EGYPT NUPS

دراسة السياسة القومية للتنمية الحضرية

NATIONAL URBAN POLICY STUDY

INTERIM ACTION REPORT

ON

THE NATIONAL URBAN POLICY STUDY

U.S.A.I.D. GRANT NO. 263 — 0042

PREPARED FOR THE

ADVISORY COMMITTEE FOR RECONSTRUCTION

MINISTRY OF DEVELOPMENT

ARAB REPUBLIC OF EGYPT

PADCO, INC.

WITH

ENGINEERING CONSULTANTS GROUP

AND

SHERIF EL-HAKIM AND ASSOCIATES

JANUARY 31, 1981

INTERIM ACTION REPORT

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Prepared for:

Advisory Committee for Reconstruction
Ministry of Development

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January 31, 1981

دراسة السياسة القومية للتنمية الحضرية

NATIONAL URBAN POLICY STUDY

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١١ شارع الدكتور المحروقى – مصر الجديدة

January 31st, 1981

Engineer Soliman Abdel Hai
Chairman,
Advisory Committee for Reconstruction
Cairo - Egypt

Dear Eng. Abdel Hai,

It is a pleasure to submit this Interim Action Report (Sub-Task 1.3.4 and 1.6.3 modified as agreed upon in the Status Report) for review. This Report contains an initial set of four alternative settlement patterns by the year 2000 for consideration by the GOE and discussion with the National Urban Policy Study Team; in order to begin the process of determining which national urban policy strategies are both feasible and most consistent with the Government's policy objectives.

As indicated in earlier submissions, there is no one policy set or settlement pattern which is likely to be the best choice to achieve all policy objectives. Consequently, we have presented a range of possible alternatives which are likely to have different mixes of benefits and costs.

The major objectives for urban policy are those of national policy:

1. Achievement of high rates of economic growth;
2. Enhancement of social justice through inter-personal and inter-regional equity;
3. Protection of arable land; and
4. Reduction of the adverse consequences of over-concentration in Cairo.

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PADCO INC
In Association with
ECG ENGINEERING CONSULTANTS GROUP
&
SHERIF EL-HAKIM & ASSOCIATES

بادكـــو انك
بالاشـــتراك مـــع
جمـاعة المهندســين الاستشاريين
و
شريف الحـكيم ومشـاركوه

The settlement patterns described in this paper are mixed strategies, which range from an emphasis in relatively concentrated investment patterns to relatively decentralized patterns. The individual patterns are based upon strategic settlement concepts developed in Chapter I of the Report and the analysis of growth potential and absorption capacity of settlements in Chapter II.

Several important issues for governmental choice have already emerged from this work:

1. Even under fairly optimistic economic growth assumptions for the nation, there are likely to be serious competing demands for industrial and commercial expansion, infrastructure development (maintenance, upgrading, new capacity) and expansion of agrictultural output. The achievement of any desirable settlement pattern will require significant urban investment for both job creation and service provision.

2. Given the expected substantial increase in urban population, most existing urban areas will have to plan for increased density within their existing boundaries; if cultivated land is to be protected from urban encroachment.

3. The Cairo Metropolitan Area is likely to grow substantially under any alternative; necessitating major choices about the form that growth will take -- in-fill of existing areas, fringe or corridor development, sattelite cities or new nuclei at greater distance from the core.

4. Since the demands on available resources are likely to be high, priorities will have to be set among places, target groups of the population, and investment types and standards (industry, infrastructure) for new capacity and maintenance; if the ultimate investment packages are to lead to the achievement of a desired settlement pattern.

We lood forward to discussing these and other implications of our work to date at your earliest convenience.

Sincerely,

Harvey A. Garn

Harvey A. Garn
Team Leader

MG/lf

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INTRODUCTION

In accordance with the Analytical Framework of the Study as contained in the Status Report of October 30, 1980, this Report presents a set of four alternative conceptual settlement patterns, each of which is theoretically capable of accommodating estimates of Egypt's urban population in the year 2000. It should be stressed that these alternatives have been selected as the basis for an initial dialogue with the Government. It is anticipated that a reduced set of alternatives will emerge, which will be costed and evaluated in subsequent phases of the Study.

The settlement pattern alternatives presented in this Report are themselves, of course, the results of a considerable reduction process based on (i) general and specific settlement strategies, (ii) empirical investigations of settlement conditions throughout Egypt, and (iii) the momentum of major urban development programs currently underway. These factors, discussed in the first two chapters of the Report, combine to generate the outputs contained in Chapter III: the Alternative Settlement Patterns.

Chapter I discusses six basic settlement concepts which are relevant both to the settlement problems unique to Egypt — such as urban development constraints imposed by the scarcity of arable land — and to those which Egypt shares with many other parts of the world — such as primate city overconcentration. These basic strategies, which are combined in different degrees and emphases in the Alternative Settlement Patterns, are population redistribution strategies, implemented primarily by shifts in the spatial distribuion of investment and employment. The principal advantage gained from the use of such strategies is that they provide first-order approximations to national settlement patterns based on their relative concern with achieving economic efficiency, inter-regional equity and other social objectives. Thus, the settlement strategies discussed in Chapter I range from relatively concentrated to relatively dispersed patterns.

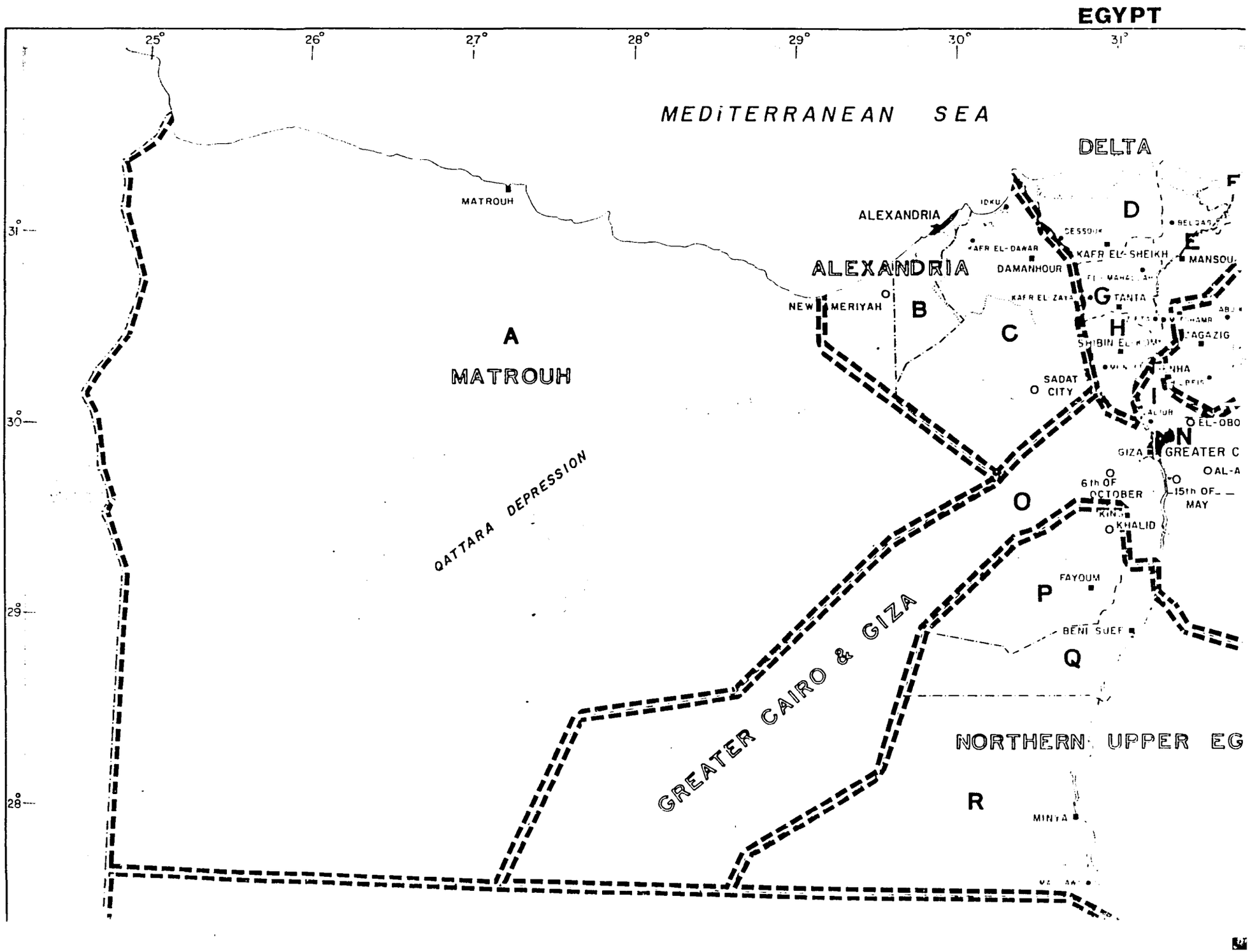
Since the (non-specific) settlement concepts contain only general prescriptions regarding concentration vs. dispersal, growth

poles vs. countermagnets, etc., the settlement analysis is pushed a step further in Chapter II, which addresses the empirical question of which specific locations in Egypt are best suited to accommodate future increases in urban population and employment under any given combination of the basic settlement strategies. To identify these locations, profiles of economic growth potential and absorption capacity are presented for nine urban planning zones and the major urban places within them. The settlement profiles consist of a combination of statistical information and impressions gained from field investigations conducted throughout Egypt over the last three months.

The second major empirical contribution to the task of generating the alternative settlement patterns is contained in Appendix I in the form of 20-year demographic and economic projections. While these include "order of magnitude" estimated of Gross Domestic Product, Gross Investment and Employment by five sectors, the most important at this stage of the Study are the demographic projections which estimate Egypt's total and urban populations in the year 2000 to be 67.5 million and 37 million respectively. Hence, an addition of 21 million to the present urban population constitutes our present estimate of the size of the settlement task.

Chapter III describes the Urban Settlement Pattern Alternatives. Again, these are the basic outputs of this Report and the candidates for GOE consideration. The four Alternatives described are each designed to accommodate the estimated 21 million increase in the urban population by the end of the century, and are each invariant with respect to a number of specific settlement objectives, the most significant of which is for the conservation of arable land in both the Delta and the Nile Valley. The Alternatives vary, therefore, in accordance with the emphasis on social objectives given by a particular combination of general settlement strategies.

Map 1 shows the governorate and current planning regions in Egypt while Map 2 shows the proposed NUPS Urban Settlement Zones. These maps are found at the back of the report. These settlement zones, which are used throughout the report to structure the report, are being suggested as possible spatial zones for locating population according to different settlement strategies which might be pursued by government.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ALEXANDRIA
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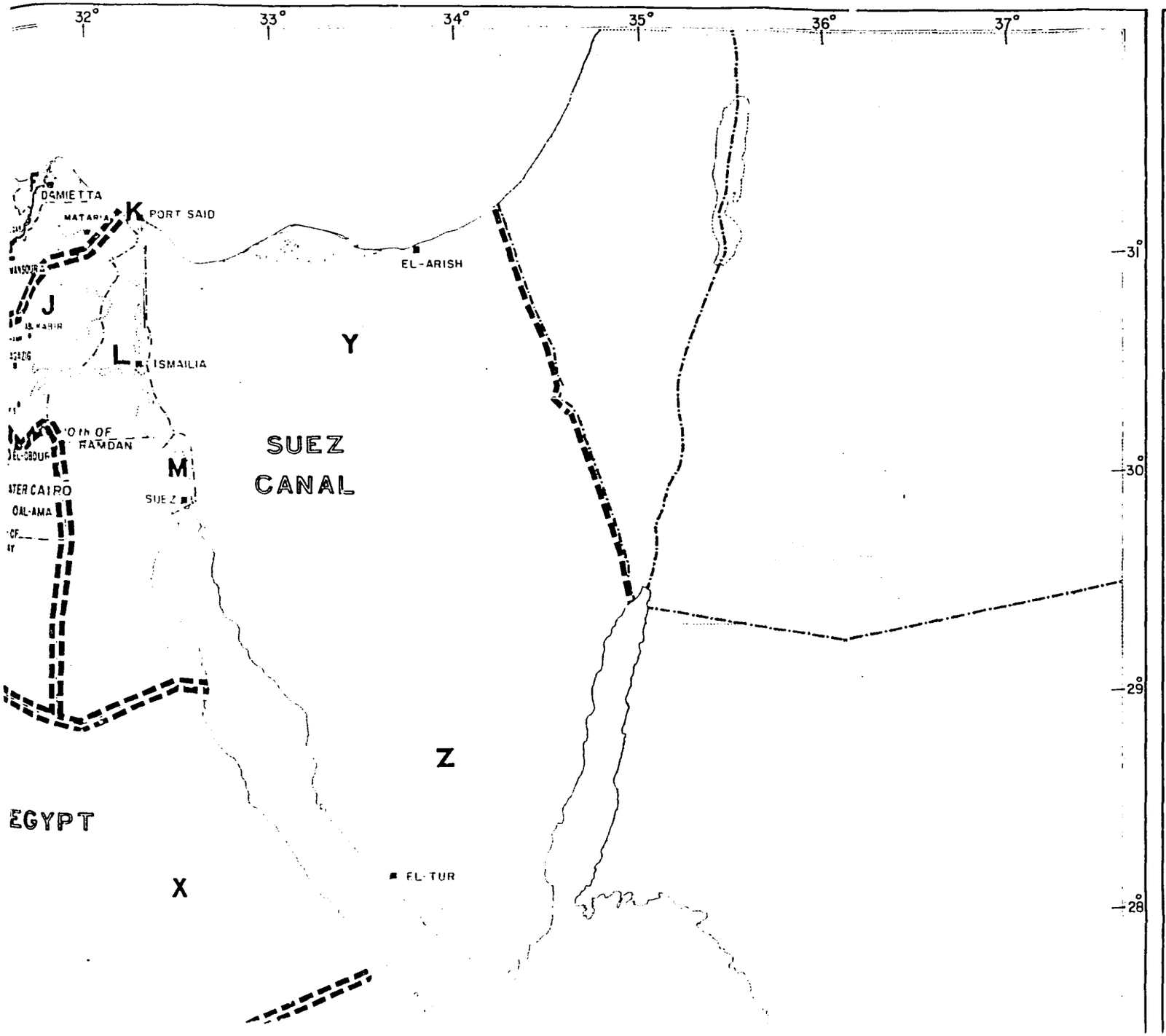
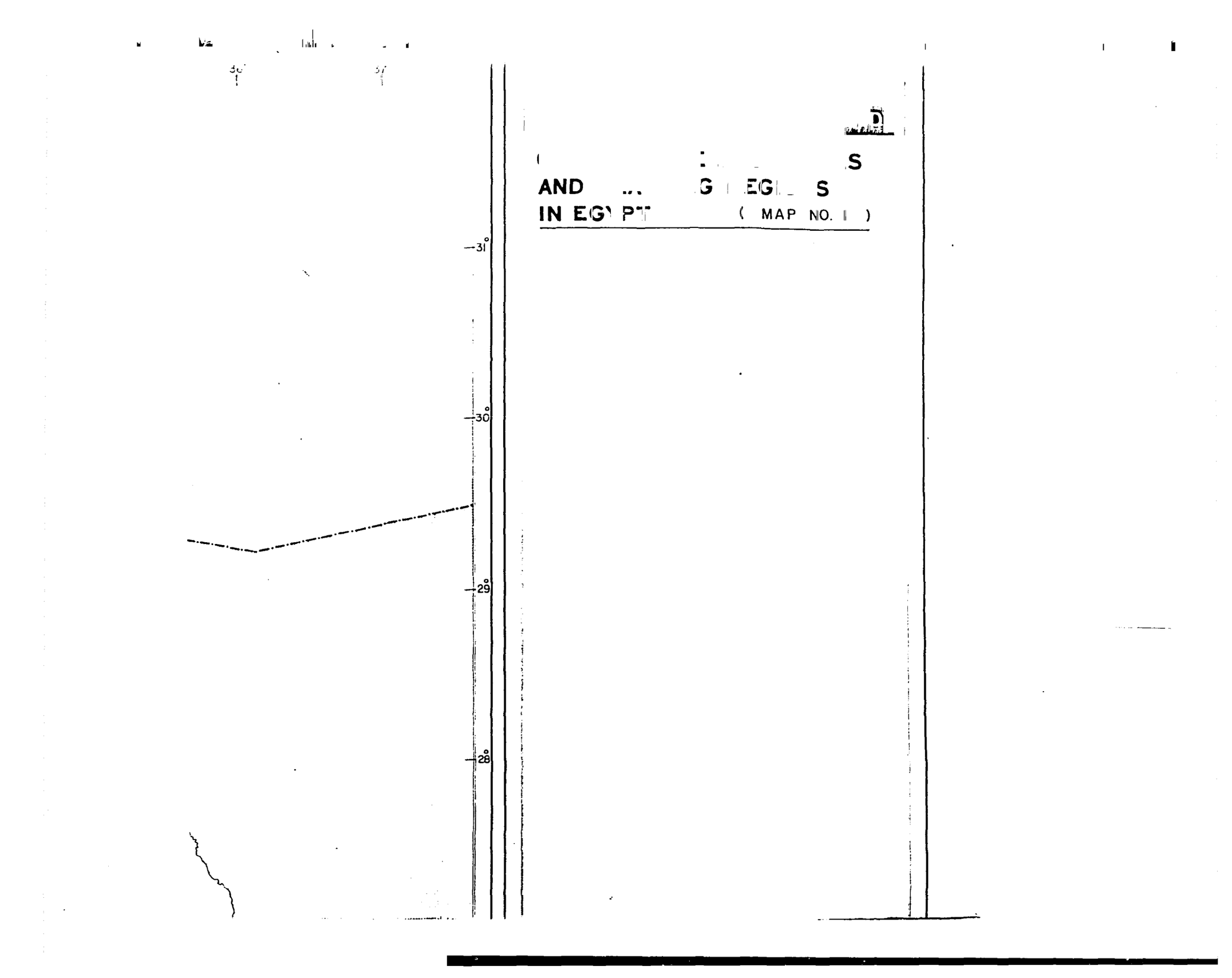


EGYPT NUPS

GOVERNORAT AND PLANNIN IN EGYPT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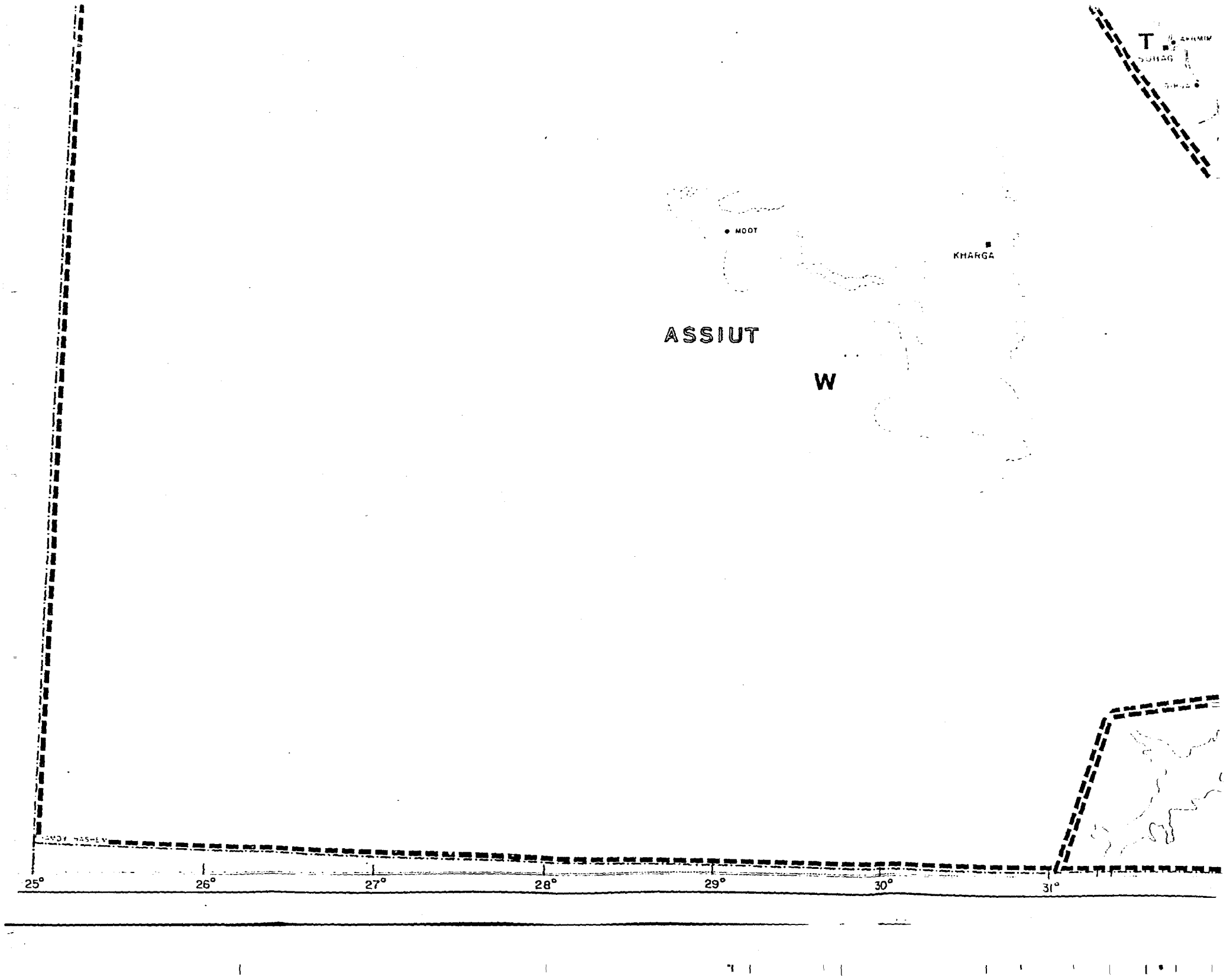
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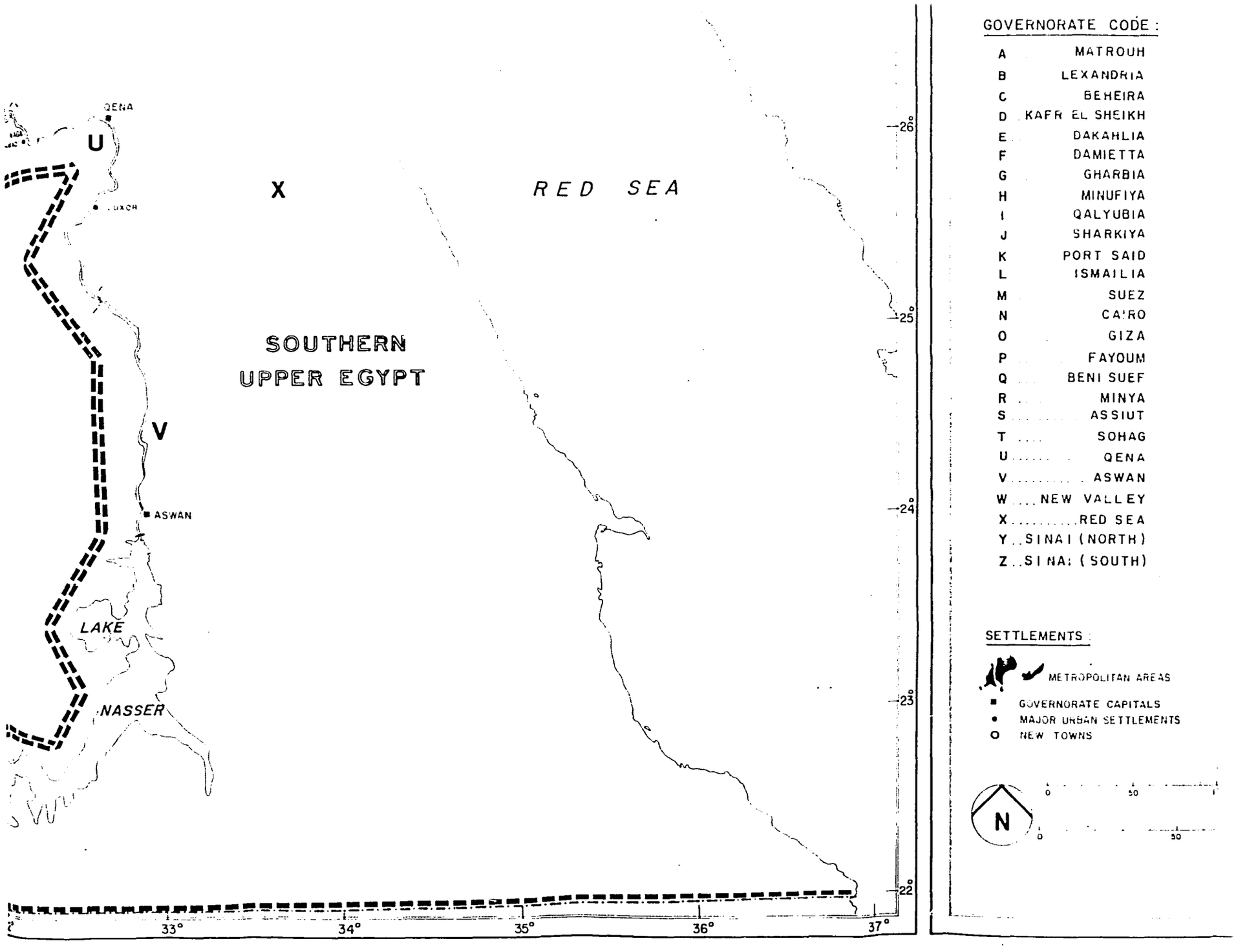
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GOVERNORATE CODE :
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B LEXANDRIA
C BEHEIRA
D KAFR EL SHEIKH
E DAKAHLIA
F DAMIETTA
G GHARBIA
H MINUFIYA
I QALYUBIA
J SHARKIYA
K PORT SAID
L ISMAILIA
M SUEZ
N CAIRO
O GIZA
P FAYOUM
Q BENI SUEF
R MINYA
S ASSIUT
T SOHAG
U QENA
V ASWAN
W NEW VALLEY
X RED SEA
Y SINAI (NORTH)
Z SINAI (SOUTH)
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METROPOLITAN AREAS
GOVERNORATE CAPITALS
MAJOR URBAN SETTLEMENTS
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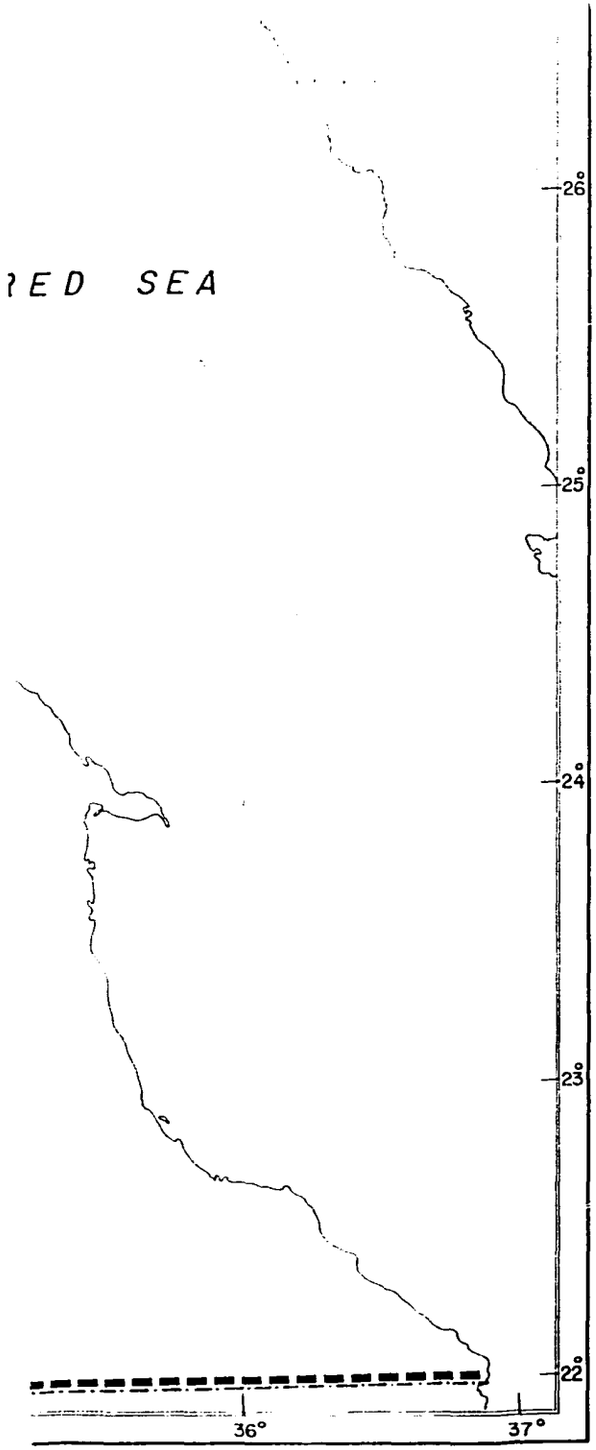

GOVERNORATE CODE :

A	MATROUH
B	LEXANDRIA
C	BEHEIRA
D	KAFR EL SHEIKH
E	DAKAHLIA
F	DAMIETTA
G	GHARBIA
H	MINUFIYA
I	QALYUBIA
J	SHARKIYA
K	PORT SAID
L	ISMAILIA
M	SUEZ
N	CAIRO
O	GIZA
P	FAYOUM
Q	BENI SUEF
R	MINYA
S	ASSIUT
T	SOHAG
U	QENA
V	ASWAN
W	NEW VALLEY
X	RED SEA
Y	SINAI (NORTH)
Z	SINAI (SOUTH)

SETTLEMENTS :

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• MAJOR URBAN SETTLEMENTS

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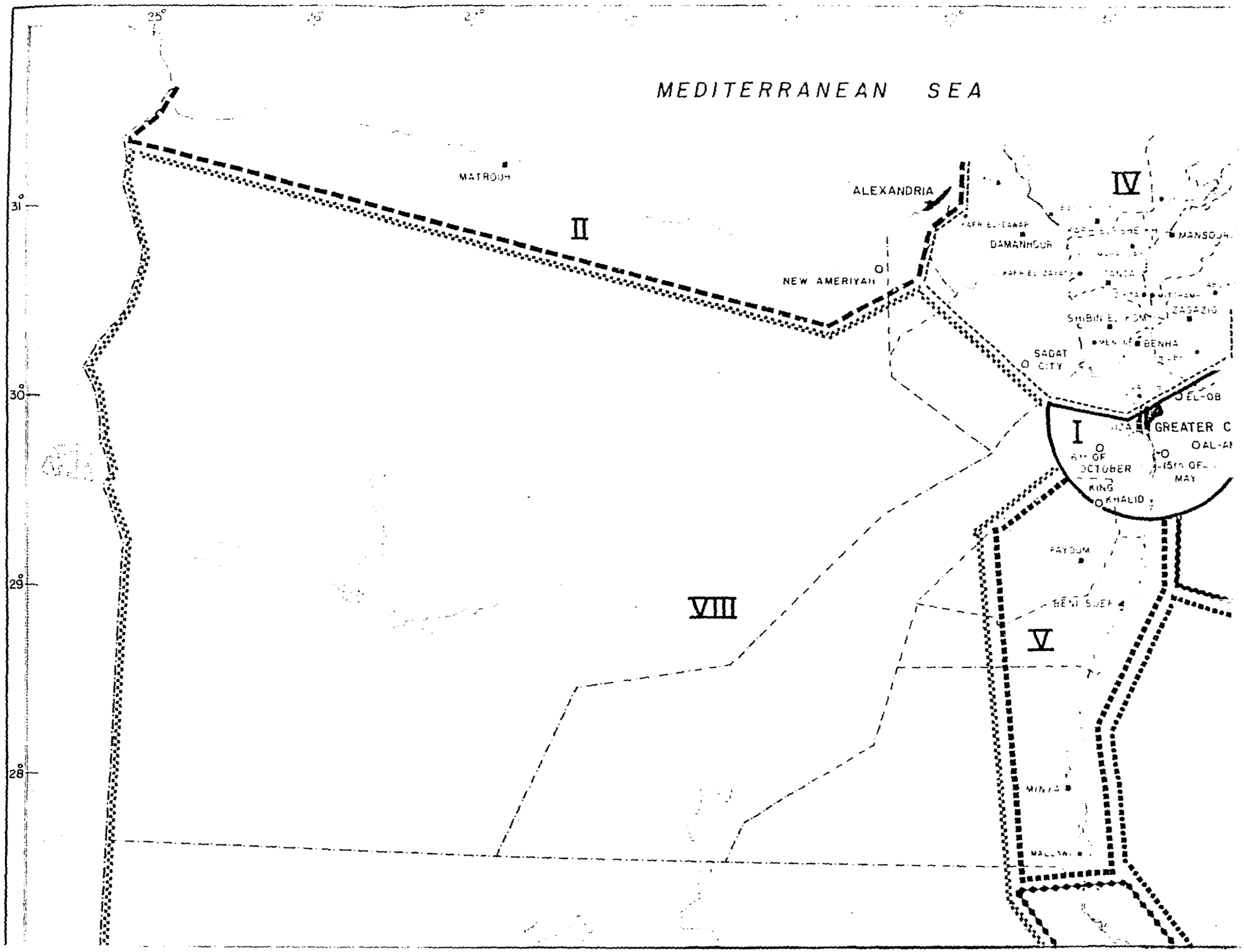
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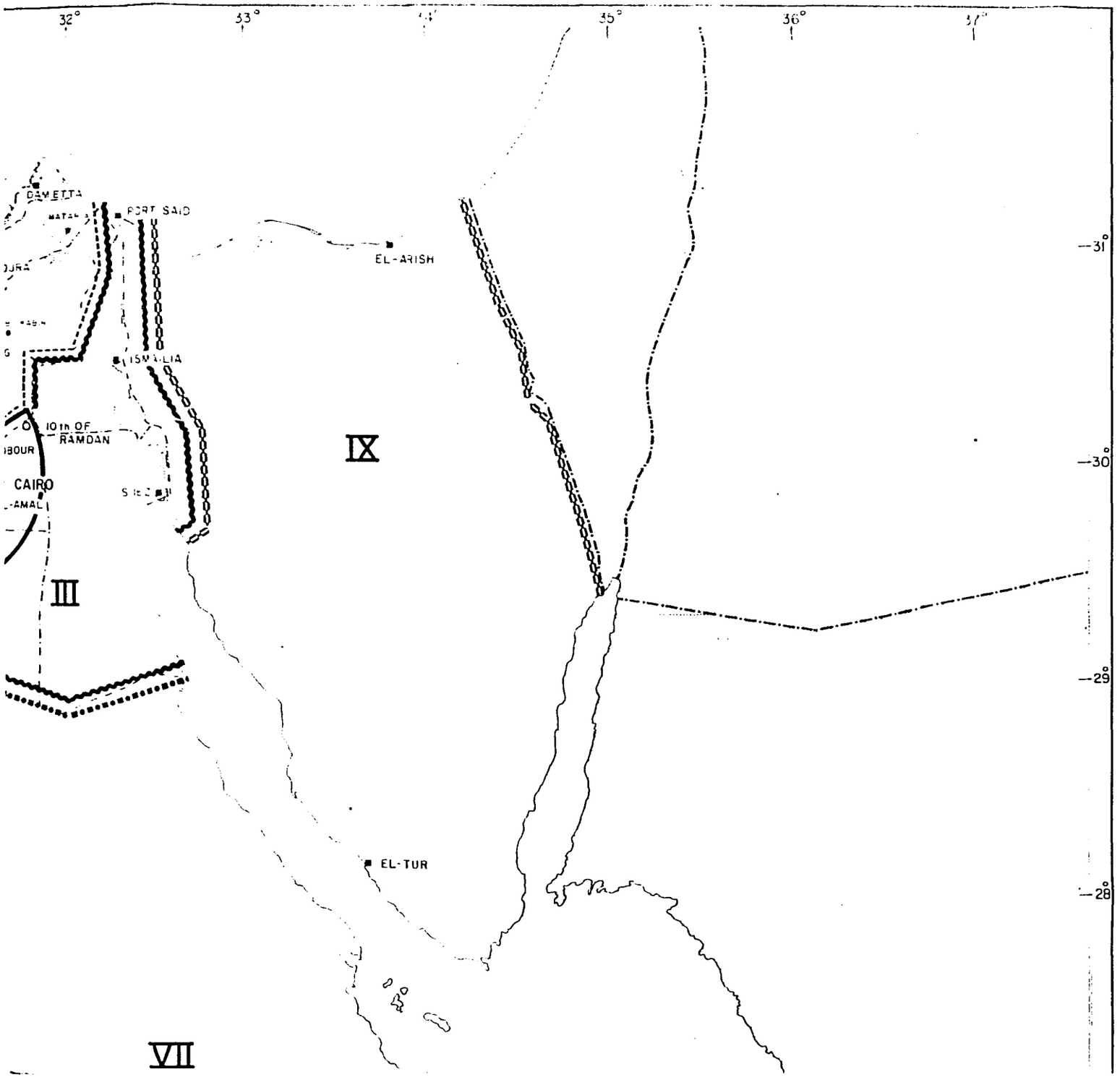

