

**WORKING PAPER NO. 16**

**RECOMMENDED PHYSICAL PLANNING  
STANDARDS FOR DEVELOPMENT OF  
MAJOR SINAI SETTLEMENTS**

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**RECOMMENDED PHYSICAL PLANNING STANDARDS FOR  
DEVELOPMENT OF MAJOR SINAI SETTLEMENTS**

SEPTEMBER 1981

SINAI DEVELOPMENT STUDY - PHASE I

PERFORMED FOR THE ADVISORY COMMITTEE FOR RECONSTRUCTION  
OF THE MINISTRY OF DEVELOPMENT

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# CONTENTS

<b>LIST OF FIGURES AND TABLES</b> . . . . .	i
<b>EXECUTIVE SUMMARY</b> . . . . .	vi
<b>1.0 INTRODUCTION: THE ROLE OF PHYSICAL PLANNING STANDARDS IN DEVELOPMENT PLANNING</b> . . . . .	1-1
<b>2.0 HOUSING STANDARDS</b> . . . . .	2-1
2.1 EXISTING CONDITIONS IN SINAI . . . . .	2-1
2.2 AFFORDABILITY OF SHELTER . . . . .	2-1
2.3 LAND COSTS . . . . .	2-7
2.4 MINIMUM LOT SIZES FOR RESIDENTIAL DEVELOPMENT . . . . .	2-9
2.4.1 The Rural and Small Settlement. . . . .	2-9
2.4.2 The Urban Settlement . . . . .	2-10
2.4.2.1 Sites and Services Programs . . . . .	2-10
2.4.2.2 Urban Home Upgrading Activities . . . . .	2-11
2.4.2.3 Standards for Core Unit Development . . . . .	2-14
2.4.2.4 Prebuilt, Moderately Priced Apartment Structures for Low- and Middle-Income Groups . . . . .	2-14
2.4.2.5 Housing for the Highly Paid Professional . . . . .	2-19
2.5 GENERAL COST CALCULATIONS FOR STRATEGY PLANNING . . . . .	2-19
<b>3.0 INFRASTRUCTURE STANDARDS.</b> . . . . .	3-1
3.1 WATER SUPPLY . . . . .	3-1
3.1.1 Existing Conditions . . . . .	3-1
3.1.2 Criteria . . . . .	3-3
3.1.3 Standards . . . . .	3-3
3.1.4 Costs . . . . .	3-4
3.2 WASTEWATER . . . . .	3-4
3.2.1 Existing Conditions . . . . .	3-4
3.2.2 Criteria . . . . .	3-6
3.2.3 Standards . . . . .	3-6
3.2.4 Costs . . . . .	3-8

## CONTENTS (cont'd)

<b>3.3</b>	<b>SOLID WASTE</b> . . . . .	<b>3-8</b>
<b>3.3.1</b>	Existing Conditions . . . . .	<b>3-8</b>
<b>3.3.2</b>	Criteria . . . . .	<b>3-9</b>
<b>3.3.3</b>	Standards . . . . .	<b>3-9</b>
<b>3.3.4</b>	Costs . . . . .	<b>3-10</b>
<b>3.4</b>	<b>COMMUNITY ROADS AND STREETS</b> . . . . .	<b>3-10</b>
<b>3.4.1</b>	Existing Conditions . . . . .	<b>3-10</b>
<b>3.4.2</b>	Criteria . . . . .	<b>3-10</b>
<b>3.4.3</b>	Standards . . . . .	<b>3-11</b>
<b>3.4.4</b>	Costs . . . . .	<b>3-12</b>
<b>3.5</b>	<b>ELECTRICAL POWER GENERATION AND OTHER ENERGY FUELS.</b> . . . . .	<b>3-12</b>
<b>3.5.1</b>	Existing Conditions . . . . .	<b>3-12</b>
<b>3.5.2</b>	Criteria . . . . .	<b>3-17</b>
<b>3.5.3</b>	Standards . . . . .	<b>3-17</b>
<b>3.5.4</b>	Costs . . . . .	<b>3-18</b>
<b>3.6</b>	<b>TELECOMMUNICATIONS</b> . . . . .	<b>3-18</b>
<b>3.6.1</b>	Existing Conditions . . . . .	<b>3-18</b>
<b>3.6.2</b>	Future Plans for Telephone Service . . . . .	<b>3-18</b>
<b>3.6.3</b>	Radio Broadcasting . . . . .	<b>3-22</b>
<b>3.6.4</b>	Television Service. . . . .	<b>3-22</b>
<b>4.0</b>	<b>SOCIAL SERVICES</b> . . . . .	<b>4-1</b>
<b>4.1</b>	<b>HEALTH CARE AND SERVICES</b> . . . . .	<b>4-1</b>
<b>4.1.1</b>	Existing Conditions . . . . .	<b>4-1</b>
<b>4.1.2</b>	Criteria . . . . .	<b>4-2</b>
<b>4.1.3</b>	Standards . . . . .	<b>4-5</b>
<b>4.1.4</b>	Costs . . . . .	<b>4-5</b>
<b>4.2</b>	<b>CULTURAL AND OTHER SOCIAL SERVICES.</b> . . . . .	<b>4-6</b>
<b>4.2.1</b>	Existing Conditions . . . . .	<b>4-6</b>
<b>4.2.2</b>	Criteria . . . . .	<b>4-6</b>
<b>4.2.3</b>	Standards . . . . .	<b>4-8</b>
<b>4.2.4</b>	Costs . . . . .	<b>4-9</b>

**CONTENTS (cont'd)**

<b>4.3</b>	<b>EDUCATION . . . . .</b>	<b>4-9</b>
<b>4.3.1</b>	<b>Existing Conditions . . . . .</b>	<b>4-9</b>
<b>4.3.2</b>	<b>Criteria . . . . .</b>	<b>4-13</b>
<b>4.3.3</b>	<b>Standards . . . . .</b>	<b>4-15</b>
<b>4.3.4</b>	<b>Costs . . . . .</b>	<b>4-16</b>
<b>APPENDIX A: REFERENCES AND LIST OF PERSONAL CONTACTS . .</b>		<b>A-1</b>
<b>APPENDIX B: INFRASTRUCTURE INVENTORY DATA FORM . . . . .</b>		<b>B-1</b>
<b>APPENDIX C: SUPPLEMENTAL INFORMATION: NEW SETTLEMENTS EAST OF GREAT BITTER LAKE . . . . .</b>		<b>C-1</b>

## FIGURES

<u>Number</u>		<u>Page</u>
ES-1	Key Sinai Settlements in Infrastructure Survey . . . . .	vii

## TABLES

ES-1	Summary of Recommended Sinai Infrastructure Planning Standards . . . . .	viii
2-1	Types of Settlements, Family Situations, and Housing Actions to be Considered in Determining Housing Standards. . . . .	2-2
2-2	Housing Data for Selected Sinai Communities (1981) . . . . .	2-4
2-3	Percentages of Public and Private Use in Some Typical Sites and Services Layouts . . . . .	2-11
2-4	Area Coverage Norms for Land Development in Urban Housing Districts . . . . .	2-12
2-5	Cost Estimates for Selected Housing Proposals for Low-Income Families in Egypt . . . . .	2-15
2-6	Representative New Residential Housing Construction in Sinai (1981) . . . . .	2-18
3-1	Community Water Supply in Sinai (1981) . . . . .	3-2
3-2	Existing and Proposed Wastewater Treatment Systems . . . . .	3-7
3-3	Space Allocation for Circulation: Roads and Walkways. . . . .	3-11
3-4	Electrical Power Generation in Sinai (1981). . . . .	3-13
3-5a	Sources of Petroleum Fuels in Sinai (1981) . . . . .	3-15
3-5b	Estimated Consumption Rates for Petroleum Fuels in Sinai (1981) . . . . .	3-16
3-6	Existing Telecommunications in Sinai (1981) . . . . .	3-19
3-7	Proposed Telephone Exchange Services in Sinai . . . . .	3-20

## TABLES (cont'd)

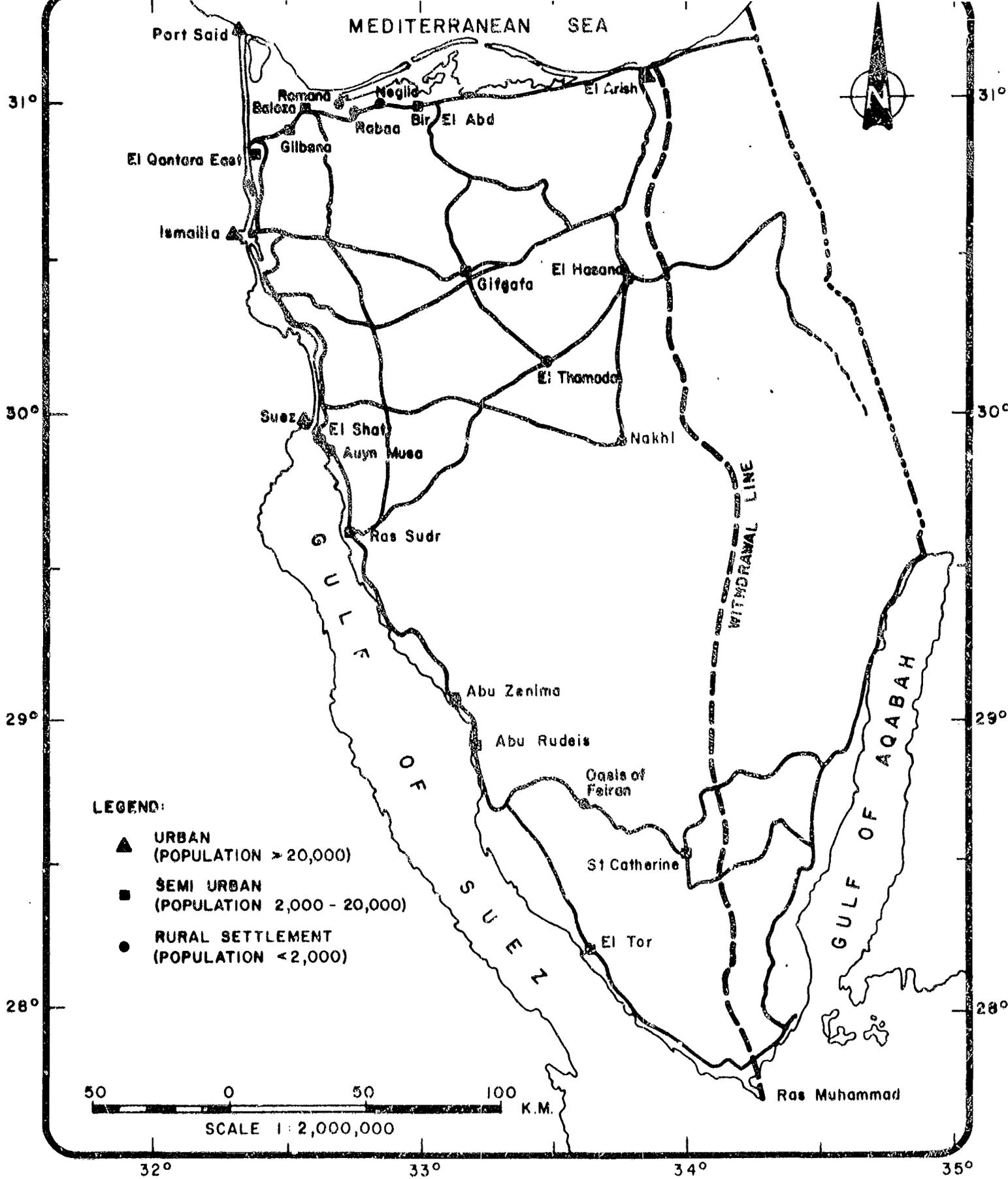
<u>Number</u>		<u>Page</u>
4-1	Medical Facilities in Sinai (1981) . . . . .	4-3
4-2	Number of Medical Personnel in Sinai (1981) . . . . .	4-4
4-3	Religious Buildings and Public Meeting Places in Sinai (1981) . . . . .	4-7
4-4	Educational Data for Sinai Public Schools (1981). . . . .	4-10
4-5	Summary of Public School Data for Sinai (1981) . . . . .	4-14
4-6	Higher Educational Facilities in El Arish and El Qantara East. . . . .	4-14
4-7	Land Allocation for Educational Facilities in Selected Communities . . . . .	4-15
C-1	Infrastructure Cost Data, East Suez Canal Project. . . . .	C-5

## EXECUTIVE SUMMARY

This working paper was prepared to assist economists and planners in estimating infrastructure requirements and costs in Sinai. Specific infrastructure standards are identified for various action projects. The standards were derived from a field survey conducted in May and June 1981, a comprehensive literature search, and analysis of existing infrastructure standards now employed throughout Egypt.

The settlements inventoried during the field survey are shown in Figure ES-1. Additionally, numerous local officials were interviewed throughout Sinai. Consultations were held with governmental officials in the Ministry of Development, the General Organization for Physical Planning, the Sinai Development Authority, and other agencies involved in establishing planning standards.

A summary of selected infrastructure standards for Sinai development programs is given in Table ES-1.



Sinai Development Study Phase I  
Ministry of Development

Dames & Moore  
V.P.

**KEY SINAI SETTLEMENTS  
IN INFRASTRUCTURE SURVEY**

FIGURE ES-1

TABLE ES-1

Summary of Recommended Sinai Infrastructure Planning Standards

<u>Functional Area and Standard or Measure</u>	<u>Estimated Cost</u>
<u>HOUSING</u>	
<u>Urban and Semiurban:</u>	<u>Per Dwelling Unit (exclusive of land):</u>
70-80% of residential zones	Professional, LE 8,000-12,000
30-40 residential lots per feddan	Low income, LE 2,000
240 persons per feddan	
<u>Rural:</u>	
Varies greatly; approximately one residential unit per 5 feddans	
<u>WATER</u>	
<u>Urban and Semiurban (house connection):</u>	<u>Annual:</u>
100-120 liters/capita/day	LE 10/capita
<u>Rural (public faucet):</u>	
30-40 liters/capita/day	LE 5/capita
<u>WASTEWATER</u>	
<u>Urban:</u>	
Sewer and wastewater treatment plant	LE 20/capita
<u>Semiurban and Rural:</u>	
Septic tank	LE 10/capita

TABLE ES-1 (cont'd)

<u>Functional Area and Standard or Measure</u>	<u>Estimated Cost</u>
<u>SOLID WASTE</u>	
One landfill per 25,000 population	
<u>Urban:</u>	
2 kg/capita/day	LE 4/capita
<u>Semiurban and Rural:</u>	
1 kg/capita/day	LE 2/capita
<u>ROADS AND WALKWAYS</u>	
15-17% of total community area	LE 100/capita
<u>ELECTRICAL POWER</u>	
<u>Residential Requirement:</u>	
<u>Urban:</u>	
400 kWh/capita/yr	LE 10/capita
<u>Semiurban and Rural:</u>	
300 kWh/capita/yr	
<u>Industrial, Trade, Services, and Institutional Requirement:</u>	
50% of the above	
Street lamps spaced at 35-meter intervals	
<u>TELECOMMUNICATIONS</u>	
No specific standards other than reasonably good radio and television reception and reliable telephone service	

TABLE ES-1 (cont'd)

<u>Functional Area and Standard or Measure</u>	<u>Estimated Cost</u>
<u>HEALTH CARE</u>	
<u>Facilities:</u>	
One hospital or polyclinic per 10,000-30,000 population	LE 250/capita
One health care center per 3,000-5,000 population	LE 10/capita
One pharmacy per 5,000 population	
<u>Personnel:</u>	
One physician/surgeon per 1,500 population	
One dentist per 2,000 population	
One registered nurse per 80 population	
One midwife per 35 population	
<u>CULTURAL AND RECREATIONAL</u>	
<u>Semiurban Settlements:</u>	
A small mosque	LE 110/m <sup>2</sup> (religious buildings)
A multipurpose social meeting/ recreational center	LE 70/m <sup>2</sup> (social buildings)
A few game fields and small parks	LE 250,000-500,000 (regional sports complex)

TABLE ES-1 (cont'd)

<u>Functional Area and Standard or Measure</u>	<u>Estimated Cost</u>
<u>For the Capitals of North and South Sinai:</u>	
Mosques for each planned neighborhood	
A regional cultural service center with cinema, library, artisan workshops, and meeting rooms	
A sports complex, including soccer fields, swimming pools, and ancillary athletic facilities	
<u>EDUCATION</u>	
<u>Student-Teacher Ratio (classroom size):</u>	
Primary-- 35:1	LE 24/capita
Preparatory-- 28:1	LE 24/capita
Secondary-- 24:1	LE 10/capita

# RECOMMENDED PHYSICAL PLANNING STANDARDS FOR DEVELOPMENT OF MAJOR SINAI SETTLEMENTS

## 1.0 INTRODUCTION: THE ROLE OF PHYSICAL PLANNING STANDARDS IN DEVELOPMENT PLANNING

This working paper is submitted in fulfillment of Subtask 8.6.1, Working Paper: Settlement Needs and Policies, of Task 8, Infrastructure and Land Use, of the Sinai Development Study, Phase I. The information presented herein will serve as major input to Tasks 11 and 12, Preliminary Development Strategy and Investment Study and Semi-Detailed Physical Plans, respectively. The purpose of Task 8 is to review the influences of infrastructure and land use patterns on development strategies and to assess short- and long-term infrastructure requirements and costs.

