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WORKING PAPER
ON
SECOND ROUND ALTERNATIVES
FOR
THE NATIONAL URBAN POLICY STUDY

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PREPARED FOR THE
ADVISORY COMMITTEE FOR RECONSTRUCTION
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ARAB REPUBLIC OF EGYPT

PADCO, INC.
WITH
ENGINEERING CONSULTANTS GROUP
AND
SHERIF EL-HAKIM AND ASSOCIATES

SEPTEMBER 15, 1981

دراسة السياسة القومية للتنمية الحضرية
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September 15th, 1981

Engineer Soliman Abdel Hai
Chairman,
Advisory Committee for Reconstruction
Ministry of Development
Cairo - A.R.E.

Dear Eng. Abdel Hai,

The National Urban Policy Study is pleased to submit our report on Second Round Alternatives. This report, as agreed at previous Steering Committee meetings, reviews the analysis of alternatives developed in the First Round Alternatives paper and describes NUPS recommended settlement strategy.

NUPS recommends a "mixed strategy which combines desirable elements of the "pure" alternatives presented earlier. In particular NUPS recommends:

- A major effort to enhance growth in Alexandria, as an essential ingredient of a long-term plan to reduce polarization of the urban system in Cairo.
- A focussed decentralization to the Canal Zone, with an emphasis on Suez City for major industrial expansion and complementary growth in Ismailia and Port Said.
- A decentralization effort to Upper Egypt through the designation of an initially limited number of "special emphasis" cities -- the most likely candidates are Assiut, Qena-Naga Hamadi, and Aswan -- to lay an industrial base and develop institutional mechanisms for more substantial decentralization in the next century.

1.

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

بادكو انك
بالاشتراك مع
جماعة المهندسين الاستشاريين
و
شريف الحكيم ومشاركوه

- A growth management strategy for Delta cities with the aim of limiting unnecessary intrusions on arable land while providing additional urban employment.
- Plans for Cairo Metropolitan Region population by 2000 of 16 to 16.5 million, with an intra-metropolitan strategy of core deconcentration and a reorientation of the major direction of growth toward desert areas to the east and west.
- An experimental approach to the settlement problems of the remote areas to utilize emerging technologies and establish implementing institutions to increase the attraction of these areas for human settlement.
- Sectoral policies for housing and infrastructure at affordable standards and mechanisms to reduce the amount of unrecovered public investment required.

We welcome your review and comments, so that we can finalize our work program for the Draft Final Report.

Sincerely,

Harvey A. Garn
Harvey A. Garn
Team Leader

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WORKING PAPER

ON

SECOND ROUND ALTERNATIVES:

RECOMMENDATIONS FOR THE PREFERRED STRATEGY

INTRODUCTION

The Government of Egypt has the possibility of adopting a national urban policy which integrates spatial and sectoral policies, builds on the strengths of the Egyptian economy, is tailored to Egyptian circumstances, and has a reasonably high chance of leading to improvements in income and the quality of life for Egyptian citizens.

The NUPS recommendation in this report is the adoption of a spatial strategy of a phased, selective decentralization to the Suez Canal Zone (with a major emphasis on Suez) and to Upper Egypt (with a priority emphasis on Qena-Naga Hamadi, Aswan and Assiut). It is recommended that these priorities be coupled with metropolitan deconcentration plans for substantial growth in Cairo and Alexandria, a growth management approach to the Delta and an experimental approach to increasing the habitability of the remote areas.

However, the choices required to adopt such a policy and implement it are many and difficult. Some choices which appear to be strongly warranted on the basis of NUPS analysis run counter to popular ideas about what the urban policy can or should be. Some choices indicate the advisability of modifying or postponing the implementation of policies already enunciated. Some will require substantial changes in the methods used to provide urban services and pay for them. Many will require coordinated choices and actions by separate ministries of the national government and local governments; which do not now tend to coordinate well or at all. Most will require a clear distinction by policy makers between what is ideally desired and what

is likely to be feasible to accomplish. Further, a recognition is needed that there is no identifiable solution to urban policy choices that will simultaneously satisfy everyone's sense of priorities -- even good policies may and usually do have some adverse consequences or their implementation may require the postponement of other good policies.

Why undertake such an arduous task? First, because the problems which need to be addressed are unlikely to be solved unless such critical choices are made. Second, because serious gaps may develop between the expectations generated by the enunciation of unimplemented or unimplementable policies and what can be shown to have been done. Third, because Egypt is now in a relatively strong economic and political position which can be used to set in motion sustainable urban policies with the prospects of success in generating long term benefits for the Egyptian people. Fourth, because a continuation of current spatial and sectoral policies without change (which does constitute an urban policy) is likely to lead to undesirable growth patterns, increase the amount of unplanned urban intrusion on arable land, and use more public resources than necessary.

The research and analysis of the NUPS team supports the adoption of a spatial (or settlement) strategy that places primary emphasis on urban locations which will contribute most substantially to national economic growth and an additional emphasis on a selective effort to achieve wider geographical distribution of economic activity and population. Similarly, the analysis supports the adoption of sectoral policies which have the primary purpose of reducing requirements for unrecovered public investment and the additional purpose of spreading the benefits of public investment more quickly to a larger segment of the low income population.

The basic dimensions of the recommended settlement strategy are these:

- 1) the exploitation of strong economic advantages of the Cairo and Alexandria metropolitan regions to absorb a major portion of the expected growth in urban population (Plans for Cairo 2000 population of 16 to 16.5 million and for Alexandria 2000 population of 5 to 5.5 million).

- 2) a concentrated effort to support growth possibilities of the Suez Canal Zone with a focus on Suez City (year 2000 population targets of 750 to 850 thousand in Suez, 400 to 500 in Ismailia, and 550 to 650 in Port Said).
- 3) a strategy for managing the expected spontaneous growth of Delta cities which aims at limiting unnecessary intrusions on arable land while providing additional urban employment (special emphasis on Tanta and Mansoura with year 2000 population targets of 525 to 575 and 500 to 550 thousand, respectively).
- 4) an effort to induce growth in an initially limited number of Upper Egypt cities to develop both an economic basis and a knowledge base for more decentralization in later time periods than the planning horizon of this study (special emphasis on Assiut, Qena-Naga Hamadi, and Aswan with year 2000 population targets of 550 to 600, 325 to 400 and 400 to 450 thousand respectively).
- 5) an experimental approach to the settlement problems of the remote areas to find ways to utilize emerging technologies and establish implementing institutions to increase the attraction of these areas for human settlement (no major urban increases anticipated, year 2000 population targets for existing urban areas of between 250 and 300 thousand).
- 6) the choice of standards for housing and infrastructure service levels that are affordable by a wider range of the population and mechanisms that will increase the proportion of public cost recovery.

Major elements of the reasoning behind these spatial recommendations are reported in the Interim Action Report, the Working Paper on First Round Alternatives, and the series of Occasional Working Papers prepared by the Study Team ^{1/}. The agreement of the ACR on the dimensions of the preferred spatial strategy, as described above, would permit the Study Team to develop detailed sectoral policy recommendations in the elaboration of the preferred strategy both to insure that desired spatial patterns are achieved and to facilitate the provision of urban and inter-urban services without excessive demands on unrecovered public investment.

^{1/} See discussion in Section II of this paper for review of summary conclusions and Appendix A for a list of most relevant Occasional Working Papers.

The benefits of adopting the basic policy directions indicated above -- an efficiency oriented settlement strategy with some decentralization and a strategy of conserving public investments -- derive from their probable positive effects on encouragement of economic growth (and thus an increase in the potential resource pool for future investment and efforts to improve the equity position of the worst-off elements of the population) and the reduction of pressure on public resources; pressures which currently limit government flexibility, increase the risks of insufficient resources to complete desirable projects and lead to popular expectations about what the Government can do that are difficult to achieve in practice.

I. THE CONTEXT FOR POLICY CHOICE

Several aspects of the current population and economic picture contribute to the conclusion that it is extremely important for the Government of Egypt to develop and implement an integrated set of urban settlement and sectoral strategies over the next two decades with an emphasis on efficiency in the settlement system and conservation of public investment in sectoral policies.

A. Population

First the magnitude of the urban population to be settled and served is large and is expected to grow rapidly. One reason this is true is that the natural rate of population increase remains high as the decline in fertility rates anticipated in many population forecasts has not yet appeared. Consequently, the resident population total of 67.5 in 2000 adopted by NUPS as a reasonable medium estimate for planning purposes, may turn out to be on the low side. It is highly unlikely that the population will be lower than this estimate.

Secondly, the resident population is a function of the rate of migration to other countries, for given rates of natural increase. Although it is very difficult to anticipate the future push and pull factors which will determine this rate of migration, there are indications that the demand for Egyptian labor is declining in other Middle Eastern countries or at least not increasing at rates which have prevailed in recent years. Consequently, external migration may fall below current estimates leading to a higher residential population than anticipated earlier.

The third aspect of the population issue is the proportion of the resident population which will settle in urban and rural areas, respectively. The estimate of year 2000 urban population used in NUPS calculation of 37.0 million assumes a decline in the rate of population growth in rural areas, but an absolute increase of over 7 million.

The amount of rural to urban migration which will occur between now and 2000 depends upon urban and rural development policies, as well as the rate of natural increase. Although the detailed examination of rural development policies is outside the scope of our current NUPS work, the team has made an attempt to understand the effects of major elements of rural development policy and agricultural prospects.

Efforts are currently being made to shift agricultural policy in directions which will tend to increase the returns to farmers for their produce, which could result in generally higher incomes in rural areas. At the same time, however, the evidence suggests that aggregate labor requirements in agriculture will increase very slowly, if at all 1/. Thus, the overall prospect is for improvements in rural standards of living, but continued need for the rural population to seek non-farm employment leading to continued high rates of rural to urban migration.

The option of large increases in non-farm employment in rural villages and farms is not appealing since it poses a direct threat to land used for farming and fails to take advantage of agglomeration economies afforded by the larger urban areas in rural governorates. These latter advantages support a recommendation of locating a substantial portion of agriculturally-related industrial and service activities (which may grow in importance in the economy, if current trends in agricultural policy are maintained) in proximity to the farm areas, but in existing urban centers.

The combination of all these factors (continued high birth rates, possible reductions in the rate of external migration, and continued high rates of rural to urban migration) means that the NUPS assumption of 37 million urban residents by the year 2000 is, if anything, on the low side 2/. Consequently, it is imperative for those dealing with urban issues to plan for at least this much urban population in estimating urban and inter-urban investment requirements. An expanded and

1/ See W. Weideman Working Paper "The Agricultural Resource Base: Status & Expectations, December 1980. "New Directions in Agricultural Policy: Relations to Industrial & Urban Development", August 1981.

2/ H.W. Richardson suggests that an urban population of at least 41 million by the year 2000 may be more likely. See Occasional Working Paper "From First Round Alternatives to a Preferred Strategy: Suggestions & Comments" p. 8.

effective population policy would clearly be desirable but would have relatively small effects on the population by 2000.

B. The Economy: Aggregate Growth, & the Resource Pool for Investment

The recent growth performance of the Egyptian economy, in aggregate terms, has been excellent. The major sources of growth in the last several years have been petroleum revenues, remittances from Egyptians working outside the country, revenues from the Suez Canal, and tourism. A recent report prepared for the Ministry of Economy 1/ as well as a recent report from the World Bank 2/, while recognizing the strength of this growth caution against assuming that (a) the recently experienced rates of growth in these sectors will continue in the post-1985 period or that (b) the growth represents any major improvement in the economic performance of domestic industry.

The investment required in the Egyptian economy to generate additional output and employment remains high by international standards and indicates the need for productivity improvements in existing industry and agriculture as well as continued efforts to select future industrial projects with a high probability of positive rates of return and locations for the projects which provide the greatest cost advantages.

As shown in earlier reports, these requirements generally favor locations in areas which already have substantial economic bases and are large enough to generate economies of agglomeration 3/.

1/ See Ministry of Economy, A.R.E. Economic Studies Unit, Recent Development in the Egyptian Economy, January 1981.

2/ See World Bank, Arab Republic of Egypt. Domestic Resource Mobilization and Growth Prospects for the 1980's, Report No.3123-EG1, December 1980.

3/ See, in particular, the discussion of the analytical framework in the Status Report, p. 6-8 in "Working Paper on Characteristics of Alternative Strategies", and p. 54-58 in the Interim Action Report.

The NUPS projections of a 7% rate of economic growth to the year 2000 assume relative stability in the relationships between investment and both output and employment. While this assumed stability is potentially achievable, it will not happen automatically -- a concerted effort to improve productivity in existing industries and agriculture and to select new investments with technical characteristics and requirements which are aligned with Egypt's factor endowments will be required.

A further aspect of the economic situation which requires specific attention is the generation of resources available for investment. The investment levels required to generate an average annual growth rate of 7% are much larger than can be financed from domestic saving unless there is a dramatic change in recent patterns. As shown in the Working Paper on First Round Alternatives:

"The fraction of output growth which was saved in 1978 and 1979 fell far short of that anticipated in the Development Plan. In words an increase in national income of one pound led to an increase in saving of only four to five piasters in 1978 and 1979. If this pattern were to persist, the investment targets would become hopelessly out of reach. Investment projects would have to be abandoned, employment growth would slow down and self-sustained economic growth would not occur" 1/.

There are three basic sources of investible resources available to Egypt: (1) foreign savings; (2) public domestic savings and (3) private domestic savings. Although foreign resources have been available in the recent past to help permit the very substantial investment program to be followed, it is reasonably clear that major improvements will need to be made in domestic public and private saving for the longer-term maintenance of investment at desired levels.

1/ p. 12 of NUPS Working Paper on First Round Alternatives.

It is worth repeating here the comment from the Ministry of Planning's Egypt's Development Strategy, Economic Management & Growth Objectives, 1980-84 cited in our earlier report:

"The domestic savings target will require special efforts, because it calls for a significant change in the existing pattern of saving. Government current expenditure will clearly have to be rationalized and the public sector enterprises and organizations will have to eliminate their deficits and generate sizeable profits. The need to increase domestic resource generation cannot be exaggerated because it is becoming clear that at the present time it is the shortage of domestic resources that is slowing down the implementation of projects and inhibiting the utilization of the project aid that has already been committed by donor countries and organizations" 1/.

Public saving is defined as the difference between Government revenue and current expenditure. In the years 1976 and 1979, current expenditures exceeded government revenue resulting in negative public savings. In 1977 and 1978, public saving was positive but covered a relatively small portion of public investment (18% in 1977 and 10% in 1979). Consequently, the Government deficit (the differences between public investment and public saving) rose from L.E. 1.265 billion for 1976 to L.E. 2.637 billion for 1979. While the Government has recently announced that the 1981/82 budget will not require Government borrowing to finance the deficit; the public saving issue remains one of finding ways to increase revenues without stifling private investment and to reduce current expenditures or the unrecovered portions of public investment.

1/ Ministry of Planning, Egypt's Development Strategy, Economic Management and Growth Objectives, 1980-84, p.13

The conclusions from these considerations about public saving and investment are that the Government should select public enterprise investments that will yield relatively high revenues, emphasize urban locations with clear economic advantages and that the Government should select housing and infrastructure policies that result in higher rates of cost recovery per pound of investment than are now achieved. The means for achieving the first result are careful evaluation of the economic consequences of the types and locations of public enterprise investments, where efficiency criteria should dominate selection. An efficiency orientation in the settlement strategy such as that recommended here will help achieve the second result. The means for achieving the last result are careful selection of affordable standards for housing and infrastructure programs and the initiation of cost-recovery mechanisms from the user's of public investments.

