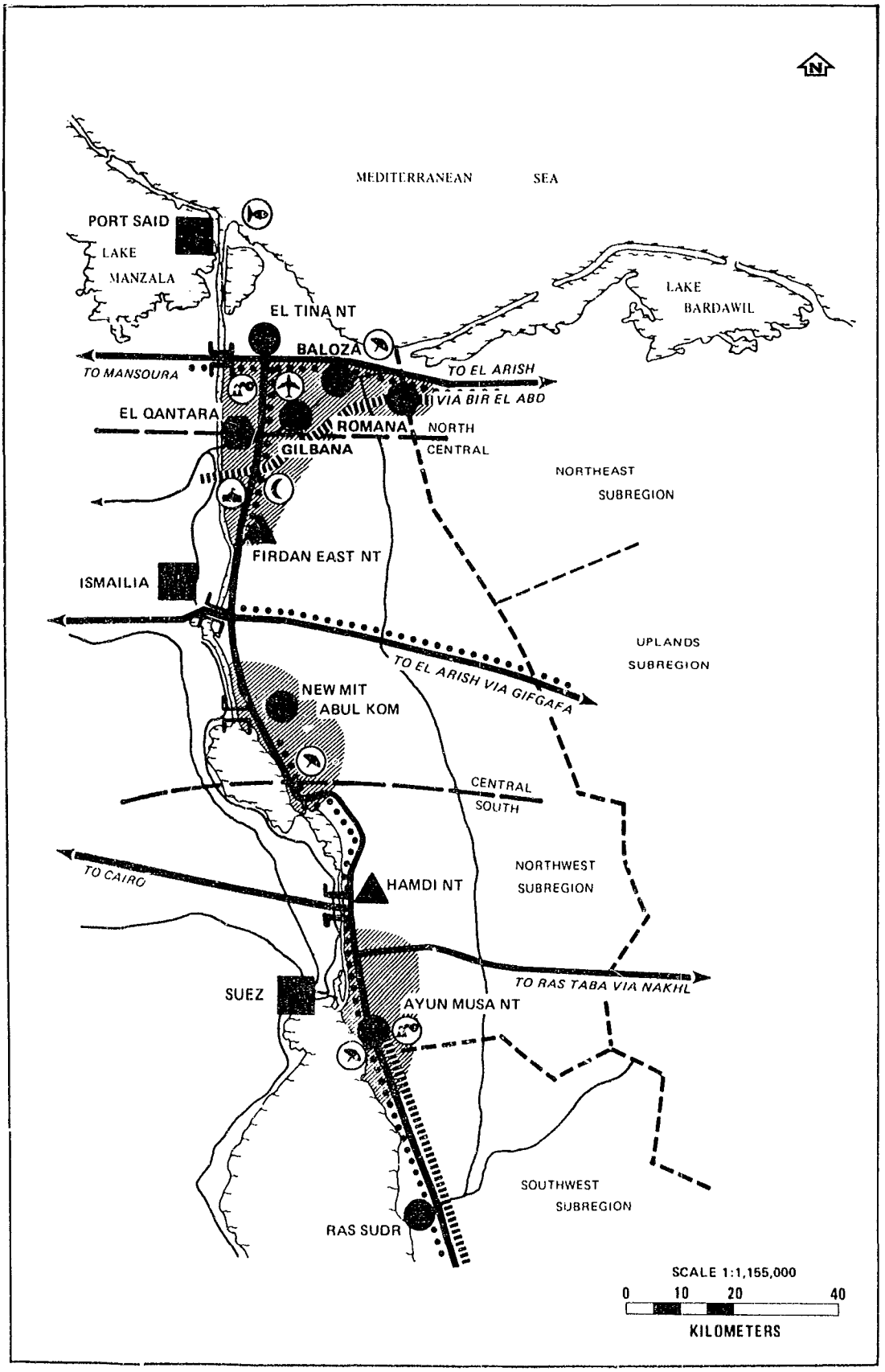
The Frontier Strategy, which views Sinai as the eastern frontier of the Nile Delta and the Suez Canal region, gives strong and early emphasis to this Subregion. The All Coasts Strategy also highlights Suez Canal regional spillover effects.