EGYPT

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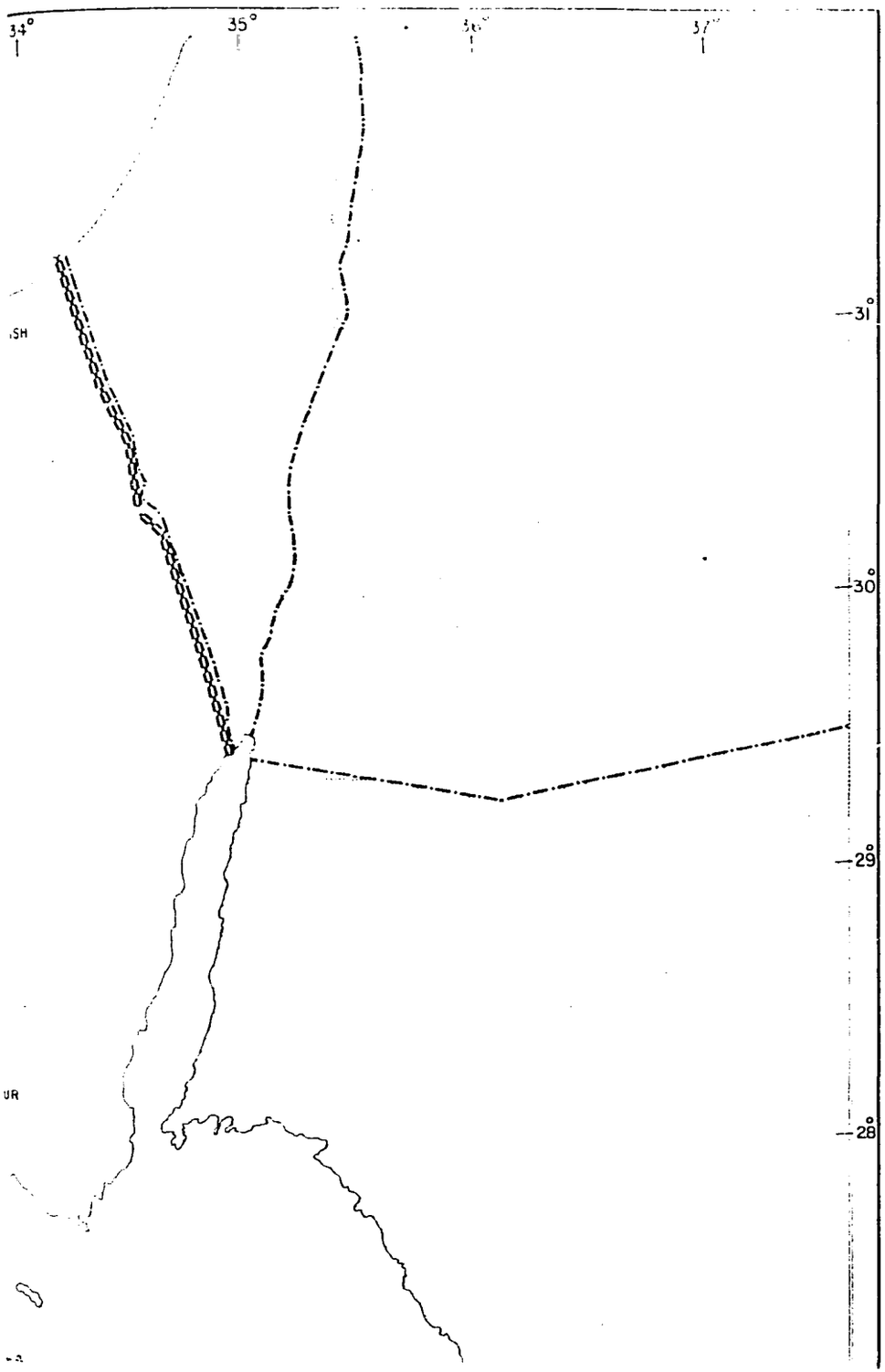
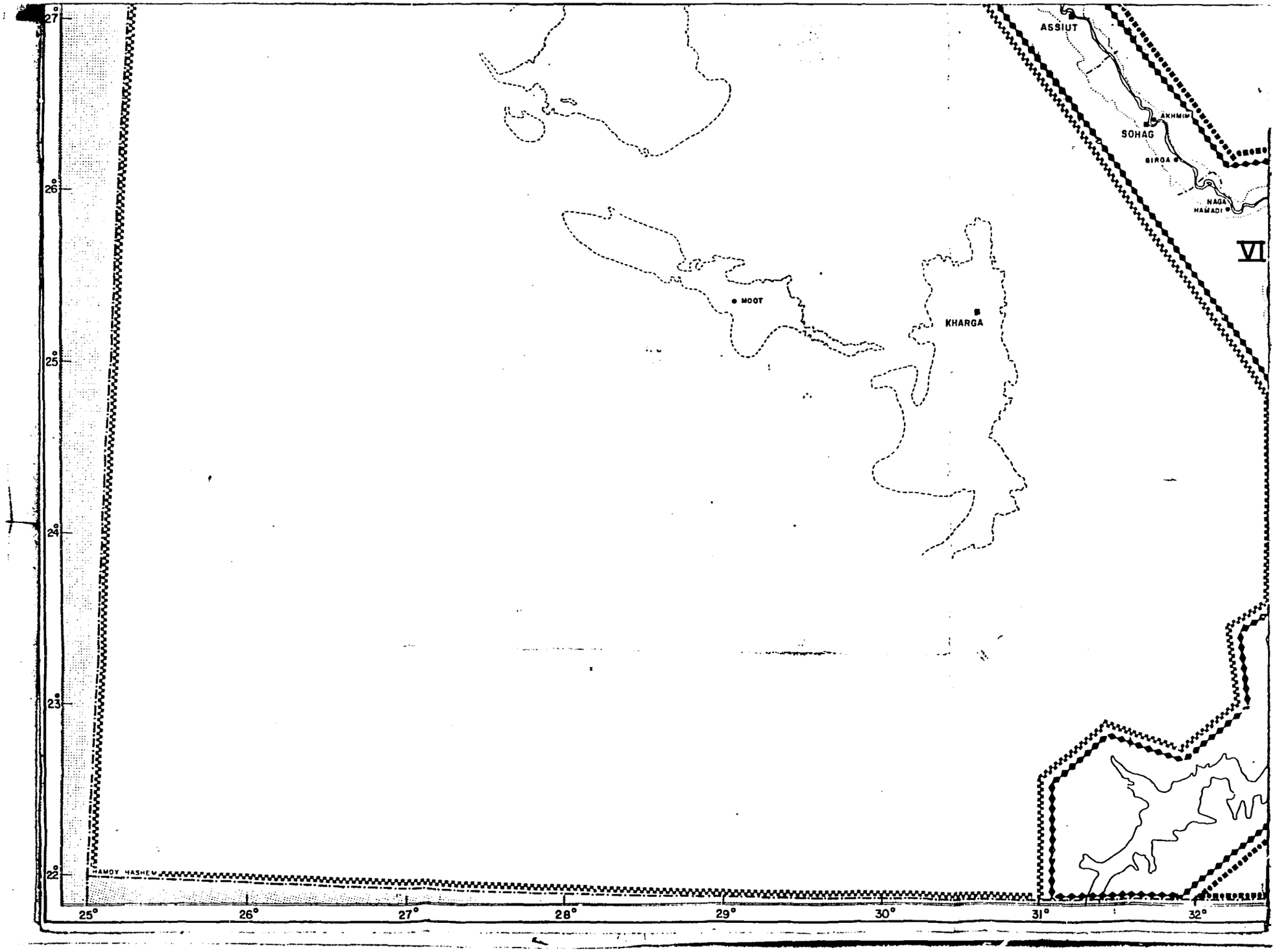


SETTLEMENT ZO ES IN EGYPT

(MAP NO. 2)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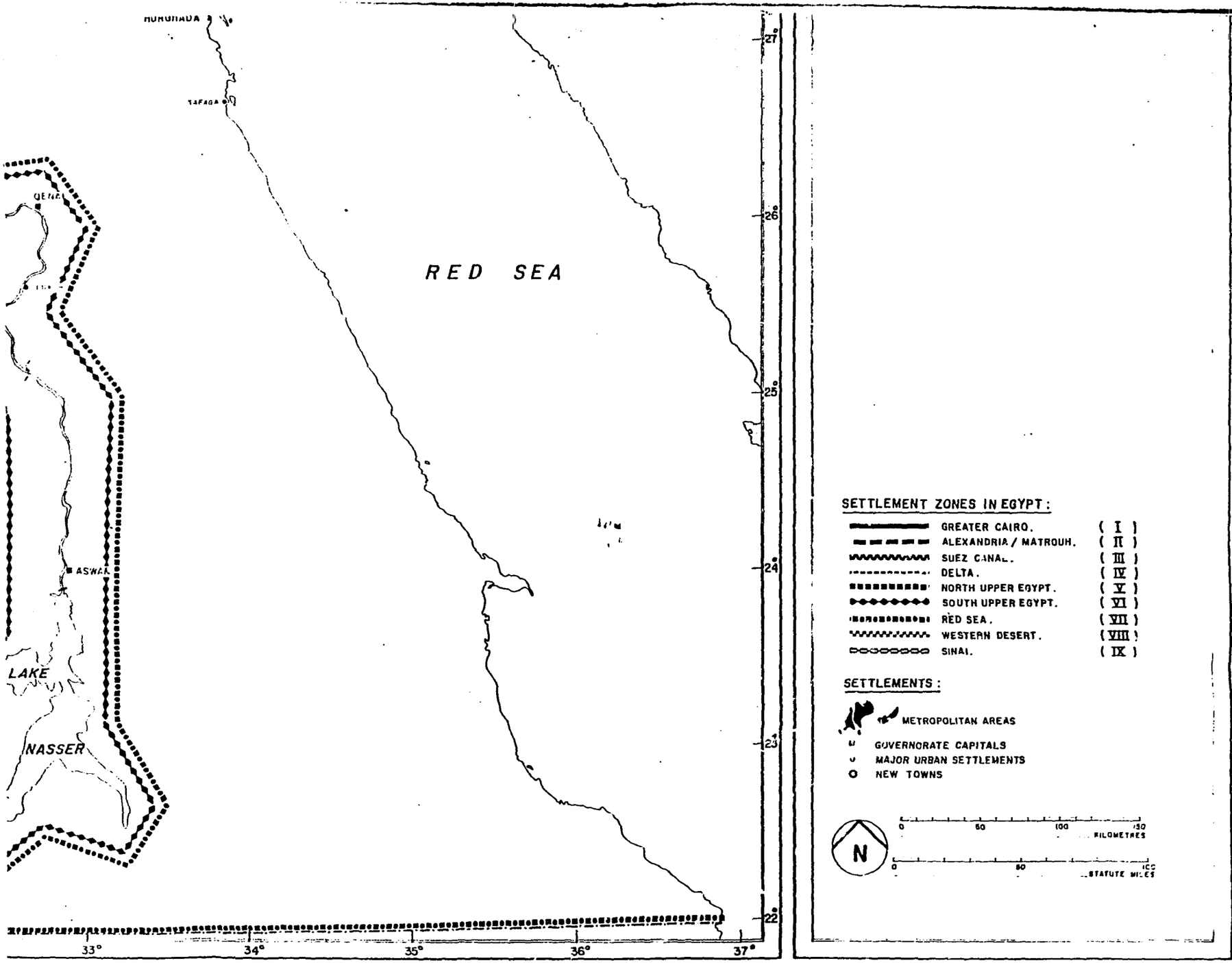
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SETTLEMENT ZONES IN EGYPT:
GREATER CAIRO. (I)
ALEXANDRIA / MATROUH. (II)
SUEZ CANAL. (III)
DELTA. (IV)
NORTH UPPER EGYPT. (V)
SOUTH UPPER EGYPT. (VI)
RED SEA. (VII)
WESTERN DESERT. (VIII)
SINAI. (IX)
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MAJOR URBAN SETTLEMENTS
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CHAPTER I

THE BASIC SETTLEMENT CONCEPTS

This chapter examines the objectives and spatial implications of a number of basic settlement concepts. It will be used to dimension the set of alternative settlement patterns presented in Chapter III. The concepts themselves fall into two distinct classes: those which respond to settlement problems unique to Egypt, and those which respond to settlement problems that Egypt shares with other nations in both the developed and developing worlds.

The use of a multiple-strategy approach is necessary not only because of the existence of special urban problems but also, as pointed out in the Status Report, because no single settlement strategy has yet been identified which at once satisfies all of the major goals of society. This is due chiefly to the fact that settlement strategies are essentially population redistribution strategies implemented by shifts in the spatial distribution of investment and employment. Towards attaining the goal of economic efficiency, some strategies require relatively concentrated spatial distributions; in pursuit of inter-regional equity, others require relatively dispersed spatial distributions. Thus, a universal technical solution would only exist if (i) all nations experienced the same kind of urban problems, and if (ii) governments sought only to promote a single social objective. Because the world is far more complex, all well-articulated national urban policies are multi-strategic in content.

The problem is to find that combination of settlement strategies which respond to local urban problems of a unique nature and which best satisfy the multiple goals of the society in question. Because these societal goals are competing goals, any given combination will necessarily involve compromise in the form of basic trade-offs between economic efficiency and inter-regional equity. In formulating national urban policy, therefore, a two-part process must be undertaken that (1) establishes dimensions of alternative sets of strategies which vary in emphasis along an efficiency/equity continuum, so that (2) the most appropriate alternative(s) may be selected from the range of options. The role of the former is played

by technical analysis; the role of the latter, by governmental decision-making.

This chapter initiates the technical analysis part of this process by identifying six (6) basic settlement concepts for Egypt which will be combined with empirical inputs later in the Report to generate the alternative settlement patterns for GOE consideration. The discussion begins by considering the concepts unique to Egypt.

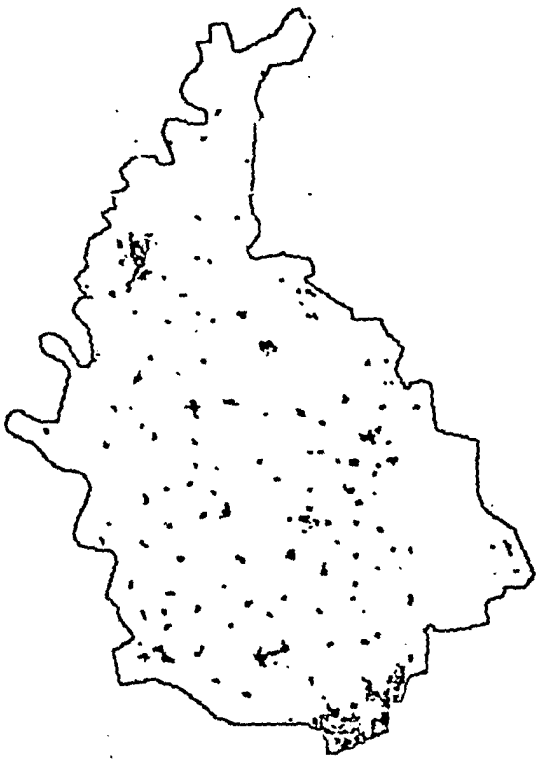
Conservation of Arable Land

A strategy of arable land conservation through the containment of urban encroachment may well represent the single most important component of a national urban policy for Egypt. It is based on harsh Egyptian realities that have witnessed a rapidly growing population whose settlement on scarce arable land have combined to contribute to food shortages. Currently a Food Security Program is of high national priority.

Frequently stated estimates indicate that 40,000 to 60,000 feddans, or 1 to 3 percent, of prime arable land are lost each year to urban encroachment.

A more exact estimate of the loss of arable land to urbanization will, hopefully, be obtained from landsat analysis of the Delta and Nile Valley areas. The first experimental results are shown in the landsat maps on the following pages. The landsat photographs show Qalyubia Governorate boundaries in blue superimposed on the landsat image. Urban centers and settlements are shown in yellow. The first image was made in 1972 and the second image was made in 1978. The third image shows in green areas in which new urbanization between 1972 and 1978 has taken place. The final diagram page indicates the same information as a digital computer print out.

Table 1 indicates the change data in feddans during the six year period. Altogether 6,732 feddans of arable land were lost to urbanization. This represents 3.33 percent of the total arable land. Urbanization occured at an average rate of a little over one half of one percent per year. While somewhat less than other estimates it



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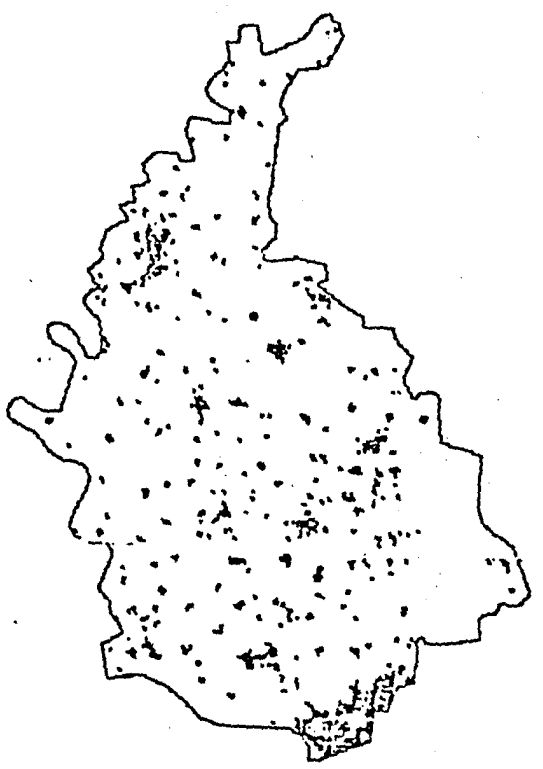
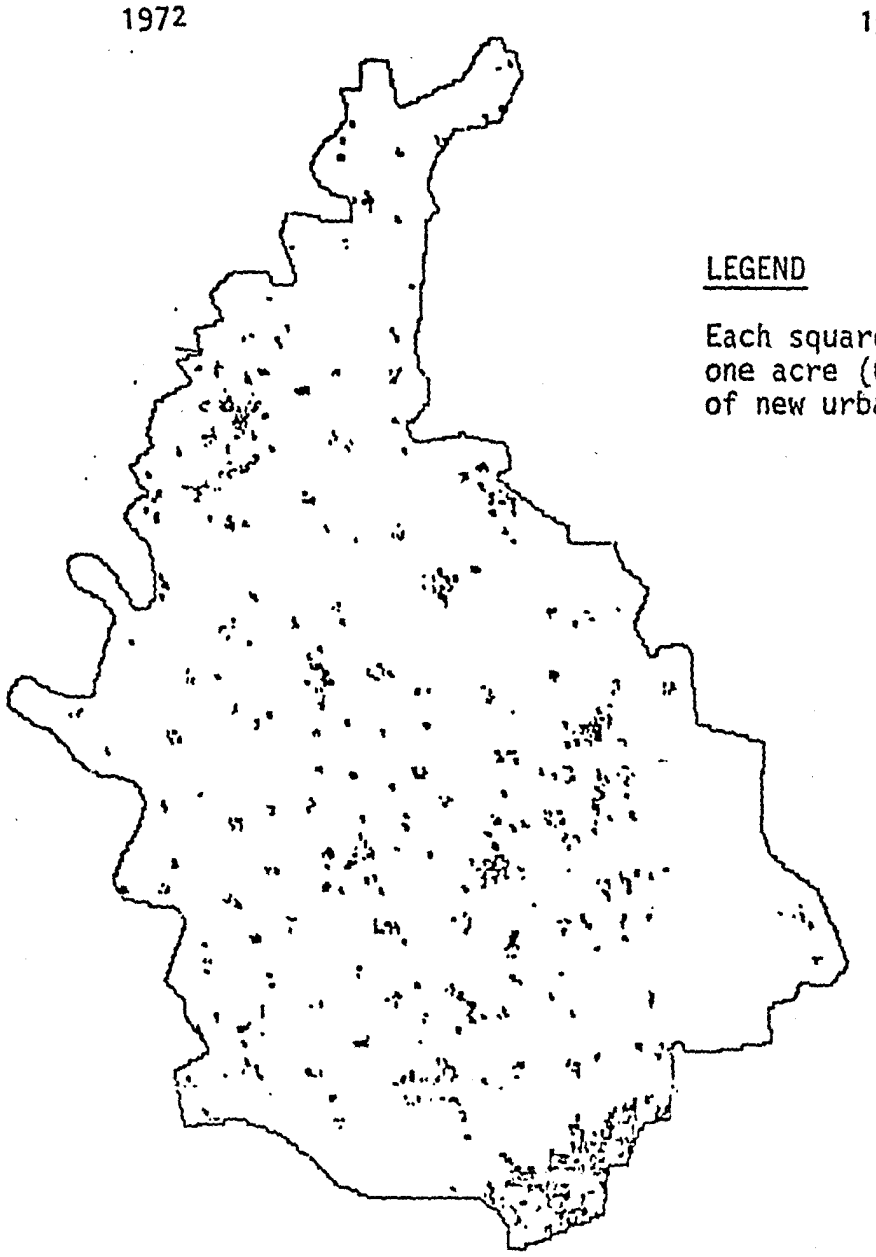


1978



LEGEND

Each square dot equals one acre (0.96 Feddans) of new urban growth.

still represents a most serious problem for Egypt.

TABLE 1

LANDSAT DERIVED LAND USE STATISTICS IN FEDDANS

QALYUBIA GOVERNORATE

Class	1972	1978	Change
Urban	7,295	14,125	+ 6,830
Water	9,343	9,343	-
Agiculture	203,429	196,647	< 6,782 >
Bare	8,927	8,879	< 48 >
Total	228,994	228,994	-

Land reclamation and associated infrastructure, though vigorously pursued by Government, has simply not kept pace with encroachment. Between 1952 and 1978 a total of 915,000 feddans were reclaimed — an annual rate of about 35,000 feddans. However, according to Professor Weidemann:

> Only 770,000 feddans of this area are considered cultiviable. Of the cultivable area, large areas either have not been brought into cultivation or have subsequently reverted to desert. Thus no firm figures are available concerning the actual amount of land reclaimed. It has been stated that only about 60% of land having been reclaimed is actually under cultivation. (Thus) a more realistic figure might be 460,000 feddans.1/

Even more disheartening is the more recent record of land reclamation: between 1970 and 1978, a total of only 48,000 feddans have been reclaimed — an annual rate of just 6,000 feddans.

Aside from its lower productivity, the major problem with land reclamation as a solution to urban encroachment is its high cost. Our estimate of the current cost of reclaiming a single feddan is in the region of L.E. 1900 (although it can go as high as L.E. 4200 per feddan as in the case of the West Nubariya Extension). Thus, if it is assumed that about 50,000 feddans are lost to urban encroachment each year, the total cost to Government of reclaiming an equal amount would be L.E. 95 million. Since it is well known that production on reclaimed land has lower yields, the actual cost would be several times

higher to replace production losses.

While the loss of agricultural land to urban uses is perhaps most acutely felt in the prime agricultural area of the Delta, it is also a serious problem throughout the Nile Valley. The strategy of arable land conservation is therefore proposed for all agricultural land. As a first step in its implementation, the strategy calls for a moratorium on industrial and institutional location on agricultural land. The Government clearly has the power to influence these location decisions and while all infringement on arable land is probably beyond present control, a ban on industrial usurpation of agricultural land would prevent or discourage the associated use of such land by commercial and residential activities.

In this connection, for example, the development of a new port at Damietta would threaten a substantial amount of prime arable land. Such development would lead to a corridor of non-agricultural, strip development in the direction of Mansura that would eventually be similar in nature to the Benha-Alexandria corridor.

Conservation of Delta land should be served by other measures as well. Direct observation of the Delta strongly suggests that its central place hierarchy is currently very inefficient due to a substantial duplication of functions in the lower-order urban settlements. This inefficient and land-consuming pattern could largely be overcome by selective expansion of the system of feeder roads, a need that is frequently confirmed by local public officials. Investment in feeder roads would permit greater local access to the higher-order centers, and would reduce the pressures for minor level settlement expansion.

Absorptive Capacity Improvement

The second settlement concept of special importance to Egypt concerns the need to improve the absorptive capacity of the major urban settlements. Given the large expected increases in the size of the urban population over the next 20 years, it would surely appear that the population redistribution concepts will have to be supplemented by preparing for population increases in the existing urban centers — particularly in Cairo, Alexandria and in the Canal cities.

Implementation of a strategy to improve absorptive capacity normally proceeds with an attempt to identify wasteful or non-urban land uses as candidates for conversion. Ordinarily, this kind of search proves to be rather difficult but, in the case of Egypt's major cities, it is relatively easy since military occupation of important land is extraordinarily widespread and on the increase. If some or all of these military installations could be relocated outside the cities on non-arable land, the pattern of urban development could be substantially rationalized, and the capacity of the major centers to absorb additional increases in population could be greatly improved.

Absorptive capacity improvement and arable land conservation, then, represent the two special settlement concepts that will be covered in this project. The following settlement concepts address those kinds of urban problems that Egypt shares with other nations.

Intra-Regional Deconcentration.

The objective of this strategy, which is called intra-regional deconcentration, is to provide a solution to the very difficult problem of primate city overconcentration within the region of the primate city itself.

Overconcentration of the primate city is a widespread problem usually found in the world's great service centers which, for the most part, are national capitals housing the machinery of central governments. Because the presence of these governments creates a strong locational attraction for most other kinds of industries as well, substantial "economies of agglomeration" have been realized and the growth of primate cities has flourished. Unfortunately, this record of spatial concentration has not occured without side effects; beyond a certain "optimal" city size, urban scale diseconomies, notably congestion, begin to (i) impair the efficient functioning of the urban core, (ii) create visible social problems; and (iii) give rise to an inefficient use of the urban periphery in the form of sprawl.

Until fairly recently, the standard prescription for dealing with primate city overconcentration came in the form of national urban policies based on decentralization, an inter-regional approach intended to

limit primate city growth by programs to deflect employment away from the capital city to secondary cities and "growth poles". Decentralization derived political support from popular beliefs that national capitals were simply too big; it derived theoretical support from academic beliefs concerning optimal city size and growth pole analysis.

Beginning in 1965, however, a uniquely different approach to primate city overconcentration was pioneered by the French in their celebrated program of deconcentration, or "decerrement". Decerrement, an intra-regional strategy basic to the official plan of the Region of Paris — the Schema Directeur, is a dispersal strategy that features the deployment of a greenbelt and five new towns for the purpose of diverting employment growth away from the urban core of the Paris region to planned communities in its suburban periphery.

The launching of this strategy was based on a number of considerations, both pragmatic and theoretical. In the first instance, it was recognized that the strategy of inter-regional decentralization, which the French (DATAR) had vigorously pursued under its metropole d'equilibres program, was simply inadequate to check the growth rate of Paris. In addition to underestimating the power of the primate city's locational factors, it was also becoming apparent that inter-regional (long distance) interventions in the locational preferences of business firms was ultimately damaging to the economy.

Thus, the French planners broke with tradition and devised decerrement, a settlement strategy that sought to satisfy locational preferences for the primate city in such a way that external diseconomies would be at a minimum. To package these apparently incompatable social objectives in a single strategy, it was necessary to reject the concept of urban scale diseconomies in favor of urban form diseconomies; core congestion and peripheral sprawl (tache d'huile) was a function of improper form, not improper size. In practice, this crucial insight will eventually result in a transformation of the Paris region from the standard radial-concentric form, in which all primary transportation routes converge on the central core, to a polynucleated system of large satellite new towns whose purposes are to (i) relieve congestion in the core, and to (ii) rationalize the pattern of

peripheral development.

The strategy of intra-regional deconcentration would therefore appear to be suited to Egyptian settlement conditions, and should be seriously considered as an important element in its national urban policy. It is clearly evident that Cairo, and to a lesser extent Alexandria, suffers greatly from primate city overconcentration caused by the existence of urban forms that are now obsolete. On the basis of a great deal of accumulated experience in other parts of the world, it is equally clear that a strategy of inter-regional decentralization will not by itself be nearly adequate to resolve the fundamental problems.

But by far the most important reason why this settlement strategy should be included in Egypt's national urban policy is the indisputable fact that it is currently being implemented in the Cairo region. Indeed, the construction plans for such satellite communities as 15 May, 10 Ramadan, 6 October, El Obur, are the virtual equivalents of the new towns of Paris both in terms of their population targets for the year 2000, and in their commuting distance from the central core. Only the location of Sadat City is sufficiently beyond commuting range to leave the northwest quadrant of the Cairo region without a deconcentrating subcenter.

If there is a major problem with this basically sound effort, it is to be found in its non-explicit, fragmentary procedures. Instead of a systems approach, each satellite community appears to have been planned in a vacuum with very little attention given to such vital matters as an appropriate regional transportation system, an appropriate set of standards, a method for accommodating infill between the new communities, etc. What is needed is a regional development plan — a Schema Directeur — for the Region of Cairo which would place the new communities within a more comprehensive framework, and would specify a polycentric system for the region tailored to the needs and resources of Egypt. Such a plan should be commissioned even in the event that inter-regional deconcentration does not become a major priority of national urban policy.

Inter-Regional Decentralization: Growth Center Emphasis.

The spatial implications and societal objectives of "decerrement" provide good illustrative background with which to contrast the remaining basic settlement strategies. These concepts which are essentially variations on the theme of inter-regional decentralization, also respond to the kinds of urban problems Egypt shares with other countries, and are also population redistribution concepts implemented by shifts in the spatial distribution of investment and employment. At this point, however, similarities between the two approaches end rather abruptly.

As implied by its title, for example, inter-regional decentralization strategies seek solutions to primate city overconcentration not within the region of the primate city itself, but within the national "system of cities", i.e., in other cities and regions located throughout the nation. This approach originated in the United Kingdom in the 1930's when the first generation of British new towns were built in an attempt to intercept the heavy migration to London coming out of the depressed areas in the north of England and Wales. Since then, or at least until the advent of "decerrement", national urban policies throughout the world have been dominated by decentralization strategies of one form or another.

While all of these forms attempt to achieve greater degrees of inter-regional equity in the distribution of economic opportunity and population, the concepts differ significantly in their choice of settlement targets: some emphasize growth centers, while others focus on small and medium-size, or secondary cities. The following pages attempt to clarify these differences, beginning with those strategies that emphasize growth centers as targets for decentralization.

1. Regional Concentration: the Countermagnet. While all growth center concepts feature inter-regional equity as their primary social objective, they also share a common secondary objective: regional economic development. Countermagnet concepts pursue these objectives by attempting to create another major metropolitan region to compete for migrants to the primate city. Such attempts to promote agglomeration economies are usually implemented by intense concen-

trations of investment in or near one of the nation's largest existing cities — as in the case of Islamabad (Rawalpindi), New Delhi (Delhi), Novi Beograd (Beograd), or New Bombay (Bombay). Brasilia, the most familiar of the countermagnets, is an exception to the rule.

The degree to which a countermagnet strategy is applicable to Egypt rests on a number of considerations. On the positive side is the simple fact that Egypt could very well use another major city. It is one of the few countries in the world with a population in excess of 40 million that has only two major metropolitan areas. Moreover, the topographical constraints on Alexandria Governorate make it likely that this city will increasingly be unable to perform its traditional role as a natural (unplanned) countermagnet to Cairo. This prospect is confirmed by the plans to construct New Ameriya, a deconcentrating satellite community to the west of the city.

If a countermagnet strategy were applicable to Egypt, a suitable site — off arable land, and at some distance from Cairo — would have to be found. In this regard, Aswan or the Qena-Naga Hamadi area in southern Upper Egypt offer remote possibilities. A more persuasive candidate would be near Fayoum because of its amenity and access factors.

Perhaps a more plausible site is clearly to be found in the greater Ismailia region, an area extending from Qantara in the north to the Great Bitter Lake in the south — on both sides of the Canal. Included among the many locational advantages of this region are its outstanding access factors, which derive mainly from the stock of existing infrastructure. These factors include (1) access to bulk water supplies provided by the Ismailia Canal; (2) access to a nearby source of electric power in Suez; (3) access to international markets with its Canal location; (4) access to large domestic markets with its dual carriageway connection to Cairo; (5) access to the Delta with both road and rail connections; and, in terms of the future (6) access to the Sinai with tunnel and perhaps bridge connections as well.

There are two other very important advantages that also make Ismailia a prime target for concentrated investment. The first rela-

tes to its centrality, or to the fact that Ismailia occupies a pivotal location on not less than four development axials: (1) Port Said - Ismailia - Suez; (2) Cairo - 10 Ramadan - Ismailia; (3) Benha - Zagazig - Ismailia; and (4) Ismailia - Sinai. Because of this unique centrality, a concentration of investment in the Ismailia area could be expected to generate important spillover effects, including (1) an acceleration of the growth of the other key centers in the network, and (2) a stimulation of industrial growth along each of the development axials, so that countermagnet strategy would lead to corridor development as well.

The second advantage concerns the regions's amenity factors which not only include a relatively good climate, but also relatively good soil conditions which would permit urban landscaping and contribute to a better living environment.

Thus, if the Ismailia region were to be designated as a countermagnet development target, it is not unreasonable to assume that the results of such a strategy would be the emergence of a third major metropolitan area in Egypt, and a deceleration in the growth rate of Cairo.

On the other hand, it must be firmly kept in mind that the countermagnet concept requires a heavy concentration of investment resources in a single region. A fact that endows it with the lowest spatial equity rating of all the inter-regional decentralization strategies. In addition with this concept the investment program must be sustained over a comparatively long period of time. A provision which requires the unwavering commitment of the Government.

In the past, the success of most countermagnets was insured by their designation as the new national capital, and by the corresponding physical transfer of the offices of central government out of the primate city. However, in cases where surface travel time between the countermagnet and primate city are not excessive — such as between Ismailia and Cairo, or even between Fayoum and Cairo — such extreme measures need not be taken. From these considerations, it would seem to follow that a countermagnet targetted for the south of Egypt would require its designation as the new capital city so as

to insure the necessary build-up of agglomeration economies. Short of this, a program of governmental decentralization would almost certainly be required.

2. Regional Dispersion: Growth Poles. Like the countermagnet concept, the growth pole concept features inter-regional equity and regional economic development as its primary and secondary objectives. Unlike countermagnets, however, this strategy attempts to induce agglomeration economies in a number of urban regions throughout the nation so as to achieve a more balanced geographical structure of development. As such, growth poles have tradionally been the most popular of all decentralization alternatives since the strategy holds out the promise of "something for everyone".

Over time, the concept and application of growth poles has undergone considerable change, an evolution that Professor Richardson has nicely condensed as follows:

> The original meaning of the concept was non-spatial. Borrowing from the Schumpeterian theory of innovations, Perroux defined a growth pole as a set of industries generating dynamic growth in the economy as a result of input-output interdependencies around a leading industry. This group of industries grows faster than the rest of the economy, and have certain typical characteristics: advanced technology and high rates of innovation; high income elasticities of demand for their output; national markets; and strong spillovere and multiplier effects on other parts of the economy.
>
> Boudeville and other French economists translated these ideas into geographical space, first by suggesting that the set of dynamic industries might be spatially clustered, second by linking this cluster to location in an urban area, and third by focusing on spillover effects in the surrounding hinterland rather than in the economy as a whole. A later dilution of the concept was to drop the base of an interrelated set of industries and to permit a growth pole to mean simply the geographical clustering of economic activity in general. This implies that spatial concentration is more efficient and more growth-inducing than dispersal.2/

This change in emphasis has affected the method of selecting growth pole targets from one based on a search for urban areas suitable to the location of "propulsive" industries, to one based on a search for relatively high-growth urban areas with the capacity to absorb additional investment in general economic activity. Accordingly, the following chapter identifies a number of possible growth pole targets based on a profile analysis of economic growth potential and absorptive capacity of the major urban areas throughout Egypt.