Domestic private savings are influenced both by the possibility of direct investment of funds not used for current consumption and the availability of financial instruments (e.g. savings accounts and investment certificates) which yield a positive return. There is, for example, strong private interest in the informal housing sector which already is producing the major share of new housing. Its encouragement, on sites the Government finds desirable -- i.e. because it is on non-arable land or because its location could contribute to desired changes in the direction of growth of expanding cities -- could further relieve the Government of requirements for unrecovered public investment in housing. Policies which encourage private entrepreneurs in other lines of productive activity would also increase the private share of the investment pool. Substantial increases in private use of financial instruments are unlikely unless the return is not only positive but greater than the rate of inflation -- otherwise funds are channelled into the purchase of consumer goods rather than into saving.

C. Summary

This review of the overall context within which national urban policy choices must be made shows that population growth in the national population, relatively little increase in the population absorption capacity of agricultural areas, and a possible slow-down in the rate of external migration all point to a substantial increase in the urban population. This in turn, leads to the conclusion that there will be very high levels of demand for jobs, housing, and infrastructure services in urban areas. Satisfying these demands will require the selection of job-generating investments (both by type and location) with a high probability of positive economic return (and, therefore, their continuing provision of employment opportunities). It will require, also, increasing the contribution of citizens to investment (as in the formal housing sector) and their contribution to the costs the Government incurs for housing and services through insuring that the standards of provided housing and services are affordable and that users pay for a larger share of the services received.

The review of the overall economic picture emphasizes the need to generate higher levels of domestic public and private saving, both to insure that there are sufficient local resources to make full use of foreign assistance and that the overall resource pool is large enough to finance purely domestic investments.

The NUPS team recognizes that the necessary actions to generate an adequate resource pool and meet the requirements of an expanding population must involve more than the Ministry of Development. However, this review suggests a potentially highly influential role for the Ministry of Development, through its adoption of a preferred strategy for national urban policy, in setting the stage for complementary actions by other ministries. This can be done by adopting spatial priorities for urban development that contribute to an efficiency-oriented settlement strategy and sectoral policies consistent with a strategy of conserving public investment -- that is the provision of housing and other infrastructure at affordable standards (reducing

initial outlays per capita) accompanied by increased efforts at higher levels of cost-recovery from those served by public investment (increasing the return flow of reinvestable funds.

The analysis of the settlement system and the costs associated with alternative settlement strategies provides a theoretical and empirical basis for choosing the major elements of an efficiency-oriented settlement strategy accompanied by efforts to achieve longer-term decentralization of the settlement system. This paper presents our recommendations for the spatial elements of that settlement strategy. The recommendations recognize the significance of expecting substantial increases in urban population and that sufficient financial resources are unlikely to be available to finance all of the sectoral investments that the Government would like to undertake.

II. REVIEW OF FIRST ROUND ALTERNATIVES WORKING PAPER

The overall dimensions of the recommended settlement strategy are listed on pp. 2-3 of this report. Their individual spatial elements will be described in more detail later in this paper. A review of the material on pp. 2-3 will show that the recommended spatial strategy does not conform exactly to any of the "pure" alternatives described in the Working Paper on First Round Alternatives. To indicate what elements of these alternatives are selected as elements of the preferred alternative, a summary of this earlier paper is provided here.

The major points developed in the Working Paper on First Round Alternatives are essential for making a choice of a preferred strategy in national urban policy. This section is designed as a brief review of the earlier paper for the reader's convenience .

In the Working Paper on First Round Alternatives, four major topics were discussed:

1. The problem of generating a sufficiently large resource pool to finance needed development investment over the next two decades. (Chapter I)
2. Cost estimates for generating employment and population - supporting infrastructure in urban areas including investment in industrial and service activities and intra-urban infrastructure for the four basic alternative spatial distributions of the urban population of Egypt*. (Chapter II and III)
3. An analysis of administrative and legal instruments--other than direct investment--required to implement national urban policy. (Chapter IV)
4. An analysis of the Cairo Metropolitan Region, its current and projected trends in development, and a preliminary concept plan for managing expanding urbanization in its region.(Chapter V)

* Two of the Alternatives were presented in two variants.

A. The Basic Alternatives

The Working Paper examines implications of four basic alternative spatial distributions of the urban population of Egypt. These alternatives are:

- 1) Alternative A: The emphasis is on generating additional output (and employment) with least cost and generates considerable growth in major metropolitan centers. That is, this alternative is the most completely oriented to economic efficiency.
- 2) Alternative B₁: The emphasis is on inter-regional decentralization through the creation of a major metropolitan area in the Suez region, preferably in Suez City.
- 3) Alternative B₂: The emphasis is on inter-regional decentralization through the expansion of multiple growth centers.
- 4) Alternative C : The emphasis is on maximum decentralization of the urban population.

The analysis of the alternatives in the report focussed on the use of direct investment in industry, services, housing, and intra-urban infrastructure as major instruments of national urban policy^{1/}. Additional administrative and legal instruments were examined also.

B. Major Conclusions

The major points made in the report were:

- The total investment costs required for creation of sufficient jobs as well as infrastructure to serve industry and people are very substantial. Our estimates for such expenditures in the 38 largest urban places only -- excluding operating cost and inter-regional systems for transportation, power, water, etc.-- ranged from about 84% to 109% of the investment pool that would be available for job creation and all infrastructure.

^{1/} Inter-urban infrastructure is critical also, to shaping the urban system. Additional cost information on inter-urban transportation power and bulk water is provided below. These cost elements were not included in the First Round Alternative Paper being reviewed in this section. (See Appendix B)

1986-2000 period, if the economy grows at 7% a year. Thus there is no alternative to a sustained effort to insure that all allocations of investment funds result in clear benefits to offset their costs.

- The achievement of a high enough growth rate in the economy to provide employment options for the expected labor force will require a substantial improvement in the ability of both the public and private sectors in Egypt to generate domestic savings which can be channelled into productive investment. The National Development Plan calls for the portion of investment to be financed from domestic saving to increase to 145% of its 1979 share by 1984. Such an expansion in saving is difficult, if not impossible, to achieve given current policies and recent expansions in consumption spending. That is, domestic saving is currently a more serious bottleneck to investment than foreign resources. Improvement in saving performance requires consideration of major government wide policy choices relating to taxes, interest rate, exchange rate, price and subsidy and productivity policies.
- The total investment pool for industrial and service jobs, housing, and intra-urban infrastructure would be about L.E. 25.6 billion in the 1986-90 period if sufficient savings are realized to finance investment. The estimated costs for direct investment in industrial and service jobs plus intra-urban infrastructure and housing only -- as described earlier -- are about L.E. 21.5 billion in the "least cost" (most spatially concentrated) alternative and about L.E. 28 billion in the most decentralized alternative.
- There are substantial differences in the costs of alternative spatial strategies for the allocation of industry and infrastructure investment. The most costly alternative -- the most decentralized -- would cost about 30% more than the least cost alternative.

The general rule applicable to the geography of Egypt is that costs increase as investments are made to more urban places and more spatially dispersed locations. That is, more comprehensive coverage and greater decentralization require increased expenditure to provide jobs and infrastructure services for the same number of people at the same infrastructure and housing standards. (If there is substantial upgrading of housing and infrastructure in dispersed locations the cost differences become even more substantial).

- Cost differences between alternatives with spatially concentrated investment patterns versus more dispersed investment patterns will be reflected also by the inclusion of operating costs for infrastructure systems and costs of inter-regional infrastructure as is shown later in this paper. (See Appendix B).
- The estimated costs and cost differences between alternatives can be positively influenced by Government project and policy choices which affect:
 - . Selection of industrial and service investments which have higher than average payoffs in terms of output and employment relative to their costs.
 - . The choice of standards of service provision for housing, physical and social infrastructure in different types of urban areas and different locations -- aiming for better matches between standards and affordability.
 - . The levels and types of subsidy associated with industrial and infrastructure systems provided and the amount of the investment cost recovered from users of the services.

- Direct investment in employment generating activities as well as physical and social infrastructure are the major instruments of national urban policy, with the first being more influential in affecting population distribution.
- Many of the urban policy instruments other than direct investment which are needed -- legal and administrative instruments -- are either already available or are being actively considered by the Government. However, the coordinated use of these instruments (as well as the direct investment instruments) requires a more structured planning framework to utilize the instruments effectively and a clarification of the required roles and actions of national ministries and the relative roles of the national and local governments.
- Regarding Cairo, the Study Team recognized the appropriateness of the government explicit policy of deconcentration of the core of the city. However, the momentum of past trends, the current direction of development, and the reinforcement of these trends and directions by individual sectoral plans and investment allocations make it difficult to achieve the purposes of the explicit policy.
- Economic incentives, the importance of agglomeration effects on choices by business and mobile segments of the population, and the natural increase of population in major metropolitan areas all suggest the likelihood of substantial continued expansion of Cairo and Alexandria. The key policy issue is how to manage that growth, harness the positive aspects of these regions for the achievement of national development objectives, and reduce the adverse consequences of their size and growth; not how to make them smaller. Efforts to deconcentrate core areas must be a major element in growth management.

C. Costing Approach used in NUPS Estimates

The procedure used to estimate direct investment costs for industry and service output and employment takes into account relative local advantages for certain types of employment associated with its existing economic structure and, what the Study Team called, "growth management" costs.

The resource base, accessibility to product markets, experience of the labor force, and degree of integration of economic activities differ by location. Places which have relative advantages in terms of such factors should be expected on average, to be able to generate output and employment at lower costs than places which do not have the advantages to the same degree. These are the advantages associated with the existing economic structure.

At the same time, the ability of urban places to absorb additional investment without creating new problems, bottlenecks (delays or shortages) in the provision of needed materials and labor congestion, and administrative difficulties is limited. Cost-increasing problems of these types (i.e. "growth management costs") increase as the rate of investment, employment, and population growth increases. Therefore, a place with initial cost advantages over other places cannot absorb unlimited amounts of investment without losing its initial cost advantage. Costs for each alternative suggested in the paper, therefore, reflect both the initial cost advantages and disadvantages as well as "growth management" costs ^{1/}. Population growth estimates for settlements were developed for each alternative after allocating job creation investment using different allocation rules for each alternative.

The allocation rule for direct investment in Alternative A was to find the employment growth rates for each settlement which resulted in the least total cost for creating the target number of new urban manufacturing and service jobs. The employment targets are derived from the macro-economic projection. The use of this rule allocates most of the

^{1/} See Appendix C, below, for a more technical discussion of the way both sets of factors were employed.

^{2/} Technically, this is the growth rate for each settlement where the additional cost of creating a new job in all settlements are equal and the sum of jobs creating in all settlements equals the total new jobs mining, manufacturing, construction and services required for each five year period (1986-90, 95-2000).

employment growth to places with existing industrial bases and agglomeration economies.

The allocation rule for B₁ was to allocate first, only enough investment in Cairo and the Delta to support urban populations in these zones of 15.0 and 7.0 million, respectively in the year 2000. Second, enough investment in the Canal Zone was allocated to support 4.0 million people in 2000. Third, the remaining direct investments to other zones were allocated using two allocation rules. The first of these rules was the same as for the entire allocation in Alternative A. That is, the residual allocation was made on a least-cost basis. This is Alternative B₁ Efficiency. The second rule was to allocate investment on an equal per capita basis for settlements not in Cairo, the Delta, and Canal Zones. This is Alternative B₁ Equity.

The application of these rules in B₁ results in exceptionally high growth rates in the Canal Cities in both B₁ Alternatives. B₁ Efficiency results, also, in high growth rates for Alexandria relative to North and South Upper Egypt and the remote areas. B₁ Equity (as a result of equal per capita shares of investment) reduced the allocation to Alexandria and increases it to the latter areas.

The intent of Alternative B₂ was to invest more in more dispersed locations than either A or B₁. Consequently, the allocation rule was first, to invest only enough in Cairo, Alexandria, and the Delta to support respective-year 2000 populations in their urban areas of 15.2, 4.4 and 7.3 million. The remaining zones then were allocated investment in two ways: as in B₁ Efficiency and as in B₁ Equity. The resulting distributions are B₂ Efficiency and B₂ Equity. The application of these rules reduces the supportable population in the canal zone relative to B₁ and increases growth rates in North & South Upper Egypt and the Remote Areas relative to B₁.

Alternative C was designed to emphasize the effects of forcing more substantial investments into the Remote Areas and Zones away from Cairo, Alexandria and the Delta. In addition to restricting investment in these latter areas, investment to support jobs for a population of 1.3 million in the Remote Areas was allocated. The residual was allocated on an equal per capita basis to the Canal, North and South Upper Egypt.

Implied Growth rates in the Remote Areas are very high in the scenario and generally higher in North and South Upper Egypt than in other alternatives.

The employment of the various allocation rules affects the total direct job investment cost for the alternatives. These are shown in Table I.

TABLE I

DIRECT JOB INVESTMENT COST
BY ALTERNATIVE
(L.E. Millions)

<u>ALTERNATIVE</u>	<u>Period</u>			<u>Total</u>
	<u>1986-90</u>	<u>91-95</u>	<u>96-2000</u>	
A	8,423	12,826	22,247	43,496
B ₁ Efficiency	8,891	13,493	23,010	45,394
B ₁ Equity	9,030	13,598	23,157	45,785
B ₂ Efficiency	9,134	13,236	22,268	44,638
B ₂ Equity	9,239	13,360	22,475	45,074
C	9,531	13,620	23,051	46,202

The procedure for estimating housing, and intra-urban physical and social infrastructure costs takes into account the effects of population size, density of settlement, and service standards on both total and per capita costs. Estimates were provided for indicative costs of land, housing, water, sanitation, roads, transportation, solid waste, education, health and social services in various combinations.

Tables II, III, IV, V, and VI summarize the cost and population variations implied by the alternatives under consideration. The alternatives range from A (the most concentrated pattern and the least cost alternative) to C (the most decentralized pattern and largest cost alternative). B₁ and B₂ emphasize growth centers other than Cairo and Alexandria in various combinations. B₁ includes a major counter-magnet in the Canal Region and B₂ a more dispersed set of growth centers.

The importance of the foregoing estimates for job creation, housing, and infrastructure does not rest solely upon the details of the estimates. Minor modifications are unlikely to affect the major policy conclusions. The analysis shows that the selection of spatial objectives for the "New Map" of Egypt is likely to have pronounced influence on the ability of the Government to achieve other development objectives and, conversely, that spatial objectives cannot be achieved without a strong government-wide commitment to follow-up with consistent investment plans and implementation mechanisms.