The scope of this paper covers housing, infrastructure, and social service requirements integral to the basic human needs of the inhabitants of Sinai. Specifically, the following elements of Task 8 are addressed--assembly of infrastructure data (Task 8.1), evaluation of energy requirements (Task 8.4), telecommunications (Task 8.5), settlement needs and policies (Task 8.6), assessment of the capacity of the infrastructure to support sector projects (Task 8.7), and impact and cost of settlement incentives (Task 8.11).\* The task areas cited above and the remaining action tasks within Task 8 will be subject to comprehensive analysis in the draft final report for Phase I.

The task of developing and applying physical planning standards is a process of gradual approximation in which guidelines are initially set forth in line with anticipated development. With each iteration the standards become more specific. In the process, they do not necessarily become less flexible, but they become clearer as statements related to preliminary development strategies are matched with specific sets of actions. The standards are clarified even further as the actions are implemented, tested, and evaluated.

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\*Task 8.4 is the subject of a separate working paper, Energy Resources Assessment and Evaluation of Energy Requirements (Working Paper No. 15), but the subject is treated herein in terms of the existing and potential needs of 20 surveyed communities in Sinai. Tasks 8.7 and 8.11 will be subject to more thorough evaluation in later submittals.

Physical planning standards prepared for Sinai should not become rigid and restrictive. They should not cast settlements into rigid, homogenous molds unsuitable for the actual requirements of the settlers, but rather serve as guidelines for actions to encourage experimentation and diversity.

The objectives of this paper are threefold:

- To determine the best practices for townbuilding in underdeveloped regions, based on experience in other parts of Egypt and the developing world in general.
- To present a preliminary analysis of conditions in Sinai in terms of planning standards.
- To present these standards in sufficient detail to permit initial calculations of costs and benefits.

Social and cultural factors influence the acceptance and use of shelter arrangements and infrastructure services and facilities. For example, strict adherence to Moslem religious practices involves the use of water in excess of "normal" health and sanitation requirements. In the following recommendations, the study team has sought to be sensitive to Islamic building practices as well as to traditional Bedouin customs and mores. It must be remembered that the standards proposed are recommendations. Subsequent stages of the planning process will both sharpen and modify these preliminary standards.

The paper is divided into three parts:

- Section 2.0, Housing Standards
- Section 3.0, Infrastructure Standards
- Section 4.0, Social Services.

An infrastructure survey of selected Sinai communities was conducted in May and June 1981. Appendix B shows a copy of the survey instrument used to gather information for 13 settlements in north Sinai and seven in south Sinai. In the last 2 years, a major land reclamation project of 30,000 feddans has been initiated east of Great Bitter Lake. Although the new communities of Akkaria, New Mit Abul Kum, and Youth Farm were not covered in the infrastructure survey, a 5-year budget plan for this east Suez Canal area is shown in Appendix C.

## 2.0 HOUSING STANDARDS

### 2.1 EXISTING CONDITIONS IN SINAI

At this point of preliminary development planning, it is possible to describe the types of settlement situations likely to be encountered under different development strategies, the types of family situations likely to require special attention, and the types of performance standards for homebuilding which are likely to be required as the first actions of townbuilding are initiated.

Table 2-1 presents some of the combinations of housing situations which might be encountered in Sinai. Table 2-2 summarizes housing data collected during the infrastructure survey in May-June 1981.

For the majority of housing actions--most notably procedural norms related to mortgage arrangements, building permits, etc.--it is too early in the planning process to try and establish standards of performance, but such action will become necessary. Meeting the housing requirements of individual families will be critical to the rapid and sustained development of key settlements. The simplification of building procedures and requirements and the provision of a few basic aids will facilitate the process of townbuilding and should reduce bureaucratic bottlenecks.

### 2.2 AFFORDABILITY OF SHELTER

A survey of 1,620 families located in the territory liberated after the second disengagement agreement (November 16, 1975)--conducted by the Ministry of Social Affairs in December 1976--reported the following information on annual family income:

- 34.6 percent, less than LE 200
- 21.3 percent, LE 200-300
- 30.1 percent, LE 300-500
- 12 percent, LE 500-1,000
- 2 percent, LE 1,000 and over.

These are, of course, extremely low income figures. Eighty-six percent of the families reported annual incomes of less than LE 500. The situation of families relocated to the Nile Delta and Nile Valley was reported by the Ministry of Social

TABLE 2-1

Types of Settlements, Family Situations, and  
Housing Actions to be Considered in  
Determining Housing Standards

<u>Types of Settlements</u>	<u>Example</u>
Existing urbanized settlement	El Arish
Existing semiurbanized settlement	Bir El Abd and El Tor
New small, rural settlement or resettlement	New Mit Abul Kum
Existing small Bedouin settlement	Nakhl
 <u>Types of Family Situations</u>	
Low-income newcomers	Those who arrive through own initiative or resettlement
Low-income consolidators	Those who are currently improving improvised structures
Low-income families in stagnating situation	Those who currently live in clusters of unimproved shacks or deterior- ating permanent structures
Middle-income newcomers	Technical people, including public employees, needed to staff new new activities
Upper-income newcomers	Professional people, including high-level entrepreneurs, needed to participate in new activities
 <u>Probable Types of Housing Actions to Require Performance Standards and Procedural Norms</u>	
Provision of surveyed housing sites (on presently unoccupied and unimproved land)	
Securing of tenure on present site of family dwelling	
Provision of minimum standard, life-support services	Water, sewage, energy, access
Provision of both sites and services (with or without core units)	

TABLE 2-1 (cont'd)

**Probable Types of Housing Actions  
to Require Performance Standards  
and Procedural Norms**

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**Provision of low-cost building  
materials**

**Provision of low-interest, flexible-  
payment, home improvement loans**

**Provision of low-interest, flexible-  
payment mortgages**

**Tax writedowns for new private con-  
struction and home improvement  
activities**

**Simplification of building permit  
procedures**

**Simplification of land subdivision  
procedures**

**Application of minimum housing  
standards for conservation or  
rehabilitation of current housing**

**Application of land use regulations**

**Control/decontrol of rental housing**

**Construction of low-income, prebuilt  
rental housing**

**Construction of middle-income, pre-  
built rental or sales housing**

TABLE 2-2

## Housing Data for Selected Sinai Communities (1981)

<u>Community</u>	<u>No. of Dwellings</u>	<u>No. of Dwellings With One Family</u>	<u>No. and Type of Multiple Dwelling<sup>a</sup></u>	
			<u>Apartment</u>	<u>Guesthouses<sup>b</sup></u>
El Arish	10,280	7,700	2,580	14
Bir El Abd	400	150	250	3
Neglia	250	90	110	6
Rabaa	330	150	180	4
Romana	622	622	(d)	12
Baloza	281	281	(d)	18
Gilbana	250	250	(d)	(d)
El Qantara East	316	220	96	3
Gifgafa	600	350	250	2
El Hasana	400 <sup>c</sup>	200	(d)	10
Bir El Thamada	200	180	20	(d)
Nakhl	1,050	(d)	16	16
El Shatt	30	30	(d)	8 <sup>f</sup>
SUBTOTAL				
(North Sinai)	<u>15,009</u>	<u>10,223</u>	<u>3,502</u>	<u>96</u>
Ayun Musa	47	47	(d)	3
Ras Sudr	1,116	1,116	(d)	17
Abu Zenima	100	95	5	(d)
Abu Rudeis	600	600	(d)	(g)
Wadi Feiran	887	887	(d)	6
St. Catherine	600	600	(d)	20
El Tor	440	440	12 <sup>e</sup>	14
SUBTOTAL				
(South Sinai)	<u>3,790</u>	<u>3,785</u>	<u>17</u>	<u>60</u>
TOTAL	<u>18,799</u>	<u>14,008</u>	<u>3,519</u>	<u>156</u>

TABLE 2-2 (cont'd)

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- <sup>a</sup> El Arish, Bir El Abd, NakhI, and Ras Sudr also have worker dormitories; Bir El Abd and Ras Sudr have 10 each, and El Arish and NakhI have one each. Abu Rudeis has several Government office buildings.
- <sup>b</sup> Guesthouses are generally used by Government officials.
- <sup>c</sup> 200 dwelling units in use and 200 under construction.
- <sup>d</sup> None reported.
- <sup>e</sup> Also used as guesthouses.
- <sup>f</sup> Temporary wood construction for school, health, and social units.
- <sup>g</sup> Several guesthouses belong to an oil company.

Affairs to be even more unfortunate.\* Over 96 percent of these families had annual incomes of less than LE 500, as shown below:

- 67.8 percent, less than LE 200
- 16.9 percent, LE 200-300
- 11.7 percent, LE 300-500
- 3.1 percent, LE 500-1,000
- 0.5 percent, LE 1,000 and over.

Many low-income families with relatively little urban experience are likely to be attracted by major townbuilding activities in Sinai. Interestingly, it has been reported that in the El Hekr housing upgrading program in Ismailia, on the western bank of the Nile, an indeterminate but significant number of the newly arrived, low-income applicants for housing have a small amount of capital acquired in the form of a self-built residence in their previous location. Although this situation is not captured in normal surveys of income, it represents an important resource for making initial payments for housing in a new location. Many families who return or migrate to Sinai should be in a comparable position.

Assuming that families in the very low-income categories can devote approximately 15 percent of their income to housing--and even that probably on an irregular basis--only the minimum type of shelter arrangements can reasonably be expected to be made available if such provision is to be made for an appreciable number of families. Actually, minimal assistance could in the long run work to the advantage of these families, since it would force plans to be made for them which place the least incumbrance on overall development efforts and maximum responsibility on the families themselves. The simple provision of land, securance of tenure, and provision of basic building materials typify the only kinds of arrangements that can possibly be expected for those of very low-income who are attracted by accelerated development efforts.

There is considerable subjective evidence that much of the increasingly active trade taking place in the northern corridor settlements of El Ar sh, Bir El Abd, Negila, Rabaa, and Qatia involves contraband. To the extent that this is true,

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\*December 1976 to March 1977 survey of 14,098 families relocated to the Nile Delta and Nile Valley, Ministry of Social Affairs.

it would surely distort family income data. However, until an effort is made to determine even in general terms the nature and extent of such illegal traffic, it is difficult to predict the economic impact on the population and, most particularly, on those of low income.

Numerous professionals will be attracted to Sinai under an accelerated development program. Agronomists, water resource experts, ecologists, teachers, extension agents, public administrators, entrepreneurs, and other technicians will be required to participate in a broad, integrated development effort. Individuals in this income class will probably be most representative of the new urban residents.

In certain key settlements--especially those that serve as regional centers--a significant proportion of the new settlers required to support development activity will fall within the LE 500 to 1,000 annual salary range. This salary level would include the majority of professional Government employees. If it is found that special economic inducements are required to attract people to Sinai, the salary range could increase markedly. The requirements for some categories of technical and professional employees can be projected relatively early in the planning process, and such estimates will be provided in the draft preliminary development strategy (Task 11).

Currently, the Government is developing housing areas in El Arish, Bir El Abd, and El Tor for an expected influx of professional personnel--primarily Government employees. Although actual costs have not been determined, the typical multifamily dwelling units now under construction (e.g., two-bedroom, bath, kitchen, combined living-dining room) should fall within the LE 8,000 to 12,000 range. The sale or rental price has not yet been determined, in large part because it is not clear which income groups will be accommodated. In any case, it is likely that a Government subsidy will be required to adjust for the imbalance between construction costs and annual income.

### 2.3 LAND COSTS

Under prevailing conditions in Sinai, it is easy to assume a relaxed attitude toward land costs. Indeed, under any strategy of accelerated development, small rural settlements to be promoted as part of land reclamation activities will probably not face land speculation problems for some time. However, this will not be the case in those key settlements where special efforts are made to concentrate development efforts and to lay the foundation for efficient urban forms. Unless

early action is taken to assemble land or in some other manner to control land speculation in these settlements, it will be extremely difficult to control development, or to provide inexpensive land for low-income newcomers or moderate-priced housing for those of somewhat higher incomes.

Currently, the Government intends to sell land in El Arish for cooperative apartment developments at a rate of 360 piasters per square meter (personal communication, M. El Hafez Kuraim, July 20, 1981). This is really to attribute zero cost to land, ostensibly because it is currently in the hands of the Government. While the financial cost of developing on public land is virtually zero, the economic cost is considerable and will, of course, increase as development proceeds.

The problem of land speculation is compounded by the special nature of the development effort in Sinai. Successful development requires a tremendous amount of publicity, promotion of a strong pioneer spirit, and vigorous promotion of specific development plans for key settlements. Unfortunately, such promotional activity, while necessary to accelerated development, seriously hampers efforts to effectively support housing and its attendant services and facilities, and resulting speculation tends to distort the land market.

Because Egypt offers relatively few outlets for investment opportunities (consider, for example, the absence of a stock market), the most common form of speculative investment is land. Given the general high visibility of Sinai on the national and international scene and the many people who consider it their homeland, land prices can be expected to increase considerably, especially in the vicinity of major settlements. Such speculation will work against the overall objectives of controlled development. Much of the speculation will not be for promotional purposes--in which one land use competes against another--but for holding the land in expectation of substantial future gain as Government programs (especially housing) are enacted.

The Government planners for several of the new housing developments under construction in El Arish and El Tor have avoided the immediate problem of land cost by placing the new subdivisions a substantial distance from the already built-up areas. The negative side effects of such actions, however, are to increase the cost of utility extensions, increase the cost of transportation, and ultimately segregate social classes within the settlements.

The problem of increasing land costs must be resolved. Once key settlements are identified and realistic ranges are projected for their population, a special study should be commissioned to analyze the land situation and make recommendations to deal with unwanted speculation.

## 2.4 MINIMUM LOT SIZES FOR RESIDENTIAL DEVELOPMENT

At this point of preliminary planning, the determination of appropriate lot sizes in key settlements is aimed at providing targets for the first sketch layouts and estimating the implications of desirable models on development programs. As emphasized in Section 1.0, it is extremely important to view physical planning standards for Sinai development as relative and flexible.

### 2.4.1 The Rural and Small Settlement

Egypt has had extensive experience in the planning and execution of rural resettlement programs. The problem of land use in rural settlements is largely a cultural one in which residential lot sizes, physical arrangements, and tenancy patterns are designed to reflect both a rural-based economy where agricultural activities--for example, the keeping of animals--occur in or in close proximity to the family residences, and a land tenure system compatible with Bedouin social customs.

Lot size and layout will vary from settlement to settlement within Sinai. Such divergency is necessary since the standard to be employed in any given rural or semirural context must ensure family holdings of sufficient size to provide settlers with an income at least comparable to that which was earned previously from both agricultural and nonagricultural activities.

Comparably, the construction of individual dwellings should focus on having each family adapt their quarters to accommodate personal requirements (e.g., polygamous relationships where as many as four wives with various sets of children might be involved). Encouragement of individual initiative in the homebuilding process should also assist in preserving and promoting Bedouin tradition and local color. Unfortunately, poverty and the unavailability of appropriate building materials at affordable prices have produced a situation where, currently, the standard Bedouin dwelling of the desert is a miserable-looking, ramshackle hut slapped together with whatever pieces of metal, cloth, wood, or palm leaf can be found. Any future rural development programs must provide appropriate building materials at reasonable prices.