While growth pole strategy has been widely applied, its impact on altering national urban hierarchies has been generally negligible. An unfortunate record that has several explanations. First and foremost is the fact that its balanced regional growth objective frequently results in a dilution of effort and capital expenditure over too many regional constituencies; the prospects of success vary inversely with the number of growth poles targetted for implementation.

Another factor inhibiting the success of this strategy has been a general underestimation of the importance of providing associated infrastructure — especially the provision of inter-regional transportation infrastructure — to ensure adequate linkages between the growth poles and domestic and international markets.

A final difficulty of relevance to Egypt is its need for an appropriate structure of government. Where the strategy has experienced any modicum of success, it has been in countries with a degree of administrative or political decentralization that has permitted the transfer of human capital, in the form of competent administrators and managers of public investments, to the areas chosen for development. Countries lacking such structures can only reasonably expect to benefit from the strategy if the growth pole targets are located close enough to the capital city to enjoy adequate access to the central government. Therefore remote areas should be considered particularly difficult targets with associated high risks of failure.

3. Secondary Cities Emphasis. The Secondary cities concept is the last of the basic settlement concepts that will be used in generating the alternative settlement patterns. The secondary cities approach focuses on the lower end of the national settlement hierarchy with the primary objective of slowing migration to the primate city by improving conditions in the medium and small-size cities.

In developing countries, these towns almost always consist of agricultural marketing centers and a multiplicy of agrovilles so that efforts to improve them involve a considerable geographical dispersal of investment resources. These resources are typically distributed in such a way as to promote the strategy's major secondary

objective: to raise the level of inter-regional equity in the provision of both technical and social infrastructure. By providing the secondary settlements with better roads, sewerage, housing, health facilities, vocational training, etc., both town dwellers and the rural population are afforded greater access to public goods and services. Thus, improvements in the inter-regional distribution of infrastructure translates into improvements in the inter-personal distribution of consumption.

In addition to promoting greater social equity, a secondary cities strategy can also be used in pursuit of regional economic development — if large unsettled areas of the nation have sufficient resources capable of being developed. In Egypt, this objective appears to warrant consideration given the present enthusiasm for opening up the Sinai and New Valley areas to agricultural development and, to a lesser extent, for promoting tourism along the Red Sea coast. For the most part, these areas lack towns and transport facilities so that secondary cities and rural-urban linkages would have to be developed de novo for residential and marketing purposes and for integration into national economic space. Without these substantial infrastructure investments, land reclamation would not be economically effective in remote areas.

However, a strategy of secondary cities, when applied to existing medium and small-size communities, probably has less potential for achieving its objectives than any of the basic settlement strategies. This is due chiefly to the fact that its implementation does not include attempts to induce agglomeration economies via inter-regional shifts in employment. Instead, it relies exclusively on inter-regional shifts in infrastructure investments. Since migration to the primate city is largely based on employment expectations, the strategy's primary objective is therefore likely to go unrealized. Even if out-migration could be reduced by these measures, however, attainment of the concept's secondary objective, a redistribution of public goods consumption, would also face difficulties resulting from capital dilution over the large number of settlement targets contained in the lower end of the hierarchy.

To achieve the best results, therefore, secondary cities strategy should be implemented by concentrating investments in (1) the largest of the existing secondary settlements, and in (2) new secondary settlements for large regions that have been targetted for development.

FOOTNOTES

1/ Weidemann, W. (1980) Effect of Urbanization on the Agricultural Land Resource Base: Status and Future Expectations. National Urban Policy Study Working Paper, Cairo.

2/ Richardson, H.W. (1977) City Size and National Spatial Strategies in Developing Countries. World Bank Staff Working Paper No. 252, Washington, D.C.

CHAPTER II

PROFILES OF SETTLEMENTS AND SETTLEMENT ZONES: GROWTH POTENTIAL AND ABSORPTION CAPACITY

INTRODUCTION

Settlement strategies, such as those described in the previous chapter, provide general guidance in the selection of alternative settlement patterns. They are necessary to a national policy because they suggest what kinds of settlement patterns need to be considered. They are not, however, sufficient to say where attention should be focused in the settlement system.

This chapter is intended to address the question of where the most promising places are in the settlement system to locate investment with a reasonable chance of economic return as well as capacity to absorb future population growth without intruding on arable land or unnecessarily increasing infrastructure costs to service the population.

An initial assessment was made of the growth potential and absorption capacity of major urban settlements and settlement zones. Attention was focussed on settlements with more than 50,000 inhabitants in 1976 containing more than 88 percent of the urban population and roughly similar proportions of total urban employment. During the study, relevant data from official government sources was collected and supplemented by field visits to the major urban areas of Egypt. Nevertheless, the data collected does not provide definitive information on where population should and can be located in the future; rather it provides suggestive indicators.

To assess the growth potential of individual settlement, we have relied heavily on two key indicators: (1) access to required inputs and outputs and (2) recent growth in population. Of these two measures access is probably the most informative and reliable.

Obviously, access to raw materials for primary industries is crucial but for secondary and tertiary industries access to inputs is more difficult to establish unambiguously. Secondary industries rely

on both labor and intermediate goods which tend to be most readily available in fairly large urban agglomerations. Tertiary industries and services rely relatively less on capital than on labor which is also most likely to be readily available in larger agglomerations. Consequently, (again excepting primary industries), proximity to large population centers is generally an economic advantage in looking for required inputs.

On the output side, industry is concerned with the sale and distribution of goods produced. The size of the market is a major factor influencing the prospects for sale and effective distribution of produced goods. For consumer goods intended to be used locally, therefore, proximity to large population centers is an advantage. Industries producing goods for the international market find it advantageous to be located near ports and airports for sea and air transport. Such facilities are predominantly available in Cairo, Alexandria, Port Said, and Suez.

Accessibility to urban agglomerations and trans-shipment points needs to be supplemented, however, by some measure of local advantages not captured by the accessibility measures. Evidence of recent employment growth in a particular place is a potential indicator of such local advantages; although it is by no means conclusive. High recent growth may be due to access, rather than other local advantage; it may have been large enough to exhaust expansion possibilities in a particular city; or it may be due to a fortuitous choice (from the local point of view) by public authorities which may or may not be repeated. Nevertheless, a pattern of recent employment growth is a signal of some locational advantages.

The Study Team has been unable to assemble a consistent data set on employment growth by urban area; or its sectoral detail. There is consistent data, however, on recent population growth by settlement. At the governorate level, where both employment and population data is available, total employment growth and population growth are closely related (the correlation is 0.96). Therefore, recent population growth was used as a proxy measure for settlement employment growth.

The ability of a city to absorb population without exceeding serious capacity restraints is an important modifier of growth potential in determining where population should go.

In Egypt, as shown in Chapter I, one of the capacity constraints which should be taken most seriously is the preservation of arable land for agricultural use. In assessing absorption capacity, therefore, measures of the ability of settlements to expand within existing boundaries to various gross density levels have been developed as an approximation of their internal holding capacity. Some urban settlements in Egypt, also have axes of development on non-arable land, therefore, settlement absorption capacity estimates have been supplemented with an indication of their ease of horizontal expansion.

In our analysis, these two measures of capacity (within-settlement density and ease of horizontal expansion) have been modified by a recognition that existing infrastructure to serve population needs is limited and may be relatively more costly to provide in some places than in others. Information on the existing water and sewer design capacities of different places, the degree to which these capacities will have to be increased to accommodate greater population, and the relative costs of doing so is presented.

To summarize, our initial evaluations of settlement possibilities in particular settlements and settlement zones will be upon judgements about their relative growth potential and absorption capacity. Growth potential is indicated by accessibility to markets and recent population growth. Settlement absorption capacity is indicated by a comparison of current densities with a range of density standards, the ease of horizontal expansion without impinging on arable land or meeting major topographical obstacles, and an assessment of the relative significance of infrastructure constraints (capacity and/or cost) on future growth.

Economic Growth Potential of Major Settlements.

Two major indicators of economic growth potential of major settlements have been used to determine where in the existing settle-

ment network investment could be made to yield the greatest returns. These are the settlement's access to major output markets and sources of non-labor inputs and its recent population growth. These indicators show the recent economic performance of the major settlements relative to each other.

1) Population and Employment Growth of Settlements

The rate of change of urban employment is considered as an indicator of the potential for economic growth or decline of an urban area. However, employment statistics are not available in census data at the settlement level, only at the governorate level. Therefore, recent rates of urban population growth at the governorate level were correlated with rates of growth in urban employment to determine if urban population growth rates could serve as a proxy for employment growth. It was found that for the period 1970-1975, that there was a strong positive, correlation coefficient between urban employment and population growth rates of 0.965.

In Table 1, the settlements have been assigned values according to settlement size or absolute increases in population and their annual rates of growth during the period 1960-1976. The combined values represent the population growth index. The table was constructed in this way in order to assess the settlements both according to absolute increases in population and their rates of change. Alexandria, for example, was assigned an overall population growth index of 3 because it had a high absolute increase in population, valued at 2, but a rather low annual growth rate valued at 1. Mit Ghamr, on the other hand, was also assigned a population growth index of 3, because although it had a low absolute increase in population, valued at 0, it had a relatively high annual rate of growth valued at 3.

The rates of population growth for the Canal Cities required special consideration since they were evacuated during the period and by 1975 had not achieved their pre-war populations. Therefore according to census data they show very low or negative population growth rates which are not considered representative

TABLE 2

MAJOR SETTLEMENT POPULATION GROWTH INDEX

ABSOLUTE POPULATION INCREASE (1960-76)	Percent of Annual Population Increase 1960-76				
	< 2.41	2.41 - 3.0	3.1 - 3.4	3.41 - 4.0	> 4.0
Value	0	1	2	3	4
SETTLEMENT POPULATION SIZE RANGE ** 2 Greater than 1,000,000		Alexandria		Greater Cairo	
Index:	2	3	4	5	6
1 100,000 999,999		Tanta Mansoura Minia Beni Suef	Mahalla Assiut Zagazig Fayoum Sohag	Port Said * Damanhour Shebin El Kom	Suez * Kafr El Dawar Ismailia * Aswan
Index:	1	2	3	4	5
0 Less than 100,000	Damietta Mallawi Qalyub Girga Akhmim	Dessouk Abu Kabir Zifta Kafr El Zayat	Qena Benha Belqas	Mit Ghamr Bilbeis Mataria	Luxor Kafr El Sheikh Idku Menouf Matrouh Naga Hammadi
Index:	0	1	2	3	4

* Master Plan Projected Growth Rates (1976-2000)

** The values assigned by settlement size correspond to absolute increases in population between 1960-1976 as follows:

Greater than 1,000,000 = absolute increase greater than 800,000
100,000 - 999,999 = " " 40,000 - 200,000
Less than 100,000 = " " less than 40,000

of their growth potential. As a consequence, their projected master plan growth rates have been used as proxies for their 1960-1976 growth rates for use in the Table.

Later in the text, the indices obtained from Table 1 are combined with those concerned with settlement access potential to sources of non-labor inputs and markets to produce an indicator of economic growth potential.

2) Settlement Access to Markets and Non-Labor Inputs

Accessibility to markets and non-labor inputs is the second indicator of a settlement's growth potential. Access to raw materials and intermediate goods and markets for products a settlement produces, as well as future changes in accessibility to inputs or sources of outlets for output contribute to growth opportunities. With the exception of access to external markets as represented by the ports and major internal markets such as Cairo or Alexandria, little detailed information is available about the exact composition of economic interchanges between regions or the volumes of internal trade represented by that internal activity.

The most recent data, though incomplete, about the activity of internal markets in Egypt is a series of origin and destination surveys included in the National Transport Study of the Ministry of Transport which measured the type and volume (measured in tonnage) of the products flowing between various governorates for some of the major modes of transport in 1979. While the study is not yet complete, and the values of these product flows are not available, information about highway transport is available. This data (which excludes the internal markets within each governorate) shows the flow of goods from one governorate to another in terms of total tonnage being transported. It also gives an indication of the relative importance of surrounding markets or sources of inputs. Finally, the origin and destination surveys show the impact which Cairo and Alexandria, due to the size and diversity of their economic activities, have on the economic activities and thus the growth potential of smaller

settlements.

This data is incomplete since it only shows highway transport. Thus only a partial picture is presented of some settlements which have sources of inputs, such as petroleum, which are transported by other modes. Indicators of the relative accessibility of settlements to sources of inputs for industrial activities or markets were developed by constructing a comparative index of settlement outputs and inputs. This index was constructed by dividing the product of the population of the settlement being examined and the urban population of the governorate which represents its principal markets or source of inputs by the square of the time distance between them. This basic gravity model was then weighted by the proportion of the settlement's outputs or inputs, measured in tons, to the total tonnage measured by the origin destination survey. Following is the formula used to construct this index.

ACCESS INDEX FORMULA

$$I_i = \sum_{j = 1,2,3} \frac{P_i \, P_j}{(D_{ij})^2} \, (W_{ij})$$

Where P_i = Settlement population

P_j = Urban population of governorates representing the three principal markets, or sources of input; (j = 1,2,3)

D_{ij} = Time distance in minutes, between the settlement and the capital of the governorates representing the three principal markets, or sources of inputs.

$W_{ij} = \frac{T_{ij}}{T}$

T_{ij} = Trade, measured in tonnage, of "All Products" between the settlement and the governorate of its markets or sources of inputs.

T = Total trade, measured in tonnage, of "All Products" exchanged between all governorates.

W_{ij} reflects the importance of each market or source of inputs relative to the total production exchanged in the country.

I_i = Index of access potential for each settlement.

TABLE 3

OVERALL ACCESS INDICES OF SETTLEMENTS TO SOURCES OF NON-LABOR INPUTS AND MARKETS

SETTLEMENT	INDEX* ACCESS TO SOURCES OF NON-LABOR INPUTS	ASSIGNED VALUE (A) 0 - 8	INDEX* ACCESS TO MARKETS	ASSIGNED VALUE (B) 0 - 8	SUM OF VALUES (A) + (B) 0 - 16	OVERALL ACCESS INDEX 0 - 5
Greater Cairo	4,136	8	3,103	7	15	5
Alexandria	1,828	7	5,632	8	15	5
Kafr El Dawar	4,720	8	2,923	7	15	5
Qalyub	1,383	7	518	5	12	4
Mahalla	375	5	1,072	6	11	4
Damanhour	815	6	500	5	11	4
Benha	789	6	299	5	11	4
Zagazig	262	5	441	5	10	4
Shebin El Kom	326	5	219	5	10	4
Tanta	134	4	294	5	9	3
Bilbeis	105	4	201	5	9	3
Idku	203	5	128	4	9	3
Mit Ghamr	608	6	47	3	9	3
Fayoum	104	4	107	4	8	3
Port Said	4	2	80	4	8	3
Mansoura	187	5	53	3	8	3
Zifta	24	3	105	4	7	3
Suez	28	3	93	4	7	3
Menouf	110	4	48	3	7	3
Kafr El Zayat	31	3	48	3	6	2
Abu Kabir	32	3	48	3	6	2
Dessouk	35	3	5	3	6	2
Kafr El Sheikh	51	3	33	3	6	2
Beni Suef	2	2	58	3	5	2
Minya	6	2	20	3	5	2
Belqas	27	3	8	2	5	2
Mataria	27	3	4	2	5	2
Damietta	36	3	2	2	5	2
Mallawi	2	2	7	2	4	1
Ismailia	10	2	7	2	4	1
Assiut	2	2	6	2	4	1
Aswan	0	0	1	2	2	0
Sohag	1	2	0	0	2	0
Qena	4	2	0	0	2	0
Luxor	1	2	0	0	2	0
Girga	0	0	0	0	0	0
Naga Hammadi	0	0	0	0	0	0
Akhmim	0	0	0	0	0	0

The time distances used in the assessment of access were derived from road distances from maps produced by the Survey Department and average speeds recorded on those roads as published by the National Transport Study or the summary report of "Planning the Entrances to Cairo Urban Area", prepared for the Ministry of Housing and Reconstruction in 1976.

Since access to markets or sources of inputs is being used to measure growth potential of settlements, the index shown is heavily influenced by the distance between settlements. As Greater Cairo and Alexandria represent the largest markets and particularly in the case of Alexandria the largest source of inputs, settlements which have those cities as markets or inputs rank higher on the index than those which do not. The data used to calculate these indices is presented in the appendices to this report.

Table 2 combines the indices of access to non-labor inputs and markets to produce an overall "access index" for each settlement on a scale from 0 to 5.1/ Settlements such as Greater Cairo, Alexandria and Kafr El Dawar which had much higher relative indices for access to sources of non-labor inputs and markets were assigned an overall access index of 5. Settlements in the intermediate range such an Tanta, Bilbeis and Idku were assigned an acess index of 3, while those which registered little or no access potential were assigned an overall index of 0.

The overall access indices are subsequently combined with the population growth indices from Table 1 to produce a final indicator of economic growth potential as described in the following section.

3) Summary of Economic Growth Potential

The final ranking of the settlements' economic growth potential based upon population growth, as a proxy for employment growth, and access potential to sources of non-labor inputs and markets is presented in the matrix in Figure 4. The matrix assigns values to each of the settlements on a scale of 0 - 5 both horizontally and vertically to produce an overall value or index of

MATRIX OF MAJOR SETTLEMENTS ECONOMIC GROWTH POTENTIAL

ACCESS POTENTIAL

POPULATION GROWTH RATES

	5	4	3	2	1	0
5	CAIRO KAFR EL DAWAR 10	9	SUEZ 8	7	ISMAILIA 6	ASWAN 5
4	9	DAMANHOUR SHEBIN EL KOM 8	PORT SAID IDKU MENOUF 7	KAFR EL SHEIKH 6	MATROUH 5	NAGA HAMMADI LUXOR 4
3	ALEXANDRIA 8	MAHALLA ZAGAZIG 7	MIT GHAMR BILBEIS FAYOUM 6	MATARIA 5	ASSIUT 4	SOHAG 3
2	7	BENHA 6	TANTA MANSOURA 5	BELQAS MINIA BENI SUEF 4	3	QENA 2
1	6	5	ZIFTA 4	DESSOUK ABU KABIR KAFR EL ZAYAT 3	2	1
0	5	QALIUB 4	3	DAMIETTA 2	MALLAWI 1	AKHMIM GIRGA 0

10. Population increase is measured vertically from down to up, while access potential is measured horizontally from right to left. Accordingly, Cairo and Kafr El Dawar have received the highest overall indices of 10, while Girga and Akhmim received the lowest indices of 0.

In essence the settlements in the upper left quadrant of Figure 4 were found to have the highest economic growth potential while those in the bottom right have the lowest. Settlements in the upper right quadrant have demonstrated high population increases though they have poor access potential to sources of non-labor inputs and markets. In the lower left quadrant, the settlements, conversely, have demonstrated high access potential but have had low population increases during the past census period.

The settlements are distributed fairly evenly among the four quadrants. However, more than a third (14), are found in the upper left quadrant indicating high economic growth potential.

In the following section, a final assessment is made in order to determine those settlements with high economic growth potential and absorption capacity.

Absorption Capacity of Major Settlements

Urban settlements grow expanding beyond boundaries into adjacent non-urban land or by increasing the densities of existing areas within given boundaries. However, expansion may be constrained by capacity and distribution of existing infrastructure networks. This section of Chapter II examines the absorption capacity of settlements within their boundaries and then, as a function of that capacity, assesses the capacity of the settlement's water and sewerage systems to service additional population. Finally, the approximate costs of servicing new population in the settlements is estimated.

1) Absorption Capacity Within Settlements

The capacity of settlements to absorb additional population within their boundaries is their ability to expand horizontally by infilling areas presently vacant or vertically by adding addi-

tional floors to existing structures or replacing old buildings with new, higher storey buildings. In many settlements, the process of infilling and vertical expansion, particularly through the addition of more floors to existing buildings, occurs simultaneously. However, the construction of new multi-storey buildings to replace existing structures is usually more difficult as it may require demolition of occupied buildings and displacement of their inhabitants.

Precise measurement of the absorption capacity of existing settlements is difficult without recent aerial photographs and detailed knowledge about the age and condition of residential structures. However, since a settlement must grow at higher densities in order to absorb more population without expanding its boundaries, a good indication of absorption capacity can be found by comparing existing gross densities which are available from census data with variable density standards.

Implicit in the assumption that existing settlements, particularly within the Delta and Nile Valley, can absorb more population through horizontal and vertical expansion is the need to convert arable land which has been administratively incorporated within their boundaries to urban uses. The need to change local land uses from agricultural to urban has been already recognized by the planning departments of several settlements. For example, planned urban expansion within the boundaries of Luxor, Assiut, Minya, and Kafr El Dawar has been approved by local town councils and their respective governorates on arable land. In the case of Luxor this expansion is occuring within a master planned area of the city.

Later in the project when remote sensing data is available, these initial assessments of absorption capacity can be verified by comparing the change in the area of the built areas of settlements with the areas enclosed by their boundaries.

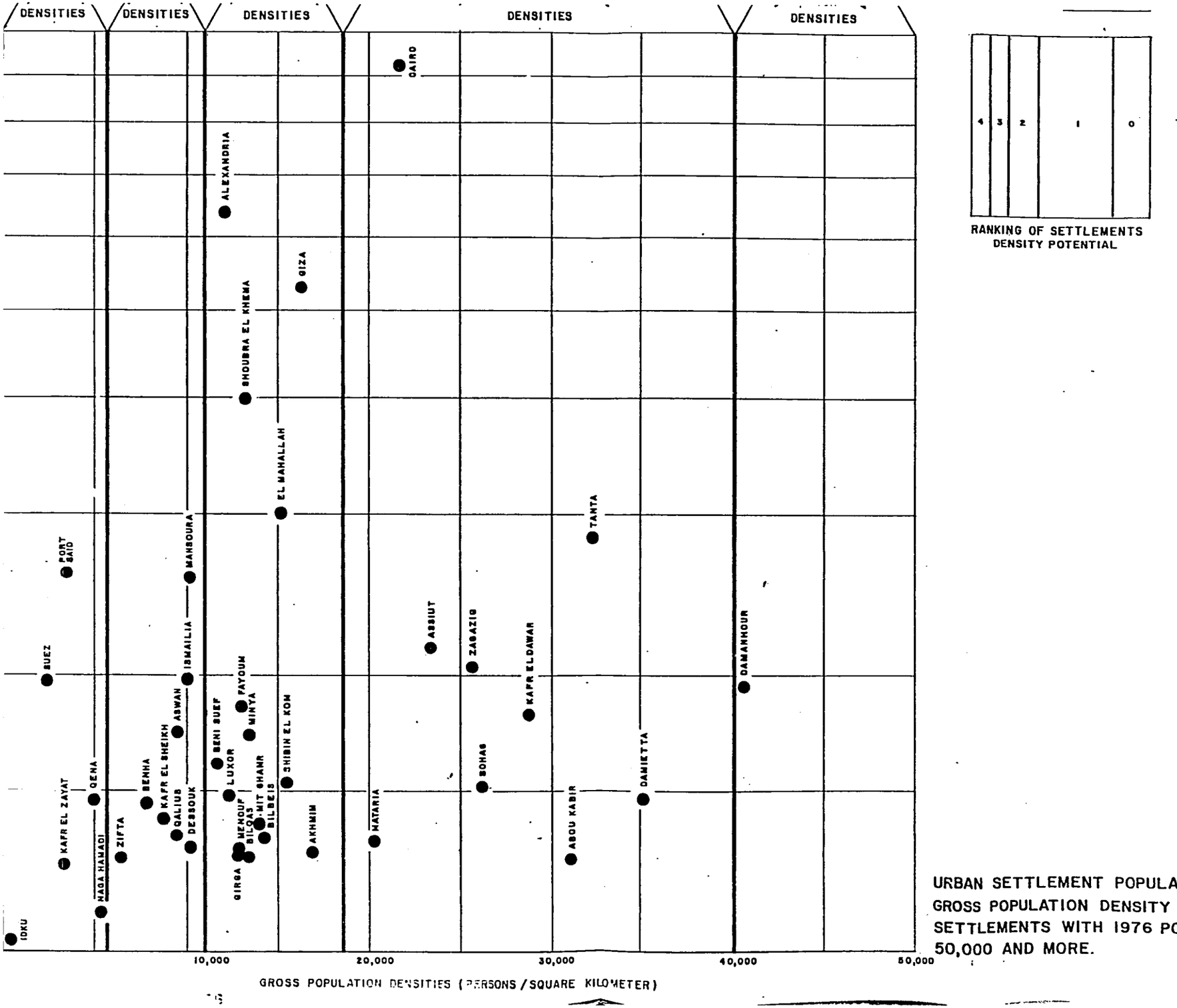
In order to give an indication of the limits of settlement population absorption at densities already reached by other settlements in Egypt, the 1976 populations and gross densities of settlements

with populations of 50,000 and more were graphed and divided into five groups representing the range of existing urban gross densities. Figure 5 shows these groups. Once the gross density groups were determined, the absorption capacities of settlements at higher densities was determined as shown in Table 4.

Using this method to determine the limits of population absorption capacity, the highest capacity was limited to the highest urban gross density, which, as enumerated by the 1976 census, was that of Damanhour in Beheira Governorate. It has a population of 188,927, an area of 4.67 square kilometers and a resultant gross density of 40,500 persons per square kilometer. Although a variety of land budgets are possible at any density, the gross density of Damanhour could be characterized by the following theoretical example: If 55 percent of the land area within the settlement were used for open space, recreation, circulation and commercial, administrative and industrial uses, the remaining net residential land area could be divided into 111 square meter plots having residential buildings with an average of two floors and two dwelling units.

The next highest group of settlement densities shown in Figure 5 ranges from 20,000 to 40,000 persons per square kilometer and has an average gross density of 28,000. The urban area of the Cairo Governorate falls within this group as its gross density is 22,000 persons per square kilometer. This group's average density is only slightly higher than the density of Maadi, a suburb of Cairo, which had a 1976 residential density of 27,000 persons per square kilometer. Urban development at this average density could be characterized by a theoretical area having buildings with an average of two storeys and two dwelling units situated on 125 square meter plots. Only 45 percent of the urban area would be devoted exclusively for net residential uses, the remainder could be used for open space, recreation, administration and other urban activities.

The average density of the middle groups of urban densities is 14,000 persons per square kilometer. This density corresponds to



URBAN SETTLEMENT POPULATIONS AND GROSS POPULATION DENSITY GROUPS IN SETTLEMENTS WITH 1976 POPULATIONS 50,000 AND MORE.

WITH A 1976 POPULATION SIZE OF 50,000 OR MORE

SETTLEMENTS AT 1976 DENSITY GROUPS	SETTLEMENT NAME	1976* POPULATION	1976* AREA	1976 GROSS DENSITY	NET URBAN POPULATION ABSORPTION CAPACITIES (000 .)				
					HIGH 1/	MEDIUM/HIGH 2/	NATIONAL 3/ AVERAGE	MEDIUM/LOW 4/	LOW 5/
					40,500	28,000	14,000	9,200	3,400
		(000's)	sq.km.	Pers/sq.km.	Pers/sq.km.	Pers/sq.km.	Pers/sq.km.	Pers/sq.km.	Pers/sq.km.
1)	Idku	62.20	238.00	2,615	4,577	6,602	3,270	2,127	741.00
	Suez	190.2	74.65	2,500	2,837	1,906	659	500	65.50
Low	Kafr El Zayat 6/	45.2	13.15	3,300	503	334	145	80	1.04
Densities	Port Said	262.6	72.07	3,600	2,659	1,759	749	403	29.00
	Qena	93.8	18.90	5,000	671	434	170	79	-
	Naga Hamadi 6/	19.8	3.50	5,600	122	78	29	13	-
	Sub-Totals	673.8	420.63	-	16,369	11,111	5,222	3,202	808.54
2)	Zifta	50.4	7.80	6,500	266	168	59	21	-
	Benha	89.0	11.16	8,000	363	223	67	13	-
Medium/Low	Damietta	93.4	11.00	8,500	353	121	60	8	-
Densities	Kafr El Sheikh	77.5	8.84	8,800	280	170	46	4	-
	Qaliub	62.7	6.63	9,500	206	123	38	-	-
	Aswan	144.4	15.06	9,600	465	277	66	-	-
	Ismailia	198.4	14.71	10,200	446	262	56	-	-
	Mansoura	257.9	24.83	10,400	748	437	89	-	-
	Desouk	58.6	5.41	10,800	161	93	17	-	-
	Sub-Totals	1,024.3	55.44	-	3,287	1,874	490	46	-
3)	Beni Suef	118.1	10.0	11,800	287	162	22	-	-
	Alexandria	2,318.6	192.6	12,000	5,496	3,086	386	-	-
Densities	Menouf	55.1	4.6	12,000	131	74	9	-	-
at National	Luxor	92.7	7.39	12,000	207	115	11	-	-
Urban	Girga	51.1	3.93	13,000	108	60	3	-	-
Average	Fayoum	167.1	12.79	13,100	350	191	12	-	-
	Shoubra El Kheima	393.7	29.60	13,300	805	435	21	-	-
	Minya	146.4	10.96	13,400	297	160	7	-	-
	Belqas	50.1	3.69	13,600	99	53	1	-	-
	Mit Ghamr	72.2	6.09	14,200	134	70	-	-	-
	Bilbeis	69.3	4.85	14,300	127	66	-	-	-
	El Mahalla	292.8	19.24	15,200	487	246	-	-	-
	Shebin El Kom	102.8	6.59	15,600	164	82	-	-	-
	Giza	1,232.7	76.65	16,100	1,870	912	-	-	-
	Akhmim	53.2	3.08	17,300	71	33	-	-	-
	Sub-Totals	5,215.5	394.26	-	10,633	5,745	472	-	-
4)	Matareya	61.2	2.94	20,800	58	21	-	-	-
	Assiut	213.9	9.58	22,300	174	55	-	-	-
Medium	Cairo	5,084.5	220.60	23,000	3,661	1,103	-	-	-
High	Zagazig	202.6	7.89	25,700	117	18	-	-	-
Densities	Sohag	101.8	3.90	26,100	58	10	-	-	-
	Kafr El Dawar	160.6	5.57	28,800	65	-	-	-	-
	Abu Kebir	54.8	1.76	31,200	16	-	-	-	-
	Tanta	284.6	8.81	32,300	72	-	-	-	-
	Damietta	93.5	11.00	35,000	58	-	-	-	-
	Sub-Totals	6,164.00	261.06	-	4,421	1,207	-	-	-
5)									
High Densities	Damanhour	188.9	4.67	40,500	-	-	-	-	-
	Total All Groups	13,266.5	1186.06	-	34,768	19,937	6,184	3,248	808

1. POPULATION ABSORPTION CAPACITY CALCULATED AT DAMANHOUR DENSITIES OF 40,500 PERSONS/sq. km.

2. POPULATION POPULATION CAPACITY CALCULATED AT 28000 PERSONS/sq.km., THE AVERAGE DENSITY OF GROUP 4 SETTLEMENTS (MEDIUM TO HIGH DENSITIES RANGING FROM 20,800 TO 35,200 PERSONS/sq.km.).

3. POPULATION ABSORPTION CAPACITY CALCULATED AT THE NATIONAL URBAN AVERAGE DENSITY OF 14,000 PERSONS/sq.km.

4 POPULATION ABSORPTION CAPACITY CALCULATED AT 9,200 PERSONS/sq.km., THE AVERAGE DENSITY OF GROUP 2 SETTLEMENTS (LOW TO MEDIUM DENSITIES RANGING FROM 6,500 TO 10,800 PERSONS/sq.km.).

5. POPULATION ABSORPTION CAPACITY CALCULATED AT 3,377 PERSONS/sq.km., THE AVERAGE DENSITY OF GROUP 1 SETTLEMENTS (DENSITIES RANGING FROM 2,500 TO 5,600 PERSONS/sq/km.).

6. KAFR EL ZAYAT AND NAGA HAMADI HAVE BEEN INCLUDED IN THIS GROUP EVEN THOUGH THEY HAVE 1976 POPULATIONS LESS THAN 50,000 BECAUSE OF THEIR SPECIAL INDUSTRIAL CHARACTERISTICS.

SOURCE OF 1976 POPULATION AND SETTLEMENT AREAS:

CAPMAS GENERAL CENSUS OF POPULATION & HOUSING 1976 - CENSUS OF BUILDING & RESIDENTIAL UNITS IN URBAN AREAS. REPORT NO. 92-15112-1978.

STATISTICAL INDICATORS OF PLANNING REGIONS, 1978 - REPORTS NO. 90 to 97-12000/78.

the national urban average gross density. As might be expected, although the range of gross densities within this group is small, the largest number of settlements having populations of 50,000 or more have gross densities which fall within this group. Again, if only 45 percent of a settlement's land budget were devoted to net residential uses, its population could be accommodated in buildings having an average of 1.5 dwelling units on 188 square meter plots.

The medium/low settlement densities range from densities of 6,500 to 10,000 persons per square kilometer and have an average density of 9,200 persons per square kilometer. Although they are not shown in the table as their existing populations are below 50,000, the new towns of 10th of Ramadan and Sadat City have gross densities which fall in this group. If roughly 65 percent of a settlement's land area is devoted to non-residential uses, a settlement could be developed at the medium/ low average density using only single storey buildings with only one family per 190 square meter plot. If these cities grew at densities equal to the medium high group of settlement densities, they could absorb an additional 1.7 million population or 1.9 times their present population.

The lowest group of settlement densities are found in Idku, Suez, Kafr El Zayat, Port Said, Qena and Naga Hamadi. Their average gross density is 3,400 persons per square meter because they all have large, undeveloped land areas within their boundaries. Since these cities have such large undeveloped areas and much lower densities in comparison with other settlements, they have the greatest settlement absorption capacity in relation to their present populations. While the group had a total 1976 population of 673,800 as shown in Table 3, they could absorb sixteen times that population within their present boundaries if they grew at medium high densities.