TABLE II
FINANCIAL COST OF ALTERNATIVES

1986 - 1990

ALTERNATIVE	Direct Investment Costs (LE Billions)	Cost as percent of Alternative A	Infrastructure Investment Cost (LE Billions)	Cost as a percent of Alternative A	Total Investment Cost (LE Billions)	Cost as a percent of Alternative A
A	8.4	100	17.3	100	25.7	100
B ₁ Efficiency	8.9	105.9	18.8	108.7	27.7	107.8
B ₁ Equity	9.0	107.1	20.8	120.2	29.8	116.0
B ₂ Efficiency	9.1	108.3	19.8	114.5	28.9	112.5
B ₂ Equity	9.2	109.5	21.5	124.3	30.7	119.5
C	9.5	113.1	23.9	138.2	33.4	130.0
A (at C standards)	8.4	100.0	19.8	114.5	28.2	109.7
C ⁰ (At A standards)	9.5	113.1	21.2	122.5	30.7	119.5

TABLE III
FINANCIAL COST OF ALTERNATIVES

1991-1995

ALTERNATIVE	Direct Investment Costs (LE Billions)	Cost as percent of Alternative A	Infrastructure Investment Cost (LE Billions)	Cost as a percent of Alternative A	Total Investment Cost (LE Billions)	Cost as a percent of Alternative A
A	12.9	100	19.6	100	32.5	100
B ₁ Efficiency	13.5	104.7	22.4	114.3	35.9	110.5
B ₁ Equity	13.6	105.4	24.0	122.4	37.6	115.7
B ₂ Efficiency	13.2	102.3	22.7	115.8	35.9	110.5
B ₂ Equity	13.4	103.9	23.5	119.9	36.9	113.5
C	13.6	105.4	30.1	153.6	43.7	134.5
A (at C standards)	12.9	100	21.5	110.0	34.4	105.8
C ⁰ (At A standards)	13.6	105.4	23.4	119.4	37.0	113.8

TABLE IV
FINANCIAL COST OF ALTERNATIVES

1996 - 2000

ALTERNATIVE	Direct Investment Costs (LE Billions)	Cost as percent of Alternative A	Infrastructure Investment Cost (LE Billions)	Cost as a percent of Alternative A	Total Investment Cost (LE Billions)	Cost as a percent of Alternative A
A	22.2	100	22.8	100	45.0	100
B ₁ Efficiency	23.0	103.6	26.6	116.7	49.6	110.2
B ₁ Equity	23.2	104.5	28.0	122.8	51.2	113.8
B ₂ Efficiency	22.3	100.5	26.5	116.2	48.8	108.4
B ₂ Equity	22.5	101.4	28.8	126.3	51.3	114.0
C	23.1	104.1	33.6	147.4	56.7	126.0
A (at C standards)	22.2	100	24.9	109.2	47.1	104.7
C ⁰ (At A standards)	23.1	104.1	28.1	123.2	51.2	113.8

TABLE V
FINANCIAL COST OF ALTERNATIVES

1986 - 2000

ALTERNATIVE	Direct Investment Costs (LE Billions)	Cost as percent of Alternative A	Infrastructure Investment Cost (LE Billions)	Cost as a percent of Alternative A	Total Investment Cost (LE Billions)	Cost as a percent of Alternative A
A	43.5	100	59.7	100	103.2	100
B ₁ Efficiency	45.4	103.5	67.9	113.7	113.3	109.8
B ₁ Equity	45.8	105.3	72.8	121.9	118.6	114.9
B ₂ Efficiency	44.6	102.5	69.0	115.6	113.6	110.1
B ₂ Equity	45.1	103.7	73.9	123.8	119.0	115.3
C	46.2	106.2	85.2	142.7	131.4	127.3
A (at C standards)	43.5	100	66.4	111.2	109.9	106.5
C ⁰ (At A standards)	46.2	106.2	72.8	121.9	119.0	115.3

TABLE VI a

KEY FEATURES OF ALTERNATIVE A (Direct investment costs)1986-2000 INVESTMENT COST

ZONE	COMMENTS	2000	1986 - 2000	Average Cost	Total Cost
		Pop.	Emp. Change (000)	Per Job	L.E. Million
Cairo	Expansion at slightly above-trend growth rates; infill in Greater Cairo; fringe expansion on East-West corridors; non-fringe settlements and new intra-regional infrastructure	16419	3714	6438	23909
Alexandria	Emphasis on Alexandria Metropolitan Region, infill to higher densities, New Ameriya development.	5778	1469	6274	9217
Canal	Expansion of Canal Cities below current master plan estimates but with some in-migration, especially in Suez.	1577	289	6581	1902
Delta	Within boundary population growth in Tanta, Mahalla and Dameitta, possibly as regional service centers; within boundary expansion of cities near Cairo region (Benha and Qalyub), and near Alexandria (Kafr El Dawar).	5175	982	6470	6354
North Upper Egypt	Greater expansion in Fayoum, but moderate expansion in all cities.	849	93	6959	682
South Upper Egypt	Emphasis on growth in Aswan, followed by Qena/Naga-Hamadi.	1581	189	6926	1309
Remote Areas	No major expansion in these zones.	270	23	7174	165
Total		31649	6764	6437	43538

SUMMARY OF INFRASTRUCTURE IN SETTLEMENT ALTERNATIVE A 1986-2000

SETTLEMENT ZONE	TOTAL COSTS L.E. (MILLIONS)	PER CAPITA COSTS (L.E.)	DESCRIPTION
GREATER CAIRO	15,679	378	Large expansion of population results in large requirement for new infrastructure. Thus zone Total costs are high. Water and sewerage at Greater Cairo masterplan standards. Other physical and social infrastructure improved to medium high standards. Housing increased to 125% of National Housing Plan standards.
ALEXANDRIA	9,944	700	Emphasis on infill of Alexandria Metropolitan Region results in large requirement for new infrastructure. Higher per capita costs due to high costs of Alexandria masterplan standards for water and sewerage. Other standards similar to Greater Cairo
CANAL	2,492	611	Reduced growth rates result in lower infrastructure requirements. Water and Sewerage standards maintain existing standards which are higher than national urban average standards. Other infrastructure similar to Greater Cairo, but housing at National Housing Plan standards.
DELTA	8,442	634	Growth of all settlements within boundaries resulting in extremely high gross densities in Zagazig, Damanhour & Kafr El Dawar. Higher existing standards in Tanta & Mansoura maintained, standards of other settlements improved to national urban average or maintained at existing levels.
NORTH UPPER EGYPT	1,675	718	Fayoum, Beni Suef and Minia at standards similar to Canal Cities, but water and sewerage improved to lower target standards for provincial cities.
SOUTH UPPER EGYPT	1,443	334	Aswan, Qena and Naga Hamadi at standards similar to growth centers in North Upper Egypt. Other settlements at standards improved to national urban average standards or maintained at existing levels.
REMOTE AREAS	772	1,022	Low growth rates do not require large investments in new infrastructure. Although standards are at national urban average standards, per capita costs are high due to low gross densities and higher unit construction costs.
TOTAL	40,447	504	Emphasis on deconcentration of major metropolitan areas. Thus standards in Greater Cairo and Alexandria zone new towns and satellites are high.

TABLE VI b

KEY FEATURES OF ALTERNATIVE B1 EFFICIENCY (Direct Investment costs)

1986-2000 INVESTMENT COSTS

ZONE	COMMENTS	2000 Pop.	1986 - 2000 Emp. Change (000)	Average Cost Per Job	Total Cost (LE Millic)
Cairo	Expansion of Cairo above natural increase rates; maximum encouragement of out-migration and migration diversion to Canal Region; requires all elements of infill, fringe and new settlement development.	14999	2947	6218	18323
Alexandria	Major development for expanded metropolitan role but at lower growth rate than Alternative A.	5258	1133	5848	6626
Canal	Expansion of Suez as new major metropolitan center, expansion of corridors plus new satellite development on both sides of Canal; expansion of all three cities over current plan; very high growth rates in all cities.	3999	1661	8368	13899
Delta	Same as Alternative A except that more out-migration is expected.	4864	823	6345	5222
North Upper Egypt	Emphasis on Fayoum as in Alternative A; lower growth rates for all cities than in Alternative A.	795	62	6548	406
South Upper Egypt	Emphasis on Aswan, Qena/Naga Hamadi as regional centers; lower growth rates for all cities than in Alternative A.	1482	128	6547	838
Remote Areas	No major expansion in these zones.	253	12	6667	80
Total		31650	6766	6709	45394

SUMMARY OF INFRASTRUCTURE IN SETTLEMENT ALTERNATIVE B₁ EFFICIENCY

(1986-2000)

SETTLEMENT ZONE	TOTAL COSTS L.E. (MILLIONS)	PER CAPITA COSTS (L.E.)	DESCRIPTION
GREATER CAIRO	12,358	318	Reduction in new population results in lower per capita costs than A due to less need for new infrastructure. Water and sewerage at masterplan standards. Other physical and social infrastructure at medium standards. Housing reduced to National Housing Plan standards.
ALEXANDRIA	7,809	570	Increase in new population plus higher costs of water and sewerage result in high per capita costs than Greater Cairo Zone. Water and sewerage at Alexandria masterplan standards. Other infrastructure similar to Greater Cairo.
CANAL	16,964	2,108	Major emphasis on growth in Canal Cities results in large requirements for new infrastructure. Standards are high (at Canal Cities masterplan standards or Sadat City masterplan standards) to induce growth especially in the counter magnet.
DELTA	7,920	621	Reduced population lowers infrastructure requirements. Tanta and Mansoura developed into regional service centers emphasizing vertical expansion. Other settlements have standards which maintain existing physical infrastructural standards but improve health and education standards. Due to reduced population growth, rehabilitation of existing stock contributes to per capita costs.
NORTH UPPER EGYPT	1,459	644	Fayoum, Beni Suef and Minia at standards higher than other secondary cities, but lower than Canal Cities. Costs remain high due to regional construction cost differences.
SOUTH UPPER EGYPT	1,308	311	Low per capita costs result from reduced infrastructure requirements due to reduced growth rates. Aswan, Qena and Naga Hamadi at standards higher than other secondary cities, but lower than Canal Cities. Secondary cities at standards which maintain existing infrastructure standards.
REMOTE AREAS	661	900	Standards bring infrastructure to national urban average standards or maintain existing standards. High per capita costs due to higher construction costs in remote regions.
TOTALS	48,479	600	Settlements with horizontal expansion potential allowed to expand boundaries when gross densities of 300 persons/hectare are reached.

TABLE VI c

KEY FEATURES OF ALTERNATIVE B1 EQUITY (Direct investment costs)

1986-2000 INVESTMENT COST

ZONE	COMMENTS	2000 Pop.	1986 - 2000 Emp. Change (000)	Average Cost Per Job	Total Cost (LE Million)
Cairo	Same as Alternative B1 Efficiency	15001	2947	6,216	18319
Alexandria	Slower population growth than Alternative B1 Efficiency. Governorate population twenty percent below Alternative A.	4630	811	5,641	4575
Canal	Same as Alternative B1 Efficiency.	3999	1661	8,368	13899
Delta	Same total population as Alternative B1 Efficiency; balanced population growth in all cities.	4869	823	6,501	5350
North Upper Egypt	Higher population growth rates than Alternative B1 Efficiency; balanced growth in all cities.	999	167	6,904	1153
South Upper Egypt	Same as North Upper Egypt	1813	298	6,933	2066
Remote Areas	Balanced growth in all areas at near natural rate of population increase.	341	58	7,259	421
Total		31652	6765	6,768	45783

SUMMARY OF INFRASTRUCTURE IN SETTLEMENT ALTERNATIVE B₁ (Equity)

(1986-2000)

SETTLEMENT ZONE	TOTAL COSTS L.E. (MILLIONS)	PER CAPITA COSTS (L.E.)	DESCRIPTION
GREATER CAIRO	12,138	332	Growth rates and standards similar to B ₁ (Efficiency)
ALEXANDRIA	5,972	486	Standards are similar to B ₁ (Efficiency), however reduced population growth rate lowers requirements for new infrastructure thus reducing per capita costs.
CANAL	17,437	2,203	Standards similar to B ₁ (Efficiency).
DELTA	9,360	737	Tanta and Mansoura developed into regional service centers as in B ₁ (Efficiency). Although all growth occurs within settlement boundaries, standards are improved to level of non-Canal Cities growth centers in B ₁ (Efficiency) to increase inter-regional equity.
NORTH UPPER EGYPT	2,502	943	All settlements at standards similar to B ₁ (Efficiency). Increased population growth rates results in higher per capita costs due to increased infrastructure requirements and regional cost variations.
SOUTH UPPER EGYPT	2,208	459	All settlements have standards similar to Aswan, Qean and Naga Hamadi in B ₁ (Efficiency). As in North Upper Egypt, increased population growth rates increases demand for new infrastructure. Per capita costs are lower than North Upper Egypt due to lower construction costs in Qena and Aswan where most growth occurs.
REMOTE REGIONS	1,763	1,972	Standards are similar to North and South Upper Egypt settlements. Per Capita costs are higher due to lower gross densities and higher regional construction costs.
TOTAL	52,180	648	Standards of all settlements at levels proposed for North and South Upper Egypt growth centers (except Greater Cairo, Alexandria and the Canal Cities) to improve inter-regional equity. Settlements with horizontal expansion potential allowed to expand onto non-arable land when gross densities reach 300 persons/hectare.

TABLE VI d

KEY FEATURES OF ALTERNATIVE B2 EFFICIENCY (Direct investment costs)

1986-2000 INVESTMENT COST

ZONE	COMMENTS	2000 Pop.	1986 - 2000 Emp. Change (000)	Average Cost Per Job	Total Cost (LE Million)
Cairo	Similar to Alternative B1	15000	2956	6232	18422
Alexandria	Similar to Alternative B2	4399	721	5692	4104
Canal	Development at about current plan levels	2165	597	7246	4326
Delta	Same as Alternative B1 Equity	4861	811	6449	5230
North Upper Egypt	Similar to Alternative B2 Efficiency although growth among cities is more balanced.	1398	384	7583	2912
South Upper Egypt	Same as North Upper Egypt	2525	682	7554	5152
Remote Areas	Expansion of Red Sea to population targets in Red Sea governorate plan (700,000); Western Desert expansions at Gharga, Dakla, Ferafra, and Beheira Oases (300,000); Expansion of Northwest Coast and Sinai (300,000).	1300	614	9886	6070
Total		31648	6765	6832	46216

TABLE VI d (cont.)