The housing policy for rural settlements to be constructed under a development strategy should emphasize the core housing unit concept discussed in Section 2.4.2.3. This would provide an important initial boost for the settlers and offer them ample opportunity to adapt housing to their particular needs.

## 2.4.2 The Urban Settlement

The determination of appropriate residential lot sizes for settlements at an urban scale can be more precise than for rural areas. However, flexibility is still required in the application of standards.

2.4.2.1 Sites and Services Programs. Sites and services programs are inexpensive approaches to the provision of housing for low-income families. Subdivided plots are provided with basic facilities of a minimum standard and sold to individuals under long-term installment schemes. Lot owners, with or without other special aids from the Government, arrange for the construction of their own homes.

In the calculation of lot sizes appropriate to sites and services development, experience with the informal sector programs in Ismailia have demonstrated that individual lots less than 108 square meters in size inhibit the normal, dynamic building process employed by urban settlers and preclude the subsequent construction of an additional room for rent or for accommodating an extended family or guests (Sudra, 1980). There is always external pressure to reduce the size of urban residential lots for low-income families to hold down costs and to achieve higher densities. While this may initially be accomplished, analysis of the normal homebuilding process in Egypt, as revealed in projects such as those in Ismailia, demonstrates that through vertical expansion and multi-family occupancy, plots of a more customary size achieve the same and even higher densities (Sudra, 1980). While the levels of physical infrastructure and social services can be increased over time, the individual lot size is fixed.

In any specific site to be developed, it is important that a variety of plot sizes be available. In general, net residential densities that fluctuate within a range of 70 to 100 lots per hectare (approximately 30 to 40 per feddan) will be acceptable.

Table 2-3 lists data for sites and services projects in several developing countries.

TAELE 2-3

Percentages of Public and Private Use in Some  
Typical Sites and Services Layouts

<u>Project Location</u>	<u>Lot Size (m<sup>2</sup>)</u>	<u>Net Density (lots/ha)</u>	<u>Percentages of Land Use</u>		
			<u>Lots</u>	<u>Social Facilities</u>	<u>Roads and Footpaths</u>
Nicaragua	110	50	55	25	20
Senegal	150	44	61	15	24
Indonesia	64 <sup>a</sup>	95	61	21	18
Jamaica	77 <sup>a</sup>	77	60	20	20
Botswana	330	20	66	14	20
Zambia	210	21	50	15	35
Tanzania	130 <sup>a</sup>	38	50	34	16
Kenya	150 <sup>a</sup>	40	60	20	20
Korea	105 <sup>a</sup>	72	76	5	19
Philippines	68 <sup>a</sup>	100	68	17	15
Curacao	320	18	59	25	16
AVERAGE	156	52	60	19	20

<sup>a</sup> Average lot size.

SOURCES: International Bank for Reconstruction and Development; Turner, 1980.

It should be noted from Table 2-3 that lot sizes offered often provide a range of options that fluctuate around a certain net residential density and that place residential land in a generally set relationship to other land uses.

The General Organization for Physical Planning of the Ministry of Development uses the standards given in Table 2-4 for the design of new communities in the interior of Egypt. Although space requirements for nonresidential land uses are treated later, Tables 2-3 and 2-4 suggest the approximate proportion of land to be devoted to residential uses in a townbuilding process that envisages moderate overall densities.

2.4.2.2 Urban Home Upgrading Activities. In areas where it is intended to upgrade existing housing, it is important to be flexible about desirable lot sizes. Ideally,

TABLE 2-4

Area Coverage Norms for Land Development in  
Urban Housing Districts<sup>a</sup>

<u>Typical Land Uses and No. of Elements or Other Standard Recommended</u>	<u>No. of Feddans<sup>b</sup> Recommended per Element</u>	<u>Total Land Surface Consumed (feddans) and Percentage of Surface</u>
Secondary school--1	5	5
Preparatory school--2	3	6
Primary school--7	1.5	10.5
SUBTOTAL (education)		<u>21.5</u> (7.7%)
Open space--0.75 feddans/person	21	21 (7.5%)
Central services (water, solid wastes, sports club, etc.)--0.70 feddans/person	20	20 (7.1%)
Commercial centers, neighbor- hood facilities--1/200 persons	0.5	3.5 (1.2%)
SUBTOTAL		<u>44.5</u> (15.8%)
Hospital (300 bed)--0.5 (1 for each 2 housing zones)	1.5 (3 feddans/ hospital)	1.5
Polyclinic--1	0.5	0.5
Childcare center--1	0.5	0.5
SUBTOTAL (health)		<u>2.5</u> (0.9%)
Mosques--1	1	1 (0.4%)
Churches--0.5		
Communications--telephone office; 1 telex/10,000 persons; 1 post office/5,000 persons		1 (0.4%)
Roads--33% of gross land surface		92.5 (33.0%)
SUBTOTAL		<u>94.5</u> (33.8%)
TOTAL (all services)		<u>163</u> (58.2%)

TABLE 2-4 (cont'd)

<u>Typical Land Uses and No. of Elements or Other Standard Recommended</u>	<u>No. of Feddans<sup>b</sup> Recommended per Element</u>	<u>Total Land Surface Consumed (feddans) and Percentage of Surface</u>
Housing		117 <sup>c</sup> (41.8%)
TOTAL (services and housing)		<u>280<sup>c</sup></u> ( <u>100.0%</u> )

<sup>a</sup> A housing district is a predominantly residential area, or nonindustrial town, with an average of 28,000 inhabitants.

<sup>b</sup> One feddan equals 1.03 acres; 1 hectare equals 2.4 feddans or 2.47 acres.

<sup>c</sup> Gross residential density is calculated on the basis of 100 persons per feddan, while net residential density is calculated on the basis of 28,000 persons (approximately 5,600 families) per 117 feddans. This is equivalent to about 114 families per hectare.

lots should be rectangular with the short side adjacent to the street, but too intensive an effort to square up lots will lead to excessive costs and family displacement. The Kampong home upgrading efforts in Indonesia, which represent one of the most successful urban improvement programs in the developing world, have proceeded with extreme caution. Few structures were displaced, and the affected community participated in any decision that would result in relocation of a family.

**2.4.2.3 Standards for Core Unit Development.** The core house concept is a variation of sites and services activities, in which usually one room, a kitchen, and a bathroom are provided in a small central structure on the residential lot, and the lot owner then progressively expands the core into a complete house (three or four rooms) and later, perhaps, into a two- or three-storey building. Building activities proceed with or without technical assistance according to the needs and economic means of the owner. Core units vary slightly with lot size and location on the lot. For example, the core unit placed on the front lot line ensures a standard facade for the street and shortens pipe lengths to the street connections. When the core unit is placed toward the center of the lot, the owner has the choice of adding to the front or back.

There are a number of core unit projects underway in Egypt that reflect different perceptions of what families require based on prevalent building types within low-income areas. A dynamic building process in Sinai should result in buildings that cover virtually the entire plot and range from one to three storeys in height (i.e., a ground floor plus two other floors).

Salient features of core unit development, including cost estimates for different types of units, are presented in Table 2-5. Core unit development offers an important middle position between a bare lot and a finished structure, especially for new settlers from an urban environment. Since only the simplest building materials are required, core units are appropriate whenever it is anticipated that the residents will be interested in self-help activities. Provision of core units is obviously not required if the initial utility services are planned to be simply a pit latrine and a water spigot, and the persons occupying the lots are expected to either pitch a tent or occupy interim rental housing in the vicinity.

**2.4.2.4 Prebuilt, Moderately Priced Apartment Structures for Low- and Middle-Income Groups.** A common type of residential construction found in many urban

TABLE 2-5

Cost Estimates for Selected Housing Proposals  
for Low-Income Families in Egypt

	<u>Width and Length of Site (meters)</u>	<u>Width and Length of Dwelling (meters)</u>	<u>Area (m<sup>2</sup>)</u>	<u>Cost/m<sup>2</sup> (LE)</u>	<u>Total Cost of Core House (LE)<sup>a</sup></u>
Type D <sup>b</sup> No. 1	6.0 x 10.8	3.6 x 4.5	16.2	47.9	1,141
Type D <sup>b</sup> No. 3	7.5 x 12.8	5.1 x 6.0	23.4	38.3	2,070
Type D <sup>b</sup> No. 5	6.0 x 15.0	6.0 x 5.4	32.4	32.6	1,109
Type C <sup>b</sup>	7.5 x 15.0	4.2 x 6.9	29.0	61.1	1,907
Type A	Variable 15.0 x 23.0	Variable 6.0 x 7.5	(c)	12.0 <sup>d</sup>	(e)

<sup>a</sup>Cost estimate does not include the cost of land or administrative expenses. The size of the core unit varies with the dimension of the lot.

<sup>b</sup>Location of core unit: centrally for No. 1 and 3, Type D; on the facade for No. 5, Type D; internally at the end of the site for Type C.

<sup>c</sup>Area, Type A dwelling: minimum = 45 square meters, average = 72 square meters, maximum = 117 square meters.

<sup>d</sup>Cost/m<sup>2</sup> includes the cost of structure plus core service only.

<sup>e</sup>Total cost depends on area bought: minimum = LE 540, average = LE 702, maximum = LE 2,104.

SOURCE: Shafiz and Goethert, 1979 (Table 1).

areas of Egypt, including El Arish--the largest settlement in Sinai--is the imara (Sudra, 1980). An imara is a moderately priced apartment house with private utilities in every unit but with various physical forms. Often these structures have developed from modest single-family houses. Through a gradual process, early, simple forms of construction (often mud or sand/cement brick) are replaced with burnt brick and concrete, and the structure is expanded to include rooms and apartments for rental income. In addition, space is often made available on the ground floor for small stores, workshops, and cafes.

In the process of expansion and adaptation, the imara accommodates nearly every type of housing need. Inexpensive rental space is made available to low-income settlers and small shopkeepers, while additional income to the owner facilitates the process of transformation. When accompanied by a variety of plot sizes, a horizontal-vertical use permits continuation of the extended and aggregate style of life customarily found in the major urban centers of Egypt. The spontaneous, or normal, housing process as represented by the imara also tends to lead to automatic control of heat, dust, and sand; buildings are clustered in the classical Eastern manner so that they shade one another and both reduce and confine open space. With the many small shops intermingled with residences, public walking and leisure spaces also are sheltered from the impact of the sun and desert winds.

Observations of how incipient middle-class Egyptians house themselves when unrestricted by prebuilt public housing or detailed regulations have been developed into a set of suggested planning guidelines by a joint team of housing analysts from Cairo University and the Massachusetts Institute of Technology (MIT), (Goethert et al., 1979). The guidelines, outlined below, are appropriate for the design of housing developments in Sinai:

- Realistically and clearly define land uses, ownership, control, and responsibility for all land segments of a development. Minimize the land under the responsibility/control of the Government; maximize the land to be sold for lots.
- Coordinate land uses, circulation layouts, lot sizes, and infrastructure to allow/encourage mutual reinforcement of activities, and to ensure a better chance of "success" in anticipating future uses and determining required demands.

- Allow mixed residential, commercial, and artisan land uses in all lots. No commercial use other than informal markets should be planned in residential areas.
- Make a distinction between streets intended for circulation and for access to lots.
- Group lots around a jointly owned court. From the standpoint of physical, social, legal, financial, and administrative use, the "cluster" is the key to residential development.

Unfortunately, housing currently being constructed by the Government in El Arish, Bir El Abd, and El Tor corresponds more closely to the physical planning standards employed in the garden city developments of Great Britain and the United States during the 1940's and 1950's than to the building traditions of Egypt. The result is that the housing developments in these settlements, which are being constructed for both middle- and low-income families (e.g., the residential development for the fishermen of El Tor), consist principally of attached apartments set in rows of 8 to 10 units--each unit containing two bedrooms, a bath, a kitchen, a living-dining room, and sometimes a small balcony or patio. The blocks of apartments are placed in rows, with large unattended voids surrounding each block of units. Where apartment units of this type have been up for some time, the large unsealed areas are a constant source of dust and sand and a repository for miscellaneous junk. The situation is so bad in some apartment blocks in Ras Sudr that sand dunes and accumulated debris are piled more than halfway to the tops of the front doors of the apartments.

Set against the basic guidelines suggested by the joint research effort of Cairo University-MIT, the new housing developments described above have the following negative effects:

- Blurring the responsibility for land maintenance and maximizing the land under the responsibility/control of the Government.
- Establishing a rigid pattern of site development that will be difficult to modify in the event of changed economic or demographic conditions.
- Segregating and confining residential, commercial, and artisan uses.
- Emphasizing use of the automobile--with the design of all streets for general circulation.

- Spreading rather than clustering development and requiring a full network of infrastructure.

Site development and construction costs for prebuilt public housing seem to be roughly the same on both sides of the Suez Canal. Although transportation costs are greater in Sinai and key construction workers are paid more, the extensive use of locally produced concrete blocks in north Sinai and of locally cut stone in south Sinai serve to balance overall construction costs. Wood, cement, and piping are imported. However, because cost estimates are not secure and market conditions are also apt to vary, the Government has not yet decided on the amount of subsidy to be offered or the type of tenancy to be promoted in Sinai housing projects. Even with regard to the housing development under construction in El Tor for local fishermen, it is not certain at this time whether the residential units will ultimately be sold or rented.

Table 2-6 presents data for a representative sample of residential housing construction activity now underway in Bir El Abd, El Arish, and El Tor.

TABLE 2-6  
Representative New Residential Housing Construction  
in Sinai (1981)

<u>Location</u>	<u>No. of Dwelling Units</u>	<u>Type of Units</u>	<u>Average Unit Size (m<sup>2</sup>)</u>	<u>Average Unit Cost (LE)<sup>a</sup></u>	<u>Expected Monthly Rent (LE)</u>
Bir El Abd	500	Standard residential	144	7,700	10
El Arish	192	Professional residential	160	12,000	12
	465	Standard residential	144	10,000	Unknown
	200	Chalet type	Unknown	Unknown	Unknown
El Tor	480	Standard residential	130	8,000	12

<sup>a</sup>Exclusive of land.

SOURCE: Personal communications, A. El Gamany (Bir El Abd), M. El Hafez Kuraim (El Arish), A. Soliman Abu Zeid (El Tor).

For purposes of initial calculations, the figures in Table 2-6 can be considered to approximate the size and cost of any type of prebuilt housing provided for middle-income families in Sinai. However, with the application of physical planning standards that reflect Islamic rather than Western traditions, a more precise scale of development can be achieved which, ultimately, should be less costly. An important activity to introduce in the housing improvement schemes for key settlements is the modification of existing site plans to achieve a more amenable environment for the current residents and to increase the overall physical attractiveness of the area.

2.4.2.5 Housing for the Highly Paid Professional. Theoretically, satisfying the housing needs of upper-income families in Sinai should not present a problem; from a practical standpoint, however, there are many obstacles, such as the overall achievement of an attractive environment and the provision of an adequate array of social, educational, and cultural facilities. The Government has already demonstrated that it can efficiently build new, fully equipped housing in Sinai. If, in townbuilding programs, a sincere effort is made to incorporate the best of Egyptian traditions, the dwelling units should not be an impediment to the attraction of professional families.

## 2.5 GENERAL COST CALCULATIONS FOR STRATEGY PLANNING

To accommodate the technical and professional people expected to be attracted to key urban and semiurban settlements in Sinai, it would be prudent to expect that, at least until the year 2000, two-thirds of the housing for these families will have to be provided in the form of prebuilt structures erected by the Government. As summarized in Table 2-6, the average cost of a housing unit can be expected to be LE 9,500; however, the physical planning standards should be significantly different from those currently applied by the Government in its building programs in Sinai.

For the lower income families expected to be attracted to key settlements, 50 percent will probably be accommodated in sites and services projects--with about half of the plots equipped with core housing units. Individual costs for core housing units will probably average LE 1,400, as summarized in Table 2-5.

Massive intervention on the part of the Government in land assembly, site development, and housing construction will be necessary to cope with the influx of

settlers. In addition to the cost of land, discussed earlier, another potential problem will be the high cost of basic building materials.

In rural situations where, for example, new agricultural settlements are to be developed or existing small communities are to be expanded, it would be important to plan on about 90 percent of the new housing being in the form of core units (Section 2.4.2.3). When compared to the urban and semiurban situation, a major effort will have to be made to increase the availability of basic construction supplies if self-help activities are to be successful in rural settlements.