The Subregion's leading sector will be agriculture, supported by industrial and trading activities at Canal crossing points. The Subregion's agriculture will find ready markets in the rapidly growing Canal cities, as well as provide exports. The Subregion will also accommodate some of the Canal cities' spillover.

Detailed soils surveys must be completed for much of the area proposed for reclamation, which have already been targeted for large projects by the Ministries of Land Reclamation and Irrigation. Ten to fifteen thousand feddans are already being reclaimed in the area of New Mit Abul Kom. There will be industrial activities at El Qantara and El Shatt, and tourist villages on the shores of the lakes and on the Gulf of Suez.

The El Tina land reclamation area in the Northern Zone will have strong linkages with Port Said and northern Delta towns.

The REGWA reconnaissance surveyed about 94,000 feddans in the El Tina Plain and recommended detailed surveys for part of that area. The Recommended Strategy includes, as a first priority, at least 20,000 feddans for initial reclamation, starting as soon as the El Salaam Canal can be brought across the Suez Canal. The first polder will probably be constructed to the south of where a new road will cross the plain along a dike. Agriculture in this only slightly undulating area will benefit from Egypt's experience with similar soils elsewhere. Baloza, at the Southeastern end of the plain and at the junction of the Northern coastal highway and the new El Tina road, will grow into a substantial service center with some processing and packaging activities. This is also a good area for aquaculture, particularly around



For legend to map, see Figure 5.13, Pages 5-37.

FIGURE 5.2

RECOMMENDED STRATEGY:
NORTHWEST SUBREGION
SPATIAL HIERARCHY AND LINKAGES

Dames & Moore

the edge of Lake Malaha and on the clayey El Tina soil in association with agriculture there (agricultural waste can provide nutritional inputs to ponds). Lake Malaha as well as Pelusium will be the sites of tourist activities.

The Central Zone is part of the Ismailia Governorate. El Qantara will serve as a growth center for both Northern and Central Zones. It will be reconstructed and expand into one of Sinai's larger towns (as it has been in the past), partly on the basis of an industrial zone containing food processing, clothing, durables and furniture manufacturing activities. It will also be a center for the production of concrete products and other building materials, including wood sash and door pieces and metal doors and fittings. The reconstruction of Qantara will begin during the first phase--the current plan has allocated to the SDA LE 1 million each for housing and water supply. However most of El Qantara's growth will take place during the second phase, when the Port Said airport will be relocated to El Tina.

After 2000 Ismailia is proposed to be extended eastwards across the Canal and will become the dominant urban center. The site will need to be set aside during the 1988/1992 plan period.

A new market center, Firdan, will be established to the south of El Qantara to serve the reclamation areas. Part of the irrigated agriculture in the area will be very intensive, mainly around El Qantara, Baloza and Firdan-east.

The Central Zone also includes the reclamation area around New Mit Abu Kom which is already becoming a service center for the zone. The relatively high density of settlement in this zone will encourage a high proportion of intensive market garden agriculture. Since part of the East Bitter Lakes area is already under cultivation, it will be able to develop rapidly even during the first phase.

A large domestic tourist area is proposed on the eastern shore of the Bitter Lakes (Volume IV, Chapter 4). Within two hours of Cairo and half an hour of Ismailia a settlement of villas and flats, focused on a marina and beach, will house many thousands of Nilotic Egyptians for six months of the year and tens of thousands of "visitor weekends".

The Southern Zone includes land reclamation and rapidly growing settlements at Ayun Musa and the Hamdi Tunnel. All strategies proposed similar amounts of land reclamation, 5,000 to 6,000 feddans, which will take place in the second phase, 1988-1992, following the southern extension of the canal leading from the Deversoir syphons. Hamdi New Town will be a third phase project when the nearby reclamation is nearing completion. However, more modest settlement activities will develop at the eastern end of the tunnel almost immediately. The Frontier Strategy proposed that Hamdi New Town be a free zone, processing agricultural products from nearby reclamation areas, and serve as a center for the development of north-western Sinai. It will be important to reserve land immediately for the new town, preferably land of limited agricultural potential.