KEY FEATURES OF ALTERNATIVE B2 EFFICIENCY (Direct investment costs)

CONT'D

ZONE	COMMENTS	2000 Pop.	1986 - 2000 Emp. Change (000)	Average Cost Per Job	Total Cost (LE Million)
Remote Areas	Partial implementation of Red Sea Governorate Plan to expand Ghardaka, Safaga, And Ras Gharib to 157,000. Expansion of Western Desert cities to serve agriculture. Expansion of urban areas in Northwest Coast and Sinai.	438	112	7714	864
Total		31645	6756	6609	44650

SUMMARY OF INFRASTRUCTURE IN SETTLEMENT ALTERNATIVE B₂ (Efficiency)
(1986-2000)

SETTLEMENT ZONE	TOTAL COSTS L.E. (MILLIONS)	PER CAPITA COSTS (L.E.)	DESCRIPTION
GREATER CAIRO	13,531	345	With the exception of water and sewerage standards which are the same as other alternatives, Greater Cairo standards are the same as non-Canal growth centers to encourage growth outside Greater Cairo. Slightly higher growth rates than B ₁ contribute to higher per capita costs.
ALEXANDRIA	5,795	495	Reduced population growth rates and an emphasis on concentration in the metropolitan area result in lower per capita costs. Water and sewerage at Alexandria masterplan costs increase per capita costs higher than Greater Cairo costs, otherwise standards are the same as Greater Cairo.
CANAL	8,445	1,446	Housing and physical infrastructure are lower than B ₁ , resulting in per capita costs.
DELTA	8,937	679	Tanta and Mansoura developed into regional service centers. Other Settlements at standards similar to B ₁ (Efficiency). Higher population growth rates result in higher gross densities as settlements are constrained to existing boundaries, but lower per capita costs.
NORTH UPPER EGYPT	4,788	1,453	Due to growth center emphasis, Fayoum, Beni Suef and Minia higher standards than B ₁ , which except for water and sewerage are at the same level as Greater Cairo and Alexandria.
SOUTH UPPER EGYPT	3,960	658	Assiut, Qena, Naga Hamadi, and Aswan are developed into growth centers and have standards similar to Greater Cairo. Other settlements have standards similar to B ₁ (Efficiency). Larger number of non-growth center settlements and reduced regional construction costs in Qena and Aswan.
REMOTE AREAS	2,133	2,014	Higher growth rates result in higher demand for infrastructure which increase per capita costs even though standards are similar to B ₁ (Efficiency).
TOTALS	47,589	593	Emphasis on improved standards in growth centers. Horizontal expansion onto non-arable land when gross densities of 300 persons/hectare are reached.

TABLE VI e

KEY FEATURES OF ALTERNATIVE B2 EQUITY (Direct investment costs)

1986-2000 INVESTMENT COST

ZONE	COMMENTS	2000 Pop.	1986 - 2000 Emp. Change (000)	Average Cost Per Job	Total Cost (LE Million)
Cairo	Same as Alternative B2 Efficiency	15200	3058	6258	19137
Alexandria	Same as Alternative B2 Efficiency	4400	725	5739	4161
Canal	Slower population growth than B2 Efficiency	2342	697	7241	5047
Delta	Same total population as Alternative B2 Efficiency; balanced population growth in all cities.	5113	967	6829	6604
North Upper Egypt	Higher population growth than Alternative B2 Efficiency; otherwise similar to it.	1456	420	7669	3221
South Upper Egypt	Same as North Upper Egypt.	2639	753	7652	5762
Remote Areas	Higher population growth than Alternative B2 Efficiency; otherwise similar to it.	502	147	7966	1171
Total		31652	6767	6664	45103

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SUMMARY OF INFRASTRUCTURE IN SETTLEMENT ALTERNATIVE B₂ (Equity)

SETTLEMENT ZONE	(1986-2000)		DESCRIPTION
	TOTAL COSTS L.E. (MILLIONS)	PER CAPITA COSTS (L.E.)	
GREATER CAIRO	13,772	351	Standards and population growth rates similar to B ₂ (Efficiency)
ALEXANDRIA	5,880	502	Standards similar to B ₂ (Efficiency)
CANAL	8,127	1,542	Standards are similar to B ₁ (Equity) which results in higher per capita costs than B ₂ (Efficiency). However per capita costs are lower in B ₂ (Equity) than B ₁ (Equity) because reduced population growth rates (especially in the counter magnet) reduce demand for new infrastructure.
DELTA	11,897	892	Tanta and Mansoura developed into regional service centers at standards of B ₁ . Other settlements at same standards as B ₁ (Equity) to improve inter-regional equity.
NORTH UPPER EGYPT	4,886	1,465	Standards the same as B ₂ (Efficiency).
SOUTH UPPER EGYPT	5,538	861	Standards in Assiut, Naga Hamadi, Qena and Aswan similar to standards of Greater Cairo due to emphasis on growth centers. Other Settlements have standards similar to B ₁ (Equity), i.e., emphasis on improving social and physical infrastructure and housing at National Housing Plan standards.
REMOTE AREAS	3,392	2,777	Standards are similar to the non-growth center settlements in North and South Upper Egypt. Increased, population growth rates result in higher demand for infrastructure which in addition to low gross densities and regional construction cost differences increase per capita costs.
TOTALS	53,492	666	Emphasis is on growth centers, however secondary settlements have infrastructure service levels improved over B ₂ (Efficiency). Horizontal expansion onto non-arable land after settlement gross densities exceed 300 persons per hectare.

TABLE VI f

KEY FEATURES OF ALTERNATIVE C (Direct investment costs)1986-2000 INVESTMENT COST

ZONE	COMMENTS	2000 Pop.	1986 - 2000 Emp. Change (000)	Average Cost Per Job	Total Cost (LE Million)
Cairo	Population growth rate slightly above Alternative B1; otherwise similar to Alternative B1.	15200	3054	6256	19106
Alexandria	Population growth rate near rate of natural increase. More emphasis on regional economic links and less on national economic links than either Alternative A or Alternative B1 Efficiency. Similar to Alternative B1 Equity.	4400	724	5721	4142
Canal	Expansion beyond current plan population levels. A major development zone in Lower Egypt but on a smaller scale than Alternative B1.	2596	832	7320	6090
Delta	Essentially the same as Alternative A.	5111	965	6510	6282
North Upper Egypt	Expansion of all four cities, creation of major new centers at Fayoum and east bank of Nile at Beni Suef.	1374	376	7593	2855
South Upper Egypt	Large and fairly balanced expansion of all cities; leading regional cities to be Aswan and Qena/Naga-Hamadi.	2526	693	7664	5311

SUMMARY OF INFRASTRUCTURE IN SETTLEMENT ALTERNATIVE C

1986-2000

SETTLEMENT ZONE	TOTAL COSTS L.E. (MILLIONS)	PER CAPITA COSTS (L.E.)	DESCRIPTION
GREATER CAIRO	13,229	341	No change in standards from B ₂ . However, reduced population growth rates result in less demand for new infrastructure and lower per capita costs.
ALEXANDRIA	5,842	499	No change from B ₂ .
CANAL	8,345	1,616	Standards similar to B ₂ (Equity), however reduced population growth rates reduce per capita costs due to lessened demand for new infrastructure.
DELTA	10,624	830	Tanta and Mansoura standards similar to B ₂ , other settlements have standards similar to Greater Cairo except for water and sewerage which are lower than Greater Cairo.
NORTH UPPER EGYPT	5,841	1,637	Fayoum, Beni Suef, and Minia have water and sewerage standards which are similar to the Canal Cities. Other infrastructure is similar to B ₂ except that housing standards have been increased 50 percent.
SOUTH UPPER EGYPT	4,965	821	Assiut, gen., Naga Hamadi, and Aswan have standards similar to North Upper Egypt growth centers. Other settlements have high standards similar to Greater Cairo and Alexandria.
REMOTE AREAS	11,955	5,106	Standards are similar to Greater Cairo and Alexandria except for water and sewerage which are at Canal Cities standards. High per capita costs result from low densities and high regional construction costs.
TOTAL	60,441	749	Decentralization is encouraged through providing most settlements with standards which are roughly equivalent to or higher than Greater Cairo & Alexandria standards. Higher per capita costs result from higher standards and regional construction cost variations. Settlements with horizontal expansion potential onto non-arable land allowed to expand boundaries with gross densities reach 300 persons per hectare.

III. Evaluation of the Alternatives

A. Design Features of Performance & Associated Implications

The various alternatives were designed to illustrate the settlement implications of emphasizing various national objectives or elements of the current urbanization strategy. Not surprisingly, therefore, the alternatives vary systematically on some significant evaluation criteria by design. These are shown in Table VII below, repeated from the First Round Alternatives Report.

TABLE VII

PERFORMANCE CRITERIA BY ALTERNATIVE

<u>Criteria</u>	<u>A</u>	<u>B₁</u> (Efficiency)	<u>B₁</u> (Equity)	<u>B₂</u> (Efficiency)	<u>B₂</u> (Equity)	<u>C</u>
1. Least Direct Cost Per Job	1	2	3	4	5	6
2. Least Total Cost (including Infrastructure)	1	3	4	2	5	6
3. More Equitable Provision of Urban Services	6	5	4	3	2	1
4. More Regional Equality in the Share of Industrial Employment	6	5	4	3	1	2
5. Reducing Population Growth in the Delta	6	1-2	1-2	3-4-6	3-4-5	3-4-5
6. Reducing Population Growth in Cairo	6	2-3	2-3	4-5	4-5	1

The generation of alternative scenarios however, that have the performance characteristics cited above carry a number of other implications which deserve highlighting since they affect the feasibility of achieving the population distributions and, therefore, their riskiness as "pure" options. The most important of these are:

- 1) all alternatives except A, have lower growth rates for Cairo than the MUPS team believe are achievable under any otherwise acceptable urban strategy.
- 2) the implied growth rate for Alexandria in Alternative A will be difficult to achieve given physical characteristics of the area and the necessity to choose to sacrifice old agricultural lands, low density resort areas or newly reclaimed land to urbanization;
- 3) the growth rates for Canal Zone cities in B₁ are extremely high (relative to both their recent experience and national norms). Achievement of these rates of growth may not be possible on a sustained basis and the attempt to achieve them would require so much investment and attention of all relevant ministries that other important areas and sectoral initiatives would be adversely affected;
- 4) implied growth rates for North and South Upper Egypt in both B₂ and C alternatives require for their achievement very substantial changes in their past patterns of growth (with a few isolated exceptions -- such as Aswan during High Dam development). In practice, it would be extremely difficult to identify enough economically attractive investments in these zones to use the allocation effectively. Alternatively, the actual project costs -- if lower payoff projects become a significant portion of the actual choices made -- could be considerably higher than our estimates;
- 5) the growth rates for the Remote Areas implied especially in C but also in B₂ appear to be larger than sustainable. Richard Meier suggests that all of the remote areas can be expected to be able to attract and support no more than about 1-2% of the expected urban growth

by the year 2000 ^{1/}. An approach to Remote Area settlement which attempted to achieve growth rates at levels indicated in B₂ and C would have a high risk of failure and could result in substantial waste of scarce investment funds.

- 6) under any realistic scenario, Cairo and Alexandria should be expected to absorb a major portion of the additional urban population. Attempts to hold the Cairo metropolitan regions below 16 million by the year 2000 are unlikely to work and would have a severe impact on other settlements as well as on national development.

B. Other Evaluation Criteria

The performance characteristics shown in Table VII are essentially derivable from the design of the alternatives and the key principles they are meant to illustrate. These design characteristics and the costs associated with them are a primary basis for evaluation. By themselves however, they do not provide a sufficient sense of how the alternatives might work in practice -- as pure alternatives -- or how well they are likely to perform on other legitimate criteria. It is, of course, extremely difficult to anticipate with assurance the performance of the strategies in practice because of inherent uncertainties and because the performance will depend upon many factors other than the spatial orientation of the strategies.^{1/}

Nevertheless, the NUPS team provides for ACR consideration the results of an effort to systematically tap the professional judgement of the team about how the alternatives might perform on a variety of measures. To develop this information, the professional staff was requested to score each alternative on a scale of 1 (best) to 10 (worst) for twenty one criteria based upon their knowledge of the Egyptian urban system, the characteristics of the alternatives, and their professional knowledge about urban policy.

^{1/} R.L. Meier, "Urban Settlement in the Remote Areas of Egypt: The Role of New Technologies (NUPS Occasional Working Paper, August, 1981 p.2)

^{1/} Other factors of considerable importance are sectoral and management policies which might be adopted.

The results of this effort are reported here in numerical form -- although the ACR is advised that they represent the informed judgments of the staff rather than precise quantitative measurement of expected outcomes.

The performance criteria used have been grouped into four general categories:

1. Social Effectiveness
2. Economic Efficiency
3. Management & Implementation, and
4. Risk Elements.

The six alternatives presented in the First Round Alternatives Working Paper are not expected to perform equally well on all of these categories of performance criteria. On the basis of average scores, the best performers on each set are:

	<u>Best</u>	<u>Second Best</u>
Social Effectiveness :	B ₂ Efficiency	A
Economic Efficiency :	A	B ₁ Efficiency
Management & Implementation	A	B ₂ Efficiency
Least Anticipated Risk :	A	B ₂ Efficiency & B ₁ Efficiency
All Criteria Combined:	A	B ₂ Efficiency

These results coupled with the results derived from the design considerations of the alternatives, suggest the outlines of the recommended "preferred" spatial strategy -- namely, the linking of some of the desirable social characteristics of B₂ Efficiency and the positive economic characteristics of B₁, with the desirable economic, management and implementation, and low risk characteristics of A.

Social effectiveness criteria considered in the evaluation and the average scores assigned by the study team are shown in Table VII. B₂ Efficiency -- with its regional decentralization features -- has the lowest average ranking, but is closely followed by Alternative A.

TABLE VIII
SOCIAL EFFECTIVENESS CRITERIA^{1/}
 (Lower Numerical Values are Better)

CRITERION	ALTERNATIVE											
	A		B1 Eff.		B1 Eq.		B2 Eff.		B2 Eq.		C	
	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank
1. Likely Contribution to Inter-regional Equity.	4.8	4.1	7.1	5.6	5.7	3.1	4.3	2.5	3.1	1.9	4.1	3.0
2. Likely Contribution to Inter-personal Equity.	2.1	1.4	4.8	3.4	4.6	3.4	3.7	2.7	5.0	4.1	8.1	6.0
3. Minimizing Social Costs (e.g. congestion and over crowding).	4.4	3.5	4.4	2.9	4.0	3.2	2.3	2.2	3.4	3.7	4.0	5.4
4. Least Social Disruption: maintenance of Family and Cultural ties.	6.5	4.6	6.2	3.7	6.0	4.3	3.5	2.0	3.8	2.1	4.7	4.0
5. Ability to absorb additional urban population at acceptable service levels.	2.0	1.3	5.9	4.0	5.3	3.4	4.8	3.4	4.4	3.0	8.3	5.7
6. Minimum Intrusion on Arable Land	4.0	3.1	2.2	1.4	3.5	2.4	5.8	4.3	6.8	5.2	6.3	4.6
Social Effectiveness Average	4.0	3.0	5.1	3.5	4.8	3.3	4.1	2.8	4.4	3.3	5.9	4.8

^{1/} Numerical Values are shown to help provide a sense of the relative differenced among alternatives as judged by NUPS professional staff. Judgements of others may differ or individual criteria may be weighted differently than the equal weighting used to derive the average values. There is no technical or scientific basis for adopting a particular weighting system. Average scores and average ranks are both shown in this table. In the procedure used an alternative could be assigned a score of 1 to 10, with a score of 1 best and 10 worst. The numerical values of the scores are a rough guide to not only which alternatives rank highest but how great the differences are among them. The average rank is simply the sum of the ranks assigned by all evaluation staff divided by their number.

Criteria related to economic efficiency and their average scores are shown in Table IX. Alternative A -- with its emphasis on least-cost allocations and exploitation of the economic potential of major Egyptian cities -- is expected to perform best on these criteria.

Alternative A is judged, also, to be the alternative which poses the least difficulties from a management and implementation point of view -- although they are formidable under any alternative. These criteria and the average scores are shown in Table IX.

Because of its expected performance on economic efficiency, management and implementation grounds and the population and economic context in which urban policy choices must be made over the next decades; alternative A is judged to be the least risky choice among the pure alternatives. The risk criteria considered and the average scores are shown in Table XI.