### 3.0 INFRASTRUCTURE STANDARDS

#### 3.1 WATER SUPPLY

##### 3.1.1 Existing Conditions

Sinai communities receive domestic water supplies from wells, tank trucks, and pipelines. According to our May-June 1981 infrastructure survey, much of the well water is brackish and unsuitable for human consumption. Many of the sweet (or fresh) water wells deliver groundwater via public faucet (standpipe). Until the El Qantara-Bir El Abd-El Arish pipeline is complete, most of the north Sinai communities must rely on tank trucks to deliver potable water.\* During this interim period, military vehicles provide water delivery service by filling barrels along the main roads.

As shown in Table 3-1, several Sinai communities receive domestic water from both wells and tank trucks. Water is piped from El Qantara West to El Qantara East, from El Arish to Gifgafa, and from Suez to El Shatt. In addition to well water, St. Catherine is also supplied with water via the Bir Zeituna-Bir Haron pipeline. Seven of the surveyed communities have permanent storage tanks (El Arish, El Qantara East, El Hasana, and Nakhl in north Sinai; Abu Zenima, Wadi Feiran, and St. Catherine in south Sinai); several other communities use steel drums and plastic barrels for temporary storage of water. El Tor has storage tanks which, at present, are not functional.

The Sinai Development Authority has plans to construct a potable water supply line from Suez to Abu Rudeis. The reported source of the water is the Nile River. Preliminary planning estimates indicate a 6-month completion date from start-up (personal communication, H. Nour, mayor of El Tor, July 1981).

Potable water is obtained free of charge from the public faucets as well as from the roadside barrels. Distances from dwellings to the faucets vary from a few meters to more than 200. The public faucets are frequently subjected to misuse and damage; in some instances, a considerable amount of water runs to waste and forms large stagnant pools (personal communication, H. Nour, July 1981). The present consumption of domestic water varies greatly. Residential

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\*According to Dr. S. Letts, a Binnie-Taylor hydrogeologist, the El Qantara-Bir El Abd-El Arish pipeline has been placed to within 5 kilometers of Bir El Abd.

## Community Water Supply in Sinai (1981)

Community	Domestic Water Sources			Quantity Delivered by Tank Truck (m <sup>3</sup> /day)	Average Daily Consumption (m <sup>3</sup> /day)	Total Storage Capacity (m <sup>3</sup> )
	No. of Wells in Use		No. of Public Faucets			
	Sweet	Brackish				
El Arish	12	2	1	--	7,000	500
Bir El Abd	--	1	--	16	16	--
Negila	--	10	--	28	28	--
Rabaa	3	3	--	16	16	--
Romana	--	4	--	16	16	--
Baloza	--	--	4	25	25	--
Gilbana	--	21	1	(c)	24	--
El Qantara East	--	--	4	--	1,000	10
Gifgafa	--	--	2	--	96	--
El Hasana	--	--	1	24	24	12
Bir El Thamada	--	1	--	(c)	24	--
Nakhl	2	2	--	4	4	32
El Shatt	--	--	--	--	2	--
SUBTOTAL (North Sinai)	<u>17</u>	<u>44</u>	<u>13</u>	<u>129</u>	<u>8,275</u>	<u>554</u>
Ayun Musa	3	--	--	1	1	--
Ras Sudr	(b)	(b)	--	40	40	--
Abu Zenima	--	--	--	4	4	60
Abu Rudeis <sup>a</sup>	--	--	--	8	8	--
Wadi Feiran	4	--	14	--	250	25
St. Catherine	2	--	6	--	50	250
El Tor	3	13	5	4	700	500
SUBTOTAL (South Sinai)	<u>12<sup>b</sup></u>	<u>13<sup>b</sup></u>	<u>25</u>	<u>57</u>	<u>1,053</u>	<u>835</u>
TOTAL	<u>29</u>	<u>57</u>	<u>38</u>	<u>186</u>	<u>9,328</u>	<u>1,389</u>

<sup>a</sup> Abu Rudeis also receives potable water by ship.

<sup>b</sup> Ras Sudr has 46 wells--32 for agriculture and 14 for domestic use.

<sup>c</sup> Unknown.

dwelling units with running water use 50 to 70 liters/capita/day. Settlements using primarily standpipes (public faucets) are experiencing a usage rate of 20 to 30 liters/capita/day. Those settlements that depend on the tank truck-barrel system are consuming much less water, probably 5 to 10 liters/capita/day.

### 3.1.2 Criteria

In an arid, dry climate, water is not only a precious resource but also the very lifeblood of the community. Within the decade, it is assumed that all Sinai settlements will be served by either individual house connections or standpipes. The current tank truck-barrel system--the major source of water for 12 Sinai communities--is not sanitary and should be replaced. Furthermore, until this system is upgraded, it will be extremely difficult to persuade settlers to relocate in Sinai. The public standpipe is an acceptable interim alternative to individual connections when it is properly constructed and managed, but it can serve only a limited number of families.

For rural settlements and many low-income areas of rapidly growing urban settlements, public standpipes are used as an interim water supply source. It is, however, necessary to construct the surface areas surrounding these faucets in an attractive, utilitarian manner so that spillage is adequately drained. Soakways have been effectively used in the Ismailia demonstration projects to minimize water waste.

### 3.1.3 Standards

Water consumption standards for new towns in Egypt vary from 200 liters/capita/day for the new community in Helwan to 973 liters/capita/day for the Tenth of Ramadan (industrial emphasis), (PADCO, Inc., 1980). The National Water Master Plan (Ministry of Irrigation, 1981), published earlier this year, predicts that urban domestic demand for water will average 116 liters/capita/day by the year 2000. In addition to the domestic component, an estimated 160 liters/capita/day is anticipated from urban requirements for trade, institutional, and industrial uses. The same study forecasts that the rural domestic demand will be 72 liters/capita/day by the year 2000.

It is recommended that two water supply standards be used in Sinai economic planning:

- 100 to 120 liters/capita/day for urban communities
- 30 to 40 liters/capita/day for rural settlements.

It is reasoned that the urban standard exceeds the current 50- to 70-liter range for dwelling unit connection and provides an extra allowance of 20 liters/capita/day for trades and light industrial activities. The rural standard assumes that water supplies will be largely provided via public faucets.

### 3.1.4 Costs

During the next 20 years, the Government of Egypt expects to invest LE 118 million in developing Sinai water supplies (Ministry of Irrigation, 1981). Culpin & Partners (1978) reports that construction costs of water pipelines used in the Ismailia demonstration projects are estimated at LE 20,000 per kilometer for a 300-millimeter diameter pipe and LE 52,000 for a 500-millimeter pipe. A PADCO, Inc., study (1980) projects a per capita range of LE 3 to 6 for low-income urban water projects. It is recommended that LE 10 and LE 5 per capita be applicable for urban communities and rural settlements, respectively, for operating estimates, and that the Culpin & Partners estimate be applied for construction cost estimates.

## 3.2 WASTEWATER

### 3.2.1 Existing Conditions

During Dames & Moore's infrastructure survey in May-June 1981, it was found that--except for temporary Bedouin housing structures--most dwellings in Sinai have a modified form of pit latrine for excreta disposal. The latrine generally consists of a rectangular hole placed close to the building in the yard or the street. The bottom of the pit is left unsealed and the walls are generally constructed of dry brick or stone lining to permit some seepage. The top of the pit is covered with a reinforced concrete slab. A squatting plate without water seal is located inside the dwelling unit and is connected to the pit by a short length of pipe. Some pit latrines are constructed water-tight, particularly where ground-water supplies are tapped. Depending on the number of persons per pit, the latrines usually fill in in about 12 months. Users of this system complain about odors, insects, the rapid rate of fill, and occasional flooding (personal communication, Sheikh A. El Sabah, Bir El Abd, June 1981). According to local opinion, the emptying process is a messy operation and constitutes one of the principal disadvantages of the system (personal communication, I. Ratah and I. Green, Culpin & Partners, July 1981).

Other wastewater systems in use in Sinai include bucket latrine, compost privy, and septic tank. The bucket latrine is the most primitive system. Excreta is deposited in a bucket which is removed for emptying daily or several times per week. It is inexpensive, but significant health hazards are encountered. This system is widely acknowledged to be an undesirable method of waste disposal.

The compost privy is similar to the pit latrine except that organic household wastes are added to the human excreta in the pit. It uses the principle of aerobic composting to break down the deposited wastes into a nutrient-rich humus; thus, handling of raw excreta is eliminated. Aerobic composting occurs with a proper balance of air, organic material, moisture, and temperature. The process uses no external sources of water, chemicals, or energy. The resulting composted humus can be used as a fertilizer/soil conditioner. The compost privy is more suitable for rural areas than for semiurban settlements or urban places in Sinai; but, in any case, its use must be closely supervised by health officials. Poor management of human excreta can lead to epidemics such as typhoid, cholera, and hepatitis.

Most of the residential dwelling units currently under construction in Sinai are being equipped with a septic tank system. In addition, most of these middle- to upper-income housing units feature flush toilets, lavatories, showers, and kitchen sinks. Indoor plumbing links these household units to a central collection point (normally a trap on the patio), from which a vitrified clay sewer pipe carries the wastewater to a central septic tank. Four or more dwelling units commonly use a single septic tank. Liquid wastes are decanted into a nearby leach (infiltration) field while excreta decomposes and is removed after about 6 months (personal communication, A. Soliman Abu Zeid, The Arab Contractors, El Tor, July 1981). Because of high initial cost and the extensive area required for effluent disposal, the use of septic tanks in densely populated urban areas is impractical.

The infrastructure survey disclosed that there are no wastewater treatment plants in Sinai. Pit latrines are predominant in the rural settlements, while septic tank systems are most commonly found in the more developed communities.

Sanitary storm drainage systems are nonexistent in Sinai. El Arish is the only urban place with a substantial amount of paved roads and walkways. At this time, it is not economically feasible to seriously consider a storm drainage system at El Arish (or any other existing community) because of the lack of significant amounts of rainfall and the scarcity of paved surfaces to catch and collect the infrequent

precipitation. Rainfall is readily absorbed into the upper soil zones and presumably contributes to the groundwater recharge of aquifers.

### 3.2.2 Criteria

The Suez Canal Regional Plan (TAMS, 1976) gives priority to the following two health policies:

- The adequate provision of potable water, wastewater treatment, and solid waste disposal to keep pace with the growing population.
- In new urban areas, the provision of water such that all householders can install a single interior tap.

Almost without exception, international experience has shown that communal sanitary facilities are subject to misuse, vandalism, and lack of proper maintenance (Culpin & Partners, 1978). They are not recommended for use in Sinai.

In evaluating and upgrading basic wastewater disposal systems for three Ismailia demonstration projects, Culpin & Partners (1978) proposed the following criteria:

- Surface soil and surface water should not be contaminated.
- Wastes must be collected, stored, and transported without endangering health.
- Odors and unsightly conditions must be minimized.
- The system must be compatible with local habits.
- Operation of the system must not require special skills.
- Installation and running costs should be compatible with the income of users.
- The system must be compatible with the eventual installation of waterborne collection systems.

All of these criteria are appropriate for application of standards in Sinai.

### 3.2.3 Standards

Table 3-2 presents a summary of existing and proposed wastewater treatment systems in Sinai. At present, only El Arish is considered an urban place; all other Sinai communities are considered either semiruban or rural settlements. Existing

wastewater systems in El Arish are predominantly pit latrine and septic tank (individual as well as collective). According to the Governor of North Sinai, a central, municipal wastewater treatment system (plant and sewer lines) must soon be constructed at El Arish if future groundwater supplies are to be free of contamination (personal communication, Y. Sabri Abu Taleb, El Arish, July 1981). As development proceeds, it is recommended that all Sinai urbanized areas be served with an adequate wastewater treatment system.

TABLE 3-2  
Existing and Proposed Wastewater Treatment Systems

<u>Community Type</u>	<u>Existing Treatment Process (1981)</u>	<u>Proposed Treatment Process (2000)</u>
Urban (20,000+)	Pit latrine Compost privy Septic tank	Wastewater treatment system (sewerage conveyance and plant)
Semiurban (2,000-20,000)	Bucket latrine Pit latrine Compost privy Septic tank	Compost privy Septic tank
Rural (less than 2,000)	Bucket latrine Pit latrine	Compost privy Septic tank

The suggested level of treatment is secondary--which implies 65 to 70 percent removal of suspended solids and about 85 to 90 percent removal of biochemical oxygen demand. Secondary wastewater treatment processes can be categorized as stabilization ponds, trickling filter, or activated sludge. Stabilization ponds are the least costly to construct and operate, while the activated sludge method is the most expensive due to the relatively high energy demands of the aeration chambers (basins). Local factors and conditions should be carefully considered and weighed prior to final selection of a treatment process. For example, in areas where there is no aquifer to recharge, a primary treatment process might be adequate and would, overall, be less expensive than any of the aforementioned secondary processes.

Depending on the ultimate use of effluent, chlorination may be advisable (particularly if the effluent is applied to irrigate greenbelts), and the sewage sludge can be returned to the soil as a fertilizer/soil conditioner on nearby agricultural

lands. The Water Master Plan (Ministry of Irrigation, 1981) recommends that all effluent from potential Sinai wastewater treatment plants be discharged into the Mediterranean Sea. This action would be a gross mismanagement of water resources. It is recommended that the wastewater effluent be applied to croplands, orchards, or park areas.

In semiurban communities, either a compost privy or a septic tank is the recommended sewage disposal system. For rural settlements, bucket latrine and pit latrine processes should be eventually phased out in favor of compost privies or septic tanks. With either of these systems, solids removed from the holding tanks would be applied as fertilizer/soil conditioner on agricultural croplands; septic tank liquids would be available for distribution on green areas (personal communication, A. Soliman Abu Zeid, The Arab Contractors, El Tor, July 1981).

#### 3.2.4 Costs

During the next 20 years, the Government expects to invest LE 71 million in constructing wastewater treatment systems in Sinai (Ministry of Irrigation, 1981). A PADCO, Inc. (1980) study projects a per capita range of LE 3 to 22 for low-income urban wastewater projects. Current construction costs for wastewater treatment systems are averaging LE 12 per cubic meter for the treatment plant and LE 4,000 per kilometer of sewerage line (personal communication, El Zamlat, Bir El Abd, July 1981). For sewerage line construction in Ismailia, Culpin & Partners (1978) estimates a range of LE 8,200 to 49,000 per kilometer.

The following costs are recommended in estimating wastewater treatment needs for Sinai:

- LE 25 per capita for urban communities
- LE 15 per capita for semiurban communities and rural settlements
- LE 25,000 per kilometer of sewer line.

### 3.3 SOLID WASTE

#### 3.3.1 Existing Conditions

In El Arish, solid wastes are collected by garbage trucks and donkey carts. The donkey carts are usually confined to the narrow streets for pick up of refuse. After recyclable materials have been extracted, the residue is either burned or dumped at an excavated landfill. Solid wastes are picked up by truck in Bir El Abd

on an infrequent schedule; the collected refuse is usually burned. However, in nearly all of the smaller Sinai communities, solid wastes are not collected, but simply buried in shallow sand near the house or thrown onto the ground. As piles of refuse accumulate health hazards are created. At present, the general impression is that solid waste disposal is not a serious problem in smaller settlements. However, this situation will change in many settlements as land use intensifies and standards of living rise.

### 3.3.2 Criteria

Long-term solutions to the problem of solid waste disposal should be inexpensive and environmentally safe. Solid waste disposal programs should emphasize the elimination of existing unsanitary conditions and help foster a feeling of community pride through the eradication of unsightly trash dumps.

### 3.3.3 Standards

Solid wastes should be collected, sorted, and placed in municipally managed landfills. Donkey carts are the most suitable collection vehicles in urban areas where streets are narrow, but garbage trucks, of course, are more efficient, reliable, and sanitary.

Any solid waste collection service should operate on a regular pick-up schedule and on a community-wide basis. Prior to final disposal, recyclable materials should be sorted and salvaged. A satisfactory method of solid waste disposal is to spread the refuse, compact it, and cover with soil. Successive layers of debris and soil can similarly be compacted and covered (SWECO, 1976).