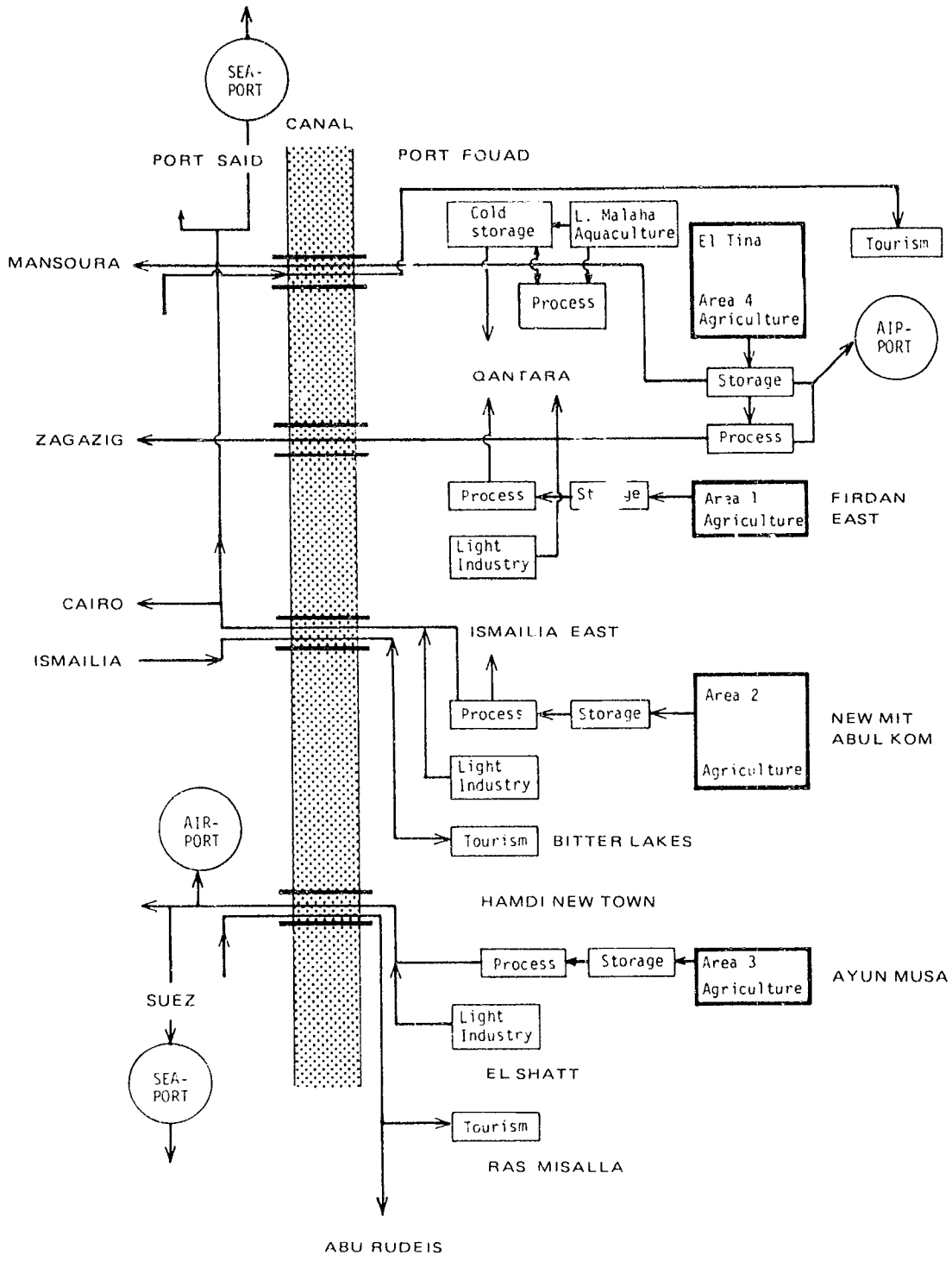


FIGURE 5.3

NW SUBREGION – SCHEMATIC REPRESENTATION OF MAJOR CROSS CANAL LINKAGES AMONG ECONOMIC ACTIVITIES