The second-best "pure" alternative to A on the above three sets of criteria are B₁ Efficiency (on economic and risk grounds) and B₂ Efficiency (on management and implementation grounds). B₁ Efficiency is designed to capitalize on the current and future economic potential of the Canal cities as Egypt becomes more industrialized and international links are expanded, which helps explain its appeal on economic and least-risk criteria. It does less well, however, on management and implementation criteria than the more broadly based decentralization alternative, B₂ Efficiency, in good part because of the necessity to focus a very substantial share of available investment and managerial effort on one zone. This in turn could create shortfalls elsewhere and limit the government's ability to change spatial, sectoral and project priorities over time as circumstances change.

TABLE IX
ECONOMIC EFFICIENCY CRITERIA^{1/}

CRITERION	ALTERNATIVE											
	A		B1 Eff.		B1 Eq.		B2 Eff.		B2 Eq.		C	
	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank
1. Economic Efficiency (Economic Growth at Least Cost)	1.3	1.0	2.9	2.1	4.4	3.3	4.3	3.6	7.1	5.0	9.4	6.0
2. Encouragement of Private Investment.	1.7	1.1	2.6	1.9	4.6	3.2	5.0	3.8	6.7	5.0	9.0	6.0
3. Ability to attract Foreign Assistance	3.3	2.6	3.2	2.5	4.9	3.8	3.8	2.4	5.0	3.8	8.1	5.9
4. Reduce Likelihood of Severe Unemployment	2.2	1.4	3.3	2.3	5.0	3.2	5.3	3.2	6.5	4.4	7.8	6.0
Economic Efficiency Average	2.1	1.5	3.1	2.2	4.7	3.4	4.6	3.2	6.7	4.6	8.6	6.0
^{1/} See Footnote Table VIII.												

TABLE X
MANAGEMENT & IMPLEMENTATION CRITERIA^{1/}

CRITERION	ALTERNATIVE											
	A		B1 Eff.		B1 Eq.		B2 Eff.		B2 Eq.		C	
	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank
1. Minimization of Administrative Cost	2.0	1.4	4.1	2.6	5.3	4.1	4.8	3.0	6.6	4.1	9.4	5.9
2. Flexibility overtime to alter;												
a. Spatial Priorities	3.0	2.1	5.9	4.4	5.6	4.5	3.0	2.0	4.1	2.6	7.1	5.2
b. Sectoral Priorities	1.8	1.3	4.2	2.8	3.9	3.7	5.0	3.3	5.7	4.5	8.6	6.0
c. Project Mix.	2.7	2.4	3.7	3.9	6.0	4.0	3.5	2.4	4.4	3.4	7.4	5.5
3. Ability to Sustain Implied Settlement Growth Rates	1.7	1.1	4.8	3.6	6.7	4.0	4.3	2.9	5.0	3.4	8.5	6.0
Management and Implementation Average	2.2	1.7	4.5	3.5	5.5	4.0	4.1	2.8	5.2	3.6	8.2	5.7

^{1/} See Footnote Table VIII.

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TABLE XI
RISK CRITERIA^{1/}

CRITERION	ALTERNATIVE											
	A		B1 Eff.		B1 Eq.		B2 Eff.		B2 Eq.		C	
	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank	Avg. Score	Avg. Rank
1. Risk of Exceeding Financial Constraints	1.6	1.1	4.4	3.1	5.6	4.1	4.8	2.5	6.6	4.3	9.6	5.9
2. Risk of Exceeding Real Resource Constraint.	1.9	1.0	4.4	2.9	6.0	3.6	5.3	3.1	6.5	4.5	9.7	6.0
3. Risk of Exceeding Management Constraint	2.1	1.3	4.4	2.2	5.4	3.4	5.0	3.4	6.7	4.4	9.3	6.0
4. Risk Environmental Damage	7.3	5.1	4.3	3.1	4.2	2.9	4.2	2.8	5.0	3.4	4.5	3.4
Risk Criteria Average	3.2	2.1	4.4	2.9	5.3	3.5	4.8	3.0	6.2	4.2	8.3	5.3

^{1/}

See Footnote Table VIII.

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C. Summary of Evaluation^{1/}

Urban policy makers in Egypt, need to plan for continuing high rates of population growth and increased urbanization. Both factors will increase the demand for urban jobs, housing, and services -- and increase the investment required to meet this demand. It is less certain that the rate of economic growth and the share of that growth which is saved (and thus available for investment) will keep pace with population requirements. This creates two major implications for the evaluation of alternative urban policy choices. First, the spatial priorities established should tilt in the direction of efficiency in generating addition output and jobs (that is, lower cost alternatives) and second, the spatial and sectoral priorities should be based upon the principle of conserving public investment.

Both efficiency considerations and conservation of public investment suggest that places with established economic advantages and high future potential should be given priority over major efforts to establish a sufficient population and economic base for self-sustaining growth in places which do not have existing economic advantages.

The design performance characteristics and costs of the Alternatives plus the more judgemental evaluation of the alternatives provided in this chapter suggest that Alternative A meets these criteria better than any other "pure" alternative. The evaluation also shows, however, that Alternative A is not likely to perform as well on social criteria as would be desirable in a national urban policy. Alternative B₁ is almost as attractive economically as A and could be made more attractive by phasing the major expansion of Suez over a longer time period than between now and 2000. Thus the beginning of a needed decentralization to selected Upper Egypt urban areas could occur during this period. Additional funds required to achieve the very high growth rates

^{1/} See Appendix D for summaries of most desirable and least desirable characteristics of each alternative.

of B₁ in the Canal Zone if diverted to Upper Egypt could form the basis of planned growth acceleration in Assiut, Qena-Naga Hamadi, and Aswan without adding the excessive financial requirements of a pure B₂ alternative. The planned priority expansion of these cities over the next twenty years could, in turn, anchor additional decentralization efforts in Upper Egypt in the next century.

The costs of a major urbanization effort in the Remote Areas in the time period to 2000, (as illustrated in Alternative C), are in the judgement of the NUPS team excessive. Furthermore, Alternative C performs least well on most of the additional criteria. The NUPS team recommends that major urbanization efforts not be undertaken in the Remote Areas. Rather, the recommended policy for these areas is the development of highly selective experiments in the introduction of technologies designed to exploit their natural resources and the development of institutional structures to increase the attractiveness of these areas to potential permanent residents.

IV. LEGAL AND ADMINISTRATIVE IMPLICATIONS OF THE SPATIAL ALTERNATIVES

Besides implications regarding costs, economic efficiency, social equity and equity among regions (decentralization), the spatial alternatives present sufficient differences concerning the ability to administer their execution that they require explicit attention. Such differences include the ability to carry out necessary infrastructure works, ability to carry out successful policies concerning the protection of arable land and the location of industry and other development activities, the ability to carry out master planning, the ability to successfully encourage economic growth through private investment and foreign investment, and the ability to increase local participation in administration and finance.

It should be understood at the outset that the differences regarding administrative implications between the alternatives are far outweighed by the administrative and legal difficulties shared by all of the alternatives, and, thus by any national urban policy. These problems include:

1. the low level of efficiency of the government bureaucracy at all levels, due to low rates of pay, lack of work incentives, the legal inability to fire incompetents and the lack of stability at the top of the system.
2. the lack of a strong planning apparatus at all levels due to the absence of a longterm planning horizon and to the lack of availability of the data required for effective development planning and administration.
3. the lack of coordination between ministries due to the hierarchical nature of the communications system which does not encourage cross-communication between equals at the middle-management level and due to the proliferation of ministries.
4. the uncertain relationship between national ministries and the local government structure due to the lack of implementation of recent Local Government laws and to the constant amendment of such laws which makes future planning difficult.

5. the stress upon legalism which leads to the belief that the passage of a law solves a problem, rather than emphasis upon effective implementation. This is seen in efforts to protect arable land, to establish an industrial location policy, and with regard to building permits and rent control. There is lack of enforcement of development control policies at all levels.
6. the lack of an effective role in the budgeting process for local governments and the lack of effective financing sources to allow local governments to carry out the professed goal of decentralization.
7. the lack of precise criteria for the designation of different levels of government. This lack of differentiation does not allow the necessary distinctions between large, middle-sized and small cities with regard to functions and financial resources, except as the largest centers also function as governorates. It further leads to a fuzziness with regard to the definition of a "town" as compared to a "village".
8. Closely related to the above is the lack of a legal definition of "urban area" in the sense of "metropolitan area" or "master planning area". A necessary first step to the effective management of the Cairo metropolitan area and the Alexandria metropolitan area are legal definitions of their boundaries which cross over both governorate and town boundaries. A similar need would arise with regard to zones for master plans which may have to cross town boundaries in many cases, even in smaller cities.

The above general issues are noted in Part A of this section as reference points from which to judge the relative ease or difficulty of administering the Alternatives.

Part B will concern itself directly with the differences among the alternatives in regard to relative difficulty of implementation. It will then suggest what might be a preferred alternative strategy for a natural urban policy when viewed from an administrative point of view, but which takes account of necessary political, economic and social factors.

A. The Spatial Alternatives Reviewed

Six spatial alternatives have been considered for the distribution of the urban population of Egypt. However, the two versions of the B1 and B2 alternatives -- B1 (equity) and B1 (Efficiency); B2 (equity) and B2 (efficiency) -- are very close to each other in their administrative requirements differing only in whether residual investment is distributed according to efficiency principles - to areas where the most can be obtained for the least cost or according to spatial equity principles - as equally as possible to all areas of the country. Thus for most purposes the discussion below will consider only the four major alternatives, except where otherwise noted. These four alternatives are as follows:

1. Alternative A - considerable growth in the major metropolitan regions of Cairo and Alexandria based upon the criterion of generating additional output and employment with the least cost. This alternative is the most centralist in character as it assumes that most of the urban growth will take place in the urban areas which already have industrial bases.
2. Alternative B1 - interregional decentralization through the creation of a major counter-magnet city in the Suez region (Suez City).
3. Alternative B2 - interregional decentralization through the expansion of secondary growth centers in Upper Egypt (initially approximately 10 such centers).
4. Alternative C - maximum decentralization of the urban population throughout the country.

Thus the alternatives move from centralization to decentralization of population. As indicated earlier the costs of supplying infrastructure and of providing employment increase as one moves from Alternative A to Alternative C. It is time to consider the additional administrative costs connected with these alternatives.

Before discussing each of the alternatives directly, it is important to note the principles upon which each will be judged. An effort has been made to look at the administrative situation from the point of view of possible effective implementation within the Egyptian context, rather than from the point of view of general administrative principles or that of societies with different legal systems and enforcement practices. As noted above, the present administrative system in Egypt is characterized by lack of effective enforcement, of effective long range planning and budgeting, of effective operations and maintenance of physical infrastructure, of coordination and an extremely hierarchical structure at the national level, of effective decentralization to the local government level, of effective development controls and location policies at any level, and of effective systems of collection for general taxes (income tax, red property tax). Thus the administrative capabilities are and will be extremely limited. The alternatives must be viewed in that context. How hard would it be to remedy the administrative problems faced by each alternative?

B. Implications of Alternatives

1. Alternative A (centralist; continued rapid growth of Cairo & Alex.)

Under Alternative A, the spatial pattern is preferred which emphasizes economic growth and the least cost provision of necessary infrastructure and community facilities to promote industrial investment and to accommodate urban growth. Because they already have most of the industrial and commercial activity in Egypt and because they have the highest existing level of infrastructure and services, the Cairo and Alexandria metropolitan areas would provide the essential element in the least cost solution to provision of the additional facilities required for the growth in urban population expected to the year 2000. In addition, this alternative requires the least change in existing trends.

However, the successful implementation of Alternative A would require an effective administration of these large metropolitan areas so as to order the future large scale development, A specific policy of planned satellit

settlements would be required to provide infrastructure most efficiently to meet a doubled population. A system of priorities for the provision of this infrastructure would be required. An effective development controls policy would be required to try to push development onto desert land and away from the present encroachment on arable land. New industrial locations would have to be chosen to avoid problems of pollution and to promote efficiency in the provision of the required infrastructure.

The system of metropolitan administration would require the coordination of three governorates in both the Cairo and Alexandria metropolitan areas. However, such metropolitan administration would be required under any of the alternatives. The problems of administration would be the essentially the same whether the Cairo metropolitan area had a population of 15 million or 22 million in the year 2000, although they would be somewhat more pressing in the latter case and the social breaking point with regard to services could occur within this range. For Alexandria, the same is true whether the population of the metropolitan area is 3.5 million or 5.5 million in 20 years. Thus Alternative A has no greater administrative problems than the other alternatives with regard to the problems of Cairo and Alexandria.

In general then, there are fewer specific administrative problems particular to Alternative A than to the other alternatives. Almost all of its problems are faced by the other alternatives and by Egyptian society in general.

2. Alternative B₁ (Creation of a major new growth center - Suez City)

Under Alternative B₁, economic growth and least cost provision of infrastructure would continue to be emphasized relative to spatial equity although there would be greater emphasis on the latter for the provision of residual investment under the B₁ (equity) variation. The major difference between Alternative A and Alternative B₁ is that Alternative B₁ concentrates investment in a major new growth center - Suez City - to create a new center to draw population away from Cairo and Alexandria. However, major population growth would continue in the latter two areas.

The emphasis upon investment in Suez would require improved administration of the Suez Governorate and a shifting of investment funds to that area. However, beyond the provision of a vastly larger number of technical personnel there would not seem to be insurmountable administrative problems in the creation of one growth center, as long as sufficient investment monies are provided. Certainly the administrative problems would be somewhat less than for the new towns or satellite cities because of the existing infrastructure and the lesser risk of failure or of providing infrastructure that is not immediately used, as Suez is the most likely spot for economic growth assuming continued stability of the political situation in the Middle East. Suez could serve as a good demonstration for the provision of adequate industrial zones to encourage private, Arab and foreign investment in manufacturing as well as low cost infrastructure standards and housing solutions.

In addition, Alternative B₁ is the first of the alternatives that attempts to constrain the future population of the Delta at about 7 million in the year 2000. Such a strategy would require effective urban management techniques - improved urban planning, effective development controls to restrain building upon arable land and greater horizontal density of development. Concentrated efforts would have to be made in at least the largest Delta cities. The illustrative development project for Tanta will focus on these problems. Such an effort would require major efforts at enforcement and planning that are not now present.

The problems of ordering the Cairo and Alexandria metropolitan areas would be the same for Alternative B₁ for Alternative A. Thus Alternative B₁ would be more difficult to implement than Alternative A because of the problems involved with carrying out such a large project as the rehabilitation of Suez City and its transformation into a major industrial center, as well as the problem of Delta urban management.

3. Alternative B₂ (emphasis on development of secondary growth centers in Upper Egypt)

Under Alternative B₂, greater emphasis is placed upon interregional

decentralization than under the previous two alternatives. Specifically, a number of secondary growth centers in Upper Egypt will receive priority treatment. Initially, approximately ten such centers are so considered. Emphasis is continued for the Canal Region but the expected population in the year 2000 is less than under Alternative B₁.