Composting pits of biodegradable substances for possible reuse as fertilizer/soil conditioner are strongly recommended. However, care must be exercised in selecting and locating municipal landfill sites to ensure that the disposal areas will not contaminate groundwater aquifers (Norconsult, 1979). Landfills are apt to vary widely in area and volumetric size (i.e., hectares and cubic meters). Culpin & Partners (1978) has suggested a minimum standard of one depot per 25,000 population for the Ismailia demonstration projects. PADCO, Inc. (1980) recommends a solid waste disposal standard of 0.5 to 4 kg/capita/day (for quantity) and 200 to 400 kg/m<sup>3</sup> (for density) in new cities.

The Culpin & Partners standard seems reasonable as an approximate measure and is recommended for application in Sinai. The PADCO, Inc., standard for larger

communities appears to be high for Sinai applications; it is recommended that the per capita quantities and densities be reduced by about 50 percent.

#### 3.3.4 Costs

Each town council should designate a municipal landfill site where refuse can be deposited without cost to residents. Initially, the annual costs to construct and maintain a landfill will be minimal--approximately LE 4 per capita for urban places and LE 2 per capita for rural settlements.

In the larger urban communities, it is possible that certain capital costs will be required to purchase earth-moving equipment, such as Caterpillar tractors, front-end loaders, or graders. Such items, however, are considered in amortizing payments over the long run from user charges.

### 3.4 COMMUNITY ROADS AND STREETS

#### 3.4.1 Existing Conditions

In general, prevailing standards for automobile circulation within newly constructed urban residential developments are much too generous. As discussed in Section 2.0, there is a tendency for the Government to plan housing developments around the Western concept of garden cities--with emphasis on automobile transportation and large open spaces. The results are waste of space, excessive cost of initial construction, and the inability of public agencies to maintain the elaborate circulation systems.

#### 3.4.2 Criteria

Criteria for evaluating site designs for residential developments (for informal or formal housing sectors) or for housing upgrading activities should include:

- Differentiation in road use for general circulation and for access to individual housing units.
- The degree to which efforts are made to minimize land under ownership/control of the Government and to maximize land under the mutual ownership/control of small groups.
- The manner in which structural units are sited to reduce exposure to glare, dust, and desert winds.

### 3.4.3 Standards

Section 2.0 stressed the importance of clustering development and reinforcing traditional Islamic urban planning principles. To the extent that this is achieved, space allocation for roads and walkways in urban and semiurban settlements should fall within 15 to 17 percent of gross land allocation. As shown in Table 3-3, the new towns of Sadat City and the 6th of October incorporate these standards. The Cairo Land Development Study (currently being conducted by Dames & Moore) also recommends use of the 15 to 17 percent range.

TABLE 3-3

Space Allocation for Circulation: Roads and Walkways

<u>Type of Project</u>	<u>Square Meters per Capita</u>	<u>Percent of Total Space Allocation</u>
<u>Public Housing</u>		
Deuwaka	7.1	17
Berket	3.3	16.5
<u>Demonstration Project</u>		
Abu Atwa	10.4	27
El Hekr	5	20
Suez	1.5	3
<u>New Projects</u>		
Tenth of Ramadan	30.5	23
Sadat City	12.7	15
6th of October	21.6	17
15th of May	27.1	40
Helwan New Community	5.5	33

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SOURCE: PADCO, Inc., 1980 (Table 2).

#### 3.4.4 Costs

Probably the easiest way to calculate costs for urban roads and walkways (when the actual amount of construction is unknown) is to employ a per capita ratio. The first stage of construction for the new community of Helwan has a per capita road construction cost of LE 97, while the updated contractor's price for road construction in the 15th of May development is estimated at LE 117 per capita (PADCO, Inc., 1980). Costs for circulation in the urban and semiurban settlements of Sinai would probably fall toward the lower portion of this range; LE 100 per capita is a reasonable estimate.

### 3.5 ELECTRICAL POWER GENERATION AND OTHER ENERGY FUELS\*

#### 3.5.1 Existing Conditions

At present, no centralized power generation sources or large power plants serve Sinai communities. The main source of electrical power is the diesel-powered generator.

Table 3-4 presents electrical power generation data collected during the May-June infrastructure survey. In north Sinai, the settlements of Gilbana, Gifgafa, Bir El Thamada, and El Shatt do not have any form of electricity for general public consumption. The other nine north Sinai communities have a total of 19 generators, with a collective rated capacity of 9,807 kilowatts. Approximately 11,600 dwelling units are served in north Sinai, with an average daily consumption of 39,475 kilowatt-hours. In addition, many privately owned generators serve small businesses in several of the north Sinai communities.

In south Sinai, electricity for the settlements of Abu Zenima and Abu Rudeis is provided by the Sinai Manganese Company and the Petrobel Oil Company, respectively. Four of the seven inventoried communities in south Sinai have a total of 14 generators, with a combined rated capacity of 1,825 kilowatts. These generators serve nearly 1,000 residences and miscellaneous businesses, with an estimated average daily consumption of 3,250 kilowatt-hours. The small settlement of Ayun Musa has no electricity.

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\*This section does not offer a detailed assessment of Sinai energy requirements. Rather, it focuses on existing and potential needs of selected communities. Data presented herein were largely obtained from the infrastructure survey in May-June 1981. A comprehensive evaluation of energy requirements is found in Working Paper No. 15, Energy Resources Assessment and Evaluation of Energy Requirements.

TABLE 3-4

## Electrical Power Generation in Sinai (1981)

<u>Community</u>	<u>No. of Generators</u>	<u>Rated Capacity (kW)</u>	<u>No. of Houses or Buildings Served</u>	<u>Average Daily Consumption (kWh)</u>
El Arish	7	8,305	10,280	35,000
Bir El Abd	1	145	250	85
Negila	1	58	250	180
Rabaa	1	90	35	200
Romana	3	210	150	690
Baloza	2	149	281	390
Gilbana <sup>a</sup>	--	--	--	--
El Qantara East	2	750	316	2,480
Gifgafa <sup>a</sup>	--	--	--	--
El Hasana	1	50	10 <sup>c</sup>	150
Bir El Thamada <sup>a</sup>	--	--	--	--
Nakhl	1	50	16 <sup>c</sup>	300
El Shatt <sup>a</sup>	--	--	--	--
SUBTOTAL (North Sinai)	<u>19</u>	<u>9,807</u>	<u>11,588</u>	<u>39,475</u>
Ayun Musa <sup>a</sup>	--	--	--	--
Ras Sudr	4	1,000	531	1,180
Abu Zenima <sup>a</sup>	--	--	--	--
Abu Rudeis <sup>a</sup>	--	--	--	--
Wadi Feiran	1	30	110	180
St. Catherine	4	300	200	1,440
El Tor <sup>b</sup>	5	495	140 <sup>d</sup>	450
SUBTOTAL (South Sinai)	<u>14</u>	<u>1,825</u>	<u>981</u>	<u>3,250</u>
TOTAL	<u>33</u>	<u>11,632</u>	<u>12,569</u>	<u>42,725</u>

<sup>a</sup> No public electrical service provided to community.

<sup>b</sup> According to the Canal Electricity Distribution Company, El Tor has two additional generators (rated capacity, 515 kilowatts) that are not used.

<sup>c</sup> Government guesthouses.

<sup>d</sup> Includes 120 guesthouses.

The power generating system in El Arish has been expanding more or less continuously since Egypt regained control of Sinai. A new plant is currently being constructed to house generators with a capacity between 17.5 and 20 megawatts. Installation of the 7.5-megawatt generator in July 1981 was expected to cost LE 1.6 million.

Eighty percent of the electrical distribution network in El Arish consists of 11-kilovolt lines, and the remaining 20 percent is expected to be converted by the end of 1981. Three existing 460-kilowatt generators were rebuilt and currently operate at a maximum capacity of 300 kilowatts. The Canal Electricity Distribution Company is studying the feasibility of water desalination in El Arish using exhaust gases from the turbine generators (personal communication, El Reweny, July 1981).

Tables 3-5a and 3-5b report the source and estimated consumption rates of supplementary energy fuels for 20 Sinai communities. These data were also collected during Dames & Moore's infrastructure survey. Petroleum-based fuels are primarily distributed in El Arish, with smaller amounts provided to Romana, Suez, Ismailia, Abu Rudeis, and El Qantara East. The daily consumption of gasoline in north Sinai is estimated at 15,400 liters, while the daily consumption in south Sinai is about 4,940 liters. Diesel fuels are consumed at an estimated daily rate of 33,670 liters in north Sinai and 8,300 liters in south Sinai. About seven times more kerosene is consumed daily in north Sinai than in south Sinai. Other than in El Arish and El Qantara East, very little butagas is consumed in Sinai.

To meet anticipated long-term Sinai electrical power requirements, the Canal Electricity Distribution Company has advanced a 6-year plan to support Sinai development (CEDCO, August 1981). The plan is expected to be implemented in three stages. The first stage is underway and is scheduled for completion by the end of 1982. During this period, power stations with gas-oil and gaseous units--along with mid- and low-tension nets--will be constructed in coastal regions where there are industrial, housing, and tourism projects. The second stage, planned for 1983 to 1985, involves construction of gaseous power stations using natural gas and ultimately linking 66-kilovolt nets and the transformer stations. The third stage is based on linking north and south Sinai with the main electrical net, constructing thermal power stations such as at the El Maghara coal mine, extending 66- and 220-kilovolt nets, and constructing transformer stations. This stage is expected to

TABLE 3-5a

## Sources of Petroleum Fuels in Sinai (1981)

<u>Community</u>	<u>Main Source of Gasoline, Diesel Fuel, and Kerosene</u>	<u>Main Source of Butagas</u>
<u>North Sinai</u>		
El Arish	El Arish	El Arish
Bir El Abd	Bir El Abd	El Arish
Negila	Romana	Ismailia or El Arish
Rabaa	Romana	El Arish
Romana	Romana	(b)
Baloza	Romana	(b)
Gilbana	El Qantara East	(b)
El Qantara East	El Qantara West	Ismailia
Gifgafa	El Arish	(b)
El Hasana	El Arish	El Arish
Bir El Thamada <sup>a</sup>	--	--
Nakhl	El Arish	El Arish
El Shatt	Suez	(b)
<u>South Sinai</u>		
Ayun Musa	Suez	(b)
Ras Sudr	Ras Sudr	(b)
Abu Zenima	Abu Rudeis	(b)
Abu Rudeis	Abu Rudeis	Suez
Wadi Feiran	St. Catherine or Belayim	Suez
St. Catherine	St. Catherine	(b)
El Tor	El Tor or Suez	(b)

<sup>a</sup>No reported use of energy fuels.<sup>b</sup>Source unknown/not reported.

TABLE 3-5b

Estimated Consumption Rates of Petroleum Fuels  
in Sinai (1981)

<u>Community</u>	<u>Estimated Daily Consumption (liters)</u>			
	<u>Gasoline</u>	<u>Diesel</u>	<u>Kerosene</u>	<u>Butagas</u>
El Arish	5,200	16,000	4,100	345
Bir El Abd	500	--	1,000	50
Negila	600	--	200	3
Rabaa	200	150	300	--
Romana	2,000	10,000	500	--
Baloza	--	400	750	--
Gilbana	--	--	1,000	--
El Qantara East	2,000	5,000	1,000	200
Gifgafa	1,800	--	3,000	--
El Hasana	1,500	2,000	1,000	--
Bir El Thamada <sup>a</sup>	--	--	--	--
Nakhl	1,600	120	4,500	10
El Shatt	--	--	150	--
SUBTOTAL (North Sinai)	<u>15,400</u>	<u>33,670</u>	<u>17,500</u>	<u>608</u>
Ayun Musa	40	--	60	--
Ras Sudr	2,200	3,000	450	--
Abu Zenima	--	--	1,000	--
Abu Rudeis	1,000	2,000	400	2
Wadi Feiran	--	1,000	200	4
St. Catherine	200	300	60	--
El Tor	1,500	2,000	500	--
SUBTOTAL (South Sinai)	<u>4,940</u>	<u>8,300</u>	<u>2,670</u>	<u>6</u>
TOTAL	<u>20,340</u>	<u>41,970</u>	<u>20,170</u>	<u>614</u>

<sup>a</sup>No reported use of energy fuels.

be completed by 1990. CEDCO (August 1981) estimates new or additional Sinai electrical power demands (in kilowatt-hours) as follows:

	<u>end of 1982</u>	<u>end of 1985</u>	<u>end of 1990</u>
● North Sinai:	13,450	47,700	1,004,500
● South Sinai:	6,200	11,550	59,150.

### 3.5.2 Criteria

A recent U.S. Agency for International Development energy assessment (unpublished) concluded that demand for commercial energy is increasing at a rate of 10 percent per annum. From a cursory examination of infrastructure survey data, it is believed that nearly one-third of all rural Sinai residences (i.e., those located in settlements with less than 2,000 population) are without electricity. As new communities are developed in Sinai, provision of electrical power through conventional means will place a heavy burden on national fuel resources, especially in the remote areas. Along with basic infrastructure elements of water, wastewater, and solid waste disposal facilities, the provision of electricity to Sinai residences and businesses is essential for the general well-being of the population.

### 3.5.3 Standards

The Tenth of Ramadan Master Plan (SWECO, 1976) assumes that a normal household of five persons has an electrical demand of 2,000 kWh/yr. Experience indicates that electricity consumption increases with a rising standard of living and demands for better comfort, especially with the use of air conditioning. The projection of 2,000 kilowatt-hours per household (or about 400 kWh/capita) appears reasonable for application to El Arish. For the other Sinai communities, 300 kWh/capita/yr seems realistic. Energy for cooking and hot water will be provided by butane gas. Assuming that the number of shops, schools, offices, and small industries (i.e., less than 20 workers) will increase in normal proportions, this collective energy demand (electricity and butagas) represents about 50 percent of the energy demand for housing.

A street lighting system is essential to the security and general convenience of settlement residents. Culpin & Partners (1978) recommended that street lamps be spaced at 35-meter intervals in the Ismailia demonstration projects. It is recommended that this standard also be applicable to Sinai community street lighting projects.

### 3.5.4 Costs

Estimated electrical power costs per capita for the Ismailia demonstration projects range from LE 16 to 20 (Culpin & Partners, 1978). Corresponding costs at Cairo's low-income project, Mansheit Nasser, are estimated at LE 7 per capita per year (PADCO, Inc., 1980). Public housing annual per capita costs in Deuwaka are estimated at LE 38, while costs for new developments in Alexandria are about LE 26 per capita per year (PADCO, Inc., 1980). Capital costs for the Ismailia demonstration projects are estimated at LE 8 per meter of 11-kilovolt overhead electricity distribution lines (double for underground lines) and LE 9,000 for each transformer at a 0.4 kilovolt per 1,000-kilowatt capacity. Based on these figures, it is recommended that a per capita cost of LE 10 per year be used in Sinai development projects.

## 3.6 TELECOMMUNICATIONS

### 3.6.1 Existing Conditions

For the purposes of this paper, telecommunications includes telephone, radio, and television. Existing telephone service in Sinai is poor. According to the infrastructure survey, many settlements either have no telephone service or the present telephone service is not working. Table 3-6 shows that there are less than 1,000 telephones in Sinai. Virtually the same situation is found with television service (i.e., either no television reception or very poor reception). However, local radio reception in Sinai is good--with the number of portable, battery-powered radios estimated at 17,500.

### 3.6.2 Future Plans for Telephone Service

Present telephone services are not adequate for modern business and administrative requirements. While the Governors' offices are connected to Cairo, they do not have convenient telecommunication connections with other towns in Sinai, and few other centers of activity have contact with each other or Cairo.