Table 5 shows the population absorption capacity of settlements within each of the major settlement zones. As shown by the table, if all of the cities with 1976 populations of 50,000 or more grew

SETTLEMENT ZONE	SETTLEMENT NAME	1976 POPULATION DENSITY	1976 POPULATION	POPULATION ABSORPTION CAPACITIES (1,000 PERSONS)				
				HIGH 1/ ABSORPTION CAPACITY 40,500 Pers/sq.km.	MEDIUM/HIGH 2/ 28,000 Pers/sq.km.	NATIONAL 3/ AVERAGE 14,000 Pers/sq.km.	MEDIUM/LOW 4/ 9,200 Pers/sq.km.	LOW 5/ 3,377 Pers/sq.km.
		(Pers/sq.km.)	('000's)					
1)								
Cairo Region Zone	Shoubra El Kheima	13,300	393.7	805	435	21	-	-
	Giza	16,100	1,232.7	1,870	912	-	-	-
	Cairo	33,000	5,084.5	3,861	1,103	-	-	-
	Zone Total		6,710.9	6,536	2,450	21	-	-
2)								
Alexandria Matrouh Zone	Alexandria	12,808	2,318.6	5,496	3,086	386	-	-
	Zone Total		2,318.6	5,496	3,086	386	-	-
3)								
Suez Canal Zone	Suez	2,500	198.2	2,837	1,984	859	509	66
	Port Said	3,600	262.6	2,659	1,759	749	403	-
	Ismailia	10,200	190.4	446	262	56	-	-
	Zone Total		643.2	5,942	3,925	1,644	903	141
4)	Idku	262	61.2	9,576	6,602	3,270	2,127	899
	Kafr El Zayat	3,300	41.2	503	334	145	88	-
Delta Zone	Zifta	6,500	50.4	266	168	59	31	-
	Benha	8,000	89.0	363	223	67	13	-
	Damietta	8,500	93.5	352	121	60	8	-
	Kafr El Sheikh	8,000	77.5	288	178	46	4	-
	Qalyub	9,500	68.7	305	123	30	-	-
	Mansoura	10,400	257.9	748	437	89	-	-
	Desouk	10,800	58.6	168	93	17	-	-
	Menouf	12,000	55.1	138	74	9	-	-
	Belqas	13,600	58.1	99	53	1	-	-
	Mit Ghamr	14,200	72.2	134	79	-	-	-
	Bilbeis	14,300	69.3	127	66	-	-	-
	El Mahalla	15,[illegible]	292.8	487	246	-	-	-
	Shebin El Kom	15,600	102.8	164	82	-	-	-
	Matareya	20,800	61.2	58	21	-	-	-
	Zagazig	25,700	202.6	119	18	-	-	-
	Kafr El Dawar	28,800	160.6	65	-	-	-	-
	Abu Kabir	31,208	54.8	16	-	-	-	-
	Tanta	32,300	284.6	72	-	-	-	-
	Zone Total	-	2,184.9	13,567	8,821	3,792	2,293	899
5)	Beni Suef	11,800	118.1	278	163	22	-	-
Northern-Upper Zone	Fayoum	13,100	167.1	350	191	12	-	-
	Minya	13,400	146.4	297	168	7	-	-
	Mallawi	19,200	74.3	83	34	-	-	-
	Zone Total		505.9	1,008	567	41	-	-
6)	Qena	5,000	93.8	671	434	170	79	-
Southern-Upper Egypt	Naga Hamadi	5,600	19.8	122	78	29	13	-
	Aswan	9,600	144.4	465	277	66	-	-
	Luxor	12,500	92.7	287	115	11	-	-
	Girga	13,000	51.1	108	60	3	-	-
	Akhmim	17,300	53.2	71	33	-	-	-
	Assiut	22,300	213.9	174	55	-	-	-
	Sohag	26,100	101.8	58	18	-	-	-
	Zone Total		770.7	1,876	1,062	279	92	-
7)	---							
Red Sea Zone	Zone Total	n.a.						
8)								
Western Desert Zone	Zone Total	n.a.						
9)								
Residual Sinai	Zone Total	n.a.						
Total All Zones	NA	NA	13,348.8	34,768	19,971	6,183	3,249	1,040

NA NOT APPLICABLE

n.a. NOT AVAILABLE

1. Population absorption capacity calculated at Damanhour densities of 40,500 persons/sq. km.
2. Population absorption capacity calculated at 28,000 persons/sq. km.
4. Population absorption capacity calculated at 9,200 persons/sq. km.
5. Population absorption capacity calculated at 3,377 persons/sq. km.

TABLE 6

RANKING OF SETTLEMENTS' ABSOLUTE ABSORPTION CAPACITY

SETTLEMENT	NET ABSORPTION CAPACITY AT MEDIUM HIGH DENSITIES (000's)	RANKING
A. 1,000,000 and more		
Idku 1/	6,602	5
Alexandria	3,086	5
Greater Cairo	2,450	5
Suez	1,904	5
Port Said	1,759	5
B. 400,000 to 999,000		
Mansoura	437	4
Qena	434	4
C. 200,000 to 399,000		
Kafr El Zayat	334	3
Aswan	277	3
Ismailia	263	3
Mahalla	246	3
Benha	223	3
D. 100,000 to 199,000		
Fayoum	191	2
Kafr El Sheikh	170	2
Zifta	168	2
Beni Suef	162	2
Minya	160	2
Qalyub	123	2
Damietta	121	2
Luxor	115	2
E. 1 to 99,000		
Dessouk	93	1
Shebin El Kom	82	1
Naga Hamadi	78	1
Menouf	74	1
Mit Ghamr	70	1
Bilbeis	66	1
Girga	60	1
Assiut	55	1
Belqas	53	1
Mallawi	34	1
Akhmim	33	1
Mataria	21	1
Zagazig	18	1
Sohag	10	1
F. Zero Absorption Capacity		
Kafr El Dawar	0	0
Tanta	0	0
Abu Kabir	0	0
Damanhour	0	0

1/ Idku's net population absorption capacity is so great because it has an area which is greater than the area of Greater Cairo but a small population.

at densities equal to the Damanhour density they could absorb a total additional population of 34.8 million. However, if settlement expansion were limited to densities equal to the 1976 average urban gross density, only an additional population of 6.2 million could be accommodated within the boundaries of existing settlements. Any additional population would require horizontal expansion of settlement boundaries, often within arable land, or new settlements. The medium/high gross densities offer an alternative solution capable of absorbing roughly double the urban populations of existing settlements without further incursion into arable land.

The ranking of the net absolute population absorption capacities at medium high densities of the settlements is shown on Table 5. This ranking divides the settlements' absorption capacities into six groups ranging from capacities greater than one million persons to no capacities. The first group has sigfnificantly higher absorption capacities than any of the other groups. This capacity is over 14 million, while the capacity of the next highest group, that of settlements having capacities in the range of 100,000 to 199,000, is only 1.2 million. As the table shows, there is a group of settlements in the Delta which already have high gross densities and thus have no population abosorption capacities at the medium high density standard. They could only expand within their boundaries through much higher gross densities.

2) Horizontal Absorption Capacity Outside Settlement Boundaries

The primary constraints to horizontal expansion of settlements beyond their present boundaries are physical constraints such as bodies of water, mountains or other drastic changes in terrain and imposed constraints such as non-incursion onto arable land. Obviously, settlements which do not have such constraints to their expansion can absorb additional population much easier than those which do. Thus, in recognition that many cities have axes of potential development into largely desert areas, settlements have been ranked according to the number of potential development axes which they have and the ease with which this development could occur.

The ranking also recognizes that there is a group of cities which are constrained by intermediate physical barriers and strips of arable land, but still have horizontal expansion possibilities if these constraints could be overcome. Many of the cities located along the Nile in Upper Egypt fall into this category, as they could expand if there were means to develop 'sister cities' on the opposite bank. However, to do so, investment would have to be made in bridges, new infrastructure networks, and public services. Thus, their expansion would be more difficult than cities with no intermediate barriers.

Settlements which are completely surrounded by arable land, such as most settlements within the Delta, can expand horizontally only if they urbanize agricultural land. If this constraint were imposed, twenty five out of the 38 settlements having populations greater than 50,000 have no horizontal expansion options. They could only absorb more population by increasing the densities within their boundaries.

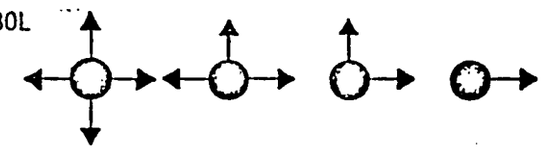
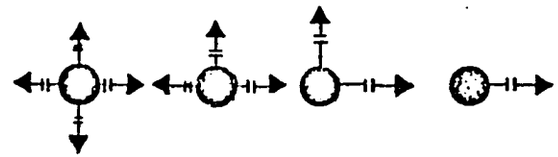
The three horizontal expansion possibilities which have been cited are summarized in Figure 6. As shown, nine settlements can absorb new population fairly easily through horizontal expansion into surrounding desert land. Where excess capacity exists within their infrastructure, they can add new population through incremental additions. Eight settlements can expand horizontally, but have intermediate barriers to that expansion.2/ All other cities have no expansion possibilities except on arable land.

3) Absorption Capacity Of Infrastructure Systems

If a settlement is to absorb more population, it must be able to provide for required urban services through excess capacities in its existing infrastructure networks systems, expand those systems or build new systems. Where serious deficits exist in the service levels of its present systems, a settlement's capacity to absorb more population is seriously constrained, as it must not only provide for the new population, but must also expand its infrastructure to serve the existing population which

FIGURE 6

PHYSICAL EXPANSION OPTIONS OF THE BOUNDARIES OF EXISTING SETTLEMENTS WITH 1976 POPULATIONS OF 50,000 OR MORE

EXPANSION OPTIONS	SETTLEMENTS WITH NO PHYSICAL BARRIERS TO EXPANSION ON NON-ARABLE LAND				SETTLEMENTS WITH INTERMEDIATE PHYSICAL BARRIERS ON NON-ARABLE LAND				SETTLEMENTS WITH NO EXPANSION OPTIONS EXCEPT ON ARABLE LAND
SETTLEMENT SYMBOL									
NO. OF DIRECTIONS OF EXPANSION	4	3	2	1	4	3	2	1	0
RANKING		5	4	3			2	1	0
SETTLEMENT NAMES	-	SUEZ	CAIRO ALEXANDRIA ISMAILIA NAGA HAMADI	ASWAN QENA DAMIETTA	-	-	PORT SAID ASSIUT MINYA BENI SUEF	GIZA SOHAG BILBEIS MATARIA	SHOUBRA EL KHEIMA EL MAHALLA TANTA MANSOURA AKHMIM ZAGAZIG DAMANHOUR FAYOUM KAFR EL DAWAR SHEBIN EL KOM LUXOR BENHA KAFR EL SHEIKH MIG GHAMR QALYUB DESSOUK ABU KABIR MENOUF GIRGA ZIFTA BILQAS KAFR EL ZAYAT MALLAWI

is lacking service. Therefore a settlement with excess capacity or only small deficits in its infrastructural systems is more able to absorb additional population than a settlement with severe deficits.

The capacities and service levels of water and sewerage systems of settlements with 1976 population of 50,000 or more were reviewed to achieve a measure of absorption capacity of infrastructural systems. Power systems were excluded from settlement assessments primarily because most settlements are connected to the national grid and therefore the capacities of their power systems are a function of the national power system's. Consequently, they are not as good a measure of settlement absorptive capacity as water and sewerage systems which do function at the settlement level.

The absorptive capacity of a settlement's water and sewerage systems was determined by comparing the design capacities of water and sewerage treatment plants with standards of consumption which were established by the Provincial Water Supplies Project. These standards, which were developed as the result of water consumption surveys in Beheira and Kafr El Sheikh governorates, provide different levels of consumption for different city sizes and functions. These standards, which were later adopted as targets for provincial water systems by the General Organization for Potable Water, were used to measure the capacity of water systems in settlements with populations less than 250,000. The projected standards of consumption adopted by the master plans for Cairo, Alexandria and the Canal Cities were used to measure capacities in larger cities.

Since these water consumption standards assume high levels of losses and in most cases continued usage of standpipes for at least a portion of a settlement's population, standards of sewerage flows were determined by subtracting losses and standpipe consumption from the water supply standards. Table 6 shows both water and sewerage standards.

It should be noted that these standards do not take into account alternative technologies of water supply and sanitation such as

TABLE 7

WATER AND SEWERAGE CONSUMPTION STANDARDS BY SETTLEMENT SIZE AND CONSUMER CLASS

CONSUMER CLASS	SETTLEMENT SIZE											
	LESS THAN 50,000		50,000–75,000		75,000–150,000		150,000–250,000		250,000–999,000		1,000,000 AND MORE	
	%	m^3/d	%	m^3/d	%	m^3/d	%	m^3/d	%	m^3/d	%	m^3/d
WATER												
-Domestic												
HIGH STANDARD	-	-	6	810	6	1,620	6	1,620	11	4,950		
MIDDLE STANDARD	12	690	20	1,875	20	3,450	21	6,038				
LOW STANDARD	48	2,160	54	3,645	54	7,290	58	13,058				
STAND PIPES	40	800	20	600	40	1,200	10	1,000				
-SUBTOTAL	100	3,560	100	13,560	100	25,038	100					
-SMALL TRADES		500		750		1,356		2,504				
-INSTITUTIONAL		609		1,152		2,237		4,131				
-INDUSTRIAL						1,492		3,580				
TOTAL		4,669		8,832		18,645		35,253				
-LOSSES	33	1,541	33	2,915	42	7,831	42	14,806				
-GRAND TOTAL		6,210		11,747		26,475		50,005				
-GRAND TOTAL PER CAPITA (l/c/d)		124.2		156.6		176.5		200.0		260.0		450.0
SEWERAGE												
-PERCENT OF WATER	59		70		66		68		68		68	
PER CAPITA (l/c/d)		73.3		109.8		116.3		137.0		176.8		306.0

1. Standards for consumption have been derived from proposed standards of water supply for provincial cities in Egypt. These provincial city standards were developed by the Provincial Water Supplies Project done by Binnie and Partners, John Taylor and Sons in association with Dr. A. Abdel Warith and Coopers and Lybrand Associates Ltd. For the Ministry of Housing of the Arab Republic of Egypt. Volume 1, p.41, October 1979.

2. These standards are the current standards of the water supply systems for the Canal Cities.

3. The proposed standards for supply of the Greater Cairo Water Supply Organization and also the standards of water supply for Sadat City.

private wells and handpumps. This is not to negate the value of alternative technologies; this procedure is being used to provide a means of comparing existing systems with possible future demand for their services. Once this comparison has been made, the potential demand for infrastructure can be met through selection of technologies capable of meeting that demand.

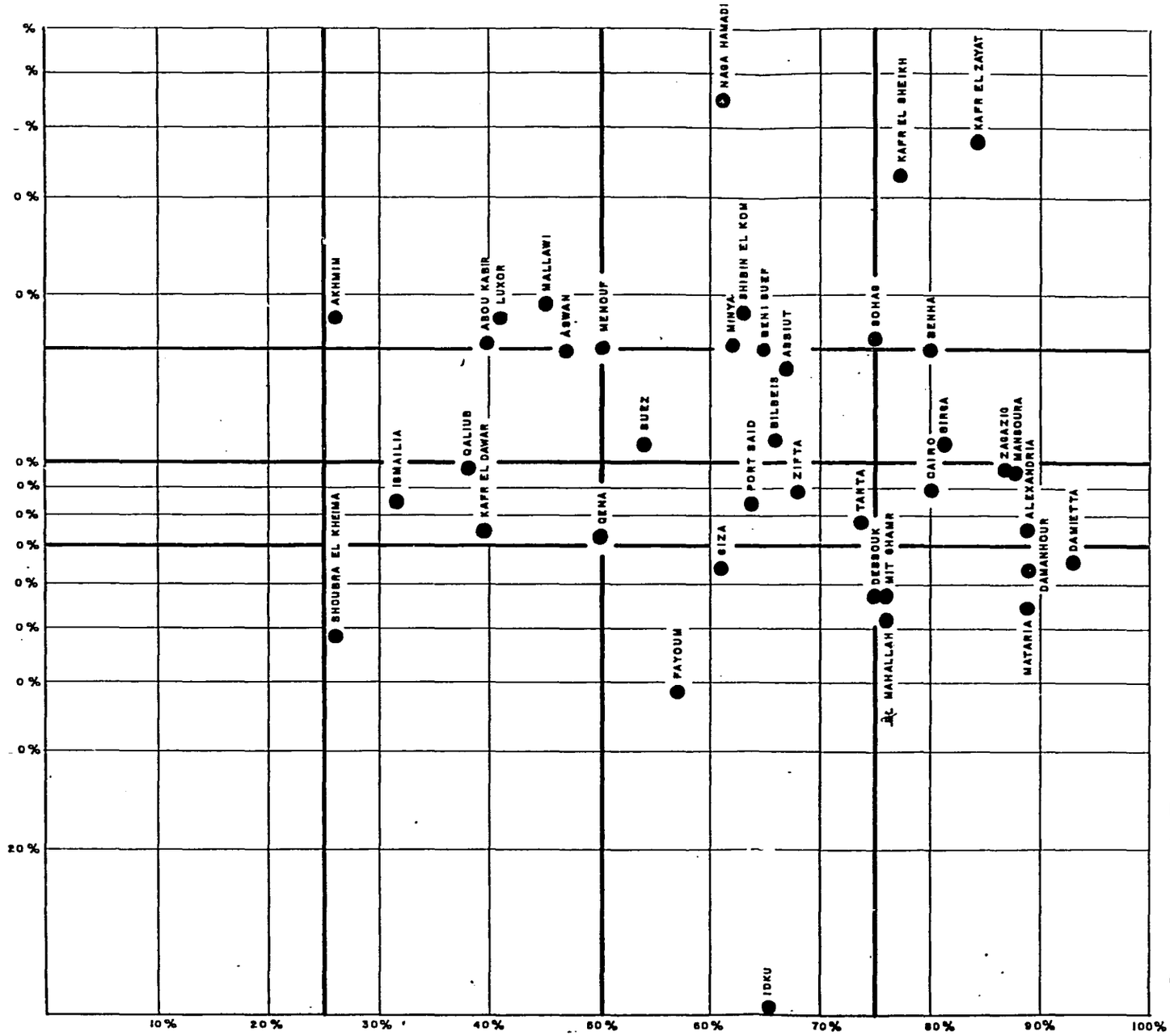
Once the existing design capacity of a settlement's utilities was determined, it was measured against the population absorption capacity determined by gross densities to give an indication of the settlement's infrastructural capacity to absorb that population. Settlement's such as Mallawi, for example, which have designed excess capacities in their water supply systems could absorb all new target population at medium high densities without requiring additional improvements. On the contrary, settlements such as Fayoum which have large deficits in their plant capacities would have to incur higher costs to absorb new population because they must improve the system to meet both present and future deficits.

Though measurement of plant capacity does give an indication of the number of persons that could be served by a system, it does not indicate the number of persons who are. For most settlements, such information is only available through census data on the number of families with access to a network connection. While this data does not give any indication about the quality of service or its frequency, it does indicate the extent of the network's distribution. Furthermore, when compared to the system's plant capacities it provides a combined measure of a system's capacity and its distribution.

In Figures 7 and 8 the settlements' water and sewerage capacities, measured in percent of the potential population served, are compared with the percent of the settlement families connected to the system.

This comparison, which gives an overall indication of the absorptive capacities of settlements' water and sewerage systems, was used to rank the settlements according to the highest levels of

FIGURE 7



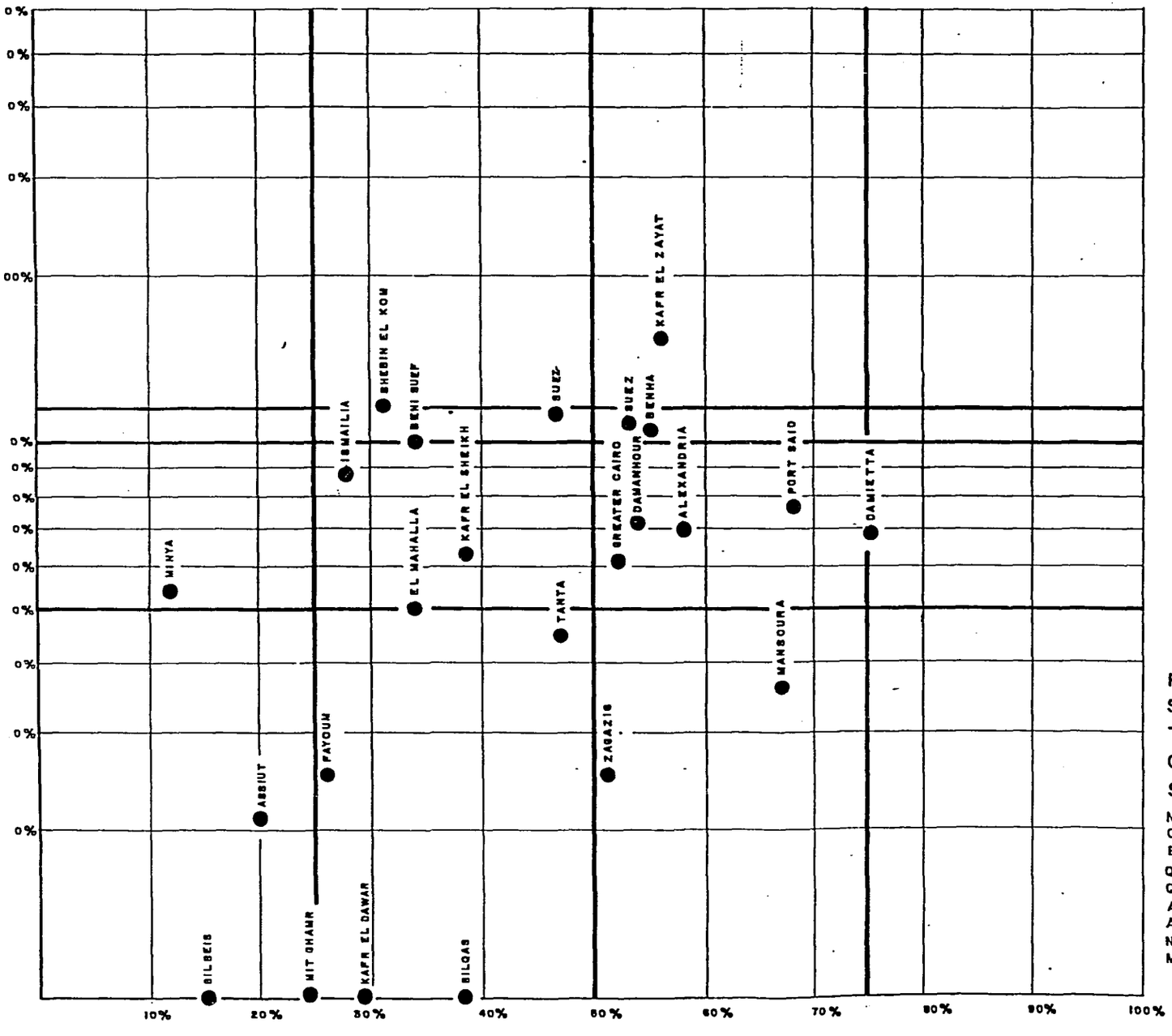
+2	+4	+6	+8
+1	+3	+5	+7
−7	−5	−3	−1
−8	−6	−4	−2

RANKING OF SETTLEMENTS

PERCENT POPULATION WHICH COULD BE SERVED BY PRESENT MUNICIPAL PLANT CAPACITIES AND PERCENT OF FAMILIES CONNECTED TO WATER SYSTEM.

NOTE:
CANAL CITIES ARE BASED ON 1980 DATA ALL OTHERS ON 1976 CENSUS DATA.

FIGURE 8



+2	+4	+6	+8
+1	+3	+5	+7
−7	−5	−3	−1
−8	−6	−4	−2

RANKING OF SETTLEMENTS

PERCENT POPULATIONS WHICH COULD BE SERVED BY MUNICIPAL SEWERAGE TREATMENT CAPACITIES AND PERCENT OF FAMILIES CONNECTED TO SEWERAGE SYSTEMS.

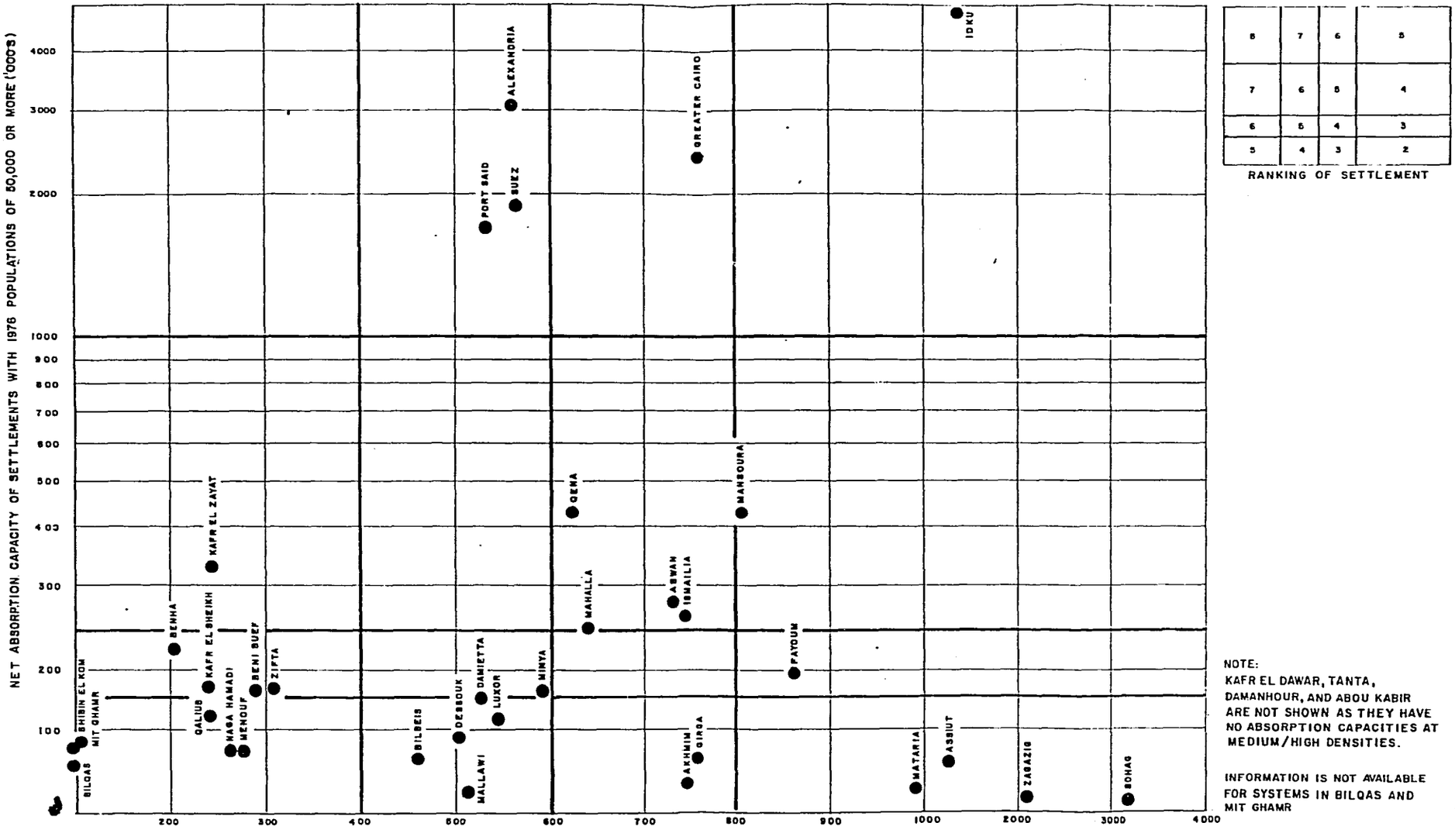
NOTE.
CANAL CITIES BASED ON 1980 DATA ALL OTHERS BASED ON 1976 DATA.

QALIUB, MENOUF, ZIFTA, DESSOUK, ABU KABIR, MALLAWI QENA, NAGA HAMADI, MATARIA, ASWAN, LUXOR, GIRGA, IDKU AKHMIM AND SOHAG HAVE NO FAMILIES CONNECTED AND NO PLANT CAPACITIES.

NO INFORMATION IS AVAILABLE ABOUT BILBEIS, MIT GHAMR, KAFR EL DAWAR AND BILQAS.

NET POPULATION ABSORPTION CAPACITY AT MEDIUM/HIGH DENSITIES AND PER CAPITA COSTS OF WATER AND SEWERAGE SYSTEM FUTURE REQUIREMENTS AT MEDIUM/HIGH DENSITIES

FIGURE 9.



8	7	6	5
7	6	5	4
6	5	4	3
5	4	3	2

RANKING OF SETTLEMENT

NOTE:
KAFR EL DAWAR, TANTA, DAMANHOUR, AND ABOU KABIR ARE NOT SHOWN AS THEY HAVE NO ABSORPTION CAPACITIES AT MEDIUM/HIGH DENSITIES.

INFORMATION IS NOT AVAILABLE FOR SYSTEMS IN BILQAS AND MIT GHAMR

capacity and distribution (connections) of their systems. To do so, it was assumed that a settlement with an excess capacity and a low level of connections, is probably in a better position to absorb additional population than a settlement with a capacity deficit and high number of connections. The level of service in the latter settlement is likely to be so poor, due to inadequate design of its treatment plants and distribution systems, that the advantages of having an extensive distribution network would be negated.

At this stage in the initial asessment of settlement strategies only approximate costs of locating additional population in different settlements can be estimated. These costs (see Appendix Tables II.3 and II.4)show the costs of expanding or constructing new water and sewerage systems to provide services for additional populations plus the costs of providing service for any deficits which may exist.

The variations in the costs are due to the relative importance of the size of the deficits in service compared to the new population which might be added to the settlement and regional variations in costs.2/ For example, the costs of settling new population in Sohag are higher than other settlements because of its distance from major sources of building materials and, more importantly, because Sohag has a relatively low absorption capacity but significantly high deficits in its water and sewerage services.

The per capita capital costs of future requirements for water and sewerage utilities were derived by dividing the total costs of providing water and sewerage infrastructure plus the costs of serving existing population currently lacking water and sewerage by the new population being added to the settlement.

Since from a cost point of view, it is more desirable to locate additional population in settlements where the least costs are incurred. Settlements were ranked according to their population absorption capacities at medium high densities and the per capita

TABLE 8

RANKING OF INFRASTRUCTURE MODIFIERS OF ABSORPTION CAPACITY

SETTLEMENT	WATER	SEWERAGE	PER CAPITA COSTS	COMBINED
Kafr El Zayat	8	6	7	21
Benha	8	5	6	19
Suez	5	3	7	15
Beni Suef	6	3	6	15
Shebin El Kom	6	4	5	15
Kafr El Sheikh	8	(5)	5	8
Minya	6	(7)	5	4
Naga Hamadi	6	(8)	5	3
Menouf	8	(8)	5	3
Alexandria	(1)	(3)	7	3
Girga	7	(8)	3	2
Sohag	8	(8)	2	2
Port Said	(3)	(3)	7	1
Aswan	4	(8)	5	1
Damietta	(2)	(1)	4	1
Mit Ghamr	2	(6)	5	1
Bilbeis	5	(8)	4	1
Greater Cairo	(3)	(3)	6	0
Mallawi	4	(8)	4	0
Mansoura	(1)	(4)	4	(1)
Assiut	5	(8)	2	(1)
Akhmim	4	(8)	3	(1)
Mahalla	(2)	(5)	5	(2)
Zagazig	(1)	(4)	2	(3)
Abu Kabir	4	(8)	0 +	(4)
Ismailia	(5)	(5)	5	(5)
Zifta	(3)	(8)	6	(5)
Qena	(3)	(8)	5	(6)
Idku	(4)	(8)	5	(7)
Fayoum	(4)	(6)	3	(7)
Dessouk	(2)	(8)	4	(8)
Luxor	(4)	(8)	4	(0)
Qalyub	(5)	(8)	5	(8)
Mataria	(2)	(8)	2	(8)
Belqas	(8)	(6)	5	(9)
Kafr El Dawar	(2)	(8)	0	(10)
Damanhour	(2)	(8)	0 +	(10)
Tanta	(3)	(8)	0 +	(11)

+ Since these settlements have no population absorption capacities

costs of providing water and sewerage for those populations. This ranking is shown in Figure 9.3/

However as these measures of infrastructural absorptive capacities are only initial assessments of infrastructure, they were used as modifiers of settlements' horizontal and within boundaries absorption capacity. To do so, the individual rankings which are shown on the key matrices of Figures 7, 8 and 9 were totalled to make an index which indicates the relative capacities of settlement infrastructure systems. This index, which is shown on Table 8, then ranks settlements according the relative costs of increasing the service populations of water and sewerage systems, e.g., the settlements with negative infrastructure indexes are more likely to incur greater costs of adding new population than those which have positive numbers.

4) Ranking of Settlements' Absorption Capacity

The combined ranking of a settlement's ease of population absorption through horizontal expansion beyond its boundaries and its absorption capacity within its boundaries at medium high densities is shown in matrix form in Figure 10. The matrix also indicates those settlements which are likely to have significant infrastructural deficits, and thus will incur greater costs when adding new population.

The matrix of absorption capacity shows that there are seven settlements which have relatively high absorption capacities both within their boundaries and adjacent to their boundaries. Suez, in the Canal Settlement Zone has the highest capacities of the group. However significantly, Egypt's two primate cities, Greater Cairo and Alexandria, and Idku (which can be viewed as an extension of Alexandria) have combined population absorption capacities in excess of 12 million.

A second group of settlements have high absorption capacities within their boundaries, but can only expand beyond their boundaries with some difficulties or at the expense of arable land. Two of these settlements, Benha and Mansoura, have important regional functions which are discussed in Chapter III. Port Said

MATRIX OF MAJOR SETTLEMENTS POPULATION ABSORPTION CAPACITY

ABSOLUTE NET POPULATION ABSORPTION CAPACITY WITHIN SETTLEMENT BOUNDARIES

EASE OF HORIZONTAL EXPANSION OUTSIDE SETTLEMENT BOUNDARIES

	5	4	3	2	1	0
5	SUEZ					
4	CAIRO ALEXANDRIA IDKU ●	ISMAILIA ●			NAGA HAMADI	
3		QENA ●	ASWAN	DAMIETTA		
2	PORT SAID			BENI SUEF MINYA	ASSIUT ●	
1					BILBEIS	
0		MANSOURA	KAFR EL ZAYAT MAHALLA ● BENHA	FAYOUM ● KAFR EL SHEIKH ZIFTA QALIUB ● LUXOR ●	DESSOUK ● SHIBIN EL KOM MENOUF MIT GHAMR BELQAS ● MALLAWI AKHMIM MATARIA ZAGAZIG ● SOHAG GIRGA	KAFR EL DAWAR ● TANTA ● ABU KABIR ● DAMANHOUR ●

● INDICATES SETTLEMENTS WHERE SUBSTANTIAL PER CAPITA COSTS MAY BE INCURRED IN ADDING NEW POPULATION TO WATER AND SEWERAGE SYSTEMS.

has high internal population absorption capacity, but very limited horizontal expansion possibilities.

Five settlements, Naga Hamadi, Damietta, Beni Suef, Minya and Assiut, make up a third group of settlementts whose internal population absorption capacity is limited, but can expand beyond their boundaries with varying degrees of difficulty. For example, the first two can expand horizontally relatively easily, while the latter three can only do so by developing sister cities on the opposite side of the Nile.

The last group of cities have very low internal population absorpiton capacities and no horizontal expansion possibilities unless they expand onto arable land. Bilbeis, which is included in the groups because of its low internal absorption capacities is an exception to the group as it is close to the edge of the Delta and could expand onto desert land. However, such development would create pressure on surrounding arable land to urbanize.

RANKING OF URBAN SETTLEMENTS ECONOMIC GROWTH POTENTIAL AND POPULATION ABSORPTION CAPACITIES

The combined ranking of the measures of economic growth potential and population absorption capacity is shown on the matrix on Figure 11. This matrix was produced by totalling the individual scores of settlements economic growth potential (see Figure 4) and population absorption capacity (see Figure 10). These individual totals were used to locate the settlements on the fine line grid shown on the matrix in Figure 11.

Four major groups of settlements result from this final ranking of economic growth potential and population absorption capacity. These groups are indicated by the heavy lines on the matrix and are described below:

A) Settlements with high development potential.

B) Settlements in which development inducements are required.

MATRIX OF ECONOMIC GROWTH POTENTIAL AND POPULATION ABSORPTION CAPACITY FOR MAJOR SETTLEMENTS IN EGYPT

ECONOMIC GROWTH POTENTIAL

POPULATION ABSORPTION CAPACITY	10	9	8	7	6	5	4	3	2	1
10			SUEZ							
9	CAIRO		ALEXANDRIA	IDKU ●						
8					ISMAILIA ●					
7				PORT SAID .					QENA ●	
6						ASWAN				
5							NAGA HAMMADI		DAMIETTA	
4						MANSOURA	BENI SUEF MINIA			
3				MAHALLA ●	BENHA		ASSIUT ●	KAFR EL ZAYAT		
2					FAYOUM ● KAFR EL SHEIKH BILBEIS		ZIFTA QALIUB ● LUXOR ●			
1	KAFR EL DAWAR ●		SHEBIN EL KOM DAMANHOUR ●	MENOUF ZAGAZIG ●	MIT GHAMR	MATARIA TANTA ●	BELQAS ●	DESSOUK. ● SOHAG . ABU KABIR ●		MALLAWI GIRGA AKHMIM

● INDICATES SETTLEMENTS WHERE SUBSTANTIAL PER CAPITA COSTS MAY BE INCURRED IN ADDING NEW POPULATION TO WATER AND SEWERAGE SYSTEMS.

C) Settlements in which positive development constraints are required, and

D) Settlements with limited growth potential.

These four major groups of settlements are briefly described as follows.