Alternative B₂ has all of the administrative problems of the previous alternatives with some major problems of its own. The development of ten secondary growth centers is beyond the capacity of the present local government structure. The continued technical brain drain to the other Arab countries, Europe and the United States make the possibility of hiring a sufficient number of additional technical personnel at the national government level to assist the local governments problematic. In addition, the financial resources required to provide the necessary infrastructure and facilities to make such growth centers attractive to industry would be very large since almost none of the proposed centers have adequate infrastructure at present. The construction ability to carry out the necessary work in a 5-10 year period is also not now available. However, the emphasis upon decentralization is necessary to build up the capacity of town governments to carry out necessary functions and to develop a system by which all decisions are not made at the level of the Minister or Governor or above. However, such policies are more likely to be successful if limited to two or three growth centers, at least initially, with later sequential development of other centers. Then experimentation can occur with regard to different types of procedures and standards of infrastructure and facilities. Those things that work can be used in other places and those that fail can be discarded.

Alternative B₂ indicates the need for a precise definition of levels of urban centers. It could be used to develop the criteria for functions and financial resources required for middle level cities, as compared to the largest cities. It could also, be used to develop policies for the agricultural regions for which these middle-sized cities are the center, thus furthering effective decentralization.

4. Alternative C (maximum decentralization of urban population)

Under Alternative C, there would be maximum decentralization of urban population throughout the country. High growth rates over the next 20 years are projected for the urban centers of both North and South Upper Egypt as well as for the remote areas, including the Red Sea and Northwest Coasts and Sinai. The growth rates for the Cairo and Alexandria metropolitan areas, and thus the urban-rural migration, are projected to be less than under the other alternatives.

Alternative C is the most costly alternative in terms of investment over the next 20 years - about 30% higher than Alternative A and 15% higher than Alternative B₁ and B₂. It is also least likely to produce economic growth given the remoteness of many areas from large-scale existing industrial activity and the low levels of existing infrastructure in these areas. Further, it is the most costly alternative from the administrative point of view. Any activity in the remote areas would be difficult to carry out with a very high risk of low economic return. The assembly of the necessary materials, machinery and labor would be a major management feat. The provision of a large amount of infrastructure to a large number of places simultaneously is beyond the existing capacity with regard to technically trained personnel and management. This argument was made above with regard to Alternative B₂ with its emphasis on ten growth centers and it is much stronger where the number of centers is twice or three times that number. Further, an extreme decentralization strategy would overstrain the planning and budgeting capacity. With an emphasis on only a few growth centers, it would be possible for the national government to assist in upgrading of planning and budgeting at the governorate level and below. If all centers are concentrated on at once, there is no possibility of effectively using existing manpower for that result. Finally, Alternative C is least likely to be able to effectively implement an effective industrial location policy and an arable land policy since it would not pinpoint priority areas for development and thus would encourage indiscriminate development in order to try to achieve economic growth in so many areas.

Thus though Alternative C at first appears attractive, it is the riskiest of all of the alternative national urban strategies. It would be likely to dissipate all of the available monies and administrative capacity of Egypt while slowing economic growth. Ironically, its ineffective implementation would be likely to increase rural-urban migration and thus more rapidly increase the size of Cairo and Alexandria.

C. SUMMARY

In summary, Alternative A would be the easiest spatial alternative national urban policy to implement from an administrative point of view. It would require the least number of changes from existing patterns of urban growth and administration, although the effective direction of development under this alternative would necessitate an efficient metropolitan planning framework for Cairo and Alexandria. It would concentrate the enforcement of development control decisions at a few places; which is the strategy most likely to succeed in the present administrative environment of Egypt.

Alternative B₁ and B₂ both present additional administrative problems from Alternative A. Alternative B₁ requires concentration upon one new growth center - Suez - while still managing growth in the Cairo and Alexandria metropolitan areas. The administrative capacity of Egypt seems able to handle the immense task of creating such a growth center, although a large amount of investment capital would be required and this capital would be monies that would be taken from other centers and sectors of the economy. In addition, Alternative B₁ introduces the Delta management issues acutely. Alternative B₂ attempts to be an effective decentralization strategy, developing a number of growth centers at the same time as competing centers to Cairo and Alexandria. Administratively, it would be much more difficult to carry out the either Alternative A or Alternative B₁ due to the shortage of monies, technical personnel and management required to develop a number of attractive growth centers at one time. However, the development of only two-three centers might well be possible and would probably be the most effective means of emphasizing decentralization. However, such centers

would be unlikely to grow rapidly until after the year 2000 given the normal rates of growth of cities. However, Alternative B₂ would carry the risks, not associated with Alternative A or with Alternative B₁, of investing monies in places that may not succeed in accelerating economic growth.

Finally, Alternative C is a very risky and costly strategy, both with regard to economic growth and to administrative capacity. It would spread investment over such a large number of centers that it would be unlikely to achieve the necessary effect of developing growth center in any of them to counter the attractions of Cairo and Alexandria. In addition, it would be much more costly in terms of investment monies. In administrative terms it would require a drastic upgrading of the administrative skills of existing local government personnel, as well as the provision of a large number of experts from the national government level who do not appear likely to be available. The dissipation of technical and management resources over a large number of centers would also mean that it would be much more difficult to carry out successful policies regarding industrial location and preservation of arable land. Such policies would require concentration upon a small number of places for encouragement and discouragement of development. The identification of a sufficiently small number of locations would be difficult under a national urban development strategy which emphasized uniform development over a large number of centers.

D. Administration of the Preferred Alternative

The previous discussion in Part B of this Section has concentrated on the differences with regard to difficulty of administration among the four basic spacial alternatives and without specific reference to the preferred alternative as set forth in Section V of this working paper. The preferred alternative is a combination of Alternatives A and B₁ with some of the decentralization orientation of Alternative B₂. It acknowledges that the Cairo and Alexandria metropolitan areas will continue to grow, while putting investment priority on the development of a small number of growth centers. Major emphasis would be placed on

Suez City with secondary emphasis on 2-3 growth centers in Upper Egypt (a modified form of Alternative B₂). Emphasis would be placed on Delta urban management.

The preferred alternative does not present the easiest job of administration. However, it is probably the best combination of low cost, economic efficiency, social equity and ease of administration. It furthers the goal of administrative and political decentralization within the bounds of technical capacity. The development of 2-3 centers in Upper Egypt, for example, is possible within the present technical manpower and management restrictions in Egypt, and within the context of also developing the major growth center at Suez. Any larger effort at decentralization (as in present Alternatives B₂ and C) would be likely to produce no result in the context of effect upon rural-urban migration, while incurring enormous investment costs. Any more intensive effort of economic growth than in the preferred alternative would further concentrate population in the Cairo and Alexandria metropolitan areas with the political and social consequences implied by that concentration. Thus the preferred alternative seems the best chance to encourage both political and administrative decentralization and economic growth at a reasonable cost.

However, any of the alternatives would have to meet the major administrative realities mentioned in the Introduction. It is these underlying realities that must be faced if Egypt is to effectively carry out a national development policy. These major administrative issues will be spelled out further in the final report.

V. The Recommended Settlement Strategy

A. From First Round Alternatives to a Recommended Mixed Strategy

The Working Paper on First Round Alternatives specified and developed indicative costs for four basic settlement patterns for urban Egypt. These alternatives were designed to encompass sufficient variation so that a "preferred strategy" could be selected from them or by combining desirable elements of them in a mixed strategy. The recommended strategy, outlined in the introduction, and alluded to in the evaluation, is a mixed strategy rather than a choice of one of the "pure" strategies. Each of the basic alternatives has desirable features but sufficiently serious drawbacks to be chosen as the preferred strategy without modification.

Substantial growth of the domestic economy is of extreme importance -- both to generate sufficient funds to carry through essential investment and to create the possibility of further improvement in the conditions and quality of life for lower income people wherever they reside. An emphasis on economic growth pulls strongly in the direction of Alternative A, the least-cost alternative. Alternative A permits exploitation of the powerful economic potential of Cairo and Alexandria to absorb a large share of the expected future urban population productively. Alternative A, also, allocates considerable investment in the Canal and Delta zones in cities with existing industrial bases and future potential.

Alternative A in its "pure" form, however, presents some serious problems and needs modification in order to address them. First, the implied growth for many of the Delta cities which are unable to expand horizontally without urbanizing agricultural land is high in Alternative A. Although this growth might be justified on economic grounds it presents a sharp challenge to agricultural land preservation policies. The recommended strategy for the Delta, therefore, should be initially more selective among Delta cities for investment allocations than would be true under Alternative A. The initial allocations should

be preceded by a substantial planning effort in several key cities -- e.g. Tanta, Kafr El Dawar, Benha, and El Mahalla -- to develop methods for increased use of land within existing boundaries for urban purposes and to determine which industries can and should be encouraged to expand or start up in Delta cities. The illustrative development project material which the NUPS team will prepare for Tanta should be of considerable assistance in this planning effort. In the Delta, the the major urban policy issue will be regulating and managing spontaneous growth rather than growth encouragement.

Second, the allocation implied by Alternative A for the Canal cities does not sufficiently take into account the longer term potential of this zone or the desirability of establishing at least one major metropolitan region within the Egyptian settlement system to complement Cairo and Alexandria. Alternative B₁ is designed to illustrate the investment requirements to develop Suez as a major metropolitan center, with complementary growth, but at lower rates, in Ismailia and Port Said. However, achieving the rates of growth for the Canal cities in Alternative B₁ would be very difficult and require a major effort to dramatically increase in-migration rates.

In spite of considerable reconstruction of the Canal cities in recent years, the current rate of in-migration is well below the level required to reach the 2000 master plan targets, which are almost 2 million fewer than the B₁ Alternative targets. The indicative cost estimates for job creation and infrastructure in Alternative B₁ compared to A for the Canal zone, illustrate the level of commitment required in addition to managerial requirements. The direct investment costs per job are estimated to be almost 40% higher in Alternative B₁ than in A in the 1986-90 period, 30% higher in the 1991-95 period and 20% higher in the 1996-2000 period. The total allocation for job creation is over seven times the allocation in A to achieve only about two and half times the population growth in this zone. Infrastructure requirements in Alternative B₁ for the Canal cities are also much higher than in A, both because of the

larger populations and because of the need to provide better services to attract population. In the 1986-90 period in B₁ per capita infrastructure costs are estimated to be about L.E. 2500 as opposed to slightly over L.E. 800 in Alternative A. As a result of these and similar considerations, the NUPS recommendation is to target Canal growth at levels above Alternative A but considerably below Alternative B₁. Current master plan targets appear to be the maximum levels that could be sought and targets below these levels more realistically achievable. Such targets would still aim at the eventual creation of a major metropolitan area in the Canal zone at Suez with complementary growth in Ismailia and Port Said.

Third, the long-term desirability of a more broadly based decentralization strategy for the urban system in Egypt on both economic and social grounds, supports adding some elements of the B₂ alternative to the recommended strategy -- namely the identification of a few Upper Egypt cities for special emphasis. The NUPS team recommends Assuit, Qena-Naga Hamadi, and Aswan as the first-phase "special emphasis" centers for Upper Egypt. These three are identified because they have desirable locations to anchor future development efforts in Upper Egypt. They present sufficiently different development problems to provide a substantial institutional knowledge base for further decentralization efforts in Upper Egypt as plans for their growth are developed and implemented.

Qena-Naga Hamadi has already been selected by the ACR and the Steering Committee for special study by NUPS as one of the two Illustrative Development Project sites. This special study should illustrate some of the key issues involved in emphasizing the growth of a few Upper Egypt cities in the preferred strategy. It is expected, also, that the Illustrative Development Project reports (for Tanta as well as Qena-Naga Hamadi) will serve as key elements in the more detailed specification of the preferred strategy in the NUPS final report.

The fourth modification of Alternative A which is recommended for the preferred strategy is the adoption of an experimental strategy for the Remote Areas that would provide a highly significant role for these areas beyond that indicated in Alternative A.

The analysis of Alternative C has shown that an effort to locate 1.3 million people in the Remote Areas by the year 2000 implies unrealistically high growth rates for these areas and excessive costs given other requirements for urban policy. Population growth rates for these areas at levels between those implied by Alternatives B₁ and A are more realistic. Thus, the role seen for the Remote Areas in the recommended NUPS strategy is not the absorption of a major portion of the expected urban population. This population will necessarily be absorbed in existing cities or the metropolitan regions of Cairo and Alexandria.

The Remote Areas do provide, on the other hand, a significant opportunity to develop controlled and carefully designed experiments in the use of new technologies and the development of supporting institutions to utilize such new technologies. Increasing the number of permanent residents in the Remote Areas requires finding ways to overcome relatively harsh conditions for human habitation in ways that do not require massive outlays of scarce investment resources.

The NUPS consultant on Remote Areas and New Technologies, Richard L. Meier^{1/} summarized his analysis as follows:

"A major change in attitude and outlook regarding the remote areas is required. Until now these areas were regarded as places to put the population over spill from the Delta and Nile Valley, even if huge subsidies were required. This is most probably not feasible. Rather it argued here that the diversity of the remote areas, and the shortages that already occupy their attention, make them the most suitable places for experimentation

^{1/} Richard L. Meier, Working Paper "Urban Settlement in the Remote Areas of Egypt" p.53.

His specific recommendations for the kinds of experiments which might be considered in the Remote Areas include:

- 1) Water pricing and water-conserving technologies;
- 2) Earth-sheltered designs for homes and work places;
- 3) Improved telecommunications, including use of portable telephones, microwave relays and communication satellite links; and
- 4) Restudy of an early proposal for development of agro-industrial complexes on coastal deserts prepared in 1969 by the Oak Ridge National Laboratory in the United States to test its feasibility given relative price changes for fossil fuels and other sources of energy since the earlier proposal was made.

D. Population Targets for Special Emphasis Cities & the Remote Areas

The combination of the modifications to Alternative A suggested above--growth management in the Delta, Canal zone expansion with a major emphasis on Suez, special priority for expansion of three Upper Egypt cities, and an experimental strategy for the Remote Areas--provides a supportable decentralization initiative. Such an initiative is consistent with the strong desire of Egyptian policy makers to begin the process of better spatial integration of the nation's territory and provide longer-term alternatives to continued polarization in Cairo. The selective nature of the proposed decentralization initiatives, while requiring greater outlays in the special emphasis zones than in Alternative A, reduce the costs in the Canal relative to B₁ and in Upper Egypt and the Remote Areas relative to B₂.

The recommended population targets, as well as the population targets implied by the "pure" alternatives, for the special emphasis locations and the Remote Areas for the year 2000 are shown in Table XII.

The population targets shown in Table XII for special emphasis cities in which growth encouragement strategies are suggested--the Canal and Upper Egypt cities--imply a requirement for more job-creating investment than in Alternative A; and result in growth rates which are more feasible to achieve than rates implied by B₁ for the Canal cities and by B₂ for the Upper Egypt cities. The target range for Tanta implies a growth rate about equivalent to its rate of growth during the 1960-1976 period; but less than the rate to be expected under all of the alternatives but C. As indicated earlier, the achievement of the growth target for Tanta will require effective management of the city and a willingness to be selective in the location of new economic activity in Tanta.

If the above targets are accepted for the special emphasis cities, there will be a residual requirement for between about 33 to 33.5 million people elsewhere in the urban system. The Remote Areas will probably not be able to absorb more than 400,000 of these without larger financial commitments than are feasible given other development requirements. This leaves approximately 30 million in the rest of the urban system.