To meet the urgent need for better telephone services, the Arab Republic of Egypt Telecommunication Organization (ARETO) has formulated a plan to be implemented over the next few years. The ARETO plan proposes telephone exchanges in 28 cities and villages in Sinai, as indicated in Table 3-7. In south Sinai, the main telephone centers will be Abu Rudeis and Ras Sudr, with an exchange capacity of 3,000 lines each; in north Sinai the automatic exchanges will

TABLE 3-6

## Existing Telecommunications in Sinai (1981)

<u>Community</u>	<u>No. of Telephones</u>	<u>No. of Radios</u>	<u>No. of Televisions</u>
El Arish	700	10,280	7,700
Bir El Abd	(a)	400	150
Negila	10 <sup>b</sup>	250	50
Rabaa	9 <sup>b</sup>	330	250
Romana	6 <sup>b</sup>	622	312
Baloza	(a)	281	113
Gilbana	(a)	250	4 <sup>f</sup>
El Qantara East	108	316	200
Gifgafa	(a)	120	4 <sup>f</sup>
El Hasana	(a)	200	10 <sup>g</sup>
Bir El Thamada	(a)	5	(a)
Nakhl	(a)	1,050	2
El Shatt	(a)	30	i
SUBTOTAL (North Sinai)	<u>833</u>	<u>14,134</u>	<u>8,796</u>
Ayun Musa	(a)	47	2
Ras Sudr	85 <sup>c</sup>	558	12
Abu Zenima	(a)	100	(h)
Abu Rudeis	(d)	600	(h)
Wadi Feiran	(a)	887	(h)
St. Catherine	(a)	600	(h)
El Tor	5 <sup>e</sup>	410	(a)
SUBTOTAL (South Sinai)	<u>90</u>	<u>3,202</u>	<u>14</u>
TOTAL	<u>923</u>	<u>17,336</u>	<u>8,810</u>

<sup>a</sup> Unknown or not reported.

<sup>b</sup> Telephone service not working.

<sup>c</sup> 15 telephones not operable.

<sup>d</sup> No public telephone service; only a direct line to the oil company.

<sup>e</sup> Only Government telephone service.

<sup>f</sup> Television operates on battery power.

<sup>g</sup> Television reception is poor.

<sup>h</sup> No television reception.

TABLE 3-7

Proposed Telephone Exchange Services in Sinai<sup>a</sup>

<u>Location</u>	<u>Capacity (no. of lines)</u>
<u>Automatic Exchanges:</u>	
El Arish	2,000
El Qantara East	1,000
SUBTOTAL	<u>3,000</u>
<u>Nonautomatic Exchanges:</u>	
Abu Rudeis	3,000
Ras Sudr	3,000
SUBTOTAL	<u>6,000</u>
<u>Manual Exchanges</u>	
El Kosaima	100
El Tor	100
Bir El Abd	100
El Hasana	150
Wadi Gharandal	50
St. Catherine	50
Belayim	25
Baloza	12
Abu Haswa	12
El Kherba	12
El Mazar	12
El Bardawil	12
Nakhl	100
Rafah	100
Wadi Feiran	100
Abu Zenima	55
Ras Malab	50

TABLE 3-7 (cont'd)

<u>Location</u>	<u>Capacity (no. of lines)</u>
<u>Manual Exchanges (cont'd)</u>	
El Shatt	25
El Petrico	25
El Kharouba	12
El Shwha	12
Akkaria	12
El Midan	12
El Sheikh Zweid	12
SUBTOTAL	<u>1,150</u>
TOTAL	<u><u>10,150</u></u>

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<sup>a</sup> Main telephone nets: one between El Arish and El Qantara, two between Suez and El Tor.

SOURCE: Ministry of Communication.

have a capacity of 2,000 in El Arish and 1,000 in El Qantara East. In addition, 24 manual exchanges of 12 to 150 lines each will be established in other towns.

The ARETO project proposes to connect the Sinai network to Egypt's main telecommunications system via El Tor and Suez, with links to all intermediate exchanges. The northern sector will be interconnected to El Arish via El Qantara East. Between these two cities, a microwave link will carry telephone channels as well as other telecommunication channel requirements.

### 3.6.3 Radio Broadcasting

The three general Arabic radio programs transmitted via wave over Egypt--the Main Program, Middle East Program, and Voice of Arabs--are also received in Sinai. These programs include entertainment and local and international news.

Tentative plans for local radio stations in Sinai include the construction of low-power broadcasting transmitters in El Arish and El Tor by 1983. Each broadcast center will comprise a power transmitting facility on medium wave with either low-amplitude modulation (AM) or high-frequency modulation (FM). The latter is probably the most suitable for Sinai to overcome interference from surrounding powerful transmitters.

### 3.6.4 Television Service

At present, the television reception in Sinai from Egyptian stations is very weak or nonexistent. However, many Sinai television receivers pick up television programs from Israel, Lebanon, or Syria. The placement of one television transmitter at El Arish and another at El Tor is part of a national program activity within the Organization of Broadcasting and Television Federation.

The television service anticipated from the El Arish and El Tor transmitters will be adequate coverage for about a 100-kilometer radius; thus, there will be gaps of poor reception, especially in south Sinai. Therefore, it is recommended that a second expansion of the television project be planned to complete coverage of the unserved communities and any new settlements.

## 4.0 SOCIAL SERVICES

### 4.1 HEALTH CARE AND SERVICES

#### 4.1.1 Existing Conditions

According to recent social research findings (Tadros, 1978):

The most common diseases of the Egyptian peasant are tuberculosis, hereditary syphilis, bilharziasis, ancylostomiasis and eye diseases. Bilharziasis and ancylostomiasis are, however, the most serious because they are widespread, sometimes afflicting over 80 percent of the population of certain governorates. Bilharziasis, which begins with the passing of blood in the urine, often develops into complications such as the stone, fistula and ulceration of the penis, and not infrequently ends with cancer of the urinary organs. The infection may reach the kidneys, the liver and even the eyes. Ancylostomiasis is even more serious. It consumes the red corpuscles of the blood, and leaves stricken men and women pale, powerless and debilitated during the best years of their lives.

Relatively high infant mortality rates are directly related to unsanitary conditions and inadequate health care. The principle causes of infant mortality are gastro-intestinal diseases and related diarrhea (Culpin & Partners, 1978). Nutrition and food consumption habits of the Bedouin appear to be inadequate for maintenance of good health.

The infrastructure survey undertaken by Dames & Moore was designed principally to cast light on the physical planning needs of Sinai settlements and not to diagnose the professional adequacy or quality of medical care nor to prescribe preferred ways for dealing with its deficiencies. The broad subjects of public health, preventive medicine, employment of paramedical personnel, nutritional programs, and the like are beyond the scope of this study.

The infrastructure survey, however, did reveal the following:

- Most of the doctors serving settlements other than El Arish are residents of Cairo, Ismailia, Port Said, or Suez. They reside temporarily at Government guesthouses during the week (Sunday through Thursday), but return to the larger cities for the weekends. Thus, there are periods of time when professional medical service is not available.

- There are frequent shortages of drugs and other medical supplies, and often the cost of prescriptions is more than the patient can pay.
- Because of the frequent or total absence of water or electricity in Sinai settlements, much of the medical equipment cannot be used. Inadequate water supplies, of course, have a disastrous effect on the cleanliness of facilities used for medical treatment.
- In an emergency, there are no speedy methods of communication, since telephones either do not exist or are out of order most of the time.

Table 4-1 categorizes the type of medical facilities found in the 20 surveyed communities. In north Sinai, the communities of Gilbana, Bir El Thamada, and El Shatt do not have any medical facilities. El Arish has two hospitals (with 64 beds), 23 clinics, six pharmacies, and one ambulance center. Another ambulance facility is under construction in El Arish (personal communication, Dr. Ibrahim Shetwey, July 1981). Bir El Abd also has an ambulance center under construction. Of the 23 health clinics in El Arish, 19 offer special services in orthopedics, obstetrics, pediatrics, anesthesiology, dermatology, and ear, nose, and throat. In El Qantara East, there is one hospital with 16 beds and one public clinic, and one pharmacy is under construction.

In south Sinai there are four hospitals, with a total 33-bed capacity; three clinics; two health centers (one of the two is an ambulance center); and three pharmacies. The community of Abu Zenima is provided hospital service by the Sinai Manganese Company.

Table 4-2 lists the number of medical personnel in the selected Sinai communities. In north Sinai, there are 75 physicians and surgeons (58 in El Arish), 12 dentists (seven in El Arish), 98 nurses (78 in El Arish), 16 midwives, and 244 support staff. The support staff includes reception personnel, drivers, and administrative and maintenance personnel. South Sinai has a total of 19 physicians and surgeons, 10 dentists, three nurses (all in Ras Sudr), and 66 support staff.

#### 4.1.2 Criteria

Basic health care is essential for a productive regional economy and for the general well-being of Sinai citizens. An inadequate water supply, poor sanitation, and inadequate solid waste disposal--all of which exist in Sinai--create conditions for gastro-intestinal diseases, diarrhea, and dysentery. Improved sanitary and refuse

TABLE 4-1

## Medical Facilities in Sinai (1981)

<u>Community</u>	<u>No. of Hospitals</u>	<u>Total Beds</u>	<u>No. of Clinics</u>	<u>No. of Health Units</u>	<u>Total Beds</u>	<u>No. of Pharmacies</u>
El Arish	2	64	23 <sup>b</sup>	--	--	6
Bir El Abd	--	--	1	1	2	--
Negila	--	--	--	1	1	--
Rabaa	--	--	--	1	1	--
Romana	--	--	--	1	1	1
Baloza	--	--	--	1	2	--
Gilbana <sup>a</sup>	--	--	--	--	--	--
El Qantara East	1	16	1	--	--	1 <sup>d</sup>
Gifgafa	--	--	--	1	1	--
El Hasana	--	--	--	1	1	--
Bir El Thamada <sup>a</sup>	--	--	--	--	--	--
Nakhl	--	--	--	1	1	--
El Shatt <sup>a</sup>	--	--	--	--	--	--
SUBTOTAL (North Sinai)	<u>3</u>	<u>80</u>	<u>25</u>	<u>8</u>	<u>10</u>	<u>8</u>
Ayun Musa	--	--	--	1 <sup>c</sup>	--	--
Ras Sudr	1	12	1	--	--	1 <sup>e</sup>
Abu Zenima <sup>a</sup>	--	--	--	--	--	--
Abu Rudeis	1	4	--	--	--	--
Wadi Feiran	--	--	--	1	1	1
St. Catherine	1	11	1	--	--	1 <sup>e</sup>
El Tor	1	6	1	--	--	--
SUBTOTAL (South Sinai)	<u>4</u>	<u>33</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>3</u>
TOTAL	<u>7</u>	<u>113</u>	<u>28</u>	<u>10</u>	<u>11</u>	<u>11</u>

<sup>a</sup>No medical facilities.

<sup>b</sup>19 are private clinics, four are public clinics.

<sup>c</sup>Ambulance center.

<sup>d</sup>Pharmacy under construction.

<sup>e</sup>Pharmacy located in hospital.

TABLE 4-2

## Number of Medical Personnel in Sinai (1981)

<u>Community</u>	<u>Physicians/ Surgeons</u>	<u>Dentists</u>	<u>Nurses</u>	<u>Midwives</u>	<u>Support Staff<sup>b</sup></u>
El Arish	58 <sup>a</sup>	7	78	2	174
Bir El Abd	3	1	2	10	12
Negila	1	1	3	1	4
Rabaa	2	1	2	1	9
Romana	1	--	3	1	7
Baloza	1	--	3	--	9
Gilbana	--	--	--	--	--
El Qantara East	3	2	4	1	20
Gifgafa	2	--	--	--	5
El Hasana	2	--	--	--	2
Bir El Thamada	--	--	--	--	--
Nakhl	2	--	3	--	2
El Shatt	--	--	--	--	--
SUBTOTAL (North Sinai)	<u>75</u>	<u>12</u>	<u>98</u>	<u>16</u>	<u>244</u>
Ayun Musa	--	--	--	--	--
Ras Sudr	6	6	3	--	35
Abu Zenima	--	--	--	--	--
Abu Rudeis	3	2	--	--	15
Wadi Feiran	2	--	--	--	2
St. Catherine	2	1	--	--	8
El Tor	6	1	--	--	6
SUBTOTAL (South Sinai)	<u>19</u>	<u>10</u>	<u>3</u>	<u>0</u>	<u>66</u>
TOTAL	<u>94</u>	<u>22</u>	<u>101</u>	<u>16</u>	<u>310</u>

<sup>a</sup>Includes 15 doctors in general practice and 43 specialists.

<sup>b</sup>Receptionists, bookkeepers, and maintenance personnel.

disposal facilities (and particularly the provision of potable water supplies) must be considered in parallel with the construction and operation of health care facilities.

#### 4.1.3 Standards

A national objective in planning health services is to relieve the pressure on hospitals through provision of polyclinics that provide specialist and diagnostic out-patient services. In Ismailia, a polyclinic serves about 100,000 people (Culpin & Partners, 1978).

Health centers, which supplement polyclinics, provide local public health services. The recommended national standard is one health center per 50,000 to 70,000 population, though the Ismailia demonstration projects are using a standard of one health center per 25,000 to 30,000 population (Culpin & Partners, 1978).

Presently, the Egyptian urban population is served by a health delivery system with a service level of 4.1 beds per 1,000 population, while rural areas have a current level of 0.4 beds per 1,000 population (PADCO, Inc., 1980).

The following suggested standards are intended to serve as planning guides in determining the level of health care services and facilities necessary to support proposed Sinai development programs. These estimates have been recommended by Dr. Ibrahim Shetwey of El Arish Hospital (personal communication, July 1981):

- Facilities

- One hospital or polyclinic per 10,000 to 30,000 population
- One health care center per 3,000 to 5,000 population
- One pharmacy per 5,000 population.

- Personnel

- One physician/surgeon per 1,500 population
- One dentist per 2,000 population
- One registered nurse per 80 population
- One midwife per 35 population.

#### 4.1.4 Costs

The National Urban Policy Study (PADCO, Inc., 1980) estimates current construction costs for new urban health care facilities as follows:

- Hospital, LE 144 to 503 per capita
- Polyclinic, LE 11 per capita
- Health care center, LE 6 to 123 per capita.

Culpin & Partners (1978) has estimated construction costs for all medical facilities which are part of the Ismailia demonstration projects at about LE 85 per square meter. Mr. Adly El Gamany, a Bir El Abd local contractor, estimates current medical facility construction costs in north Sinai at LE 105 per square meter for hospitals and polyclinics and LE 92 per square meter for health care units (personal communication, July 1981). For planning purposes in Sinai, it is recommended that the cost per square meter be LE 105 for hospitals and polyclinics and LE 90 for health care centers.

## 4.2 CULTURAL AND OTHER SOCIAL SERVICES

### 4.2.1 Existing Conditions

Religious functions and activities play an important role in Bedouin culture. Lives are heavily influenced by the Koran, and Islamic-based teachings directly affect the Bedouin lifestyle. As indicated in Table 4-3, mosques are located in all but four of the smaller Sinai settlements. Christian churches--Catholic, Protestant, and Greek Orthodox--are located in El Qantara East, El Arish, and St. Catherine.

Thirteen public meeting halls are located in north Sinai, and three are found in south Sinai. Numerous small meeting places are located throughout Sinai. No parks or playgrounds or organized recreational activity areas were reported in the infrastructure survey.

### 4.2.2 Criteria

As existing Sinai communities expand and grow and as new settlements are built, considerable emphasis will be given to the provision of additional mosques. Aside from religious activities, each settlement should consider establishing a community development society much like those in the northwestern Nile Delta communities. According to Tadros (1978):

The Society endeavors (a) to discover the needs of the community and design different plans to meet these needs; (b) to carry out different projects within the community in order to raise the social, economic, and health standards of settlers, using all available community resources and

TABLE 4-3

## Religious Buildings and Public Meeting Places in Sinai (1981)

<u>Community</u>	<u>No. of Mosques</u>	<u>No. of Churches</u>	<u>No. of Public Meeting Halls</u>
El Arish	15	1	4
Bir El Abd	2	--	3
Negila	1	--	--
Rabaa	1	--	--
Romana	2	--	--
Baloza	1	--	--
Gilbana	2	--	--
El Qantara East	4	1	2
Gifgafa	--	--	--
El Hasana	1	--	2
Bir El Thamada	--	--	--
Nakhl	1	--	2
El Shatt	--	--	--
SUBTOTAL (North Sinai)	<u>30</u>	<u>2</u>	<u>13</u>
Ayun Musa	--	--	--
Ras Sudr	1	--	--
Abu Zenima	1	--	1
Abu Rudeis	1	--	--
Wadi Feiran	3	1	--
Saint Catherine	1	1	1
El Tor	4	1	1
SUBTOTAL (South Sinai)	<u>11</u>	<u>3</u>	<u>3</u>
TOTAL	<u>41</u>	<u>5</u>	<u>16</u>

especially raw materials; (c) to motivate and to organize settlers' popular participation in the self-help projects; (d) to design cultural and illiteracy combat programs; (e) to maintain public utilities in the community, including the lighting of the village roads, planting of road-side trees, and urging settlers to maintain and clean their houses; (f) to launch social and sports clubs for the youth; (g) to establish day care centers for children; and (h) to train local leaders through service to their communities.