1) Settlements With High Development Potential. The first group of settlements can be characterized as settlements which have developed rapidly in the past and can be expected to continue to grow in the future. This group of settlements consists of Egypt's primate cities, Greater Cairo and Alexandria, the Canal Cities, Suez, Port Said and Ismailia, and Idku as previously mentioned. Idku should largely be considered as an extension of Alexandria due to its proximity to Alexandria.

   All of the settlements in this group have high economic growth potential and absorption capacities. The high economic growth potentials in three of the settlements result because they are Egypt's major ports and thus have strong linkages with the rest of Egypt and with Greater Cairo. Three of the settlements, Greater Cairo, Alexandria and Suez, have received much of Egypt's past industrial investment and have a strong employment base from which they can grow. Although Ismailia has the lowest economic growth ranking of the settlements in the group, it is included in this group because of its central location in the Canal Zone and its good access to Greater Cairo and Delta cities.

2) Settlements In Which Development Inducements Are Required. The seven settlements which comprise the second group of settlements have relatively weak economic growth potential, but due to their locations have important regional functions. These settlements are Qena, Aswan, Naga Hamadi, Damietta, Mansoura, Beni Suef and Minya. Only two of these settlements have internal population absorption capacities which exceed 400,000, Qena and Mahsoura. The other settlements in the group, however, can either expand horizontally beyond their boundaries on non-arable land or can develop new settlement

CHAPTER III

ALTERNATIVE SETTLEMENT PATTERNS

INTRODUCTION

Possible future distributions of the population (alternative settlement patterns) are presented in this chapter. The alternatives are mixes of the Settlement Strategies appropriate to Egypt discussed in Chapter I and make use of the Settlement Profiles from Chapter II in determining where within zones, settlement emphasis should be placed. Appendix I provides estimates of the urban population expected to the year 2000 and order of magnitude estimates of investment required to sustain different levels of economic growth.

The population of Egypt is currently growing rapidly at a time when there are also high rates of economic growth. The future demographic estimates are based upon a declining but still rapid rate of population growth. The Study Team has estimated that urban population will increase from its 1976 level of 16 million to 37 million in 2000 - an increase of 21 million urban residents. Increased urbanization will be both a consequence and facilitator of expansion of industrial activity and is likely to be required as a location for additional rural migrants.

Two important general consequences for future settlement patterns flow from the expectation of such large increases in urban population. First, most of the increase in urban population will be in or immediately adjacent to existing urban areas which are already generally deficient in housing and infrastructure. There are certain to be substantial requirements for investment in infrastructure for repairing existing systems, developing new capacity, and system maintenance. There will, therefore, be severe competition for national investment funds between industrial, agricultural, housing and infrastructure needs.

The second consequence of the large urban increase is that most urban areas will have to plan for substantial increases in their densities within their existing city boundaries. As strongly urged in

lopment of vacant areas, verticle expansion in areas which presently have low density development, and continued repair and maintenance of other built areas.

4) Settlements With Limited Growth Potential. The final group of settlements have both low economic growth potential and low population absorption capacities. All of these settlements are located in the Delta or within the Nile Valley and can only expand at the expense of further encroachment onto arable land. Furthermore, these settlements have experienced either relatively low growth rates in the past or are distant from their markets or sources of non-labor inputs.

Future development of these settlements should probably focus on repair and maintenance of existing infrastructure and, where necessary, provision of basic standards of urban services to prevent their deterioration. This focus is necessary because these settlements have very little or no population absorption capacity and based on previous economic growth, do not have strong growth potential.

Two settlements within this group deserve special attention due to their unique characteristics: Luxor and Kafr El Zayat. Luxor is a major international tourism center, therefore its economic growth potential did not register on the access index as the index reviewed highway traffic. However, even though it has high economic growth potential, Luxor is unlikely doe to the nature of its major industry, tourism, to absorb large populations. Therefore, its future development should focus around its expansion of the tourism industry, but not on absorbing large populations.

Kafr El Zayat is presently an idustrial center. Although it could absorb roughly 300,000 population within its boundaries, further industrial development would probably encourage continued development of urbanization along a corridor which is presently developing between Cairo and Alexandria along the Delta Highway. Thus its growth potential should probably be treated similarly to the Group 3 settlements which have similar characteristics.

FOOTNOTES

1/ In order to obtain the overall "access index" for each settlement, the indices for access to sources of non-labor inputs and markets were first grouped, by numerical importance, and given values ranging from 0 to 8. These values were then combined to produce a range from 0 - 16, and regrouped on a scale of 0 - 5 according to their numerical distribution to produce the final overall "access index".

2/ Giza was included in this group because its expansion into the desert is constrained by archeological areas. Port Said was included in this group because dredging and filling is required to reclaim land for its expansion.

3/ Detailed calculations of the surplus or deficits and cost estimates are shown in the appendices to Chapter II.

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INTRODUCTION

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The second consequence of the large urban increase is that most urban areas will have to plan for substantial increases in their densities within their existing city boundaries. As strongly urged in

Chapter I, urban expansion outside existing boundaries should be on non-arable land to the extent possible. The pressures of population growth in most areas of the country, however, will severely test local capacity to restrict peripheral growth on arable land and undertake rationalization of land use and standards to accommodate higher densities within the boundaries. If such capacity does not exist or is not exercised, spread effects of population growth will result in severe reductions in arable land frustrating the effort to sustain or increase agricultural production.

Our examination of the growth potential and absorption capacity of settlement zones and their major settlements indicates that there are locational difficulties in achieving a reasonable balance between a settlement pattern that is conducive to economic growth and protective of arable land. Zones differ considerably in their combination of economic growth potential, absorption capacity within settlement boundaries, ease of horizontal expansion and cost for infrastructure improvements and expansion.

The information in Chapter II have been used to help identify which zones and settlements within zones should receive emphasis in the alternatives suggested. In general, the more concentrated the Settlement Strategy being given priority in the pattern mix, the more emphasis is given to zones with relatively high economic growth potential and sufficient absorption capacity to accommodate additional population. It is recognized in Chapter II, that absorption capacity is not solely a result of topography and land availability for growth. In assessing absorption capacity, an effort has been made to incorporate some preliminary estimates of the relative costs of serving additional population — although it is premature to attempt full cost analysis.

On the basis of growth potential and absorption capacity considerations — and leaving the Delta Zone aside for the moment — the settlement zones with the highest economic growth potential and considerable absorption capacity seem to be the Cairo, Alexandria West and Canal Zones. The two Upper Egypt Zones are next; but are difficult to rank relative to each other. North Upper Egypt is more

centrally located and, therefore, has advantages associated with accessibility. South Upper Egypt, on the other hand, is somewhat compensated for its distant location by mineral resources, the High Dam Lake, well-known tourist attractions, and some rapidly growing settlements. The outlying regions — the Red Sea, Western Desert, and Sinai zones and the north west coast of the Alexandria West Zone — present relatively fewer economic growth advantages and higher costs of absorbing population on their abundant land. Of these four areas, the north west coast and the Red Sea Zone seem to have the most advantages for urban settlement; although this should be treated as a tentative judgement since our current information, particularly regarding possibilities for urban and rural settlements in the Sinai, is limited.

The Delta Zone must be treated as a special case. Its central location, in the heavily populated part of Egypt, helps provide high economic growth potential for its urban areas as does the agriculturally rich hinterland of these cities. Since the Delta contains most of the total cultivated land of Egypt and its major settlements are surrounded by this land, the physical absorption capacity without intruding on the land is limited. Unless urban areas in the Delta can be largely confined to their existing city boundaries and increase their densities as population grows — which is difficult to achieve — the encouragement of non-agricultural economic activities and new labor requirements in the Delta will result in significant losses of arable land. Although arable land is threatened by urban expansion in other zones, the Delta Zone presents a very sharp choice for GOE decision-makers between the protection of arable land and the encouragement of industry.

A similar procedure to that used in the Zone Analysis — identifying settlements with economic growth potential and relatively high absorption capacity — has been employed in selecting settlements as growth centers within zones. Growth center variants of the mixed strategies will give priority attention to such settlements in allocating population targets. The range of choice, of course, widens as other large centers and secondary cities are added to the mix; but

necessitates choosing places with lower growth potential, absorption capacity or both.

Chapter I identifies the four major spatial strategies which are to be considered in locating future investment priorities and population expansion. Intra-regional deconcentration strategies apply to Cairo and Alexandria; both of which will be expected to experience considerable population growth under all alternatives.

Inter-regional decentralization strategies — counter-magnet and growth center variants — require identification of other promising sites. There are four sites which might be considered for designation as counter-magnets in the first of these strategies: Ismailia, Fayoum/Beni Suef, Qena, and Aswan. In order to have sufficient attraction, the economic potential of Qena or Aswan would probably have to be supplemented by a major relocation of Government functions from Cairo. Since such a major relocation to these sites is highly improbable, and the sites would not confer obvious additional benefits to the country as alternative capitals, their further consideration as counter-magnets does not appear warranted. Ismailia and Fayoum/Beni Suef, on the other hand, are sufficiently close to Cairo that their expansion as counter-magnet cities would not justify nor necessitate the relocation of the Government. Of these two sites, Ismailia seems the better choice as a counter-magnet. Its expansion as a counter-magnet could be confined more easily to desert land; it provides the possibility of substantial linked development in the Sinai, corridor development of both sides of the Suez Canal, accessibility to major metropolitan services and facilities for the Eastern portion of the Delta, and would encourage further development on the desert corridor from Cairo to Ismailia through 10th of Ramadan.

The Nile Valley Zones and the Suez Canal Zone have sites that could be designated as growth centers in the second Inter-regional Decentralization Strategy. The most promising of these sites are listed below by zones:

Suez Canal: Port Said, Suez and Ismailia.
North Upper Egypt: Fayoum and Beni Suef.
South Upper Egypt: Qena, Naga Hamadi and Aswan.

Several Delta Zone cities could be designated as growth centers as shown in Chapter II; were it not for their limited absorption capacity threat to arable land that would follow major expansion. Benha, Mansoura, Shebin El Kom, Kafr El Sheikh and Idku could all absorb some additional population within their existing boundaries and the first four could possibly be considered for expanded functions related primarily to servicing their agricultural hinterland. Such expansion, however, would have to be carefully planned and coupled with improved feeder roads to facilitate the service role and prevent overspill onto agricultural land. A danger in using Benha and Shebin El Kom in this way is the encouragement it would provide to further strip development along the Cairo-Benha-Alexandria and Cairo-Shebin El Kom-Alexandria corridors. This danger is less pronounced in the case of Kafr El Sheikh and Mansoura.

The identified growth centers in other zones, all have some absorption capacity within their boundaries and possibilities for horizontal expansion on non-cultivated land, although in the case of Fayoum, such land is not adjacent to the city.

Among the settlements in the more remote areas, growth center designation might be considered for Ghardaka, Kharga and Matruh; although these cities are likely to be more difficult to develop as substantial growth centers than the sites listed above.

The final spatial strategy described in Chapter I is Inter-regional Decentralization to Secondary cities and rural service centers. As indicated in Chapter I, a secondary city strategy has the lowest probability of influencing migration to major metropolitan areas and should probably be concentrated in the largest of these. The intent of such a strategy would be to upgrade the infrastructure and local service facilities of the secondary cities to improve their capacity to hold expected population growth, rather than to induce substantial in-migration. Cities which should be considered in this strategy component are mostly in North and South Upper Egypt and include: Minya, Mallawi, Assiut, Sohag, Akhmim and Luxor.

In the more remote regions; Matruh, Kharga, Mut, Ghardaka, Ras Ghareb, Safaga, and El Arish are possibilities. Possible growth

centers identified earlier, when not included in a Settlement Pattern Alternative, would need to be considered, also, for infrastructure maintenance and possible upgrading.

The entire expected urban population of 37 million in the year 2000 is allocated in each of the settlement patterns to be presented; although only centers receiving priority in the pattern will be separately identified. Because of the momentum of past trends, time is required to begin to observe effects of alternative redistribution strategies. Consequently, we will assume that all settlement patterns will share a common 1985 population distribution derived from past trends.

Four alternative patterns are presented for GOE consideration. The first is the pattern (the Trend Pattern) that would result from a continuation of the population growth trends by settlement of the 1960-1976 period of 2000. These patterns are modified by the choice of strategic emphasis in the other patterns.

Alternative A assumes continued growth at the trend rate of growth for the Cairo Zone. The increase will require infill and deconcentration of the core area. It assumes, also, accelerated growth for the Alexandria Zone, achievement of population targets for the Canal Zone, and some increase over the trend in North Upper Egypt. Alternative A — a major metropolitan area strategy — would be expected to reduce the growth of the Delta Zone when compared to the Trend Pattern.

Alternative B emphasizes inter-regional decentralization through two types of growth center strategies. Alternative B_1 calls for creation of a major counter-magnet in the Canal Zone — at Ismailia — to draw additional population away from the Cairo and Delta Zones. Alternative B_2 is a growth center strategy emphasizing additional growth poles in North and South Upper Egypt and a reduced but still substantial emphasis on Canal Zone expansion relative to B_1 -- the counter-magnet strategy.

Alternative C is a more extreme decentralization strategy emphasis which includes more expansion of secondary cities in Upper

TABLE 9

SUMMARY SETTLEMENT PATTERNS
FOUR ALTERNATIVES

(POPULATION IN MILLIONS)

	1976		1985		2000		2000 POPULATION					
					TREND PATTERN		ALTERNATIVE A		ALTERNATIVE B1		ALTERNATIVE B2	
ZONE	URBAN POPU-LATION	%	URBAN POPU-LATION	%	URBAN POPU-LATION	%	URBAN POPU-LATION	%	URBAN POPU-LATION	%	URBAN POPU-LATION	%
Cairo Metropolitan	6.84	42.5	9.77	43.2	16.33	44.1	16.35	44.2	15.00	40.5	15.20	41.1
Alexandria/West	2.37	14.7	3.11	13.8	4.59	12.4	5.60	15.1	5.60	15.1	4.50	12.2
Canal*	0.63	3.9	1.04	4.6	2.20	6.0	2.20	6.0	4.00	10.8	3.00	8.1
Delta	3.67	22.8	5.02	22.4	8.01	21.7	7.45	20.1	7.00	18.9	7.30	19.7
North Upper Egypt	0.98	6.1	1.27	5.7	1.83	4.9	2.00	5.4	2.20	5.9	3.00	8.1
South Upper Egypt	1.49	9.2	2.12	9.5	3.63	9.8	3.20	8.6	3.00	8.1	3.40	9.2
Red Sea	0.05	0.3	0.08	0.3	0.16	0.4	0.10	0.3	0.10	0.3	0.40	1.1
Western Desert	0.05	0.3	0.09	0.4	0.21	0.6	0.07	0.2	0.07	0.2	0.15	0.4
Sinai	0.01	0.1	0.01	0.1	0.02	0.1	0.03	0.1	0.03	0.1	0.05	0.1
Totals	16.08	99.9 **	22.51	100.0	36.98	100.0	37.00	100.0	37.00	99.9	37.00	100.0

* Past trends are not useful in projecting the population of the Canal Cities. The Trend Pattern is based upon the current planning Canal Zone.

** Do not add to 100 percent due to rounding.

Egypt and the outlying settlements of the northwest coast as well as the Red Sea, Western Desert and Sinai Zones. The intent of the strategy is to hold considerably more people in areas from which substantial numbers of people now migrate to Cairo by maintaining and improving secondary cities' infrastructure and developing capacity service rural populations.

It is necessary to emphasize that the feasibility of these patterns in terms of possible financial, real resource and other constraints has not yet been tested nor the costs associated with each alternative calculated. Nevertheless, it is to be expected that the costs associated with these alternatives will vary considerably; both because of differences in technical and social infrastructure required and differences in the financial incentives required to induce the industrial and population location patterns implied by the respective alternatives. These latter costs are likely to increase as a function of the degree of decentralization and encouragement of growth in urban areas other than those which already have signficant growth potential.

Table 9 shows a summary of the urban population distribution by zone for the four alternatives. Further details on individual settlements selected as priority targets are included in the discussion of individual alternatives.

The Trend Settlement Pattern

While there is no necessary predictive value to a trend projection of the urban settlement system, it helps provide a future reference point for the discussion of other suggested alternatives. Each of the other alternatives — since they represent the choice of a particular strategic emphasis — implies a somewhat different distribution from that which would follow from the extrapolation of past trends. A discussion of some of the implications of a continuation of past trends will provide a comparative context for interpreting the differences. The Trend Pattern is shown in Table 10.

One of the more striking features of the Trend Pattern is the large absolute increase in the population of the Cairo Zone —

BY ZONE

(URBAN POPULATION IN THOUSANDS)

ZONE	1976 POPULATION	1976 PERCENT	1985 POPULATION	1985 PERCENT	2000 POPULATION	2000 PERCENT	ABSOLUTE INCREASE	PERCENTAGE POINT INCREASE
CAIRO								
Over 50,000	6,711	41.7	9,505	42.3	15,944	43.1	9,227	1.4
Under 50,000	132	.8	202	.8.9	387	1.0	255	.2
TOTAL	6,843	42.5	9,707	43.2	16,331	44.1	9,482	1.6
ALEX/WEST								
Over 50,000	2,319	14.4	3,042	13.5	4,495	12.1	2,175	(2.3)
Under 50,000	51	.3	67	.3	99	.3	48	0
TOTAL	2,370	14.7	3,19	13.8	4,594	12.4	2,223	(2.3)
DELTA								
Over 50,000	2,348	14.5	3,347	14.8	5,672	15.3	3,321	.8
Under 50,000	1,320	8.3	1,676	7.5	2,342	6.4	1,022	(1.9)
TOTAL	3,668	22.8	5,023	22.4	8,014	21.7	4,343	(1.1)
NUE								
Over 50,000	505	3.1	668	3.0	987	2.7	482	(.4)
Under 50,000	478	3.0	605	2.7	843	2.2	365	(.8)
TOTAL	983	6.1	1,273	5.7	1,830	4.9	847	(1.2)
SUE								
Over 50,000	799	5.0	1,221	5.4	2,307	6.2	1,508	1.2
Under 50,000	689	4.2	901	4.1	1,322	3.6	633	(.6)
TOTAL	1,488	9.2	2,122	9.5	3,629	9.8	2,141	.6
CANAL								
Over 50,000	630	3.9	1,041	4.6	2,200	6.0	1,580	2.1
OUTLYING ZONES								
Red Sea	48	.3	77	.3	163	.4	115	.1
New Valley	48	.3	86	.4	210	.6	162	.3
Sinai	10	.1	14	.1	24	.1	14	0
TOTAL	106	.7	177	.8	397	1.1	291	.4
GRAND TOTAL	16,088		22,452		36,995		20,907	

almost 10 million people. This many people cannot be accommodated within the current boundaries of Cairo, Giza and Shubra El Kheima without a substantial increase in the population density. The overall gross density in 1976 for these areas of slightly over 20,000 per square kilometer would have to rise to over 47,000 per square kilometer to accommodate the expansion in existing urban boundaries.

The completion and full occupancy of the currently planned satellites and 10th of Ramadan could provide for about 1.60 million of this increase. An increase of the size suggested by trend growth may require additional infill, fringe development, or new cities or satellites. The continuation of recent trends indicates that Shubra El Kheima would be expected to expand considerably. While its current density (13,300 per square kilometer) could be increased, it is likely that a major increase in population would spill over into adjacent arable land. These trend figures, therefore, strongly suggest the advisability of initiating a comprehensive plan for the entire Cairo Zone, as was suggested in Chapter I.

The Trend Pattern reflects the relatively low population growth of Alexandria in the 1960-76 period — an absolute increase of a little under 2 million by the year 2000 and a decline in the zone's share of urban population is indicated. The reasons for the relatively slow growth in the 1960-76 period are not clear. Post 1976 economic expansion as well as our estimates of economic growth potential and absorption capacity, however, make Alexandria a strong candidate for accelerated investment.

A third prominent feature of the Trend Pattern is the continued expansion of urban population in the cities of the Delta Zone. Some of the major cities in the Delta have considerable absorption capacity within their existing boundaries as do many of the cities under 50,000; nevertheless, growth of the magnitude suggested by past trends will be likely to spill over into arable land. The Landsat data discussed in Chapter I shows that this is already happening to a considerable extent in Qalyubia. The Trend Pattern, therefore, illustrates the importance of improved land use control to protect arable land in the Delta and the necessity for alternative urban loca-

tions for Delta population if arable land is to be protected.

The picture is complicated by the fact that the zone has considerable growth potential due to its favorable location and relatively high access to markets. High trend rates of population growth in the zone are an indicator of this potential. No other zone in Egypt presents such a sharp choice for GOE decision makers between the protection of arable land and the expansion of industry leading to greater population growth. Thr Trend Pattern illustrates this dilemma clearly by showing an absolute growth of about 4.5 million people in the urban areas of the Delta and a small relative increase in the Delta's share of urban population.

North Upper Egypt would be expected to have an absolute increase but a relative decline in its share of the urban population. South Upper Egypt is projected to increase its share of total population. The absolute increase would be mostly in 50,000 plus cities, pushing against the within settlement absorption capacity in many of them.

Alternatives to Trend Pattern

The alternatives to the Trend Patterns can be visualized as possible results of choosing different spatial investment paths over the 1980-2000 period from those which would tend to result with a continuation of 1960-76 investment patterns. The deviations of the alternatives from the Trend Pattern, therefore, are indicators of the relative emphases of the four alternatives. These deviations are shown in Table 11.

1. Alternative A: The major emphasis of Alternative A is on the large metropolitan areas of Cairo and Alexandria. In this alternative, Cairo is assumed to grow at the 1960-76 trend rate and reach a population of 16:35 million by the year 2000. The Alexandria Zone — with an emphasis on the metropolitan region of the zone — is assumed to be encouraged to grow more rapidly than the trend through increased job-creating and social/technical

SETTLEMENT ALTERNATIVES

VARIATIONS FROM TREND

ZONE	TREND POPULATION	POPULATION CHANGE FROM TREND FOR ALTERNATIVES			
		A	B_1	B_2	C
Cairo Metropolitan	16.30	+ 0.5	- 1.3	- 1.1	- 0.8
Alexandria West	4.60	+ 1.0	+ 1.0	- 0.9	- 0.2
Canal	2.20*	No Change	+ 1.8	+ 0.8	+ 0.8
Delta	8.00	- 0.6	- 1.0	- 0.7	- 1.0
North Upper Egypt	1.80	+ 0.2	+ 0.3	+ 1.2	+ 0.2
South Upper Egypt	3.60	- 0.4	- 0.6	- 0.2	- 0.1
Red Sea	0.20	- 0.1	- 0.1	+ 0.2	+ 0.5
Western Desert	0.20	- 0.1	- 0.1	- 0.1	+ 0.1
Sinai	0.02	No Change	No Change	+ 0.02	+ 0..3

* Past trends are not useful in projecting the population of the Canal Cities. The Trend Pattern is based upon the current planning figures for the Canal Zone.

TABLE 12

KEY FEATURES OF ALTERNATIVE A

ZONE	COMMENTS	URBAN TREND POPU-LATION	URBAN TARGETED POPU-LATION	URBAN CHANGE FROM TREND	IMPLIED ZONE 1985 - 2000 MIGRATION *
Cairo	Expansion at trend growth rates; infill in Greater Cairo; fringe expansion on East-West corridors; satellites and new intra-regional infrastructure.	16.33	16.35	+ .02	+ 1.66
Alexandria/West	Emphasis on Alexandria Metropolitan Region, infill to higher densities, New Ameriya development. Limited expansion in Northwest coast at trend rates.	4.59	5.60	+ 1.01	+ 1.01
Canal	Expansion of Canal Cities to current master plant estimates.	2.20	2.20	0	+ 0.60
Delta	Within boundary population growth in Benha; Kafr El Sheikh Mansoura; and possibly Kafr El Zayat and Shebin El Kom as regional service centers; restriction on industrial expansion; improved feeder roads to serve agricultural areas; limitations on urban use of arable land.	8.01	7.45	- 0.56	- 3.12
North Upper Egypt	Planned expansion of Fayoum and Beni Suef at higher densities; Fayoum to 400,000 population and Beni Suef to 500,000.	1.83	2.00	+ 0.17	- 0.97
South Upper Egypt	Emphasis on growth in Qena, Naga Hamadi and Aswan; Qena to 700,000, Naga Hamadi to 100,000 and Aswan to 400,000.	3.63	3.20	- 0.43	- 1.66
Remote Areas:		0.40	0.20	- 0.20	- 0.60
Red Sea Western Desert Sinai	No major expansion in these zones				
General	Other cities, not included for specific emphasis, are considered for infrastructure maintenance and possible upgrading — i.e. as secondary cities.				

* The implied zone migration represents the difference between the targeted population for the zone and the population it would have if it grew at trend growth rates to 1985 and at the rate of natural population increase from 1985-2000.

ALTERNATIVE SETTLEMENT PATTERN A

(POPULATION IN 000'S)

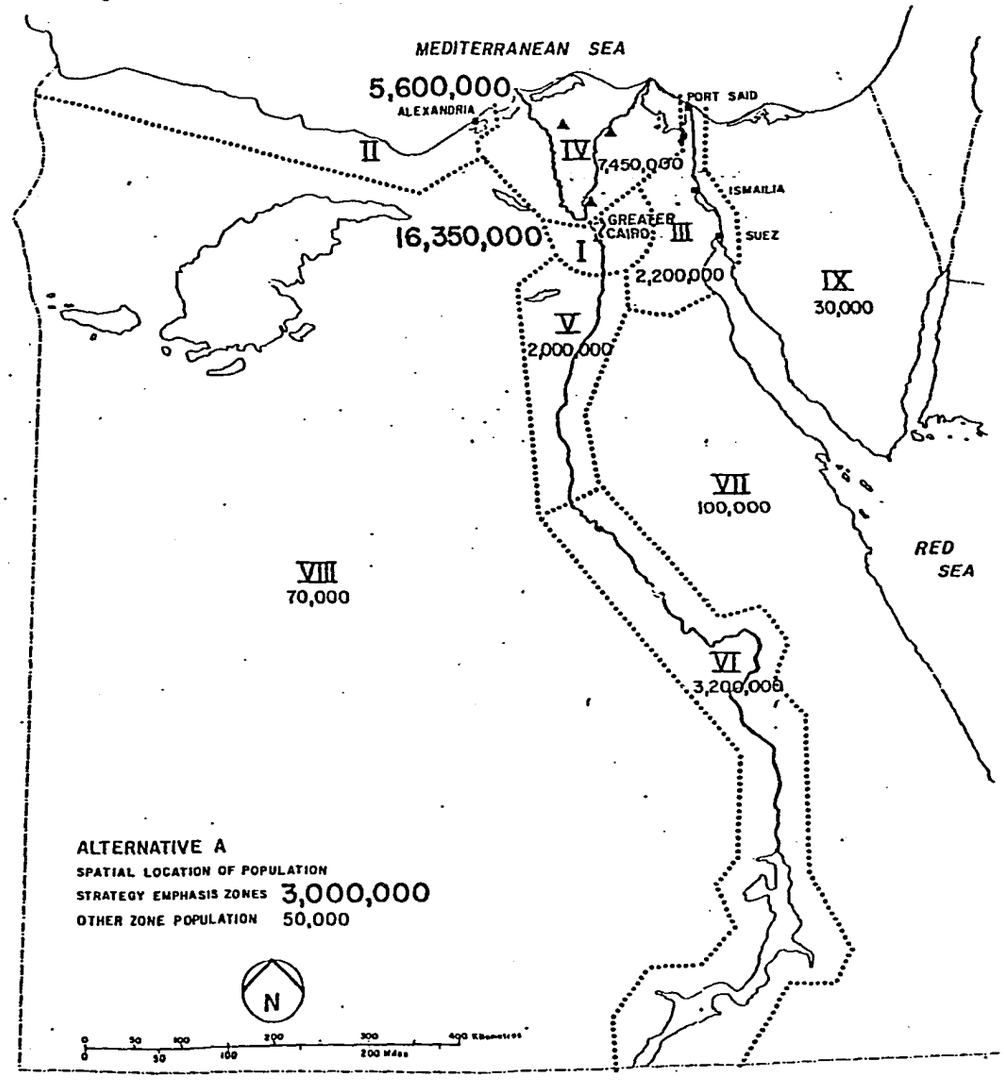
SETTLEMENT ZONES	1976 URBAN POPULATION	ALTERNATIVE A YEAR 2000 URBAN POPULATION	CHANGE FROM 1976
ATER CAIRO REGION	6,843	16,350	9,507
IIA - MATRUH	2,370	5,600	3,230
IAL	630	2,200	1,570
	3,668	7,450	3,782
UPPER EGYPT	983	2,000	1,017
N UPPER EGYPT	1,488	3,200	1,712
	48	100	52
------	48	70	22
	10	30	20
	16,088	37,000	20,912

LEGEND

- ZONE BOUNDARY

DELTA REGIONAL CENTERS (BENHA , MANSOURA , KAFR EL-SHEIKH)

MAP. 3



infrastructure investments in the metropolitan region of the zone. Key characteristics of Alternative A are shown on Table 12 and Map 3.

This alternative includes, also, as a secondary emphasis a larger amount of investment in industry and infrastructure in the Fayoum and Beni Suef in the North Upper Egypt Zone to encourage growth to 400 and 500 thousand respectively in these two places. This growth could be accommodated within the existing city boundaries by a planned increase in gross density. In the case of Beni Suef some of this additional growth could be planned, also, for an initial phase of new city development on the east bank of the Nile to exploit the linkage possibilities of the new Nile Bridge being constructed there.

The Canal Cities would be encouraged to grow to their currently planned year 2000 populations. As indicated in Chapter II, this may require more investment and migration inducements in the zone than currently planned since these cities are falling behind the rate of population growth anticipated in the zone. There is apparently a slower rate of immigration than had been projected in the master plans.

One of the purposes of this alternative is to encourage outmigration from the Delta through the creation of additional urban options in Alexandria to complement options created by trend growth of Cairo and planned growth of the Canal cities. In our view, such positive options for outmigration from the Delta need to be complemented by improvements in the urban hierarchy of the Delta through the planned expansion of three to five regional service centers and improvements in the feeder road system in agricultural areas.

Benha, Mansoura and Kafr El Sheikh have promising locations for development as regional service centers and the absorption capacity within their existing boundaries for this to be accomplished without necessarily intruding on arable land. Possible, but somewhat less appealing, additional locations for this function are Kafr El Zayat and Shebin El Kom. The expansion of Kafr El

Zayat could relieve some pressure on Tanta and Damanhour, which are relatively high density areas and are already spilling over into agricultural land. The expansion of Shebin El Kom could provide additional services to its agricultural hinterland; but may lead to more industrial and commercial development along the Cairo-Shebin El Kom-Alexandria corridor.

Because of the strategic emphasis on major metropolitan areas in this alternative (and the implicit demand for large amounts of urban investment in these major areas) no expansions of the Red Sea, Western Desert and Sinai beyond their trend pattern is included. In this and all other alternatives an as yet unidentified amount of investment funds will have to be allocated to the maintenance and expansion of infrastructure in secondary cities — even though they may be expected to grow only at their trend rate or even more slowly — because of the existing infrastructure deficits in most places.

The expansion of Cairo at its trend rate of growth and acceleraleration of growth in Alexandria — the major features of Alternative A — will require detailed metropolitan region planning to determine where and how much infill can occur and how much growth should be allowed in desert fringe areas and planned for new settlements. As shown in Chapter II, both Cairo and Alexandria could absorb substantial increases of population within existing urban boundaries by increasing densities. The well-founded concern with increased core congestion in both places — but especially Cairo —suggests that care would have to be exercised in locating infill and fringe growth so that it does not unnecessarily add to existing diseconomies. New settlements -- in addition to currently planned satellites and new towns such as New Ameriya and 10th of Ramadan — will be needed to locate the large populations in these areas contemplated in Alternative A.

2. Alternative B_1: Alternative B_1 -- which emphasizes a regional decentralization strategy with a major counter-magnet — has as its primary feature a very substantial planned expansion of

TABLE 13

KEY FEATURES OF ALTERNATIVE B1

ZONE	COMMENTS	TREND POPU-LATION	TARGETED POPU-LATION	CHANGE FROM TREND	IMPLIED ZONE 1985 - 2000 MIGRATION *
Cairo	Expansion of Cairo at near natural increase rates; maximum encouragement of out migratiion and migration diversion to other major metropolitan centers; requires all elements of infill, fringe and new center development.	16.33	15.00	- 1.33	+ 0.32
Alexandria/West	Same as Alternative A.	4.59	5.60	+ 1.01	+ 1.01
Canal	Expansion of Ismailia as new major metropolitan center, expansion on corridors plus new satellite development on both sides of Canal; expansion of Port Said over current plan total due to increased port requirements.	2.20	4.00	+ 1.80	+2.40
Delta	Same as Alternative A except that more outmigration is expected.	8.01	7.00	- 1.01	- 3.57
North Upper Egypt	Same as Alternative A except for additional expansion of Minya to 400,000.	1.83	2.20	+0.37	- 0.77
South Upper Egypt	More limited development of Qena, Naga Hamadi and Aswan than in Alternative A.	3.63	3.00	- 0.63	- 1.86
Remote Areas:		0.40	0.20	- 0.20	- 0.06
Red Sea Western Desert Sinai	Same as alternative A.				
General	Other cities, not included for specific emphasis are considered for infrastructure maintenance and possible upgrading — i.e. as secondary cities.				

* The implied zone migration represents the difference between the targeted population for the zone and the population it would have if it grew at trend growth rates to 1985 and at the rate of natural population increase from 1985 - 2000.

ALTERNATIVE SETTLEMENT PATTERN B I

(POPULATION IN 000'S)

SETTLEMENT ZONES	1976 URBAN POPULATION	ALTERNATIVE B I YEAR 2000 URBAN POPULATION	CHANGE FROM 1976
ATER CAIRO REGION	6,843	15,000	8,157
A - MATRUH	2,370	5,600	3,230
AL	630	4,000	3,370
	3,668	7,000	3,332
THERN UPPER EGYPT	983	2,200	1,217
IN UPPER EGYPT	1,488	3,000	1,512
	48	100	52
N DESERT	48	70	22
INAI	10	30	20
TOTAL -	16,088	37,000	20,912

2

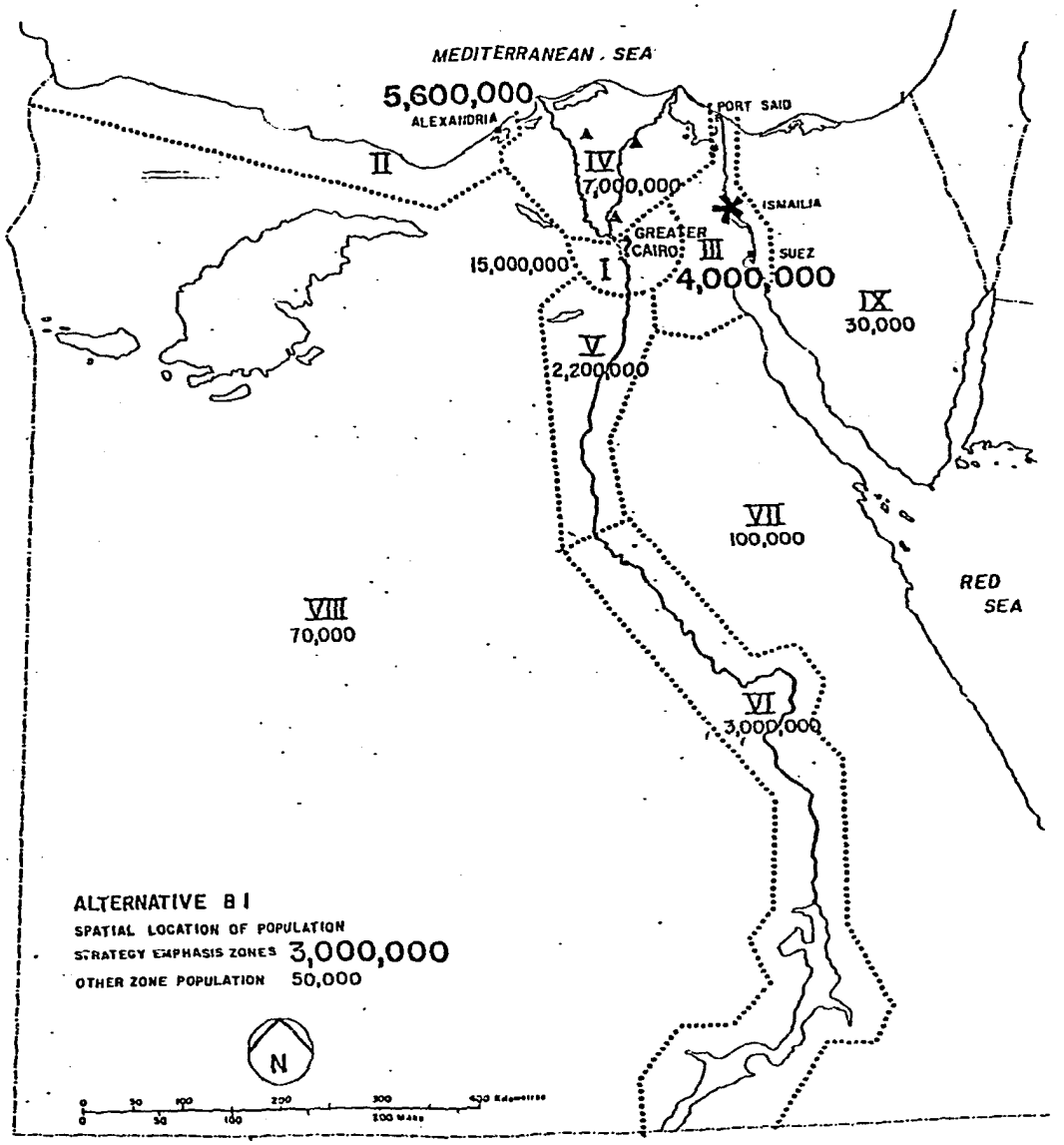
LEGEND

ZONE BOUNDARY

DELTA REGIONAL CENTERS (BENHA , MANSOURA , KAFR EL-SHEIXH)

SPECIAL DEVELOPMENT AREA.