There are three possible location alternatives for the residual 30 million urban population: (1) the major metropolitan regions of Cairo and Alexandria; (2) non-special emphasis cities; and (3) smaller urban areas (50,000 in 1976). Some growth must be expected in the smaller urban areas; although on average they grew by less than 2% a year in the 1960-1976 period. If they continued to grow at the same rate up to 2000, they would have a total population of slightly over 4.6 million. The NUPS alternatives assumed an increased growth rate in these areas of about 2.7%, higher than their historical rate which would bring their 2000 population to about 5.4 million. This is possibly an overestimate for these places which traditionally have considerable out-migration; but, if achieved, would still leave over 24 million people for location in the major metropolitan areas and non-special

TABLE XII
 POPULATION TARGETS FOR SPECIAL EMPHASIS CITIES
 IN 2000 (IN THOUSANDS)

CITY	A	B ₁ EFFICIENCY	B ₁ EQUITY	B ₂ EFFICIENCY	B ₂ EQUITY	C	RECOMMENDED
SUEZ	582	1505	1505	965	706	651	750 - 850
ISMAILIA	422	1052	1052	690	697	599	400 - 500
PORT SAID	573	1442	1443	941	989	914	550 - 650
SUB TOTAL	1577	3999	3998	2596	2342	2164	1700 - 2000
ASSIUT	355	334	435	559	635	607	550 - 600
QENA	167	156	188	265	273	264	175 - 225
NAGA HAMADI	121	119	142	202	207	195	150 - 175
ASWAN	386	360	410	621	595	570	400 - 450
SUB TOTAL	1029	969	1175	1647	1710	1636	1275 - 1450
TANTA	680	637	555	669	580	553	525 - 575
OVERALL TOTAL	3286	5605	5728	4912	4632	4353	3500 - 4025

emphasis cities. Trend growth rates for Delta cities-- particularly large ones such as Mehalla (3.39%, Mansoura(3.36%), Zagazig (3.31%), Kafr El Dawar (8.6%), Shebin El Kom (1.0%), and Kafr El Sheikh (4.43%)--would substantially increase the threat to surrounding agricultural land. The strategy of growth management and possibly restricted growth for these cities, suggested for Tanta earlier, appears to be more realistic than encouraging or allowing their growth at trend rates. At any rate, substantial investment in these cities should be made only after an investigation of how to effectively manage their growth, such as will be suggested for Tanta in our forthcoming Illustrative Development Project Report. The most realistic assumption is that any feasible urban population distribution will have to assume (and plan for) substantial growth in Cairo and Alexandria--on the order of 21 to 22 million in the two regions.

H.W. Richardson, in his recent working paper for NUPS, strongly supported this view:

" No matter how ingeniously the figures are juggled, it is virtually impossible to avoid doubling of the populations of the two major metropolitan areas over the next decades. Any attempt to constrain the growth of Cairo below these anticipated levels would require a battery of negative policy instruments rather than a positive approach emphasizing the promotion of other urban places. Moreover, these negative measures would have to be so draconian in their intensity that it is doubtful whether any government could survive their consequences. Allowing Cairo to grow might appear, therefore, the lesser of two evils. But it can be argued that there is a positive side to the Cairo strategy. The city remains the major source of agglomeration economics on which sustained economic growth can be built and the main channel via which poor migrants can increase their income and welfare. Also, its diseconomies of congestion can be mitigated by reorganizing its spatial structure in an efficient manner". 1/

1/ H.W. Richardson, NUPS Occasional Working Paper, "From First Round Alternatives to a Preferred Strategy", pp. 11-12, See also, Appendix.. "Could Cairo's Growth be Slowed" from the same paper, pp. 26-35.

C. Alexandria in the Preferred Strategy

By far the most important single element of the preferred strategy as it relates to reducing the polarization of the urban system in Cairo is the recommendation to encourage substantial population growth in Alexandria. Our recommendation is that 5 to 5.5 million be adopted as the year 2000 population target for Alexandria. This target implies higher rates of growth for Alexandria than were achieved there in the 1960-1976 period, during which time Alexandria grew by less than the national urban average. Alexandria is the only major urban competitor of Cairo. Its relatively slow growth during this period provided insufficient drawing power to migrants seeking the opportunities to be found in most abundance in major urban centers. The result was that the Cairo region received most of these migrants.

The NUPS analysis of Alexandria, contained in the Concept Plan for Alexandria, noted recent substantial growth in economic activity and population but emphasizes that achievement of the population targets recommended will require "a concerted set of government initiatives.... to stimulate economic and population growth to the year 2000" ^{1/}.

The effort to expand the growth in Alexandria is worthwhile in its own right since it is the major port of Egypt; but is also worthwhile to reduce the rate of polarization of the population in Cairo. No other city in Egypt has the possibility of productively absorbing as much of the expected urban population as Alexandria over the next twenty years.

There are many problems however, to be overcome to achieve growth at the levels needed in an orderly way. Our analysis shows that most of the growth occurring within the Alexandria region is on the old cultivated land to the southeast, including Ramleh, Montaza and Kafr El Dawar. There is, also, considerable haphazard development in desert areas to the southwest.

^{1/} See NUPS Occasional Working Paper, "Alexandria Concept Plan". This paper is a preliminary concept plan for Alexandria, which parallels the concept plan for Cairo presented in the "Working Paper on First Round Alternatives".

The patterns of growth cross governorate boundaries of Alexandria, Beheira, and Matrouh which creates difficult planning and administrative problems for the metropolitan region. The current master plan effort, however desirable it might be in rationalizing development of Alexandria proper, does not have a sufficiently broad regional focus to integrate development efforts in the region as a whole.

This situation is particularly acute in Alexandria, given the physical characteristics of the area, since future urban development requirements cannot be satisfied (even at population levels lower than we are recommending) in non-arable development areas. Current land uses for tourism, housing, industry and reclamation projects are strongly competitive for available land and the competition is contributing to haphazard development. Land controlled by housing cooperatives has effectively blocked future expansion of the port area (such as designated tourist areas in Agamy) for more dense housing and social and industrial services along the coast. The result is that orderly development in Alexandria will require the government to make the difficult choice of utilizing low density tourism areas, old agricultural lands, or newly reclaimed land for Alexandria expansion.

The NUPS team recognizes that New Ameriya city is considered a possible site for some of this expansion; but, the contribution of this new city to the overall development needs of Alexandria is not expected to be significant in this century. Our review of the development prospects indicates that Ameriya, Idku and the District of Moharram Bey in reclaimed areas offer the best alternative sites for future development. If a decision were made to change land use in Agamy and the adjacent coastal areas, additional port servicing and more dense housing development could occur in this area. The corridor between Alexandria and Kafr El Dawar is growing rapidly and additional corridor build-up is likely and will cause a large loss of arable land in the future if not controlled.

D. Cairo Metropolitan Region

The NUPS team recommends metropolitan Cairo planning on the assumption that the Cairo metropolitan region will have approximately 16 to 16.5 million people by the year 2000. At the same time, the analysis strongly supports additional efforts to insure deconcentration of the core of the city. As in Alexandria, it is essential that future planning for Cairo examine the requirements for the whole metropolitan region, rather than the individual governorates of Cairo, Giza, and Qalyubia and the new city of 10th of Ramadan and other closer-in sites such as El Abour, 15th of May and 6th of October as separate planning problems.

A major problem associated with uncoordinated sector plans and too limited spatial coverage of the region in master plans is that interactions among sectors and spatial sites are not sufficiently assessed (whether the interactions are necessary and desirable or undesirable). One of the consequences of this situation is that sectoral plans, both for industry, and infrastructure, tend to be based upon trend extrapolation of the location of labor supply and service demands. In turn, the implementation of these plans reinforces the current directions of urban area growth, which are already jeopardizing valuable arable land to the north, northwest, west and south of the city. Although part of this growth on arable land is for industrial use; most of it is due to informal housing development. The informal housing responds to a genuine demand for housing and is making a major contribution to meeting existing housing shortages. It now tends to occur on arable land, however, because of the availability of water, nearby employment opportunities, relative ease of land acquisition, and the lack of alternative usable sites in desert areas.

The growth of 10th of Ramadan at a considerably slower rate than anticipated in the plan for the New City; plus the design standards and costs for the development which has occurred, indicate that the New Communities should not be expected to make a major impact on accommodating future urban growth between now and the year 2000. Furthermore, because of the exceptionally high costs associated with current design and standards of construction a continuation of the development without substantial modification is not recommended. Rather the NUPS recommendation is to

encourage the further development of closer-in satellite towns (such as El Abour and 6th of October) as a higher priority in a mixed strategy for the region with the continuing aim of core deconcentration. This shift of priorities is seen as a means of more effectively responding to the expected population growth in Cairo than a movement into the second phase of development in 10th of Ramadan at this time.^{1/}

Because the metropolitan region will continue to grow and because the New Communities will not be able to absorb much of this growth by 2000, a mix of sub-strategies as part of the general strategy of core deconcentration is required. NUPS principle recommendations regarding these sub-strategies are:

- A major effort to redirect the direction of Cairo's growth from an essentially north-south orientation to an east-west orientation.
- This effort should include redirection of major government investments in industry, transport, housing and infrastructure to support growth, primarily on desert land to the east and west of the core.
- A major commitment to the preservation of arable land must be made; not only through use of the law but by the provision of alternative desert sites for informal development (housing and small-scale industry) and the introduction of restrictive land used on key corridors to encourage nodal growth.
- Additional growth should be permitted, however, in the Maadi-Helwan corridor, particularly for low income households; and in Nasr City and its immediate environs.
- Non-contiguous development, protected by restrictive land use should be encouraged in the Cairo, Bilbeis, 10th of Ramadan triangle (the initial site of El Abour is the most promising location) and 6th of October.
- Additional satellite towns, at standards largely affordable by industrial workers, should be considered near Helwan on in desert areas on the west Bank of the Nile to meet demand from Helwan's rising industrial employment and to offer alternative sites to development in arable land on the west Bank.
- Major rehabilitation of the existing housing and infrastructure stock is required. Very high densities in northern districts should be reduced; while low density, high standard districts such as Nasr City and Nozha should be increased in density.

^{1/} See S. Sherer, "New Town and Satellite Cities: A Strategy for Deconcentration of Urban Development in Egypt", for an analysis of the current new town and new community programs and preliminary recommendations for enhancing their role in development policy at reduced cost to the government.

Summary

The preferred strategy for national urban policy recommended in this report combines desirable features of the alternatives presented in the Working Paper on First Round Alternatives. The major strategy elements are those listed in the introduction to this report:

- 1) the exploitation of strong economic advantages of the Cairo and Alexandria metropolitan regions to absorb a major portion of the expected growth in urban population (Plans for Cairo 2000 population of 16 to 16.5 million and for Alexandria 2000 population of 5 to 5.5 million).
- 2) a concentrated effort to support growth possibilities of the Suez Canal Zone with a focus on Suez City (year 2000 population targets of 750 to 850 thousand in Suez, 400 to 500 in Ismailia, and 550 to 650 in Port Said).
- 3) a strategy for managing the expected spontaneous growth of Delta cities which aims at limiting unnecessary intrusions on arable land while providing additional urban employment (special emphasis on Tanta and Mansoura with year 2000 population targets of 525 to 575 and 500 to 550 thousand, respectively).
- 4) an effort to induce growth in an initially limited number of Upper Egypt cities to develop both an economic basis and a knowledge base for more decentralization in later time periods than the planning horizon of this study (special emphasis on Assiut, Qena-Naga Hamadi, and Aswan with year 2000 population targets of 550 to 600, 325 to 400 and 400 to 450 thousand respectively).
- 5) an experimental approach to the settlement problems of the remote areas to find ways to utilize emerging technologies and establish implementing institutions to increase the attraction of these areas for human settlement (no major urban increases anticipated, year 2000 population targets for existing urban areas of between 250 and 300 thousand).
- 6) the choice of standards for housing and infrastructure service levels that are affordable by a wider range of the population and mechanisms that will increase the proportion of public cost recovery.

This mixed strategy recognizes the importance of seeking an efficiency-oriented settlement system while introducing implementable and feasible levels of decentralization of the urban hierarchy away from Cairo. A strategy of core deconcentration for Cairo and Alexandria along the lines of current stated policy, but with more emphasis on increased density in low density areas, serviced fringe locations on desert land, and closer-in satellites than the current New Towns of 10th of Ramadan, Sadat City, and New America) is recommended. The metropolitan regions of these two cities must be expected to absorb a large portion of the urban population.

The major decentralizing elements are in the Canal and Upper Egypt zones. On both cost and implementation grounds; it is recommended that major efforts be devoted to a limited number of special emphasis cities-- Suez City, Assiut, Qena-Naga Hamadi, and Aswan.

The recommended strategy emphasizes the special growth management problems of the Delta--a zone which has been somewhat neglected in planning and overt urban policy design. Significant choices need to be made in the very near future regarding urbanization of the Delta. The overwhelming size of Cairo and its associated service and management problems have diverted attention from the relatively uncontrolled growth of Delta cities and the substantial build-up of the corridors of Cairo-Benha; Tanta-Damanhour - Kafr El Dawar-Alexandria. The whole set of urban and rural development issues; industrialization and agricultural growth; and orderly use of both urban and arable land find expression in the Delta. It is not an exaggeration to say that the ability to manage urban and rural growth effectively in the Delta may be the key to the long-term development path of Egypt.

APPENDIX A

MOST RELEVANT OCCASIONAL WORKING PAPERS

1. S. Moharram and A. Gorvine; "Decentralization in Egypt: Law & Practice", October 1980.
2. W. Weidemann; "The Agricultural Resource Base: Status & Expectations", December 1980.
3. W. Weidemann; "New Directions in Agricultural Policy: Relations to Industrial & Urban Development", August 1981.
4. H.W. Richardson; "From First Round Alternatives to a Preferred Strategy", August 1981.
5. R. Meier; "Urban Settlement in the Remote Areas of Egypt", August 1981.
6. D. Kissick & Abdel Rahman; "Alexandria Concept Plan", September 1981.

APPENDIX BPOPULATION DISTRIBUTION & ESTIMATED URBAN DEVELOPMENT

This appendix updates and completes the estimates of direct investment and urban infrastructure costs. It also contains estimates of the interregional infrastructure costs through 2000. The direct investment and urban infrastructure costs follow the methodology described in the Working Paper on First Round Alternatives. The infrastructure costing methodologies are described in the annexes as follows: Annex B-a, Intra-urban Infrastructure Costs; Annex B-b, Interregional Infrastructure Costs Methodology; Annex B-c, Operations and Maintenance Costs of Intra-urban Infrastructure.

The urban population distribution and growth rates, by zone, for the year 2000 are shown in Table B-1. The corresponding table in the Working Paper on First Round Alternatives is Table II-2, p.25. The direct investment costs for job creation in the final five-year period 1996-2000, are shown in Table B-2. This table in conjunction with Table II-3, p.30 of the Working Paper on First Round Alternatives contains the fifteen-year (1986-2000) direct investment costs.

Table B-3 through B-6 are the intra-urban infrastructure costs for the periods 1986-1990, 1991-1995, 1996-2000 and 1986-2000. Table B-3 updates Table II-6, p.39 in the Working Paper on First Round Alternatives.

The interregional infrastructure costs for all three periods are shown in Table B-7. Direct investment costs, intra-urban infrastructure costs, and interregional infrastructure costs for all three periods are summarized in Table B-8.