#### 4.2.3 Standards

An important requirement for key Sinai settlements (i.e., those expected to experience accelerated growth) is to provide recreational services and facilities that will both assist in the attraction of people and serve their needs after arrival. The settlements designated to serve as regional centers for both north and south Sinai must be well equipped; for example, El Arish should have a regulation soccer field, an olympic-size swimming pool, a cinema, a public library, a cultural center, and sporting club facilities that permit organized competitions and training activities to take place within the region.

Probably all settlements of a semiurban character--2,000 to 20,000 inhabitants--require some type of combined public meeting house and cultural center. If equipped with several meeting rooms, such facilities can serve as artisan workshops and sites for various training and cultural activities.

Culpin & Partners (1978) recommended the following cultural and recreational standards for the Ismailia demonstration projects:

- A small mosque (400 square meters) for each planned neighborhood
- 0.2 hectare per 1,000 population for small parks and recreational areas.

For planning purposes, the following cultural, social, and recreational standards are recommended for Sinai:

- For semiurban settlements
  - A small mosque
  - A multipurpose social meeting/recreation center
  - A few game fields and small parks.
- For the two Sinai capital communities
  - Mosques for each planned neighborhood

- A regional cultural service center with cinema, library, artisan workshops, and meeting rooms
- A sports complex, including soccer fields, swimming pools, and ancillary athletic facilities.

#### 4.2.4 Costs

Average construction costs are estimated at LE 110 per square meter for religious buildings and LE 70 per square meter for social facilities (Culpin & Partners, 1978). The cost of a regional sports complex would range from LE 250,000 to 500,000.

### 4.3 EDUCATION

#### 4.3.1 Existing Conditions

Dames & Moore's infrastructure survey was undertaken to assist in determining the physical planning needs of Sinai settlements. Although a considerable amount of current information on public education was collected, additional study will be needed to analyze the nature and magnitude of educational problems that confront Sinai. For example, answers are needed to such important questions as:

- How many children are eligible for school and how many actually attend?
- How does the physical availability of schools compare to the actual location of the children?
- What is the quality of the education offered?
- Why do a significant number of children drop out of school?

For a developing area such as Sinai, there is an urgent need to equip young people with intellectual and mechanical tools and to instill a desire to participate in the advancement of their homeland. It is impossible to attract into a large, poor area all of the technical and professional skills needed to initiate and carry out the many complex development activities. Local technical or training institutes must be established, and students must progress through the requisite primary and secondary levels so as to qualify for the advanced training centers.

Table 4-4 lists public education data for 20 Sinai communities. The north Sinai settlements of Bir El Thamada, Nakhl, and El Shatt reported no schools in operation. All other settlements have at least one public school. Seven

TABLE 4-4

## Educational Data for Sinai Public Schools (1981)

<u>Settlements</u>	<u>Primary Schools</u>					
	<u>No. of Schools (and Rooms)</u>		<u>No. of Students</u>		<u>No. of Teachers</u>	<u>Others Employed<sup>a</sup></u>
			<u>Girls</u>	<u>Boys</u>		
El Arish	16	(195)	4,495	4,029	207	224
Bir El Abd	1	(8)	112	272	11	5
Negila	1	(8)	60	220	11	--
Rabaa	1	(9)	85	260	12	6
Romana	1	(6)	30	120	12	4
Baloza	1	(6)	40	155	17	--
Gilbana	1	(2)	5	25	1	3
El Qantara East	2	(15)	256	297	24	14
Gifgafa	1	(5)	28	145	8	2
El Hasana	1	(2)	7	36	3	--
Bir El Thamada <sup>b</sup>	--	(--)	--	--	--	--
Nakhl <sup>b</sup>	--	(--)	--	--	--	--
El Shatt <sup>b</sup>	--	(--)	--	--	--	--
SUBTOTAL (North Sinai)	<u>26</u>	<u>(256)</u>	<u>5,118</u>	<u>5,559</u>	<u>306</u>	<u>258</u>
Ayun Musa	1	1	4	11	1	2
Ras Sudr	3	17	78	167	30	6
Abu Zenima	1	3	25	20	3	--
Abu Rudeis	1	4	1	15	3	2
Wadi Feiran	6	23	29	183	20	9
St. Catherine	3	12	17	145	11	6
El Tor	2	12	85	159	15	6
SUBTOTAL (South Sinai)	<u>17</u>	<u>(72)</u>	<u>239</u>	<u>700</u>	<u>83</u>	<u>31</u>
TOTAL	<u>43</u>	<u>(328)</u>	<u>5,357</u>	<u>6,259</u>	<u>389</u>	<u>289</u>

<sup>a</sup>Includes administrative, clerical, and custodial personnel.

<sup>b</sup>No primary schools in operation.

TABLE 4-4 (cont'd)

Settlements	Preparatory Schools					
	No. of Schools (and Rooms)		No. of Students		No. of Teachers	Others Employed <sup>a</sup>
			Girls	Boys		
El Arish	5	(69)	1,285	1,616	101	36
Bir El Abd	1	(5)	21	145	8	3
Negila <sup>b</sup>	--	(--)	--	--	--	--
Rabaa	1	(13)	70	260	15	7
Romana	1	(4)	25	100	11	4
Baloza <sup>b</sup>	--	(--)	--	--	--	--
Gilbana <sup>b</sup>	--	(--)	--	--	--	--
El Qantara East	1	(6)	77	118	12	12
Gifgafa <sup>b</sup>	--	(--)	--	--	--	--
El Hasana <sup>b</sup>	--	(--)	--	--	--	--
Bir El Thamada <sup>b</sup>	--	(--)	--	--	--	--
Nakhl <sup>b</sup>	--	(--)	--	--	--	--
El Shatt <sup>b</sup>	--	(--)	--	--	--	--
SUBTOTAL (North Sinai)	<u>9</u>	<u>(97)</u>	<u>1,478</u>	<u>2,239</u>	<u>147</u>	<u>62</u>
Ayun Musa <sup>b</sup>	--	(--)	--	--	--	--
Ras Sudr	1	3	12	48	15	5
Abu Zenima <sup>b</sup>	--	(--)	--	--	--	--
Abu Rudeis <sup>b</sup>	--	(--)	--	--	--	--
Wasi Feiran <sup>b</sup>	--	(--)	--	--	--	--
St. Catherine <sup>b</sup>	--	(--)	--	--	--	--
El Tor	1	2	12	18	14	3
SUBTOTAL (South Sinai)	<u>2</u>	<u>(5)</u>	<u>24</u>	<u>66</u>	<u>29</u>	<u>8</u>
TOTAL	<u>11</u>	<u>(102)</u>	<u>1,502</u>	<u>2,305</u>	<u>176</u>	<u>70</u>

<sup>a</sup>Includes administrative, clerical, and custodial personnel.

<sup>b</sup>No preparatory schools in operation.

TABLE 4-4 (cont'd)

<u>Settlements</u>	<u>Secondary Schools</u>					
	<u>No. of Schools (and Rooms)</u>		<u>No. of Students</u>		<u>No. of Teachers</u>	<u>Others Employed<sup>a</sup></u>
			<u>Girls</u>	<u>Boys</u>		
El Arish	3	(46)	499	900	96	20
Bir El Abd <sup>b</sup>	--	(--)	--	--	--	--
Negila <sup>b</sup>	--	(--)	--	--	--	--
Rabaa	1	(14)	54	240	20	6
Romana <sup>b</sup>	--	(--)	--	--	--	--
Baloza <sup>b</sup>	--	(--)	--	--	--	--
Gilbana <sup>b</sup>	--	(--)	--	--	--	--
El Qantara East <sup>b</sup>	--	(--)	--	--	--	--
Giigafa <sup>b</sup>	--	(--)	--	--	--	--
El Hasana <sup>b</sup>	--	(--)	--	--	--	--
Bir El Thamada <sup>b</sup>	--	(--)	--	--	--	--
Nakhl <sup>b</sup>	--	(--)	--	--	--	--
El Shatt <sup>b</sup>	--	(--)	--	--	--	--
SUBTOTAL (North Sinai)	<u>4</u>	<u>(60)</u>	<u>553</u>	<u>1,140</u>	<u>116</u>	<u>26</u>
Ayun Musa <sup>b</sup>	--	(--)	--	--	--	--
Ras Sudr	1	(3)	12	48	15	5
Abu Zenima <sup>b</sup>	--	(--)	--	--	--	--
Abu Rudeis <sup>b</sup>	--	(--)	--	--	--	--
Wasi Feiran <sup>b</sup>	--	(--)	--	--	--	--
St. Catherine <sup>b</sup>	--	(--)	--	--	--	--
El Tor <sup>b</sup>	--	(--)	--	--	--	--
SUBTOTAL (South Sinai)	<u>1</u>	<u>(3)</u>	<u>12</u>	<u>48</u>	<u>15</u>	<u>5</u>
TOTAL	<u>5</u>	<u>(63)</u>	<u>565</u>	<u>1,188</u>	<u>131</u>	<u>31</u>

<sup>a</sup>Includes administrative, clerical, and custodial personnel.

<sup>b</sup>No secondary schools in operation.

communities provide preparatory schools, while only three have secondary schools. The enrollment at all schools in El Arish accounts for about 75 percent (12,824 students out of 17,176 students) of the total public school enrollment in all of Sinai. Except in the El Arish primary schools, more boys are enrolled than girls in all of the north and south Sinai primary schools. Boys also outnumber girls in secondary and high schools.

There are 43 primary schools, 11 preparatory schools, and five secondary schools in Sinai. The number of rooms per school averages 7.6, 9.3, and 12.6, respectively. The number of boys exceeds the number of girls at all three school levels. The boy-girl ratios are 54:46 for primary schools, 61:39 for preparatory schools, and 68:32 for secondary schools. The student-teacher ratios are 30:1, 22:1, and 13:1, respectively.

Table 4-5 presents an overall summary of public school data for north and south Sinai. Sixty-eight percent of all students are in the primary grades, 22 percent are enrolled in preparatory schools, and the remaining 10 percent are in secondary schools.

Table 4-6 shows additional data on higher education facilities in El Arish and El Qantara East. Only boys attend the technical school in El Arish. However, at the commercial school, girls exceed boys by a margin of nearly 2 to 1. At the teachers college, the enrollment by sex is about equal--114 boys and 110 girls. The student-teacher ratios are 9:1, 19:1, and 11:1 for the technical school, the commercial school, and the teachers college, respectively. The commercial school in El Qantara East is attended by 57 girls and 45 boys. The student-teacher ratio is 17:1.

#### 4.3.2 Criteria

The following general criteria should be applicable in establishing educational standards and planning for public schools in Sinai (Tadros, 1978; SWECO, 1976):

- As a minimum, every settlement should provide free primary coeducation.
- As part of their compensation, school teachers in rural areas should be provided with governmental housing.
- School buildings should be centrally located in each community and should have functional water, wastewater, and electrical systems.

TABLE 4-5  
Summary of Public School Data for Sinai (1981)

	<u>North Sinai</u>	<u>South Sinai</u>	<u>Total</u>
Number of primary, preparatory, and secondary schools	39	20	59
Total enrollment	16,087	1,089	17,176
Boys	8,938	814	9,752
Girls	7,149	275	7,424
Percent enrollment			
Primary schools	66	86	68
Preparatory schools	23	8	22
Secondary schools	11	6	10
Total number of teachers	569	127	696
Student-teacher ratio	28:1	9:1	25:1

TABLE 4-6  
Higher Educational Facilities in  
El Arish and El Qantara East

<u>Location</u>	<u>No. of Rooms</u>	<u>No. of Students</u>		<u>School Personnel</u>	
		<u>Girls</u>	<u>Boys</u>	<u>No. of Teachers</u>	<u>Others</u>
<u>El Arish</u>					
One technical school	8	--	238	27	9
One commercial school	9	191	97	15	5
One teachers college	3	110	114	20	6
<u>El Qantara East</u>					
One commercial school	3	57	45	6	4

- School facilities should be available for community functions, adult education programs, and other community-service related activities.
- Children should be encouraged (and parents counselled) to remain in school until age 15 or completion of preparatory school.
- Counterpart educational facilities, such as technical, commercial, agricultural, and clinical schools, should be provided to secondary-age students (16 to 18 years).

### 4.3.3 Standards

Table 4-7 presents data on the land allocation for educational facilities in selected Egyptian communities. Standards employed by the General Organization for Physical Planning (GOPP) require that at least 10 percent of the land area of a community be devoted to schools, excluding vocational and training schools. In Sinai, the vocational and training schools are important for youngsters who complete preparatory schooling (grades 7 to 9 or through age 15 years), but do not continue at the secondary school level.

TABLE 4-7  
Land Allocation for Educational Facilities  
in Selected Communities

<u>Location</u>	<u>Percent of Total Area Devoted to Public Schools</u>
Ismailia (El Hekr)	11.0
Suez (Cabanon)	3.6
Alexandria (MOH/WB)	5.5
Tenth of Ramadan	4.7
Sadat City	3.0
15th of May	5.8
Helwan	3.2

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SOURCE: Unpublished data from Dames & Moore's Cairo Land Development Study, Chapter 5.

Space requirements for educational facilities vary with a number of factors, such as the ratio of school-age population to total population, student-teacher ratio, and space per student ratio in square meters. While some of the physical and educational standards are governed by national regulations determined by the Ministry of Education and the Ministry of Development, the major element in forecasting physical needs is the projection of school population. Currently, a shortage of space in El Arish public schools has resulted in double-shifts for some students. It is obviously necessary that school facilities be constructed to accommodate all children in a single shift.

The student-teacher ratio (or students per classroom) is useful for determining the number of teachers required and the amount of new school construction required. The Ismailia master plan for new areas recommends a class size standard of 33 children per primary class and 30 children per preparatory class (Culpin & Partners, 1978). The Ministry of Education has recommended a class size standard (student-teacher ratio) of 35 students for primary schools, 23 students for preparatory schools, and 19 students for secondary schools (personal communication, G. Ibrahim El Saway, July 1981).

For planning purposes, it is recommended that the class size (student-teacher ratio) in Sinai be 35 students for primary schools, 28 students for preparatory schools, and 24 students for secondary schools.

#### 4.3.4 Costs

The cost of constructing public school facilities should be borne by the Ministry of Education. The operating (maintenance) costs of the buildings, however, should be the responsibility of the local community, except for teachers' salaries, which should be a joint responsibility of both the community and the ministry.

The current estimate for construction of educational facilities at the three Ismailia demonstration projects is LE 70 per square meter (Culpin & Partners, 1978). A Bir El Abd contractor recently estimated construction costs for primary schools and for preparatory and secondary schools at LE 85 and LE 90 per square meter, respectively (personal communication, Moussa El Sabbah, July 1981). The per capita costs of schools in the Cabanon community of Suez are LE 24 for primary and preparatory schools and LE 10 for secondary schools (PADCO, Inc., 1980).

Because the ratio of all students to the total Sinai population--either current or projected--is unknown, it is advisable to use a simple ratio of average cost per inhabitant. Therefore, it is recommended that per capita cost estimates be used in planning Sinai public schools.