MAP. 4



Ismailia as a new major metropolitan region. This would be coupled with the same degree of expansion of Alexandria as in Alternative A. Key features of Alternative B_1 are on Table 12 and Map 4.

Alternative B_1, by providing somewhat more equivalent urban amenities and job opportunities in Alexandria and Ismailia to those of Cairo, would be expected to divert some migration from Cairo and induce some migration from Cairo itself. This alternative would be expected, also, to permit more substantial outmigration from the Delta than other alternatives by providing three major urban areas as destinations readily accessible to Delta residents. Diversion of growth from Cairo would be encouraged in this alternative by planning for an additional 200,000 in North Upper Egypt -- possibly through a new town near Beni Suef or in the areas north and south of the Canal linking Fayoum and Beni Suef.

In considering possible locations for a major counter-magnet city, the Study Team has concluded that Ismailia has the best combination of characteristics. As suggested in Chapter I, only two zones possess sufficient locational advantages to be serious candidates — the Canal and North Upper Egypt. Delta cities are ruled out because of the need to protect arable land and other zones are too remote. North Upper Egypt, particularly the Fayoum/Beni Suef section, is a possibility. Its major drawbacks are that it is too close to Cairo, on one hand, and too remote from the Delta to appeal to potential Delta outmigrants, on the other hand.

Within the Canal Zone, both Ismailia and Suez are possibilities in terms of having nearby non-cultivated land that is suitable for urban development. Ismailia seems a better choice than Suez, however, because of its central location on the Canal, its accessibility to and from the Delta on the Ismailia-Zagazig highway, the availibility of water from the Ismailia canal and its direct link to Cairo on the desert road (which could be expanded if necessary without threatening agricultural land. The current

master plan for Ismailia emphasizes flexibility to leave open the possibility of signficant expansion beyond the current population target. Expansion possibilities noted in the Master Plan are: increased city density, expansion on the northeast, northwest, southeast and southwest corridors, and future city development on the east bank of the Canal along Lake Timsah.

3. Alternative B_2: This alternative — a strategic emphasis on regional decentralization through growth center emphasis — spreads the population growth that would go to Alexandria in Alternative A and B_1 and the concentrated growth of Ismailia in Alternative B_1 to all other settlement zones except Cairo and the Delta. Key features of Alternative B_2 are on Table 14 and Map 5.

   This alternative includes the expansion of urban areas on the Red Sea by an additional 200,000 people in planned growth in Ghardaka, Ras Ghareb and Saffaga. This amount of growth is a little over half of that proposed in the current Red Sea Governorate Plan. A small increase in Kharga to serve agricultural areas is included; as is a small increase in the Sinai at El Arish or in new agricultural settlements.

   In South Upper Egypt, Aswan and Qena/Naga Hamadi expansion would be emphasized, with additional growth in Assiut and secondary cities as well as expanded settlements in the High Dam Lake Area.

   The geographic spread of this alternative is expected to have the effect of reducing population growth in Cairo and the Delta, but not by as much as Alternative B_1. Both Alexandria and the Canal cities receive less emphasis in this alternative than in B_1 and consequently would not be as able to divert migrants from Cairo and attract such potential migrants from Cairo and the Delta.

4. Alternative C: Alternative C is the most extreme decentralization pattern included in this report. It combines regional decentralization to the Canal, North and South Upper Egypt with substantial expansion of the outlying areas: the Northwest Coast, Red Sea, Western Desert and Sinai zones. In this alternative, the Northwest Coast and Red Sea are assumed to grow at

TABLE 14

KEY FEATURES OF ALTERNATIVE B2

ZONE	COMMENTS	TREND POPU-LATION	TARGETED POPU-LATION	CHANGE FROM TREND	IMPLIED ZONE 1985 - 2000 MIGRATION *
Cairo	Expansion at slightly above natural increase rates; otherwise similar to B1.	16.33	15.20	- 1013	+0.51
Alexandria/West	Concentration on Alexandria Metropolitan zone; lower rate of expansion than B1; otherwise similar to B1 and A.	4.59	4.50	- 0.09	- 0.09
Canal	Same as B1 except for more limited development of Ismailia.	2.20	3.00	+ 0.80	+ 1.40
Delta	Same as Alternative A except for expected rate of migration.	8.01	7.30	- 0.71	- 3.27
North Upper Egypt	Expansion of Fayoum, Beni Suef and Minya as in B1; creation of major new center on East Bank of Nile at Beni Suef and Fayoum.	1.83	3.00	+ 1.17	+ 0.03
South Upper Egypt	Expansion of Qena, Naga Hamadi, Aswan; planned limited expansions in Assiut, Sohag; additional development in High Dam Lake area.	3.63	3.40	- 0.23	- 1.46
Remote Areas:		0.40	0.60	+0.20	+ 0.34
Red Sea Western Desert Sinai	Partial implementation of Red Sea governorate plan to expand Ghardaka, Safaga and Ras Gharib to 400,000; expansion of Kharga and Mut to serve agriculture in Western Desert to 150,000; expansion at El Arich to 50,000.				
General	Other cities, not included for specific emphasis, are considered for infrastructure maintenance and possible upgrading — i.e. as secondary cities.				

* The implied zone migration represents the difference between the targeted population for the zone and the population it would have if it grew at trend growth rates to 1985 and at the rate of natural population increase from 1985 - 2000

ALTERNATIVE SETTLEMENT PATTERN B 2

	SETTLEMENT ZONES	1976 URBAN POPULATION	ALTERNATIVE B 2 YEAR 2000 URBAN POPULATION	CHANGE FROM 1976
	GREATER CAIRO REGION	6,843	15,200	8,357
	ALEXANDRIA - MATRUH	2,370	4,500	2,130
	SUEZ CANAL	630	3,000	2,370
	DELTA	3,668	7,300	3,632
	NORTHERN UPPER EGYPT	983	3,000	2,017
VI	SOUTHERN UPPER EGYPT	1,488	3,400	1,912
VII	RED SEA	48	400	352
	WESTERN DESERT	48	150	102
	SINAI	10	50	40
	TOTAL	16,088	37,000	20,912

LEGEND

- ••••• ZONE BOUNDARY
- ▲ DELTA REGIONAL CENTERS (BENHA , MANSOURA , KAFR EL-SHEIKH)
- ✱ SPECIAL DEVELOPEMENT AREAS

MAP. 5

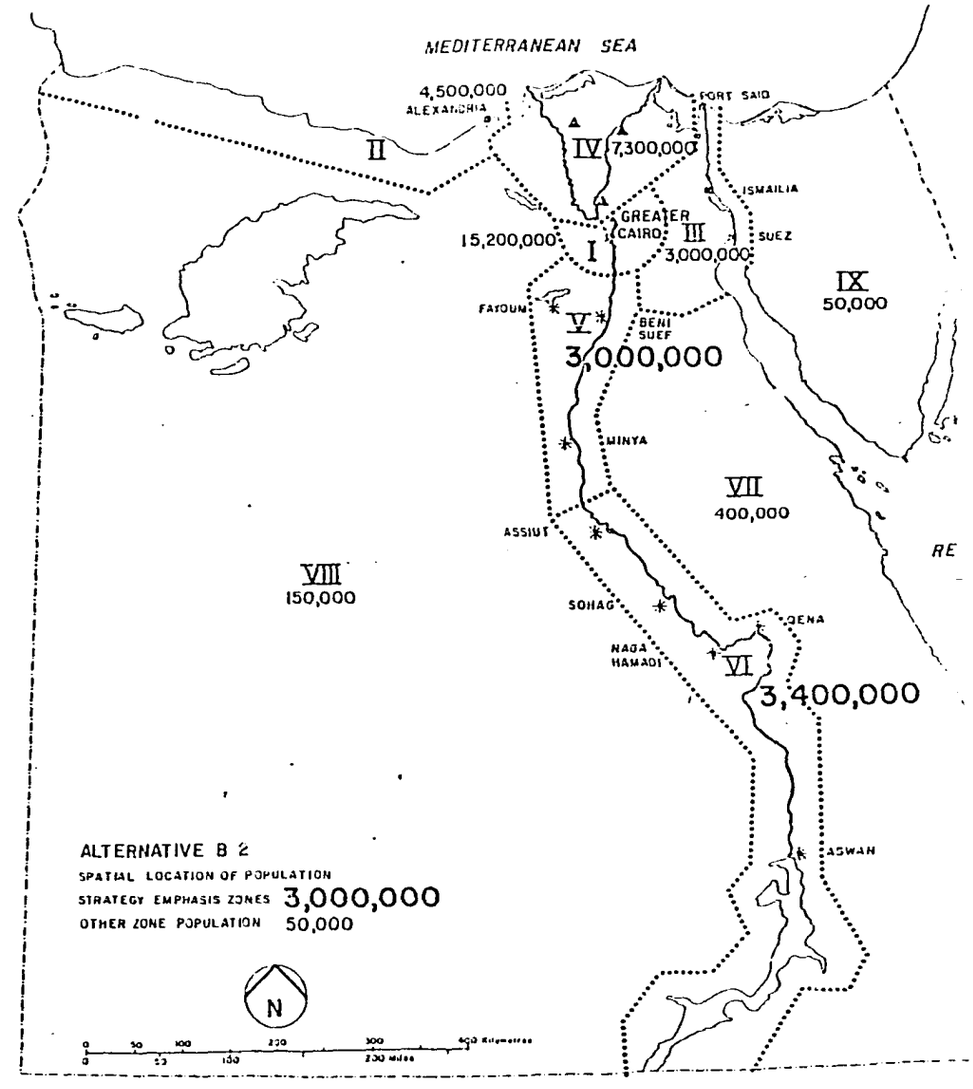


TABLE 15

KEY FEATURES OF ALTERNATIVE C

ZONE	COMMENTS	TREND POPU-LATION	TARGETED POPU-LATION	CHANGE FROM TREND	IMPLIED ZONE 1985 - 2000 MIGRATION *
Cairo	Greater expansion than in B1 and B2; otherwise similar to B2.	16.33	15.50	- 0.83	+ 0.82
Alexandria/West	Expansion of Alexandria to 4 million; growth at less than trend growth; expansion of Northwest coast at levels in Northwest coast plan (750.000).	4.59	4.75	+ 0.16	+ 0.16
Canal	Planned development of Ismailia as reduced major center (1.25 million); otherwise as in current plans.	2.20	2.95	+ 0.75	+ 1.35
Delta	Same as Alternative A except for the anticipated migration.	8.01	7.00	- 1.01	- 3.57
North Upper Egypt	Same as Alternative A.	1.83	2.00	+ 0.17	- 0.97
South Upper Egypt	Major expansions in Qena and Naga Hamadi, expansion of Aswan and High Dam Lake at currently planned levels (High Dam Lake Study); limited expansion of Assiut and Sohag.	3.63	3.50	- 0.13	- 1.36
Remote Areas:					
Red Sea	Expansion of Red Sea to population targets in Red Sea governorate plan (700,000) Western Desert expansions at Gharga, Dakla, Ferafra and Beheira Oasis (300,000), expansion of El Arish, El Tur and rural settlements in Sinai (300,000).	0.40	1.30	+ 0.90	+ 1.04
General	Other cities, not included for specific emphasis are considered for infrastructure maintenance and possible upgrading — i.e. as secondary cities.				

* The implied zone migration represents the difference between the targeted population for the zone and the population it would have if it grew at trend growth rates to 1985 and at the rate of natural population increase from 1985 - 2000.

ALTERNATIVE SETTLEMENT PATTERN C

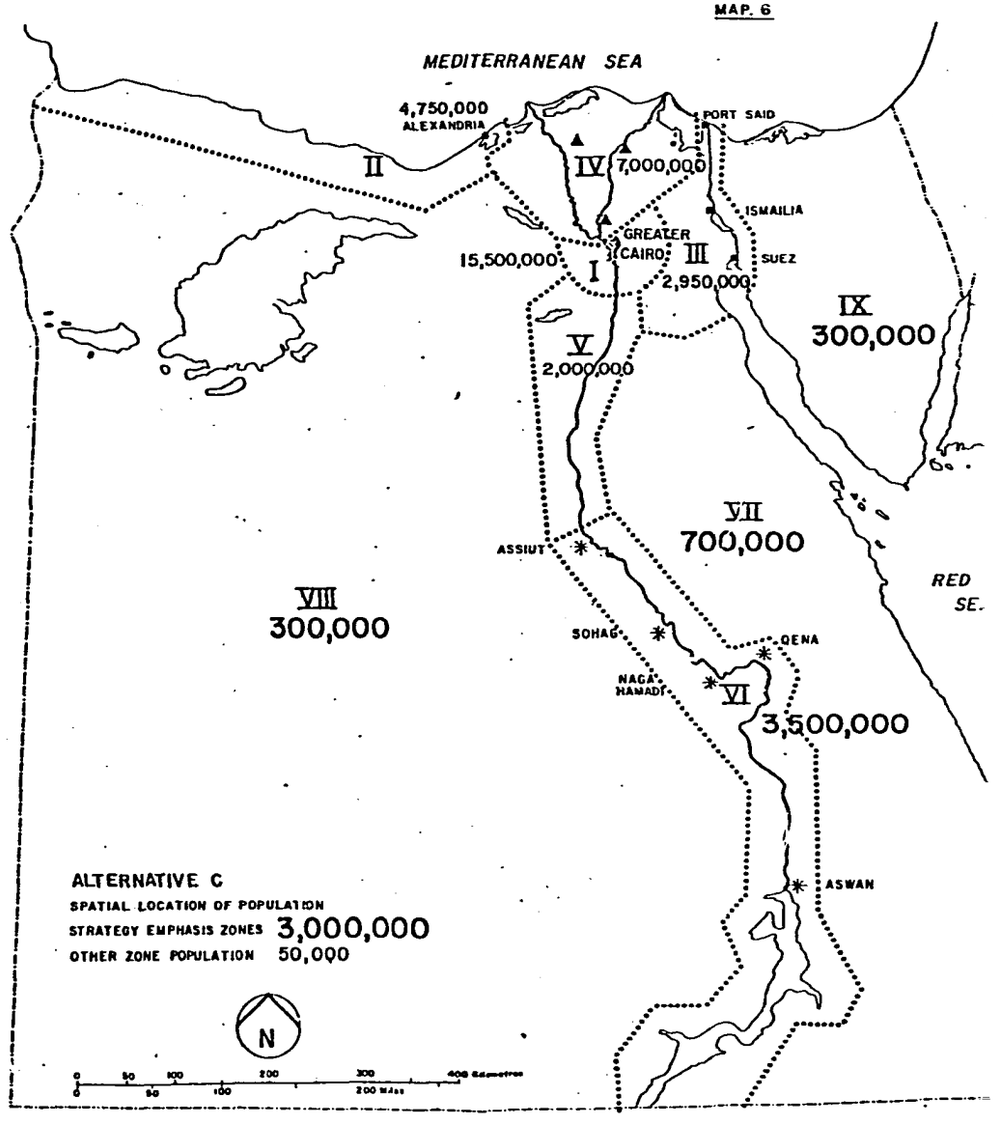
(POPULATION IN 000'S)

SETTLEMENT ZONES	1976 URBAN POPULATION	ALTERNATIVE C YEAR 2000 URBAN POPULATION	CHANGE FROM 1976
R CAIRO REGION	6,843	15,500	8,657
NDRIA - MATRUH	2,370	4,750	2,380
CANAL	630	2,950	2,320
	3,668	7,000	3,332
HERN UPPER EGYPT	983	2,000	1,017
RN UPPER EGYPT	1,488	3,500	2,012
	48	700	652
N DESERT	48	300	252
	10	300	290
	16,088	37,000	20,912

LEGEND

- ••••• ZONE BOUNDARY
- ▲ DELTA REGIONAL CENTERS (BENHA, MANSOURA, KAFR EL-SHEIKH)
- ✱ SPECIAL DEVELOPMENT AREA.

MAP. 6



the rates proposed in the "Regional Plan for the Coastal Zone of the Western Desert" and in the recent Red Sea Governorate Plan. Similar plans have not yet been developed for the Sinai and Western Desert. However, in this alternative, urban expansion at El Arish; possibly El Tur; and Kharga is expected to be complemented by some expansion of rural settlements in the Sinai and the smaller areas of Mut, Farafra and Beheira in the Western Oases. Key features of Alternative C are on Table 15 and Map 6.

The growth in North and South Upper Egypt contemplated in this alternative will require investments in not only the 100,000 plus cities but also the secondary cities (50-100,000) in these zones to encourage more rapid expansion than the trend pattern.

This alternative will probably require the provision of substantial inducements to migration to outlying areas; in addition to direct investments in industry and infrastructure. The evidence for this is the failure of the Canal cities to keep pace with the growth required by their year 2000 population projections in spite of the reconstruction and investment expenditures already incurred there. The Red Sea Governorate Plan contains recommendations for substantial per capita expenditures for industry and infrastructure to achieve the total population target of 700,000 by the year 2000.

The alternative shows a reduction in population — relative to the trend — for Cairo and Alexandria. The implied rate of growth of Cairo in this alternative is somewhat more than the 1976-2000 rate of growth of natural increase for the population as a whole. Nevertheless it implies a strong effort to attract Cairo residents to the decentralized locations and to divert would-be migrants — from North and South Upper Egypt particularly — to these alternative sites. Alexandria's growth is reduced on the assumption that expansion of the Northwest Coast will draw migrants from Alexandria or from other nearby Delta areas that would have gone to Alexandria.

Summary

The Alternative Patterns, described here in terms of their major features, range from a relatively centralized major metropolitan emphasis to a relatively decentralized emphasis on outlying zones as well as secondary cities in North and South Upper Egypt. The intent in presenting a range of options is to facilitate joint exploration of the significance of different strategic choices for future investment plans between GOE and the Study Team.

Several general points regarding these choices seem to be clear. First, under any option, the population of Cairo and, to a lesser extent, Alexandria will grow substantially. This will necessitate signficant choices relating to the intra-metropolitan form and location of the population — infill, horizontal expansion at the fringe or along existing corridors and the development of new centers as nuclei outside the currently built-up area — as well as major expansions and improvements of infrastructure systems to handle the requirements of both the current and expected new populations.

Second, although all strategies have as part of their purpose the protection of arable land; it is necesary to contemplate substantial additions to existing urban areas throughout the Delta and Upper Nile Valley that will threaten cultivated land. Both controls and positive migration incentives will be required to prevent overspill. It is expected that local administrative capacity and the enforceability of laws regarding use of arable land for non-agricultural purposes will be severely tested.

Third, although the alternatives represent redistribution of trend patterns, virtually all existing urban areas will experience some population increase. Very few urban areas have sufficient excess capacity in their infrastructure and most are deficient in maintenance of their existing systems. The requirements for infrastructure costs (operations, maintenance, creation of new capacity) will have to be balanced with requirements for job-creating investment.

Fourth, population increases in most urban areas will result increased densities within existing boundaries. At least for major urban areas, more rational land use would probably be facilitated by developing master plans based upon assumptions of higher density

growth.

Fifth, the higher densities plus intense competition for funds between agricultural land expansion, job-creating investment and infrastructure needs will require choices about standards for new development. The possibility of selective adjustment of standards will need to be considered seriously by the GOE.

Sixth, it will need to be recognized that choice of population and spatial targets for investment will mean that not all portions of the urban system can be expected to receive equal per capita investment over the 1980-2000 period. At the same time, a failure to select priorities, allocate funds and follow-through with planned investments would be likely to result in less benefits for the whole country than are potentially achievable.

Seventh, the alternatives suggested in this paper will carry substantial but variable costs for their implementation. These costs have not yet been calculated for these patterns. Costing of the patterns is included in the next step of our analysis. It would be very beneficial if a review and discussion of this document lead to some narrowing of the alternatives for cost estimation and more complete development. An indication of GOE preferences regarding the characteristics of the patterns which might be given government support, if feasible, could lead to a clear focus for subsequent work.

Finally, the implementation of any of these alternative patterns will require integrated efforts from many central ministries and significant development planning and operations at local levels. Administrative mechanisms to insure such integration, development of appropriate instruments and the effectiveness of local inputs will need strengthening or, where they do not now exist, their creation.

APPENDIX I: DEMOGRAPHIC AND ECONOMIC PROJECTIONS TO 2000

Demographic and economic projections provide an idea of the population which must be served by settlement strategies — through provisions of jobs, housing and services — and the resources required to implement them. The projections presented here provide order-of-magnitude estimates of some of the major elements of a demographic and economic profile of Egypt through the year 2000 — total and urban population, expected labor force, Gross Domestic Product (GDP), employment and investment.

As the National Urban Policy Study continues, additional work will be done — particularly on the economic projections — to add other elements (such as public and private savings) and indicate possible effects of policy choices on the range of expected outcomes.

The 1980 population of Egypt is 42 million. Approximately 19 million live in areas classified as urban places. According to our current medium estimate, the population will reach about 68 million by 2000, of which about 65 million will be resident in the country. The corresponding urban population in the year 2000 is expected to be about 37 million (with a range of 34 to 39 million), nearly double the current urban population.

In 1979, GDP was L.E. 10.2 billion — about L.E. 250 per capita. Economic growth is projected to be on average between 5.5 and 7 per cent per year over the twenty year period. At these rates of growth, Gross Domestic Product in the year 2000 would be between L.E. 35 billion and 43 billion — L.E. 490 and 650 on a per capita basis in 1979 prices.

The growth of the basic population and economic variables is shown in Table II.1. The projection variables are discussed in the next section. The Appendix concludes with a discussion of methodology used in developing these estimates.

TABLE I.1

Projections of Basic Variables

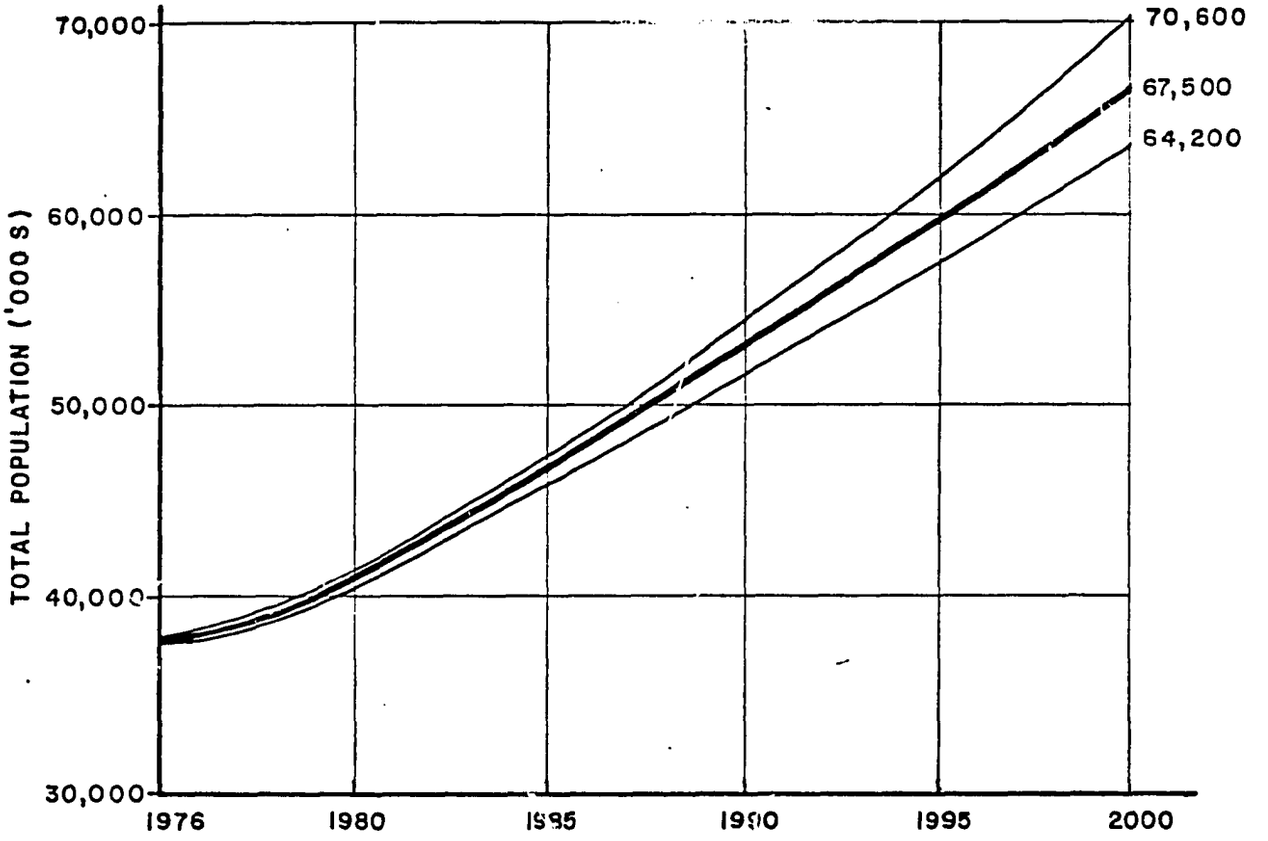
	1980	1990		2000	
Demographic Projections					
(In Millions)					
Total Population	42.1	53.8		67.5	
Labor Force	12.6	16.2		20.9	
Urban Population	18.7	26.7		37.0	
Economic		A	B	A	B
GDP (L.E. Billions)	11.2	23.4	21.4	43.4	32.9
Employment (Millions)	10.8	15.4	14.4	21.2	19.6
Investment (L.E. Billions)	3.4	3.3	6.7	12.6	6.6

DEMOGRAPHIC PROJECTIONS

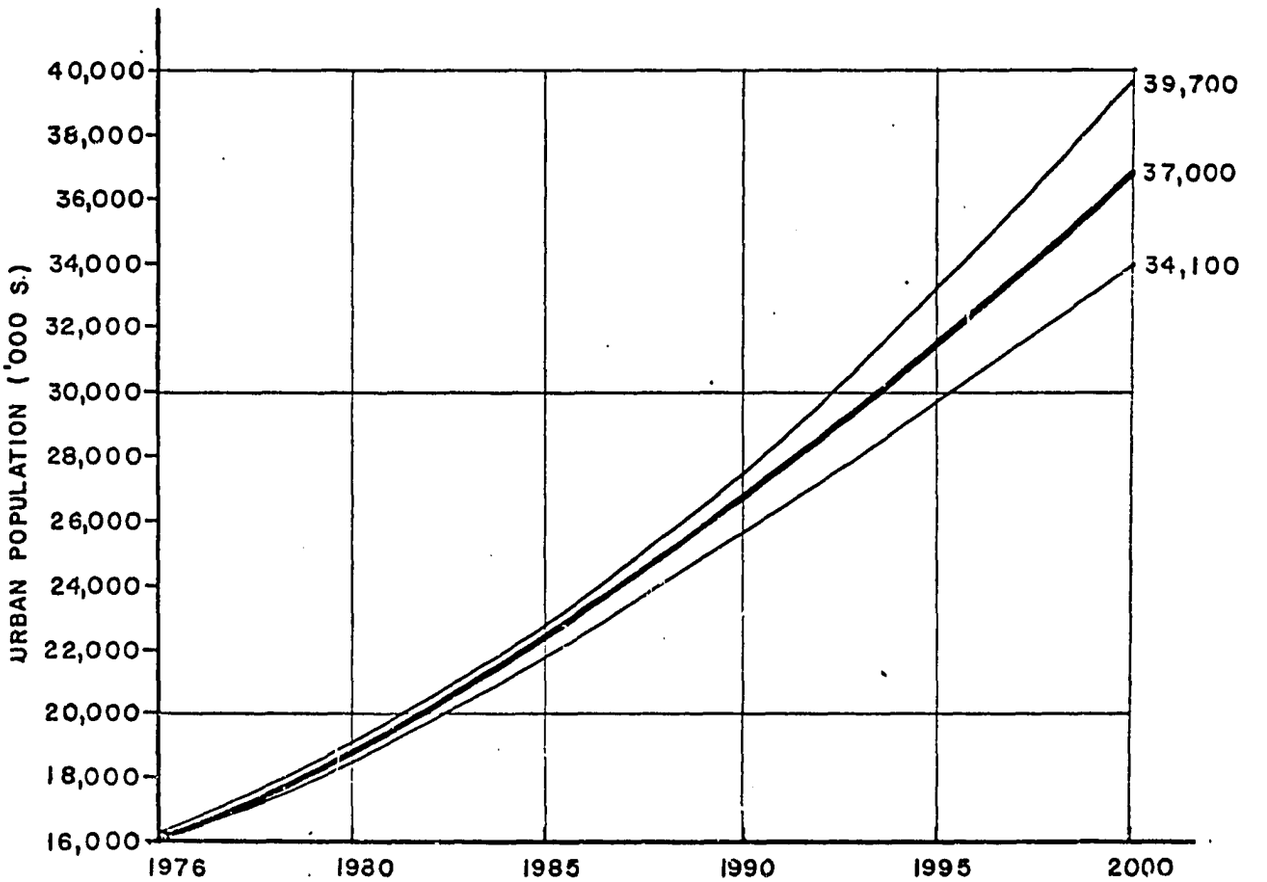
The projections of total population, shown in Figure 1, are derived from alternative assumptions regarding the extent of decline in the population growth rate. Future changes in the birth rate are the major source of difference between the projections. Associated with each projection of total population there is a projection of urban population, also shown in Figure I.1. These projections are more tentative than those of total population since rural/urban migration as well as natural increase affect the estimates.

High population density, increasing mechanization of farm production processes, restrictions on construction on arable land and the difficulty of expanding cultivable land are likely to limit the capacity of rural areas to absorb population. It is likely that rural/urban migration rates will increase even while the rate of natural increase of the total population is decreasing. The degree of urbanization associated with the projections ranges from 55 percent (low population projection) to 59 percent (high population projection).

TOTAL POPULATION 1976-2000



URBAN POPULATION 1976-2000



The labor force projection for each population growth variant is shown in Figure I.2. The annual growth of the labor force is projected to be between 2.5 and 2.7 percent with a medium variant value of 2.6 percent. This projection exceeds the 1970-1977 growth rate of 2.2 percent, but is consistent with the experience of countries whose population and economic growth rates coincide with the rates used in this study.

Total population, urban population and labor force for the medium variant, in five year intervals, are shown in Table I.2.

TABLE I.2

DEMOGRAPHIC PROJECTIONS, Medium Variant (000)

(In Millions)

Year	Total Population	Urban Population	Labor Force
1980	42.1	18.7	12.6
1985	47.7	22.5	14.3
1990	53.8	26.6	16.3
1995	60.3	31.4	18.6
2000	67.5	37.0	21.2

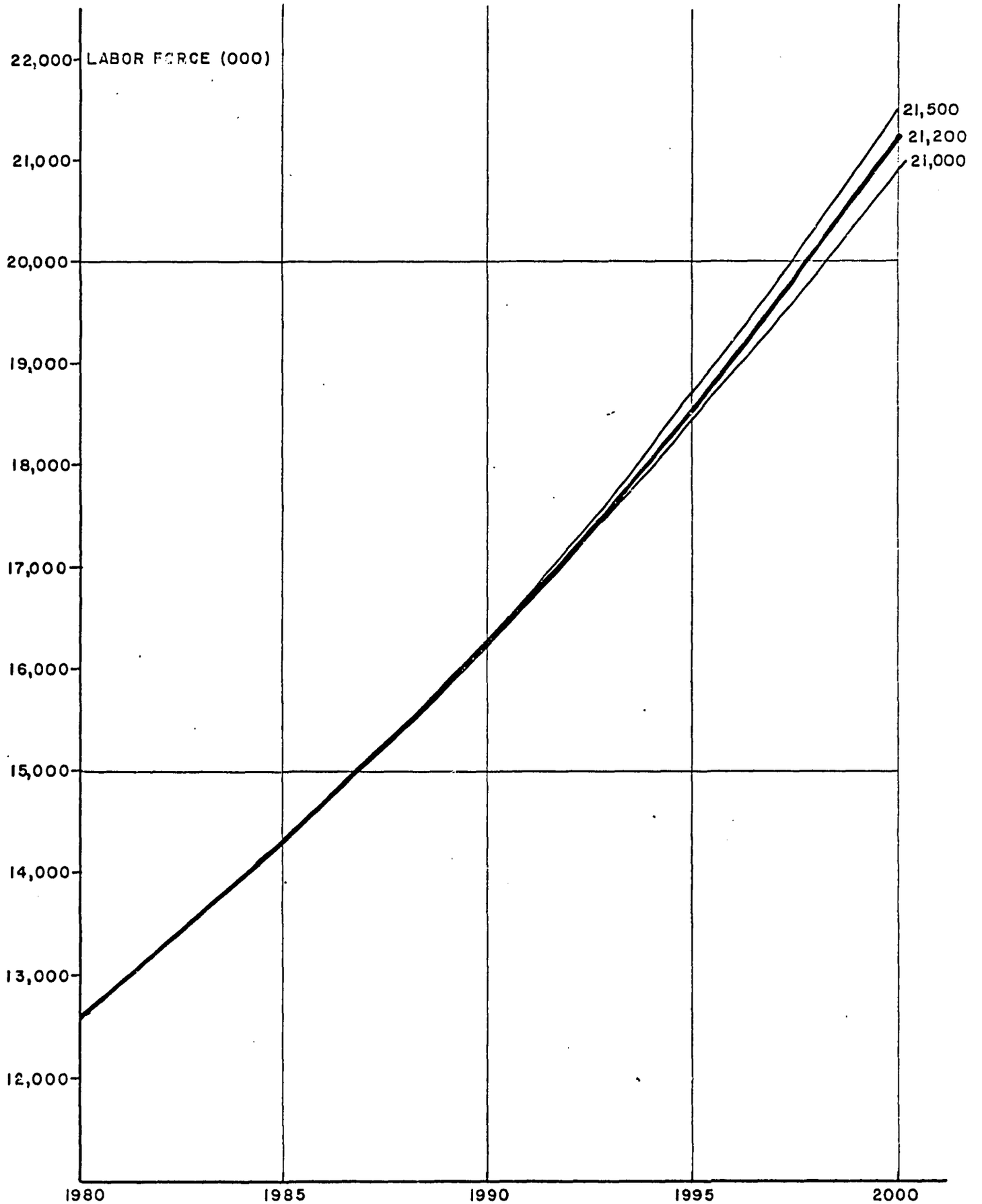
The settlement patterns described in Chapter III are distributions of the estimated 37 million people in urban areas by settlement zone. The population distribution which would occur if past trends of growth continue are shown in Chapter III as well as four alternatives reflecting different strategic emphasis for urban settlement policy.