**APPENDIX A**  
**REFERENCES AND LIST OF PERSONAL CONTACTS**

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## PERSONAL CONTACTS

Sheikh Attia El Sabah, Bir El Abd, June 1981

Ibrahim Ratah and Ian Green, Culpin & Partners, Ismailia, July 1981

Ali Soliman Abu Zeid, The Arab Contractors, El Tor, July 1981

Yousef Sabri Abou Taleb, Governor of North Sinai, El Arish, July 1981

M. El Zamlat, Bir El Abd contractor, July 1981

Dr. S. Letts, Binnie-Taylor hydrogeologist, June 1981

Dr. Ali Abu Zeid, Sinai Development Authority, July 1981

H. Nour, Mayor of El Tor, July 1981

Mohammed El Hafez Kuraim, El Arish, July 1981

Ahmed Hassan El Reweny, Chairman, Canal Electricity Distribution Company,  
July 1981

Dr. Ibrahim Shetwey, El Arish Hospital, July 1981

Adly El Gamany, Bir El Abd contractor, July 1981

Gareb Ibrahim El Saway, Ministry of Education, July 1981

Moussa El Sabbah, Bir El Abd contractor, July 1981

**APPENDIX B**  
**INFRASTRUCTURE INVENTORY DATA FORM**

# INFRASTRUCTURE INVENTORY

1. Name of Town or Village \_\_\_\_\_
2. Location (crossroads, wadi, etc.) \_\_\_\_\_
3. Number of Inhabitants (estimated, 1981) \_\_\_\_\_
4. Housing Inventory:
  - a) Number of dwellings (total all kinds) \_\_\_\_\_
  - b) Number of houses with one family only \_\_\_\_\_
  - c) Number of multiple dwelling units  
(flats, apartments, worker dormitories):
    - (1) Apartment buildings \_\_\_\_\_
    - (2) Apartment units \_\_\_\_\_
    - (3) Worker dormitories \_\_\_\_\_
    - (4) Other (describe) \_\_\_\_\_
5. Education Inventory:
  - a) Primary schools:\*
    - (1) Number of schools (or rooms) \_\_\_\_\_
    - (2) Number of students \_\_\_\_\_
    - (3) Number of teachers \_\_\_\_\_
  - b) Secondary (high) schools:\*
    - (1) Number of schools (or rooms) \_\_\_\_\_
    - (2) Number of students \_\_\_\_\_
    - (3) Number of teachers \_\_\_\_\_
  - c) Technical schools:\*
    - (1) Number of schools (or rooms) \_\_\_\_\_
    - (2) Number of students \_\_\_\_\_
    - (3) Number of teachers \_\_\_\_\_
6. Health Care Inventory:
  - a) Hospitals and clinics:
    - (1) Number of hospitals\* \_\_\_\_\_

(a) Name _____	No. of beds _____
(b) Name _____	No. of beds _____
(c) Name _____	No. of beds _____

-----  
\*If none in the village, state where people go for such services.

INFRASTRUCTURE INVENTORY (cont'd)

- (2) Number of clinics\* \_\_\_\_\_  
    (a) Name \_\_\_\_\_ Type of service\*\* \_\_\_\_\_  
    (b) Name \_\_\_\_\_ Type of service\*\* \_\_\_\_\_  
    (c) Name \_\_\_\_\_ Type of service\*\* \_\_\_\_\_

- b) Number of pharmacies \_\_\_\_\_  
c) Number of medical personnel \_\_\_\_\_  
    (1) Physicians/surgeons \_\_\_\_\_  
    (2) Dentists \_\_\_\_\_  
    (3) Nurses \_\_\_\_\_  
    (4) Midwives \_\_\_\_\_  
    (5) Other (describe) \_\_\_\_\_  
\_\_\_\_\_

7. Public Safety Inventory:

- a) Number of police stations \_\_\_\_\_  
b) Number of policemen \_\_\_\_\_  
c) Number of fire stations \_\_\_\_\_  
d) Number of firemen \_\_\_\_\_  
e) Type of fire-fighting equipment (describe) \_\_\_\_\_  
\_\_\_\_\_

- f) Number of jails and capacity \_\_\_\_\_

8. Public Welfare Inventory:

- a) Number of orphanages \_\_\_\_\_  
b) Number of orphans \_\_\_\_\_  
c) Number of rest homes \_\_\_\_\_  
d) Number of patients \_\_\_\_\_  
e) Number of asylums for mentally handicapped \_\_\_\_\_  
f) Number of patients \_\_\_\_\_

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\*If none in the village, state where people go for such services.  
\*\*Dentistry, maternity, out-patient care, etc.

## INFRASTRUCTURE INVENTORY (cont'd)

### 9. Utility Inventory:

#### a) Water supply:

(1) What is main source of water for this town or village?

(a) Wells: number sweet \_\_\_\_\_, number brackish \_\_\_\_\_

(b) Tank truck (amount and frequency of deliveries)  
\_\_\_\_\_

(c) River (name) \_\_\_\_\_

(d) Canal (name) \_\_\_\_\_

(e) Pipeline (name) \_\_\_\_\_

(2) What is average total daily consumption in the village?

\_\_\_\_\_ m<sup>3</sup>/day

(3) What water storage facilities are there? \_\_\_\_\_

What is their capacity? \_\_\_\_\_ m<sup>3</sup>

(4) Is there a water purification or treatment plant(s)? \_\_\_\_\_

(5) Is water delivered by pipe to any individual house(s)? \_\_\_\_\_

How many? \_\_\_\_\_

(6) How many public faucets are there in town? \_\_\_\_\_

(7) What is the water supply for livestock and crops in  
the vicinity? \_\_\_\_\_

#### b) Electric power:

(1) Main source of electric power to village (describe--

local generator, transmission line from elsewhere) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

If locally generated, what is capacity of power plant?

\_\_\_\_\_ kilowatts

(2) How many houses and buildings are served with electricity?  
\_\_\_\_\_

(3) What is total average daily consumption of electricity?

\_\_\_\_\_ kilowatt-hours

## INFRASTRUCTURE INVENTORY (cont'd)

c) Motor fuel, kerosene, and butagas:

(1) Main source of gasoline, deisel fuel, and kerosene in village \_\_\_\_\_

(2) Main source of butagas \_\_\_\_\_

(3) What is average daily consumption of fuels?

- gasoline \_\_\_\_\_ liters

- diesel \_\_\_\_\_ liters

- kerosene \_\_\_\_\_ liters

- butagas \_\_\_\_\_ liters

d) Sanitary and waste treatment:

(1) How many houses are served? \_\_\_\_\_

(2) Does the village have sewers and a sewage treatment plant? \_\_\_\_\_

(3) How many houses are served? \_\_\_\_\_

(4) Describe facilities \_\_\_\_\_

(5) How is solid waste and refuse disposed of (town dump, truck, etc.)? \_\_\_\_\_

e) Communications:

(1) Is there telephone service? \_\_\_\_\_

(2) How many telephones are in use? \_\_\_\_\_

(3) How many houses have a radio? \_\_\_\_\_

(4) How many houses have a television? \_\_\_\_\_

10. Recreation and Cultural Inventory:

a) Number of mosques and churches \_\_\_\_\_

b) Number of meeting halls \_\_\_\_\_

c) Number of cinemas \_\_\_\_\_

d) Number of parks \_\_\_\_\_

Total area \_\_\_\_\_

**APPENDIX C**  
**SUPPLEMENTAL INFORMATION:**  
**NEW SETTLEMENTS EAST OF GREAT BITTER LAKE**

MEMORANDUM

TO: D&M  
FROM: A. SHATA  
DATE: 11-4-81  
SUBJECT: DETAILS ABOUT THE EAST SUEZ CANAL PROJECT

Attached herewith are details about the 30,000 F. reclamation project in the East Suez Canal District. Information obtained from the 5-Year Plan of the Ministry of Land Reclamation (1979-83). Certain modifications are expected, particularly with regard to the northward extension of the project area to cover the area of New Mit Abul Kom.

/s/ A. Shata

  
\_\_\_\_\_

## EAST SUEZ CANAL PROJECT

TOTAL AREA: 30,000 F.

RECLAIMED AREA: 1250 F. (up to 1978)

FIVE YEAR PLAN 1979-83: 28,750 F. - According to schedule:

YEAR	FEDDANS
1979	1,000
1980	1,000
1981	6,750
1982	10,000
1983	10,000

LOCATION: East Bitter Lakes

TOPOGRAPHY: Land relief varies from +1 m to +20 m and is generally undulating.

SOILS: Typified by heavy clay with occasional gypsum layers.

IRRIGATION & DRAINAGE: From surface Nile water transported through a siphon with an initial daily capacity of 6.5 million m<sup>3</sup> (has been enlarged). There are pump stations for the successive lifting of water. Sprinkler irrigation techniques will be applied, except for 1,250 F., using basin irrigation.

EXPENDITURE: Project will be financed by the government, and the land will be sold after reclamation to joint venture companies; details are given in Tables.

PROJECT AREA 30,000F

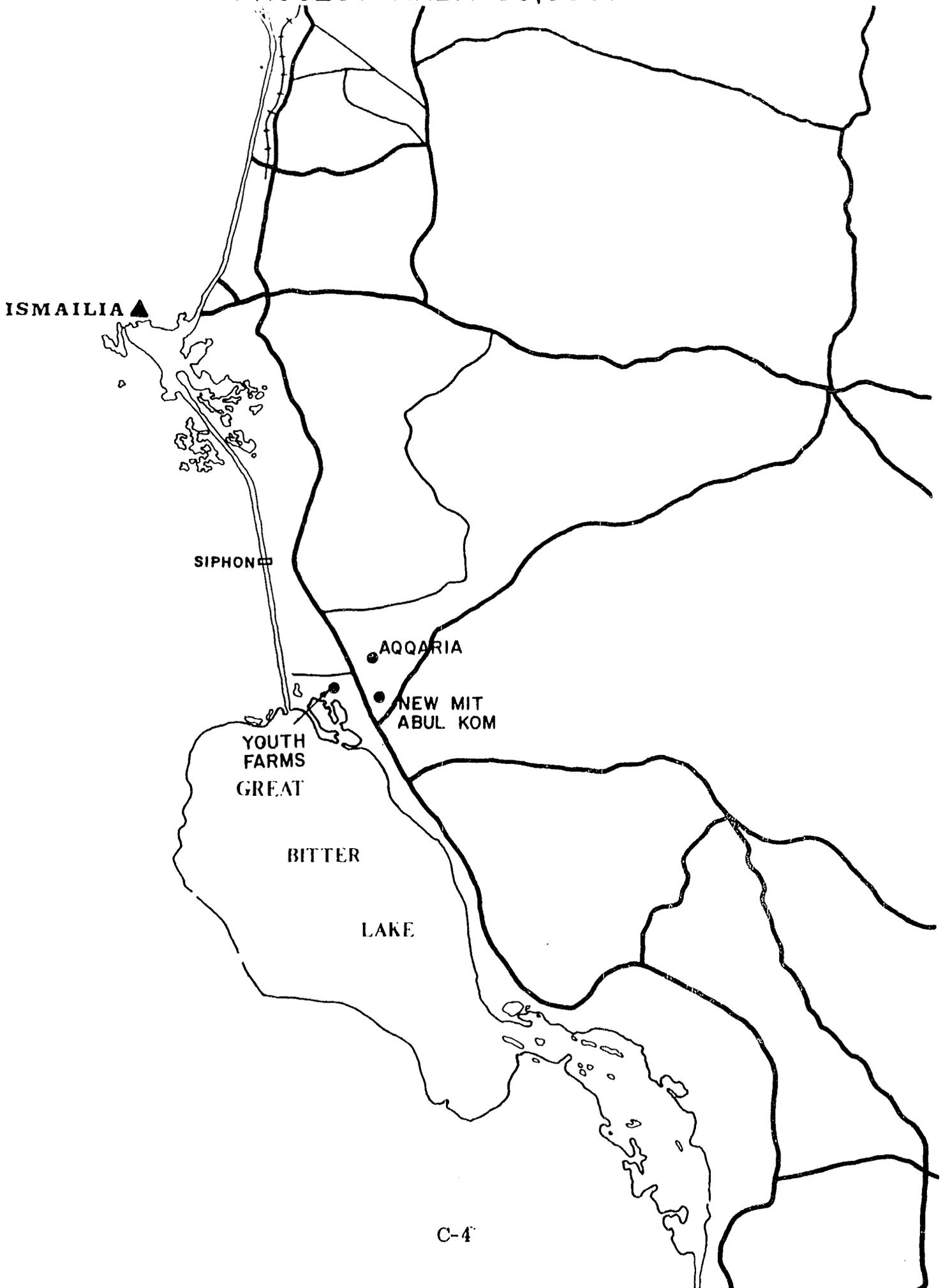


TABLE C-1

## Infrastructure Cost Data, East Suez Canal Project

	Cost Per Feddan (LE)	Five-Year Plan <sup>a</sup> (thousand LE)					Total	Needed After 1983
		1979	1980	1981	1982	1983		
<b><u>Agriculture</u></b>								
Studies	5.0	5.0	5.0	33.7	50.0	50.0	143.7	
Leveling	35.0	35.0	35.0	236.3	350.0	350.0	1,006.3	
Housing	20.0	20.0	20.0	135.0	200.0	200.0	575.0	
<b>SUBTOTAL</b>	<b>60.0</b>	<b>60.0</b>	<b>60.0</b>	<b>405.0</b>	<b>600.0</b>	<b>600.0</b>	<b>1,725.0</b>	
<b><u>Irrigation and Drainage</u></b>								
Studies	5.0	5.0	5.0	33.7	50.0	50.0	143.7	
Canals and Drains	100.0	100.0	100.0	675.0	1,000.0	1,000.0	2,875.0	
Drilling Wells	--	--	--	--	--	--	--	
Station Buildings	25.0	25.0	25.0	168.8	250.0	250.0	718.8	
Irrigation Stations	40.0	40.0	40.0	270.0	400.0	400.0	1,150.0	
Sprinkler	350.0	350.0	350.0	2,362.5	3,500.0	3,500.0	10,062.5	
<b>SUBTOTAL</b>	<b>520.0</b>	<b>520.0</b>	<b>520.0</b>	<b>3,510.0</b>	<b>5,200.0</b>	<b>5,200.0</b>	<b>14,950.0</b>	
<b><u>Electricity</u></b>								
Main Lines	50.0	50.0	50.0	337.5	500.0	500.0	1,437.5	
Branches	40.0	40.0	40.0	270.0	400.0	400.0	1,150.0	
Station Buildings	10.0	10.0	10.0	87.5	100.0	100.0	307.5	
Equipment	40.0	40.0	40.0	270.0	400.0	400.0	1,150.0	
<b>SUBTOTAL</b>	<b>140.0</b>	<b>140.0</b>	<b>140.0</b>	<b>965.0</b>	<b>1,400.0</b>	<b>1,400.0</b>	<b>4,045.0</b>	
<b><u>Housing</u></b>								
Laborers	25.0	25.0	25.0	168.8	250.0	250.0	718.8	
Farmers	75.0	--	75.0	75.0	506.2	750.0	1,406.2	750.0
<b>SUBTOTAL</b>	<b>100.0</b>	<b>25.0</b>	<b>100.0</b>	<b>243.8</b>	<b>756.2</b>	<b>1,000.0</b>	<b>2,125.0</b>	<b>750.0</b>

TABLE C-1 (cont'd)

	Cost Per Feddan (LE)	Five-Year Plan <sup>a</sup> (thousand LE)					Total	Needed After 1983
		1979	1980	1981	1982	1983		
<b>Pipelines</b>								
Main Lines	10.0	10.0	10.0	67.5	100.0	100.0	287.5	
Branches	20.0	20.0	20.0	135.0	200.0	200.0	575.0	
SUBTOTAL	<u>30.0</u>	<u>30.0</u>	<u>30.0</u>	<u>202.5</u>	<u>300.0</u>	<u>300.0</u>	<u>862.5</u>	
<b>Communication and Transport</b>								
Main Lines	--	--	--	--	--	--	--	
Branches	80.0	80.0	80.0	540.0	800.0	800.0	2,300.0	
SUBTOTAL	<u>80.0</u>	<u>80.0</u>	<u>80.0</u>	<u>540.0</u>	<u>800.0</u>	<u>800.0</u>	<u>2,300.0</u>	
<b>Services</b>								
Health	8.0	--	8.0	8.0	54.0	80.0	150.0	80.0
Education	12.0	--	12.0	12.0	81.0	120.0	225.0	120.0
Religion	1.0	--	1.0	1.0	6.7	10.0	18.7	10.0
Security	1.0	--	1.0	1.0	6.7	10.0	18.7	10.0
Social	2.0	--	2.0	2.0	13.5	20.0	37.5	20.0
Others	1.0	--	1.0	1.0	6.7	10.0	18.7	10.0
SUBTOTAL	<u>25.0</u>	<u>0</u>	<u>25.0</u>	<u>25.0</u>	<u>168.6</u>	<u>250.0</u>	<u>468.5</u>	<u>250.0</u>
TOTAL	<u>955.0</u>	<u>855.0</u>	<u>955.0</u>	<u>5,891.0</u>	<u>9,224.8</u>	<u>9,550.0</u>	<u>26,476.0</u>	<u>1,000.0</u>

<sup>a</sup>28,750 feddans scheduled for reclamation during the 5-year plan--1,000 in 1979, 1,000 in 1980, 6,750 in 1981, 10,000 in 1982, 10,000 in 1983.