ECONOMIC PROJECTIONS

Two sets of initial economic projections have been prepared; one reflects a favorable scenario and the other a less favorable scenario.

The initial projections show possible consequences on the rate of growth of domestic product and employment of different levels of investment in the economy. The amount of investment which can be

LABOR FORCE, 1980 - 2000

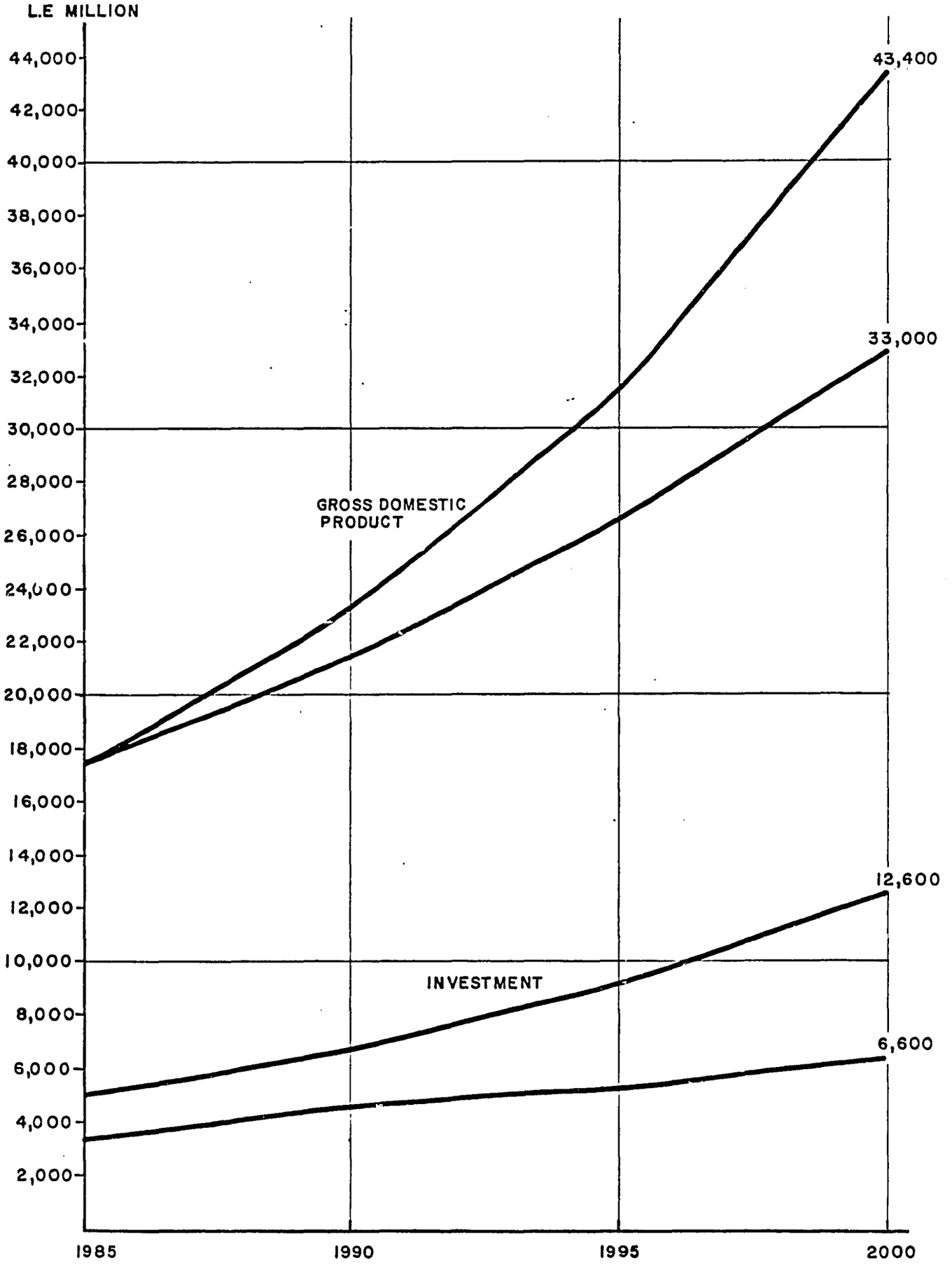


achieved depends upon the amount of resources which are saved — that is, not used for consumption. An additional study of expected savings of public and private domestic resources and foreign resource available to Egypt is being conducted. The amount of saving is strongly influenced by public policy. Consequently, ways of increasing the amount of saving are being investigated also. The results of this study will be used to make revisions in the current assumptions about investment if that is warranted by the findings. For this initial set of projections, we have assumed that — in the favorable scenario — twenty nine percent of the Gross Domestic Product will be available for investment. This is the proportion that is assumed in the current 1980-84 Development Plan. If consumption requirements are higher than anticipated in this plan, the amount of possible investment will be lower. To account for this possibility, an estimate of the growth that might be achieved if investment is reduced to twenty percent of Gross Domestic Product is provided — the less-favorable scenario.

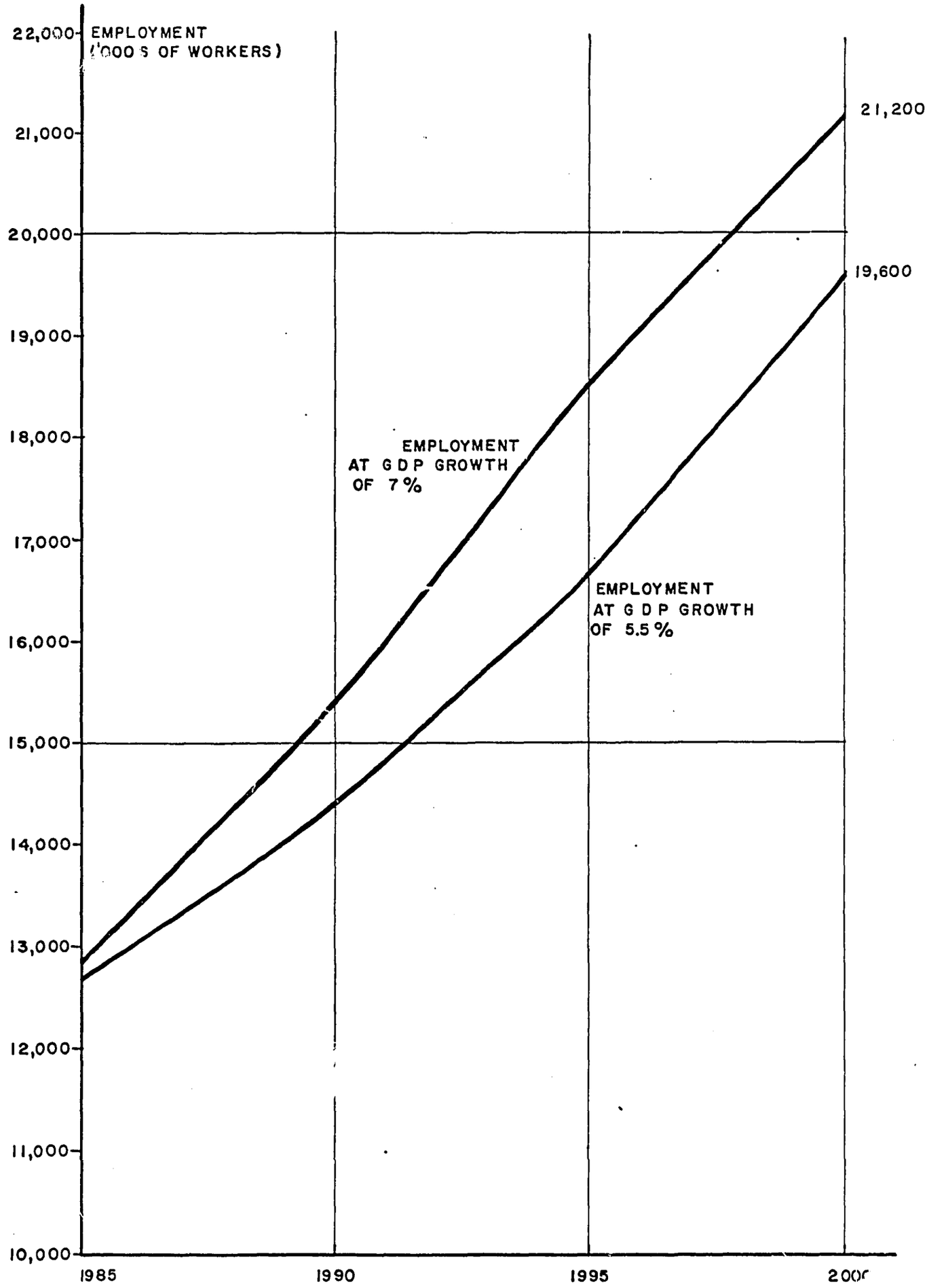
There is a great deal of uncertainty about both the amount of future saving that is possible in Egypt since it depends upon so many factors including public policy choices and economic circumstances not completely controllable by public policy. There is uncertainty, also, about the degree to which future investment and its allocation by sector will yield economic growth. Consequently, the first round projections should be viewed as an effort to establish a range of possible economic levels for the economy rather than a firm prediction.

The initial more favorable and less favorable projections of GDP investment and employment are shown in Table I.3 and, graphically, in Figures

GROSS DOMESTIC PRODUCT AND INVESTMENT, 1985 - 2000



EMPLOYMENT 1985 - 2000



	FAVORABLE			LESS FAVORABLE		
	GDP	INVESTMENT	EMPLOYMENT	GDP	INVESTMENT	EMPLOYMENT
1980	11,227	3,350	10,821	11,227	3,350	10,821
1985	17,500	5,100	12,900	17,500	3,500	12,700
1990	23,400	6,800	15,400	21,400	4,300	14,400
1995	31,700	9,200	18,600	26,500	5,300	16,600
2000	43,400	12,600	21,200	33,000	6,600	19,600

* Gross Domestic Product and Investment are in L.E. millions and employment in thousands of employees.

As indicated above there is uncertainty about both the amount of investment and the allocation of investment by sector, both of which influence the growth of Gross Domestic Product and employment. The sectoral distribution of investment implied by the favorable and less favorable scenarios are shown in Figure I.5. The distributions which will actually be made are subject to policy choice in Egypt as well as to the investment choices made by private investors. Consequently, the distributions shown are illustrative only. In particular, they do not represent a preferred or recommended sectoral distribution by the National Urban Policy Study.

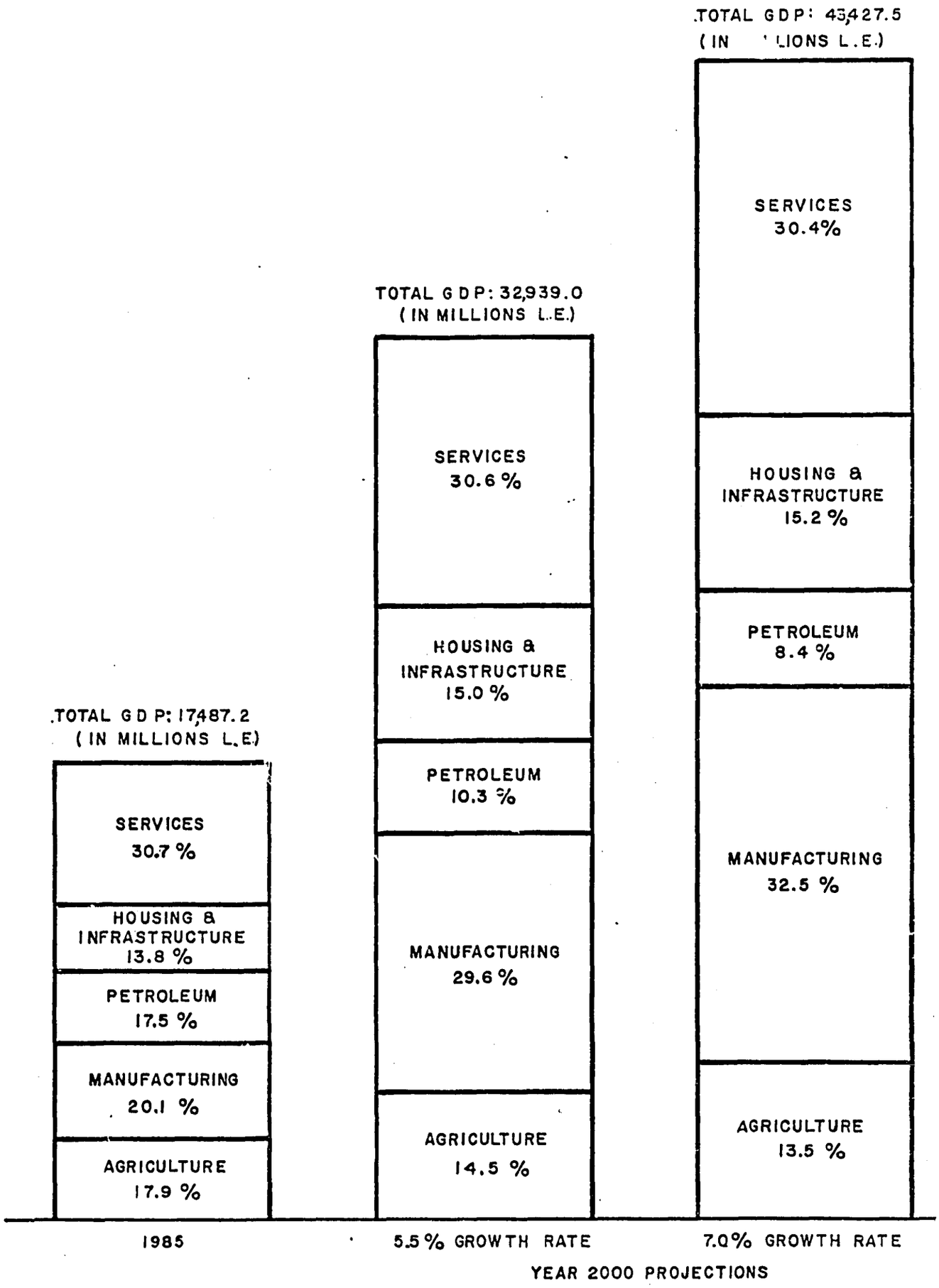
Table I.4 summarizes the effect of the investment assumption made on the growth rates of Gross Domestic Product, investment and employment.

TABLE I.4

Annual Growth Rates of Economic Variables (1980-2000)

	Favorable	Less Favorable
Gross Domestic Product	7.0%	5.5%
Investment	6.8%	3.4%
Employment	3.4%	3.0%

The difficulty of maintaining an output growth rate of 7 percent over a twenty year period should be recognized. In a World Bank tabulation of one hundred and twenty five countries, only seven countries were able to maintain this growth rate over a seventeen year period. 1/ Three factors stand out from among those which may impede the attempt to achieve such sustained high growth rates. First, the import content of investment is high. Therefore, rapid growth will



SECTOR SHARES OF GROSS DOMESTIC PRODUCT
1985 AND YEAR 2000 PROJECTIONS.

generate a large demand for foreign exchange. Secondly, rapid growth imposes increasingly high demands for management skills.

Finally, it is difficult to align investment strategies with factor endowments. Imported technologies tend to be labor-saving rather than capital-saving, while labor-intensive technologies may be better suited to using Egypt's growing labor supply. An investment strategy that includes some imported capital-intensive projects with long gestation periods may be necessary, but may increase the difficulty of achieving an appropriate balance between growth in Gross Domestic Product and employment.

DEMOGRAPHIC METHODOLOGY

The methodology used to derive the estimates of total population are explained in the NUPS status report of October 30, 1980. Briefly, a comparative analysis of seven sets of projections of population growth which contained a total of fourteen projections was undertaken. The projected population size by the year 2000 ranges between 57 million and 72.6 million in the projections reviewed.

Declining fertility is assumed in thirteen of the fourteen projections; variation in the estimated 2000 population total stems from differences in the rates of fertility decline. Based on a review of historial population trends in Egypt and a judgement of their likely future movements, we concluded that most plausible projections for the year 2000 range between 64.7 million and 70.3 million.2/

The key assumption underlying the urban population estimates is that the rural growth rate (after accounting for migration) will fall at an increasing rate between 1980 and 2000. The rural growth rates used in the projection are:

1976-1980	1.50
1980-1985	1.45
1985-1990	1.35
1990-1995	1.19
1995-2000	0.97

Urban population is calculated as the difference between total resi-

dent population and rural population. The estimates of non-resident population are from CAPMAS. The urban growth rates corresponding to these rural rates are:

Annual Urban Growth Rates

	Low	Medium	High
1976-1980	3.71	3.90	3.93
1980-1985	3.45	3.74	3.96
1985-1990	3.12	3.51	3.95
1990-1995	2.95	3.34	3.79
1995-2000	2.89	3.31	3.67

Labor force estimates are derived from the population projections using labor force participation rates calculated by Wahba. 3/

ECONOMIC METHODOLOGY

The model used to generate the initial economic projections was described on page 37 of the Status Report, where it was referred to as the Fixed Component System. Two modifications have been made in this system since the Status Report was written: (1) the Production Block has been disaggregated to sectors and (2) the number of sectors has been reduced from ten to five. The Fixed Component System used is shown in Figure 6.

The Fixed Component System is an investment-driven model; that is, it is assumed that both increases in output (lagged one year) and employment are linked to the amount of investment spending. In this formulation the economic growth rate is, therefore, a function of the ratio of investment to GDP and the ability of investment to generate future output - as measured by the incremental capital-output ratios (ICOR).

In the remainder of this section the parameters are described, the data base supporting the estimation of parameter values is discussed, and the assumed time trends in parameter values are discussed. The data sources are identified in the annex to this Appendix.

We now turn to a description of the parameters. The incremental

FIGURE I.6: Equation of the Fixed Structure Component

Production Block	
Gross Domestic Product, Agriculture (GDP_t)	$= GDPA_{t-1}+IA_{t-1}/ICORA$
Gross Domestic Product, Manufacturing, Mining and Construction ($GDPM_t$)	$= GDPM_{t-1}+IM_{t-1}/ICORM$
Gross Domestic Product, Petroleum ($GDPP_t$)	$= GDPP_{t-1}+IP_{t-1}/ICORP$
Gross Domestic Product, Housing & Infrastructure ($GDPH_t$)	$= GDPH_{t-1}+IH_{t-1}/ICORH$
Gross Domestic Product, Services ($GDPS_t$)	$= GDPS_{t-1}+IS_{t-1}/ICORS$
Investment Block	
Total Investment (I_t)	$= a\ GDP_t$
Investment, Agriculture (IA_t)	$= b_1 I_t$
Investment, Manufacturing, Mining and Construction (IM_t)	$= b_2 I_t$
Investment, Petroleum (IP_t)	$= b_3 I_t$
Investment, Housing & Infrastructure (IH_t)	$= b_4 I_t$
Investment, Services (IS_t)	$= b_5 I_t$
Employment Block	
Employment, Agriculture (EA_t)	$= EA_{t-1}+d_1 IA_t$
Employment, Manufacturing, Mining and Construction (EM_t)	$= EM_{t-1}+d_2 IM_t$
Employment, Petroleum (EP_t)	$= EP_{t-1}+d_3 IP_t$
Employment, Housing & Infrastructure (EH_t)	$= EH_{t-1}+d_4 IH_t$
Employment, Services (ES_t)	$= ES_{t-1}+d_5 IS_t$

TABLE I.5

BASIC ECONOMIC DATA

SECTOR	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
GDP (L.E.MILLION)	6,926	7,614	8,122	8,874	10,160	11,227	12,479	13,677	15,007	16,475
Agriculture	2,129	2,295	2,455	2,547	2,580	2,640	2,714	2,861	2,909	3023
Man. Mining & Construction	1,542	1,632	1,684	1,836	1,892	2,130	2,319	2,595	2,866	3,235
Petroleum	215	417	564	683	1,680	1,874	2,128	2,466	2,717	3,030
Housing & Infrastructure	677	845	847	1,050	1,124	1,293	1,632	1,825	1,968	2,164
Services	2,363	2,425	2,572	2,758	2,884	3,290	3,686	3,930	4,547	5,023
GROSS INVESTMENT (L.E.MILLION)	1,897	1,995	2,230	2,520	2,574	3,350	3,600	3,920	4,385	4,830
Agriculture	138	129	167	203	200	436	468	509	570	628
Man. Mining & Construction	433	567	692	697	645	637	684	744	833	918
Petroleum	258	387	239	200	230	100	108	118	131	145
Housing & Infrastructure	942	791	978	1,167	1,145	1,708	1,836	2,001	2,237	2,463
Services	126	121	154	253	354	469	504	548	614	676
EMPLOYMENT (THOUSAND)	9,432	9,505	9,715	10,069	10,459	10,821	11,228	11,630	12,038	12,436
Agriculture	4,217	4,068	4,104	4,135	4,164	4,226	4,290	4,354	4,419	4,485
Man. Mining & Construction	1,606	1,661	1,684	1,825	1,970	2,072	2,180	2,294	2,412	2,538
Petroleum	18	19	19	26	27	29	32	34	37	40
Housing & Infrastructure	638	658	692	722	785	827	870	916	965	1,016
Services	2,953	3,099	3,216	3,361	3,513	3,667	3,856	4,032	4,205	4,357

SOURCE: SEE ANNEX. GDP AND INVESTMENT ARE IN 1979 PRICES.

capital-output ratios (ICOR) indicate the amount of investment required in year t to generate one Pound of output in year t+1. Annual estimates of ICORS often display erratic shifts due to short-run clyclical economic effects. Nevertheless, an effort has been made to identify the underlying secular level and trend of the ICOR's used.

The ratio of investment to GDP (a) measures the extent to which output is devoted to capital formation rather than current consumption. During the 1975-1979 period this ratio fluctuated around 0.27 and is expected to increase during the Plan years to 0.29. A high ratio of investment to GDP must be maintained to sustain economic growth. 4/

The third set of parameters is the sectoral shares of investment (b_i). Since most investment in Egypt now takes place through the public sector these parameters largely reflect policy choice of government. As private sector investment increases, the private sector will influence the sectoral shares.

The final set of parameters is the sectoral employment multipliers (d_i). These coefficients indicate the employment effect of investment spending. The growth rate of employment is a function of these parameters and the sectoral allocation of investment. An analytically equivalent and more commonly encountered statistic of employment creation is capital per worker, the amount of fixed capital introduced into the production process with each new worker. These statistics, based on 1980-1984 average employment multiplier for each sector, derived from the 1980-84 Development Plan are as follows:

TABLE I.6

1980-84 DEVELOPMENT PLAN, CAPITAL PER WORKER

SECTOR	CAPITAL PER WORKER (1979 Prices)
Agriculture	L.E. 8,100
Manufacturing, Mining and Construction	6,700
Petroleum	47,600
Housing and Infrastructure	43,500
Services	3,300

The data base used to derive the parameter values is shown in Table 6. The historical data (1975-1979) is expressed in constant 1979 prices to conform to the Plan data (1980-1984) and to facilitate calculation of the parameters. The parameter values were calculated for each of the ten years (1975-1984). 5/

The following general comments apply to the parameter values used in the initial 1985-2000 projections: (1) the 1980-1984 parameter values form the basis of the 1985 parameter values, (2) the ratio of investment to GDP remains constant at 0.29 through 2000 for the favorable projection and is 0.20 for the less favorable projection, (3) the investment share of the manufacturing sector is assumed to increase over time while that of the housing and infrastructure sector declines, (4) the ICORs are assumed to increase over time, and (5) the employment multipliers are assumed to decline over time. 6/

Although the likely direction of change of the ICORS and employemnt multipliers over the next twenty years seems clear as a result of bath employing long lasting capital and more relative capital use in production processes, the rate of change is uncertain. In the selection of parameter values used in these projections, it was assumed that the economy wide ICOR although rising would remain below five and that the sectoral capital/labor ratios would rise by ten percent, on average, between 1985 and 2000.

ANNEX TO APPENDIX I

A. The ten sectors found in Egypt's National Income Accounts have been grouped in the Fixed Component System as follows:

Agriculture

Manufacturing, Mining, Construction

Petroleum, Housing and Infrastructure — includes Housing, Public Utilities

Transportation, Communication, and Storage, and Electricity

Services -- Trade and Finance, Other Services

B. The sources of the basic data are as follows:

Gross Domestic Product

1975-1978: Arab Republic of Egypt, Economic Development and External Capital Requirements, World Bank, November 1979.

1979,1980,1984: Egypt's Development Strategy, Economic Management and Growth Objectives, 1980-1984. Ministry of Planning, November 1979.

1981-1983: Derived from the General Equilibrium of the 5 year plan contained in the Ministry of Planning Documents. The General Equilibrium shows gross output for each sector but not the sectoral GDP. The ratio of gross output to GDP in each sector was calculated for the year 1979, 1980, and 1984. The 1981-1983 ratios were selected to move incrementally from the 1980 ratio to the 1984 ratio.

Gross Investment

1975-1979: Same as GDP 1975-1978

1980-1984: Based on the Ministry of Planning documents cited above and General Framework for Socio-Economic Development, Five Year Plan, Ministry of Planning, October 1979. Both documents contain five year sectoral investment totals and sectoral prcentage shares, but they do not show the same figures. The

annual investment amounts are from the General Equilibrium of the 5 year plan. The sectoral shares are from the General Framework.

Employment

1975-1976: Statistical Yearbook, A.R.E. July 1979

1977-1978: Same as GDP 1975-1978

1979 : World Bank

1980-1984: Total annual employment is from General Framework. Sectoral employment is not given. The annual rate of growth of each of the four non-agricultural sectors was calculated. These sectors are assumed to expand at their historical growth rates. This left a residual of 321 thousand jobs which was allocated to agriculture, producing a growth rate of one percent in that sector.

Constant Price GDP and Investment

1975-1979: GDP, in current and constant 1975 prices, is found in Arab Republic of Egypt-Recent Economic Developments, International Monetary Fund, February 25, 1980. From this data, an implicit GDP deflator was calculated and the base year was changed to 1979. The calculated deflators are:

Implicit GDP deflator (1979-100)	
1975	69
1976	76
1977	83
1978	88
1979	100

TABLE I.7

HISTORICAL PARAMETER VALUES AND VALUES DERIVED FROM 1980 - 84 PLAN

		HISTORICAL					1980-84 PLAN				
		1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
(a)	Ratio of Investment to Gross Domestic Product	27.4	26.2	27.5	28.4	25.3	30.2	29.0	28.7	29.1	29.0
(bi)	Sectoral Shares of Investment - Percent of Total										
	Agriculture	7.3	6.5	7.5	8.1	7.7	12.8	12.9	13.0	13.1	13.1
	Mfg Mining & Construction	22.8	28.4	31.0	27.6	25.1	18.8	18.8	19.0	19.1	19.2
	Petroleum	13.6	19.4	10.7	7.9	8.9	4.3	3.6	3.0	2.5	2.1
	Housing & Infrastructure	49.7	39.6	43.9	46.3	44.5	50.3	50.7	51.0	51.3	51.5
	Services	6.6	6.1	6.9	10.0	13.8	13.8	13.9	14.0	14.0	14.1
(c)	Employment To Investment Ratio*	.21	.04	.09	.14	.15	.11	.11	.10	.09	.08
	Agriculture	.036	-	.216	.152	.145	.142	.136	.126	.114	.105
	Mfg Mining & Construction	.365	.097	.033	.202	.225	.160	.159	.153	.142	.137
	Petroleum	.003	.003	.000	.035	.004	.020	.027	.017	.027	.030
	Housing & Infrastructure	.022	.025	.035	.026	.055	.025	.023	.023	.022	.021
	Services	1.722	1.207	.760	.573	.429	.328	.375	.321	.282	.225
	ICOR: Ratio of Investment to change in Gross Domestic Product		2.90	4.38	3.35	2.00	3.18	2.89	3.27	3.28	3.26
	Agriculture		0.77	1.04	2.20	6.06	7.27	6.32	3.46	11.88	5.51
	Mfg Mining & Construction		6.30	13.31	4.59	11.52	2.68	3.62	2.70	3.07	2.49
	Petroleum		1.92	1.63	1.68	0.23	0.75	0.52	0.35	0.43	0.32
	Housing & Infrastructure		4.70	489.00	5.75	15.47	10.11	5.42	10.37	15.64	12.57
	Services		1.95	1.05	1.36	2.81	1.16	1.27	2.25	0.99	1.42

* Thousands of jobs per L.E. million of investment (1979 prices)

TABLE I.8

PARAMETERS USED IN FIXED SYSTEM COMPONENT

	1985-1989	1990-1994	1995-2000
Production Block			
ICOR, Agriculture	6.00	6.20	6.50
ICOR, Manufacturing	3.20	3.40	3.65
ICOR, Petroleum	4.00	4.20	4.40
ICOR, Housing & Infrastructure	10.00	11.00	11.50
ICOR, Services	2.00	2.10	2.20
Investment Block			
b_1 (Agriculture)	.13	.15	.15
b_2 (Manufacturing)	.20	.29	.39
b_3 (Petroleum)	.02	.02	.02
b_4 (Housing & Infrastructure)	.51	.40	.30
b_5 (Services)	.14	.14	.14
Employment Block			
d_1 (Agriculture)	0.100	0.095	0.090
d_2 (Manufacturing)	0.135	0.128	0.123
d_3 (Petroleum)	0.003	0.003	0.003
d_4 (Housing & Infrastructure)	0.020	0.018	0.016
d_5 (Services)	0.225	0.224	0.223

FOOTNOTES

1/ World Develpment Indicators, World Bank, June, 1979.

2/ The continuation of currently high feasifility rates would cause this range to be on the low side.

3/ Mostafa Abdel Ghani Wahba, "The Structure of the Labor Force in the Egyptian Economy Up to the Year 2000", U.N. - A.R.E. Cairo Demographic Centre, Doc. CDC/579/17, December, 1979.

4/ For comparison, we note that the ratio in Japan is over 0.30.

5/ These values are presented in the Annex.

6/ The parameter values are presented in the Annex.

APPENDIX II: TABLES RELATED TO CHAPTER II

The following are data tables which support the information presented in Chapter II regarding the access potential of major settlements (Table 2) and the absorption capacities of infrastructure systems of major settlements (Figures 7, 8, and 9). The source of data for Tables II.1 and II.2 is the "Egypt National Transport Study. Three Month Progress Report". Volume I, 15/7/1980, conducted for the Transport Planning Authority of the Ministry of Transport, Arab Republic of Egypt, by NEDICO (Netherlands Engineering Consultants), Table 5.23. The sources of data for Table II.3 and II.4 are presented in the notes to these tables. The following tables are included:

TABLE No.	TITLE
II.1.	Index of Access to Settlement's Markets
II.2	Index of Access to Sources of Inputs for Major Settlements
II.3	Existing Design Capacities of Municipal Water Treatment Plants and Estimated Capital Costs of System Requirements to Serve Additional Population at Different Absorption Capacities
II.4	Present Design Capacity of Sewerage Plants and Estimated Capital Costs of System Requirements to Serve Additional Populations at Different Absorption Rates.

TABLE II.1

INDEX OF ACCESS TO SETTLEMENT'S MARKETS

GOVERNORATE	SETTLEMENT AND POPULATION (000)	MARKET	POPULATION (000)	DISTANCE (KM)	TIME (MIN)	WEIGHT	INDIVIDUAL INDEX	TOTAL INDEX
Greater Cairo	Greater Cairo	Qalyubia	290.9	49	43	21.93	2,315.10	3,103.30
		Sharkiya	530.4	83	73	8.66	578.64	
	6710.8	Beheira	653.5	156	134	8.58	209.56	
Alexandria	Alexandria	Cairo	6,710.8	221	192	76.93	3,247.33	
		Beheira	653.5	65	56	41.99	2,028.88	5,632.2
	2318.7	Gharbia	766.3	128	110	24.25	356.08	
Suez	Suez	Cairo	6,710.8	134	117	9.37	89.09	
		Sharkiya	530.4	173	150	5.31	2.43	92.55
	194.0	Gharbia	766.3	224	227	3.56	1.03	
Port Said	Port Said	Dakahlia	655.3	216	210	13.43	5.24	
		Ismailia	174.2	80	70	9.95	9.29	79.65
	262.6	Cairo	6,710.8	220	197	12.31	58.85	
Ismailia	Ismailia	Gharbia	766.3	140	136	3.03	1.83	
		Port Said	262.6	80	70	2.57	2.01	6.67
	145.9	Sharkiya	530.4	79	69	1.74	2.83	

TABLE II.1 (CONT'D)

INDEX OF ACCESS TO SETTLEMENT'S MARKETS

GOVERNORATE	SETTLEMENT AND POPULATION (000)	MARKET	POPULATION (000)	DISTANCE (KM)	TIME (MIN)	WEIGHT	INDIVIDUAL INDEX	TOTAL INDEX
Kafr El Sheikh	Kafr El Sheikh	Alexandria	2,318.7	115	105	10.07	16.42	
		Cairo	6,710.8	143	131	3.69	11.18	33.44
	77.5	Gharbia	766.3	50	49	2.36	5.84	
	Dessouk	Alexandria	2,318.7	82	73	10.7	25.73	
		Cairo	6,710.8	160	147	3.69	6.73	35.13
	58.7	Gharbia	766.3	85	63	2.36	2.68	
Gharbia	Tanta	Dakahlia	655.3	52	50	19.07	142.24	
		Beheira	653.5	63	61	14.42	72.10	293.82
	284.6	Sharkiya	530.4	56	49	12.64	79.48	
	El Mahalla	Dakahlia	655.3	20	19	19.07	1,013.78	
		Beheira	653.5	91	88	14.42	35.65	1,071.66
	292.9	Sharkiya	530.4	108	94	12.64	22.23	
	Zefta	Dakahlia	655.3	45	44	19.07	32.53	
		Beheira	653.5	88	85	14.42	6.58	102.99
	50.4	Sharkiya	530.4	27	23	12.64	63.89	
	Kafr El Zayat	Dakahlia	655.3	70	68	19.07	12.21	
		Beheira	653.5	40	39	14.42	28.01	48.11
	45.2	Sharkiya	530.4	71	62	12.64	7.88	
Dakahlia	Mansoura	Gharbia	766.3	52	50	5.26	41.61	
		Damietta	142.8	65	63	3.44	3.19	53.38
	257.9	Alexandria	2,318.7	176	153	3.36	8.58	

TABLE II.1 (CONT'D)

INDEX OF ACCESS TO SETTLEMENT'S MARKETS

GOVERNORATE	SETTLEMENT AND POPULATION (000)	MARKET	POPULATION (000)	DISTANCE (KM)	TIME (MIN)	WEIGHT	INDIVIDUAL INDEX	TOTAL INDEX
	Mit Ghamr	Gharbia	766.3	27	26	5.26	43.08	
		Damietta	142.8	110	107	3.44	0.31	46.67
	72.2	Alexandria	2,318.7	151	131	3.36	3.28	
	Mataria	Gharbia	766.3	122	118	5.26	1.77	
		Damietta	142.8	57	55	3.44	0.99	3.73
	61.2	Alexandria	2,318.7	248	223	3.36	0.96	
	Belqas	Gharbia	766.3	65	63	5.26	5.09	
		Damietta	142.8	55	53	3.44	0.88	7.77
	50.1	Alexandria	2,318.7	152	147	3.36	1.80	
Damietta	Damietta	Port Said	262.6	269	251	4.52	0.18	
		Gharbia	766.3	122	118	1.62	0.83	1.78
	93.6	Dakahlia	655.3	65	63	0.50	0.77	
Sharkiya	Zagazig	Cairo	6,710.8	83	84	21.97	423.32	
		Gharbia	766.3	66	65	13.44	12.64	440.95
	202.6	Alexandria	2,318.7	184	164	12.86	5.00	
	Bilbeis	Cairo	6,710.8	55	72	21.97	192.08	
		Gharbia	766.3	86	84	13.44	2.59	201.05
	69.3	Alexandria	2,318.7	209	183	12.86	1.37	
	Abu Kabir	Cairo	6,710.8	103	134	121.97	45.08	
		Gharbia	766.3	86	84	3.44	2.05	48.01
	54.9	Alexandria	2,318.7	207	203	2.86	0.88	

TABLE II.1 (CONT'D)

INDEX OF ACCESS TO SETTLEMENT'S MARKETS

GOVERNORATE	SETTLEMENT AND POPULATION (000)	MARKET	POPULATION (000)	DISTANCE (KM)	TIME (MIN)	WEIGHT	INDIVIDUAL INDEX	TOTAL INDEX
Qalyubia	Benha	Cairo	6,710.8	49	43	8.95	289.21	
		Sharkiya	530.4	38	37	2.11	7.29	299.08
	89.0	Dakahlia	655.3	77	67	1.99	2.58	
	Qalyiub	Cairo	6,710.8	15	27	8.95	516.77	
		Sharkiya	530.4	70	68	2.11	1.52	518.82
	62.7	Dakahlia	655.3	125	125	1.99	0.52	
Menoufia	Shebin El Kom	Cairo	6,710.8	82	62	6.92	196.74	
		Alexandria	2,318.7	154	135	2.65	5.49	219.26
	162.8	Gharbia	766.3	28	27	0.99	17.02	
	Menouf	Cairo	6,710.8	72	77	6.92	43.17	
		Alexandria	2,318.7	160	160	2.65	1.32	47.92
	55.1	Gharbia	766.3	36	35	0.99	3.43	
Beheira	Damanhour	Alexandria	2,318.7	65	56	30.76	429.57	
		Cairo	6,710.8	156	134	11.76	83.02	513.5
	188.9	Qalyubia	290.9	107	92	1.43	0.93	
	Kafr El Dawar	Alexandria	2,318.7	23	20	30.76	2,863.30	
		Cairo	6,710.8	185	159	11.76	50.13	2,914.2
	16.6	Qalyubia	290.9	108	93	1.43	0.77	
	Idku	Alexandria	2,318.7	56	61	30.76	119.22	
		Cairo	6,710.8	267	220	11.76	10.14	129.5
	62.2	Qalyubia	290.9	190	154	1.43	0.11	

TABLE II.1 (CONT'D)

INDEX OF ACCESS TO SETTLEMENT'S MARKETS

GOVERNORATE	SETTLEMENT AND POPULATION (000)	MARKET	POPULATION (000)	DISTANCE (KM)	TIME (MIN)	WEIGHT	INDIVIDUAL INDEX	TOTAL INDEX
Fayoum	Fayoum	Cairo	6,710.3	112	113	12.19	107.02	
		Sohag	405.3	407	446	1.53	0.05	107.08
	167.1	Aswan	229.7	868	930	0.99	0.004	
Beni Suef	Beni Suef	Cairo	6,710.8	116	120	6.51	35.85	
		Minya	434.8	128	140	1.37	0.36	57.68
	118.2	Alexandria	2,318.7	331	341	0.91	21.48	
Minya	Minya	Cairo	6,710.8	241	260	13.47	19.58	
		Alexandria	2,318.7	462	452	2.65	0.44	20.10
	146.4	Beheira	653.5	397	394	1.28	0.08	
	Mallawi	Cairo	6,710.8	287	311	13.47	6.94	
		Alexandria	2,318.7	508	503	2.65	0.18	7.16
	74.3	Beheira	653.5	444	441	1.28	0.03	
Assiut	Assiut	Cairo	6,710.8	380	415	4.02	3.35	
		Minya	434.8	139	146	3.27	1.43	6.16
	21.4	Sohag	405.3	115	128	2.61	1.38	
Sohag	Sohag	Qena	391.1	155	164	1.58	0.23	
		Beni Suef	276.2	379	423	1.37	0.02	0.31
	101.8	Minya	430.8	254	275	1.08	0.06	

TABLE II.1 (CONT'D)

INDEX OF ACCESS TO SETTLEMENT'S MARKETS

GOVERNORATE	SETTLEMENT AND POPULATION (000)	MARKET	POPULATION (000)	DISTANCE (KM)	TIME (MIN)	WEIGHT	INDIVIDUAL INDEX	TOTAL INDEX
	Akhmin	Qena	391.1	160	170	1.58	0.11	
		Beni Suef	267.2	385	430	1.37	0.01	0.16
	53.2	Minya	430.8	259	281	1.08	0.03	
	Girga	Qena	391.1	124	129	1.58	0.19	
		Beni Suef	276.2	417	466	1.37	0.01	0.22
	51.1	Minya	430.8	288	313	1.08	0.02	
Qena	Qena	Cairo	6,710.8	650	716	1.74	0.21	
		Menoufia	336.7	732	818	1.12	0.01	0.26
	93.8	Aswan	229.7	309	345	1.08	0.02	
	Naga Hamadi	Cairo	6,710.8	590	651	1.74		
		Menoufia	336.7	679	758	1.12	0.003	0.06
	19.8	Aswan	229.7	362	404	1.08	0.003	
	Luxor	Cairo	6,710.8	716	792	1.74	0.17	
		Menoufia	336.7	800	894	1.12	0.004	0.21
	92.8	Aswan	229.7	235	263	1.08	0.03	
Aswan	Aswan	Cairo	6,710.8	939	1040	7.05	0.63	
		Alexandria	2,318.7	1160	1232	4.10	0.09	1.12
	144.4	Qena	391.1	309	345	1.28	0.04	

TABLE II.1 (CONT'D)

INDEX OF ACCESS TO SETTLEMENT'S MARKETS

GOVERNORATE	SETTLEMENT AND POPULATION (000)	MARKET	POPULATION (000)	DISTANCE (KM)	TIME (MIN)	WEIGHT	INDIVIDUAL INDEX	TOTAL INDEX
Red Sea	Hurdha	Qena	391.1	198	173	27.73	0.38	
	Hurghada	Sohag	405.3	353	337	11.44	0.06	0.45
	10.6	Aswan	470.0	523	518	3.40	0.01	
	Safaga	Qena	391.1	141	123	27.73	0.65	
		Sohag	405.3	296	287	11.44	0.05	0.70
	9.0	Aswan	470.0	470	468	340	0.01	
Western Desert	Matrouh	Alexandria	2,318.7	291	254	1.78	0.33	
		Cairo	6,710.8	451	446	1.99	0.34	0.69
	51.0	Beheira	653.5	351	310	0.58	0.02	
Sinai	10.1							

TABLE II.2

INDEX OF ACCESS TO SOURCES OF INPUTS OF MAJOR SETTLEMENTS

GOVERNORATE	SETTLEMENT AND POPULATION (000)	SOURCE OF NON LABOR INPUTS	POPULATION (000)	DISTANCE (KM)	TIME (MIN)	WEIGHT	INDIVIDUAL INDEX	TOTAL INDEX
Greater Cairo	Greater Cairo	Alexandria	2,318.7	221	192	64.0	27.01	
		Sharkiya	530.4	83	73	21.1	14.16	4136.00
	6,710.8	Minya	146.4	241	260	13.1	19.00	
Alexandria	Alexandria	Beheira	653.5	65	56	30.8	14.88	
		Kafr El Sheikh	291.9	130	106	10.1	61.00	1828.00
	2318.7	Cairo	6,710.8	221	192	6.6	2.79	
Suez	Suez	Port Said	262.6	173	150	4.6	1.00	
		Sharkiya	530.4	173	150	1.9	0.30	2.10
	194.0	Ismailia	124.2	88	77	1.7	0.80	
Port Said	Port Said	Damietta	142.8	269	246	4.5	0.3	
		Gharbia	766.3	215	206	3.8	1.8	4.5
	262.6	Ismailia	174.2	80	70	2.6	2.4	
Ismailia	Ismailia	Port Said	262.6	80	70	10.0	7.8	
		Gharbia	766.3	140	136	3.2	1.9	10.5
	145.2	Suez	194.0	88	77	1.7	0.8	
Qalyubia	Benha	Cairo	6,710.8	49	43	23.8	768.8	
		Alexandria	2,318.7	172	148	21.0	19.8	7.89
	89.0	Port Said	262.6	197	188	5.0	0.3	
	Qalyub	Cairo	6,710.8	15	27	23.8	1,373.7	
		Alexandria	2,318.7	206	177	21.0	9.8	138.3
	62.7	Port Said	262.6	216	177	5.0	0.3	

TABLE II.2 (CONT'D)

INDEX OF ACCESS TO SOURCES OF INPUTS OF MAJOR SETTLEMENTS

GOVERNORATE	SETTLEMENT AND POPULATION (000)	SOURCE OF NON LABOR INPUTS	POPULATION (000)	DISTANCE (KM)	TIME (MIN)	WEIGHT	INDIVIDUAL INDEX	TOTAL INDEX
Menoufia	Shebin El Kom	Alexandria	2,318.7	154	135	11.6	24.0	
		Cairo	6,710.8	82	71	8.4	182.1	326
	162.8	Gharbia	766.3	28	27	7.0	119.8	
	Menouf	Alexandria	2,318.7	160	160	11.6	5.8	
		Cairo	6,710.8	72	62	8.4	80.8	110.7
	55.1	Gharbia	766.3	36	35	7.0	24.1	
Beheira	Damanhour	Alexandria	2,318.7	65	56	42.0	586.5	
		Gharbia	766.3	63	61	14.4	56.0	703.2
	188.9	Cairo	6,710.8	156	134	8.6	60.7	
	Kafr El Dawar	Alexandria	2,318.7	23	20	42.0	3909.10	
		Gharbia	766.3	105	90	14.4	21.8	3977.5
	160.6	Cairo	6,710.8	143	141	8.6	46.6	
	Idku	Alexandria	2,318.7	56	61	42.0	162.8	
		Gharbia	766.3	187	204	14.4	1.7	171.9
	62.2	Cairo	6,710.8	267	220	8.6	7.4	
Kafr El Sheikh	Kafr El Sheikh	Alexandria	2,318.7	115	105	10.3	16.8	
		Gharbia	766.3	37	36	7.6	34.8	51.8
	77.5	Port Said	262.6	265	237	6.4	0.2	
	Dessouk	Alexandria	2,318.7	82	73	10.3	26.3	
		Gharbia	766.3	65	63	7.6	8.6	35.1
	58.7	Port Said	262.6	296	243	6.4	0.2	

TABLE II.2 (CONT'D)

INDEX OF ACCESS TO SOURCES OF INPUTS OF MAJOR SETTLEMENTS

GOVERNORATE	SETTLEMENT AND POPULATION (000)	SOURCE OF NON LABOR INPUTS	POPULATION (000)	DISTANCE (KM)	TIME (MIN)	WEIGHT	INDIVIDUAL INDEX	TOTAL INDEX
Gharbia	Tanta	Alexandria	2,318.7	128	11	24.2	132.0	
		Port Said	262.6	210	200	7.8	1.5	134
	284.6	Dakahlia	655.3	52	50	5.3	0.5	
	El Mahalla	Alexandria	2,318.7	155	133	24.2	92.9	
		Port Said	262.6	243	230	7.8	1.1	375.8
	292.9	Dakahlia	655.3	20	19	5.3	281.8	
	Zefta	Alexandria	2,318.7	155	136	24.2	15.3	
		Port Said	262.6	192	182	7.8	0.3	24.6
	50.4	Dakahlia	655.3	45	44	5.3	9.0	
	Kafr el Zayat	Alexandria	2,318.7	111	95	24.2	28.1	
		Port Said	262.6	233	214	7.8	0.2	31.7
	45.2	Dakahlia	655.3	70	68	5.3	3.4	
Dakahlia	Mansoura	Gharbia	766.3	52	50	19.1	151.0	
		Port Said	262.6	216	205	13.5	2.2	187.4
	257.9	Alexandria	2,318.7	176	153	13.4	34.2	
	Mit Ghamr	Gharbia	766.3	28	26	19.1	558.4	
		Port Said	262.6	183	171	13.5	3.1	608.2
	72.2	Alexandria	2,318.7	151	131	13.4	46.7	
	Mataria	Gharbia	766.3	117	118	19.1	6.4	
		Port Said	262.6	25	35	13.5	17.7	27.9
	61.2	Alexandria	2,318.7	248	223	13.4	3.8	

TABLE II.2 (CONT'D)

INDEX OF ACCESS TO SOURCES OF INPUTS OF MAJOR SETTLEMENTS

GOVERNORATE	SETTLEMENT AND POPULATION (000)	SOURCE OF NON LABOR INPUTS	POPULATION (000)	DISTANCE (KM)	TIME (MIN)	WEIGHT	INDIVIDUAL INDEX	TOTAL INDEX
	Belqas	Gharbia	766.3	67	63	19.1	18.5	
		Port Said	262.6	115	108	13.5	1.5	27.2
	50.1	Alexandria	2,318.7	152	147	13.4	7.2	
Damietta	Damietta	Port Said	262.6	269	251	6.9	0.3	
		Gharbia	766.3	122	118	6.2	3.2	36.0
	93.6	Alexandria	655.3	65	63	3.4	5.3	
Sharkia	Zagazig	Alexandria	2,318.7	184	164	13.3	23.2	
		Gharbia	766.3	66	65	12.6	46.3	262.2
	202.6	Cairo	6,710.8	83	84	10.0	192.7	
	Bilbeis	Alexandria	2,318.7	209	183	13.3	6.4	
		Gharbia	766.3	86	84	12.6	9.5	105.6
	69.3	Cairo	6,710.8	55	72	10.0	89.7	
	Abu Kabr	Alexandria	207	203	13.3	4.10	4.1	
		Gharbia	86	84	12.6	7.50	7.5	32.1
	54.9	Cairo	103	134	10.0	20.50	20.5	
Fayoum	Fayoum	Cairo	6,710.8	112	98	8.5	99.2	
		Alexandria	2,318.7	334	254	7.8	4.7	104.0
	167.1	Port Said	262.6	334	305	1.7	0.1	
Beni Suef	Beni Suef	Alexandria	2,318.7	331	341	9.4	2.20	
		Port Said	262.6	336	342	2.5	0.10	2.40
	118.2	Assiut	470.0	496	296	1.5	0.10	

TABLE II.2 (CONT'D)

INDEX OF ACCESS TO SOURCES OF INPUTS OF MAJOR SETTLEMENTS

GOVERNORATE	SETTLEMENT AND POPULATION (000)	SOURCE OF NON LABOR INPUTS	POPULATION (000)	DISTANCE (KM)	TIME (MIN)	WEIGHT	INDIVIDUAL INDEX	TOTAL INDEX
Minya	Minya	Alexandria	2,318.7	462	452	14.3	2.40	
		Port Said	262.6	461	452	3.3	0.10	6.
	146.4	Cairo	6,710.8	241	260	2.7	3.90	
	Mallawi	Alexandria	2,318.7	508	503	14.3	1.0	
		Port Said	262.6	507	503	3.3	0.0	2.
	74.3	Cairo	6,710.8	287	311	2.7	1.4	
Assiut	Assiut	Alexandria	2,318.7	601	607	12.7	1.70	
		Port Said	262.6	600	607	2.9	0.00	1.
	214	Minya	146.4	139	155	1.7	0.20	
Sohag	Sohag	Red Sea	48.0	296	287	11.40	0.10	
		Alexandria	2,318.7	716	735	5.10	0.20	0.
	101.8	Cairo	6,710.8	495	543	2.4	0.50	
	Akhmim	Red Sea	48.0	301	293	11.40	0.0	
		Alexandria	2,318.7	721	741	5.10	0.10	0.3
	53.2	Cairo	6,710.8	500	548	2.40	0.20	
	Girga	Red Sea	48.0	265	252	11.40	0.0	
		Alexandria	2,318.7	750	773	5.10	0.10	0.3
	51.1	Cairo	6,710.8	533	585	2.40	0.20	

TABLE II.2 (CONT'D)

INDEX OF ACCESS TO SOURCES OF INPUTS OF MAJOR SETTLEMENTS

GOVERNORATE	SETTLEMENT AND POPULATION (000)	SOURCE OF NON LABOR INPUTS	POPULATION (000)	DISTANCE (KM)	TIME (MIN)	WEIGHT	INDIVIDUAL INDEX	TOTAL INDEX
Qena	Qena	Red Sea	48.0	141	123	27.7	0.80	
		Alexandria	2,318.7	871	908	12.7	0.30	4.10
	93.8	Cairo	6,710.8	650	717	3.2	3.00	
	Naga Hamadi	Red Sea	48.0	201	188	27.7	0.10	
		Alexandria	2,318.7	811	843	12.7	0.10	0.30
	19.8	Cairo	6,710.8	590	650	3.2	0.10	
	Luxor	Red Sea	48.0	207	199	27.7	0.30	
		Alexandria	2,318.7	997	984	12.7	0.30	0.9
	92.8	Cairo	6,710.8	716	792	3.2	0.30	
Aswan	Aswan	Alexandria	2,318.7	1160	1232	4.8	0.10	
		Red Sea	48.0	470	485	3.4	0.00	0.20
	144.4	Cairo	6,710.8	939	1040	1.2	0.10	
Red Sea	Hurdha	Suez	194.0	403	351	3.4	0.0	
	Hurghada	Sohag	101.8	369	360	0.7	0.0	0.0
	10.6	Cairo	6,710.8	327	285	0.2	0.0	
	Safaga	Suez	194.0	460	401	3.4	0.0	
		Sohag	101.8	316	314	0.7	0.0	0.0
	9.0	Cairo	6,710.8	380	331	0.2	0.0	
Western Desert	Matrouh	Alexandria	2,318.7	291	254	6.0	0.10	1.10
	51.0	Beheira	653.5	351	310	0.9	0.0	
Sinai	10.1							

TABLE II.3

EXISTING DESIGN CAPACITIES OF SETTLEMENT WATER TREATMENT PLANTS AND ESTIMATED CAPITAL COSTS OF SYSTEM REQUIREMENTS TO SERVE ADDITIONAL POPULATION AT DIFFERENT ABSORPTION CAPACITIES (1979 PRICES)

SETTLEMENT ZONE	SETTLEMENT NAME	1976 SETTLEMENT POPULATION ('000s)	EXISTING AND PLANNED DESIGN CAPACITY OF WATER TREATMENT PLANTS 1/ PRESENT POPULATION DESIGN CAPACITIES (000's)	EXCESS OR(DEFICIT) CAPACITY (000's)	ESTIMATED CAPITAL COSTS OF FUTURE REQUIREMENTS TO SERVE ADDITIONAL POPULATION AT DIFFERENT ABSORPTION DENSITIES 2/ HIGH (L.E. MILLIONS)	MEDIUM/ HIGH (L.E. MILLIONS)	NATIONAL AVERAGE (L.E. MILLIONS)	PER CAPITA COSTS AT MEDIUM/HIGH (L.E./CAPITA) 3/
1.	Shoubra El Kheima	393.7	192.3	(201.4)	197.0	194.6	43.5	286.44
CAIRO REGION	Giza	1,232.7	795.6	(437.1)	451.6	264.1	85.6	289.58
ZONE 4/	Cairo	5,084.7	4,537.8	(546.2)	862.7	322.8	242.0	292.66
	ZONE TOTAL	6,317.4	5,525.7	(1,184.7)	1,511.3	711.8	371.1	290.53
2.	Alexandria	2,823.8	1,539.4	(779.2)	940.8	579.5	174.7	187.78
ALEXANDRIA 5/	ZONE TOTAL	2,823.8	1,539.4	(779.2)	940.8	579.5	174.7	187.78
3.	Suez	306.0	350.7	44.7	1,166.8	776.9	340.3	408.04
SUEZ CANAL	Port Said	255.0	214.8	(40.2)	1,041.9	694.5	304.6	394.83
ZONE 6/	Ismailia	240.0	202.2	(37.2)	354.4	126.6	212.8	488.21
	ZONE TOTAL	801.0	767.1	(33.0)	2,563.1	1,590.0	667.7	407.13
4.	Benha	89.0	147.3	58.3	49.1	18.4	0.8	82.51
DELTA ZONE	Qalyub	62.7	60.4	(2.7)	23.3	10.6	2.5	86.18
	Menouf	55.1	89.4	34.3	12.0	4.4	-	59.46
	Bilbeis	69.3	85.1	13.7	20.5	7.7	-	116.36
	Kafr el zayat	45.2	172.4	127.2	58.6	24.8	1.7	74.25
	Zifta	50.4	44.7	(5.7)	42.5	20.8	6.9	123.81
	Kafr El Sheikh	77.5	238.0	160.5	26.1	1.6	-	9.41
	Mansoura	257.9	250.0	(7.9)	159.2	93.7	20.4	214.42
	Dessouk	58.6	33.4	(25.2)	31.2	17.5	5.6	188.17
	Bilqas	50.1	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

TABLE II.3 (CONT'D)

EXISTING DESIGN CAPACITIES OF SETTLEMENT WATER TREATMENT PLANTS AND ESTIMATED CAPITAL COSTS OF SYSTEM REQUIREMENTS TO SERVE ADDITIONAL POPULATION AT DIFFERENT ABSORPTION CAPACITIES (1979 PRICES)

SETTLEMENT ZONE	SETTLEMENT NAME	1976 SETTLEMENT POPULATION ('000s)	EXISTING AND PLANNED DESIGN CAPACITY OF WATER TREATMENT PLANTS 1/ PRESENT POPULATION DESIGN CAPACITIES (000's)	EXCESS OR(DEFICIT) CAPACITY (000's)	ESTIMATED CAPITAL COSTS OF FUTURE REQUIREMENTS TO SERVE ADDITIONAL POPULATION AT DIFFERENT ABSORPTION DENSITIES 2/ HIGH (L.E. MILLIONS)	MEDIUM/ HIGH (L.E. MILLIONS)	NATIONAL AVERAGE (L.E. MILLIONS)	PER CAPITA COSTS AT MEDIUM/HIGH (L.E./CAPITA) 3/
4.	Damietta	93.5	62.3	(31.8)	102.8	31.5	16.7	260.33
	Mit Ghamr	72.2	41.3	(30.9)	23.6	14.4	3.9	205.71
DELTA ZONE	El Mahalla	292.8	153.9	(138.9)	97.6	60.0	21.7	243.90
	Shebin El Kom	102.8	180.0	77.2	14.0	0.6	-	7.32
(CONT'D)	Mataria	61.2	33.4	(27.8)	12.3	7.0	3.5	333.33
	Zagazig	202.6	195.4	(7.6)	26.9	4.3	1.3	238.89
	Kafr El Dawar	160.6	104.2	(56.4)	14.1	-	-	N.C.
	Abu Kabir	54.8	66.8	12.0	1.6	-	-	N.C.
	Tanta	284.6	223.1	(61.5)	20.8	-	-	N.C.
	Damanhour	188.9	135.0	(53.9)	6.3	-	-	N.C.
	Idku **	62.2	-	(62.2)	4,467.7	3,157.4	1544.4	478.25
	ZONE TOTAL	2,392.0	2,208.8	(287.3)	5,123.6	3,473.0	1,612.7	390.18
5.	Beni Suef	118.1	198.3	80.2	33.9	14.4	-	88.89
NORTHERN-UPPER	Fayoum	167.1	65.0	(102.1)	111.7	72.4	21.9	379.06
EGYPT ZONE	Minya	146.4	187.0	40.6	59.3	27.6	-	172.5
	Mallawi	74.3	140.3	65.9	2.5	-*	-	-
	ZONE TOTAL	505.9	590.6	84.6	207.4	114.4	21.9	209.14

* Excess capacity is sufficient to cover net absorption capacity

** The settlement currently relies on a regional network which is judged insufficient by the Study Team to serve very large increases in population. Therefore it was assumed a completely new system would have to be built. Thus no capacity is shown.

TABLE II.3 (CONT'D)

EXISTING DESIGN CAPACITIES OF SETTLEMENT WATER TREATMENT PLANTS AND ESTIMATED CAPITAL COSTS OF SYSTEM REQUIREMENTS TO SERVE ADDITIONAL POPULATION AT DIFFERENT ABSORPTION CAPACITIES (1979 PRICES)

SETTLEMENT ZONE	SETTLEMENT NAME	1976 SETTLEMENT POPULATION ('000s)	EXISTING AND PLANNED DESIGN CAPACITY OF WATER TREATMENT PLANTS 1/		ESTIMATED CAPITAL COSTS OF FUTURE REQUIREMENTS TO SERVE ADDITIONAL POPULATION AT DIFFERENT ABSORPTION DENSITIES 2/			
			PRESENT POPULATION DESIGN CAPACITIES (000's)	EXCESS OR(DEFICIT) CAPACITY (000's)	HIGH (L.E. MILLIONS)	MEDIUM/ HIGH (L.E. MILLIONS)	NATIONAL AVERAGE (L.E. MILLIONS)	PER CAPITA COSTS AT MEDIUM/HIGH (L.E./CAPITA) 3/
6. SOUTHERN-UPPER EGYPT ZONE	Qena	93.8	68.0	(25.8)	174.0	114.7	48.9	264.29
	Naga Hamadi	19.8	88.6	68.7	9.0	1.6	-*	20.51
	Aswan	144.4	170.0	25.6	121.1	65.4	8.6	236.10
	Luxor	92.7	153.0	60.3	36.5	10.5	10.5	91.30
	Girga	51.1	60.1	6.9	25.2	13.2	0.6	220.00
	Aklimim	53.2	86.1	33.6	10.6	-*	-	*
	Assiut	213.9	234.6	20.7	37.2	29.5	-	536.36
	Sohag	101.8	136.0	34.2	6.7	-*	-	-*
	ZONE TOTAL	770.7	997.1	224.2	420.3	234.9	68.6	221.19
OTHER ZONES 7/								
TOTAL ALL ZONES 8/		13,340.8	11,628.7	1,975.4				

* NEW GROWTH CAN BE ACCOMMODATED BY EXCESS CAPACITY

NC - No adsorption capacity
NA - Not Available

1. Percent water plant treatment capacities were taken from pages 37-40 of Volume II of the Draft Final Report of the "Provincial Water Supplies Project", done for the Ministry of Housing by Binnie and Partners, John Taylor and Sons in association with Dr. A. Abdel-Warith and Coopers and Lybrand Associates, Ltd., except for those plant capacities noted below.

2. Regional variations in the costs of adding new capacity to water treatment plants was taken from page 66 of Volume I of the Provincial Water Supplies Project Report.

3. Per capita costs were found by dividing the costs of the future requirements of water systems to serve additional population at medium high densities by the estimated population absorption capacity at medium/high densities.

4. Source: Greater Cairo Waterworks Development Program. "Final Report. Waterworks Master Plan". Part I - Immediate phase. Part II - Staged Development. Prepared for Ministry of Housing and Reconstruction, Arab Republic of Egypt. Prepared by ES-PARSONS, a Joint-Venture in association with ECG-Cairo. February 21, 1979.

5. Source: "Management and Tariff Studies Relative to Water Sewage Systems. Water Utility Tariffs". For Ministry of Development and New Communities, Arab Republic of Egypt. By: BVI-ATK Associates with Sabbour Associates. April 1979.

6. As 1976 reliable census data and plant capacities were not available for the Canal Cities, 1980 data was used. These estimates are based on 1979 cost however.

7. There are no existing cities in these zones having populations of 50,000 or greater.

8. Due to problems with double counting resulting from using total zonal population absorption capacities, total costs cannot be estimated until final population settlement distributions are made.

TABLE II.4

PRESENT DESIGN CAPACITY OF SEWERAGE PLANTS AND ESTIMATED CAPITAL COSTS OF SYSTEM REQUIREMENTS TO SERVE ADDITIONAL POPULATIONS AT DIFFERENT ABSORPTION RATES (1979 PRICES)

SETTLEMENT ZONE	SETTLEMENT NAME	1976 SETTLEMENT POPULATION (000's)	DESIGN CAPACITY OF SEWERAGE PLANT 1/		TOTAL FUTURE SYSTEM REQUIREMENTS TO SERVE ADDITIONAL POPULATIONS AT DIFFERENT ABSORPTION RATES			
					L.E. MILLIONS			
			PRESENT POPULATION DESIGN CAPACITIES (000's)	EXCESS OR (DEFICIT) CAPACITIES (000's)	HIGH	MEDIUM/ HIGH	NATIONAL AVERAGE	DENSITIES (L.E PER CAPITA COSTS AT 2/ MEDIUM/HIGH
1. CAIRO REGION 3/	Giza	1,232.7	4,150.3	(2,560.1)	2,678.2	1,151.2	593.1	469.88
	Cairo	5,084.0						
	Shoubra El Kheima	393.7						
	ZONE TOTAL	6,711.1	4,150.3	(2,560.1)	2,678.2	1,151.2	593.1	469.88
2. ALEXANDRIA 3/	Alexandria	2,318.6	1,634.0	(684.6)	1,905.0	1,162.2	329.9	376.6
	ZONE TOTAL	2,318.6	1,634.0	(684.6)	1,905.0	1,162.2	329.9	376.6
3. SUEZ CANAL REGION 4/	Suez	190.2	219.0	28.8	455.2	304.0	134.6	159.66
	Port Said	262.6	203.6	(59.0)	626.8	419.2	186.3	238.32
	Ismailia	190.4	167.9	(22.5)	113.7	69.0	19.1	263.35
	ZONE TOTAL	643.2	590.5	(52.7)	1,195.7	792.2	340.0	

TABLE II.4 (CONT'D)

PRESENT DESIGN CAPACITY OF SEWERAGE PLANTS AND ESTIMATED CAPITAL COSTS OF SYSTEM REQUIREMENTS TO SERVE ADDITIONAL POPULATIONS AT DIFFERENT ABSORPTION RATES (1979 PRICES)

SETTLEMENT ZONE	SETTLEMENT NAME	1976 SETTLEMENT POPULATION (000's)	DESIGN CAPACITY OF SEWERAGE PLANT 1/		TOTAL FUTURE SYSTEM REQUIREMENTS TO SERVE ADDITIONAL POPULATIONS AT DIFFERENT ABSORPTION RATES (L.E. MILLIONS)			
			PRESENT POPULATION DESIGN CAPACITIES (000's)	EXCESS OR (DEFICIT) CAPACITIES (000's)	L.E. MILLIONS HIGH	MEDIUM/ HIGH	NATIONAL AVERAGE	PER CAPITA COSTS AT MEDIUM/HIGH DENSITIES (L.
4. DELTA	Benha	89.0	99.1	10.1	46.9	28.3	0.3	126.9
	Qalyub	62.7	-	(62.7)	35.7	19.1	8.1	155.28
	Menouf	55.1	-	(55.1)	27.6	16.2	7.6	218.92
	Bilbeis	69.3	NA	(69.3)	40.0	22.8	11.0	345.45
	Kafr El Zayat	45.2	70.7	25.5	88.7	57.3	17.2	171.56
	Zifta	50.4	-	(50.4)	58.8	31.5	13.4	187.23
	Kafr El Sheikh	77.5	49.5	(28.0)	79.7	39.7	12.6	233.64
	Mansoura	257.9	92.9	(165.1)	394.4	260.1	63.4	595.17
	Dessouk	58.6	-	(58.6)	42.5	29.3	12.4	315.05
	Belqas	50.1	NA	NA				
	Mit Ghamr	72.2	NA	NA				
	El Mahalla	292.8	147.7	(145.1)	273.1	97.6	23.8	396.80
	Shebin El Kom	102.8	118.9	16.1	28.3	8.3	-	101.06
	Mataria	61.2		(61.2)	20.1	13.9	9.5	659.7
	Zagazig	202.6	52.6	(150.1)	68.4	33.4		1,855.56
	Kafr El Dawar	160.6	NA	NA				
	Abu Kabir	54.8	-	(54.8)	11.9			N.C.
	Tanta	284.6	130.3	(154.3)	72.8			N.C.
	Damietta	93.5	74.3	(19.2)	118.3	34.6	16.6	285.0
	Damanhour	188.9	134.5	(54.4)				N.C.
	Idku	62.2	-	(62.2)	5,349.0	3755.8	1,215.3	568.91
	ZONE TOTAL	2,395.0	970.5	(961.8)	6,637.9	4413.3	1,394.6	495.82

TABLE II.4 (CONT'D)

PRESENT DESIGN CAPACITY OF SEWERAGE PLANTS AND ESTIMATED CAPITAL COSTS OF SYSTEM REQUIREMENTS TO SERVE ADDITIONAL POPULATIONS AT DIFFERENT ABSORPTION RATES (1979 PRICES)

SETTLEMENT ZONE	SETTLEMENT NAME	1976 SETTLEMENT POPULATION (000's)	DESIGN CAPACITY OF SEWERAGE PLANT 1/		TOTAL FUTURE SYSTEM REQUIREMENTS TO SERVE ADDITIONAL POPULATIONS AT DIFFERENT ABSORPTION RATES			
			PRESENT POPULATION DESIGN CAPACITIES (000's)	EXCESS OR (DEFICIT) CAPACITIES '000's)	L.E. MILLIONS HIGH	L.E. MILLIONS MEDIUM/ HIGH	L.E. MILLIONS NATIONAL AVERAGE	PER CAPITA COSTS AT MEDIUM/HIGH DENSITIES (L.
5. NORTHERN UPPER EGYPT	Beni Suef	118.1	118.1	-	56.5	32.9	158.9	203.12
	Fayoum	167.1	42.0	(125.1)	139.39	92.7	31.17	485.56
	Minya	146.4	79.2	(67.2)	106.9	66.7	14.3	416.62
	Mallawi	74.3	-	(74.3)	28.4	19.6	N.C.	575.8
	ZONE TOTAL	505.9	239.3	(266.6)	302.8	211.9	204.4	387.39
6. SOUTHERN UPPER EGYPT	Qena	93.8	-	(93.8)	226.4	156.3	78.1	360.03
	Naga Hamadi	19.8	-	(19.8)	27.6	19.1	9.0	244.18
	Aswan	144.4	-	(144.4)	198.0	137.36	53.2	495.87
	Luxor	92.7	-	(92.7)	97.7	52.5	22.3	456.69
	Girga	51.1	-	(51.1)	53.7	31.8	14.6	530.39
	Akhmim	53.2	-	(53.2)	35.6	24.7	-	748.21
	Assiut	213.9	46.3	(167.7)	78.1	39.4	-	716.44
	Sohag	101.8	-	(101.8)	53.9	32.0		3,202.33
	ZONE TOTAL	770.1	46.3	(724.5)	771.9	493.2	177.2	464.41

TABLE II.4 (CONT'D)

PRESENT DESIGN CAPACITY OF SEWERAGE PLANTS AND ESTIMATED CAPITAL COSTS OF SYSTEM REQUIREMENTS TO SERVE ADDITIONAL POPULATIONS AT DIFFERENT ABSORPTION DATES (1979 PRICES)

SETTLEMENT ZONE	SETTLEMENT NAME	1976 SETTLEMENT POPULATION (000's)	DESIGN CAPACITY OF SEWERAGE PLANT 1/		TOTAL FUTURE SYSTEM REQUIREMENTS TO SERVE ADDITIONAL POPULATIONS AT DIFFERENT ABSORPTION RATES			
			PRESENT POPULATION DESIGN CAPACITIES (000's)	EXCESS OR (DEFICIT) CAPACITIES (000's)	L.E. MILLIONS HIGH	L.E. MILLIONS MEDIUM/ HIGH	L.E. MILLIONS NATIONAL AVERAGE	PER CAPITA COSTS AT MEDIUM/HIGH DENSITIES (L.
7. RED SEA ZONE	5/							
8. WESTERN DESERT ZONE	5/							
9. RESIDUAL SINAI	5/							
TOTALS ALL ZONES	6/	13,340.8	7,630.9	(5,250.3)				

NC - No population absorption capacity at this density.

NA - Not available

1. Municipal design capacities were taken from Table 2.6.2 of the "Provincial Water Supplies Project. Draft Final Report. Volume II - Existing Situation". Done for the Ministry of Housing by Binnie and Partners, John Taylor and Sons in association with Dr. A. Abdel Warith and Coopers and Lybrand Associates, Ltd., October 1979.

2. Per capita costs of adding new population to existing systems.

3. Source: "Management and Tariff Studies Relative to Water Sewerage Systems. Sewerage Utility Tariffs". BVI - ATK with Sabbour Associates for Ministry of Development and New Communities. 1979.

   The figures shown are for all three settlements as only one sewerage utility serves three.

4. Source: same as No. 3 above. Since historical data was not available for the Canal Cities, 1980 projections were used to calculate costs and capacities.

5. These zones do not have existing cities with populations of 50,000 or more.

6. Due to problems with double counting total estimates of costs cannot be made until final population distributions are made.