TABLE B - 3
 INTRAURBAN INFRASTRUCTURE COSTS-1/
 1986 - 1990

ZONE	A		B ₁ EFFICIENCY		B ₁ EQUITY		B ₂ EFFICIENCY		B ₂ EQUITY		C		A at C Standards		C at A Standards	
	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST
CAIRO	4519	394	3623	327	3583	324	3944	355	4012	361	3854	349	4532	396	3782	343
ALEXANDRIA	2820	740	2593	671	2184	600	1745	507	1770	515	1791	521	2828	742	1742	506
DELTA	2894	750	2508	673	3113	833	2756	731	3253	864	3463	919	3676	953	2621	696
CANAL	837	705	3472	2138	3921	2414	2682	1808	2851	2019	2675	1936	1456	1227	1399	1012
NORTH UPPER EGYPT	570	790	642	883	1004	1257	1517	1726	1734	1922	1882	2064	848	1184	1384	1518
SOUTH UPPER EGYPT	496	375	577	430	961	1656	1275	790	1529	923	1827	1095	1061	803	1287	772
REMOTE AREAS	293	1231	313	1310	762	2912	725	2491	1117	3627	2311	5706	502	2109	1379	3405
TOTAL	12429	550	13728	608	15528	687	14646	648	16266	720	17803	788	14903	660	13594	601

1/ Total Cost in L.E. million; per capita cost in L.E.

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TOTAL B - 4
 INTRAURBAN INFRASTRUCTURE COSTS ^{1/}
 195. 95

ZONE	A		B ₁ EFFICIENCY		B ₁ EQUITY		B ₂ EFFICIENCY		B ₂ EQUITY		C		A at C Standards		C at A Standards	
	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST
CAIRO	5158	375	4198	325	4399	341	4454	343	4534	349	4363	339	5158	375	4363	339
ALEXANDRIA	3307	700	2810	606	1809	432	1913	492	1941	499	1983	507	3305	699	1983	507
DELTA	2648	593	2603	612	3178	747	2860	657	3514	808	3539	827	3573	822	2535	592
CANAL	805	588	5704	2237	5728	2246	2712	1355	3110	1682	2772	1574	1456	1064	465	832
NORTH UPPER EGYPT	554	710	453	591	772	846	1560	1402	1805	1547	1758	1530	681	873	1421	1237
SOUTH UPPER EGYPT	471	327	413	289	642	386	1287	630	1543	725	1511	723	613	426	1170	560
REMOTE AREAS	257	1012	213	855	601	1932	688	1906	1104	2760	3585	4952	387	1524	2240	3094
TOTAL	13200	493	16394	612	17129	640	15474	578	17551	655	19511	729	15273	570	15177	567

^{1/} Total Cost in L.E. million; per capita cost in L.E.

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TABLE B - 5
INTRA URBAN INFRASTRUCTURE COSTS ^{1/}
1996 - 2000

	A		B ₁ EFFICIENCY		B ₁ EQUITY		B ₂ EFFICIENCY		B ₂ EQUITY		C		A at C Standards		C at A Standards	
	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST
ZONE:																
CAIRO	6002	366	4537	303	4956	330	5133	338	5226	344	5012	334	6001	366	5012	334
ALEXANDRIA	3817	661	2406	458	1979	427	2137	486	2169	493	2068	470	3004	659	2068	470
DELTA	2900	560	2809	578	3069	630	3319	650	5130	1003	3622	745	3915	757	2637	543
CANAL	850	539	7788	1948	7788	1948	3051	1175	2166	925	2898	1339	1575	999	1597	738
NORTH UPPER EGYPT	551	649	364	458	726	727	1711	1245	1347	925	1041	1317	694	817	1491	1067
SOUTH UPPER EGYPT	476	301	318	215	605	334	1398	553	2 66	934	1627	644	596	377	1179	467
REMOTE AREAS	222	822	135	534	400	1173	720	1644	1171	1945	6059	4661	341	1263	3691	2839
TOTAL	14818	468	13357	580	19523	617	17469	552	19675	622	23127	731	16926	535	17675	559

^{1/} Total cost in L.E. million; per capita cost in L.E.

TABLE B - 6
 INTRAURBAN INFRASTRUCTURE COSTS I/
 1966 - 2000

	A		B ₁ EFFICIENCY		B ₁ EQUITY		B ₂ EFFICIENCY		B ₂ EQUITY		C		A at C Standards		C at A Standards	
	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST	TOTAL COST	PER CAPITA COST
CAIRO	15679	378	12358	318	12938	332	13531	345	13772	351	13229	341	15691	379	13157	339
ALEXANDRIA	9944	700	7609	578	5972	486	5795	495	5860	502	5842	499	9937	700	5793	494
DELTA	8442	634	7920	621	9360	737	8937	679	11897	892	10624	830	11264	844	7793	610
CAVAL	2492	611	16964	2108	17437	2203	8445	1446	8127	1542	8345	1616	487	097	4461	861
NORTH UPPER EGYPT	1675	718	1459	644	2502	943	4788	1458	4886	1465	5481	1637	2223	958	4296	1274
SOUTH UPPER EGYPT	1443	334	1308	311	2208	459	3960	658	5538	861	4965	821	2270	535	3636	600
REMOTE AREAS	772	1022	661	900	1763	1972	2133	2014	3392	2777	11955	5106	1230	1632	7310	3113
TOTAL	40447	504	48479	600	52180	648	47589	593	53492	666	60441	749	47102	588	46446	576

I/ Total cost in L.E. million; per capita cost, an average of the three period costs, in L.E.

TABLE B-7

INTERREGIONAL INFRASTRUCTURE COSTS (L.E. MILLION)
1986 - 2000

	A	B ₁ EFFICIENCY	B ₁ EQUITY	B ₂ EFFICIENCY	B ₂ EQUITY	C
		<u>1986-1990</u>				
POWER	3234	3353	3482	3432	3487	3989
TRANSPORTATION	1649	1764	1764	1760	1760	1977
WATER	-	-	34	-	32	105
TOTAL	4883	5117	5280	5192	5279	6071
		<u>1991 - 1995</u>				
POWER	4585	4101	4962	5288	4006	5920
TRANSPORTATION	1790	1915	1915	1911	1911	2147
WATER	-	-	-	-	32	145
TOTAL	6375	6016	6877	7199	5949	8212
		<u>1996 - 2000</u>				
POWER	5935	6087	6298	5851	6943	7861
TRANSPORTATION	2055	2198	2198	2193	2193	2464
WATER	-	-	-	-	-	143
TOTAL	7990	8285	8496	9044	9136	10468

TABLE B - 8
SUMMARY OF URBAN DEVELOPMENT COSTS
1986 - 2000 (L.E. MILLIONS)

SECTOR	A	B ₁ EFFICIENCY	B ₁ EQUITY 1986-1990	B ₂ EFFICIENCY	B ₂ EQUITY	C
INDUSTRY	8423	8891	9030	9134	9239	9531
URBAN INFRASTRUCTURE	12429	13728	15528	14646	16266	17803
INTER-URBAN INFRASTRUCTURE	4883	5117	5280	5192	5279	6071
TOTAL	25735	27736	29838	27972	30784	33405
<u>1991 - 1995:</u>						
INDUSTRY	12826	13493	13598	13236	13360	13620
URBAN INFRASTRUCTURE	13200	16394	17129	15474	17551	21884
INTER-URBAN INFRASTRUCTURE	6375	6016	3877	7199	5949	8212
TOTAL	32401	35903	37604	35909	36860	43716
<u>1996 - 2000</u>						
INDUSTRY	22247	23010	23157	22268	22475	23051
URBAN INFRASTRUCTURE	14818	18357	19523	17469	19675	23127
INTER-URBAN INFRASTRUCTURE	7990	8285	8496	9044	9136	10468
TOTAL	45055	49652	51176	48781	51286	56646
<u>1986 - 2000</u>						
INDUSTRY	43496	45394	45785	44638	45074	46202
URBAN INFRASTRUCTURE	40447	48479	52180	47589	53492	60441
INTER-URBAN INFRASTRUCTURE	19248	19418	20653	21435	20364	24751
TOTAL	103191	113291	118618	113662	118930	131394

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ANNEX B-aIntra-Urban Infrastructure Costs

The total costs of intra-urban infrastructure of the Alternatives shown in the First Round Alternatives were based on the assumption that massive amounts of rehabilitation would occur during the 1980-1985 period. It was also assumed that settlements which did not have sewerage systems in 1980 would have them constructed by 1985. Thus by 1985 the major deficits which exist in most intra-urban infrastructure would have been eliminated. The First Round Alternatives intra-urban infrastructure costing did however assume that rehabilitation of new stock built in previous periods and of existing stock would continue throughout the 20 year period, but that due to the massive rehabilitation during the 1980-1985 period rehabilitation in later periods would require less investment than in earlier periods.

These assumptions were reviewed in preparing revised intra-urban infrastructure costs for the Second Round Alternatives as the assumption made in the First Round Alternatives regarding rehabilitation during the 1980-1985 period and construction of new sewerage facilities appeared overly optimistic. Therefore, in preparing the intra-urban cost estimates for the Second Round Alternatives, these requirements for massive rehabilitation and construction of new sewerage facilities were phased over the twenty year plan period (1) because it is unlikely that amount of construction can be achieved during the last three years of the 1980-1985 period (if adopted, implementation of the preferred strategy could not begin until FY 1982/1983 and much of the initial implementation would involve feasibility studies and design phases thus little actual investment could occur), and (2) to provide more flexibility in spreading

investment costs over the twenty year periods. The phasing which was used to estimate these requirements are presented below:

Phasing Constants Used To Project Rehabilitation of Existing Stock and Construction of New Sewerage Systems.

PERIOD	PHASING OF REHABILITATION OF EXISTING INFRASTRUCTURE STOCK ^{1/}	PHASING OF NEW SEWERAGE IN SETTLEMENTS LACKING SEWERAGE SYSTEMS
1980 - 1985	15%	15%
1986 - 1990	60%	60%
1991 - 1995	20%	20%
1996 - 2000	5%	5%

^{1/}. Water, sewerage, and education.

The per capita costs used to estimate the requirements for rehabilitation of existing infrastructure stock are similar to those used in the First Round Alternatives Report and are presented below:

TABLE B-9

CONSTANTS USED TO PROJECT INFRASTRUCTURE COSTS OF REHABILITATION OF EXISTING STOCK

INFRASTRUCTURE	PER CAPITA REHABILITATION COSTS AS A PROPORTION OF PER CAPITA COSTS OF NEW INFRASTRUCTURE		REMARKS
	STOCK EXISTING BEFORE 1980-85 PERIOD	REHABILITATION OF STOCK BUILT DURING LATER PERIODS	
WATER AND SEWERAGE	74%	3%	Based on unpublished estimates of costs of strengthening existing systems from provincial water supplies project and depreciation allowances shown in masterplans for major metropolitan systems.
CIRCULATION	1%	0.5%	Estimates from National Transportation Investment Plan
ELECTRICITY	20%	10%	Early period has provisions for expansion of service, while later period assumes an average service life of 10 years.
OTHER PHYSICAL INFRASTRUCTURE	20%	10%	Assumption similar to electricity.
HOUSING	50%	5%	Similar to First Round Alternatives.
EDUCATION	35%	2%	Based on estimates of rehabilitation requirements resulting from 1977 survey of educational facilities. Later period rehabilitation assumes only minor rehabilitation necessary.
HEALTH	10%	10%	Assumes that 10 percent of existing stock will be rehabilitated in each period and that stock added in later periods has an average life of 10 years due to large investment requirements in equipment.
OTHER SOCIAL INFRASTRUCTURE	2%	1%	Assumed relationships

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ANNEX B-b

INTER REGIONAL INFRASTRUCTURE COSTS

This section of the Annex discusses inter-regional infrastructure costs for transportation--highway, rail, and inland waterways--bulk water, and electrical power. The variation in costs of these systems depending upon different settlement alternatives is shown.

INTER-REGIONAL TRANSPORTATIONInvestment & Operating Costs

The National Urban Policy Study Team has utilized the Draft Final Report of the Egypt National Transport Study (NEDECO) to develop inter-regional investment and operating costs and to provide order-of-magnitude differences in costs to compare alternative settlement strategies.

Total investments recommended by NEDECO between 1981 and 2000 for rail, highway and internal waterways are shown in Table B-10 below. The NEDECO investments are usually given in their report as two period totals (1981-87 and 1987-2000). They have been distributed on an annual basis as described by NEDECO for 81-87 but by the NUPS team for 87-2000 since NEDECO did not generally provide such annual totals.

The total investment costs include fixed and variable maintenance costs, costs of new investment plus rehabilitation, and costs of initial investments in vehicle fleets for the three modes. They do not include, however, operating costs which are calculated by mode on a passenger-kilometer or ton-kilometer basis.

Table B-11 shows the distribution of financial costs by mode and between passenger and freight for 1979, which do include operating costs.

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Table B-11 shows the distribution of financial costs by mode and between passenger and freight for 1979, which do include operating costs.

Table B-10

TOTAL TRANSPORT INVESTMENTS 1989-2000 MILLION L.E. IN 1979 PRICES (ECONOMIC)

YEAR	RAIL INVESTMENT ^{1/}		HIGHWAY EXCLUDES MAIN. AND FLEET	INVESTMENTS ^{2/}		WATERWAY INVESTMENT ^{3/}		Ports Pipelines Air ^{4/}	TOTAL INVESTMENT	
	ROLLING STOCK ONLY	TOTAL ALL		INCLUDES MAINT. AND FLEET ^{a/}	EXCL. MAINT. AND FLEET	INCL. MAINT. AND FLEET	MAINT. & FLEET INCL.		EXCL.	
1981		13.8	32.7	282.5	2.6	8.8	No Recommendations - Not in terms of Reference No Details available and not included No Recommendations For 1980-84 see Annex VII p.343 ff.	305.1	49.1	
82		15.3	54.4	307.1	2.6	8.8		331.2	72.3	
83		21.1	51.7	307.5	2.6	8.8		337.4	75.4	
84	(57.0)	76.8	55.3	314.6	2.6	8.8		400.2	77.7	
85	(9.7)	29.0	42.4	305.4	2.6	8.8		343.2	64.8	
86	(9.3)	31.3	52.1	319.1	2.6	8.8		359.2	76.7	
87	(23.2)	43.1	52.7	324.6	2.9	9.1		376.8	75.5	
88	(15.6)	43.5	52.0	326.4	1.1	8.2		378.1	81.0	
89	(17.7)	37.4	52	329.8	1.1	8.2		375.4	72.8	
90	(76.2)	49.9	55	335.4	1.1	8.7		393.5	79.8	
91	(27.6)	53.0	58	342.0	1.2	8.3		403.3	83.6	
92	(28.9)	46.1	61	348.4	1.2	8.3		402.8	79.4	
93	(74.4)	35.1	64	356.6	1.2	8.3		400.0	70.9	
94	(32.1)	37.8	66	362.6	1.2	8.3		408.7	72.9	
95	(45.7)	51.0	70	370.7	1.2	8.3		430.0	76.5	
96	(37.2)	39.9	74	379.9	1.2	8.3		428.1	77.9	
97	(38.7)	41.4	78	383.2	1.2	8.3		437.9	81.9	
98	(77.8)	75.5	82	397.7	1.2	8.3		481.5	85.9	
99	(60.7)	63.4	86	407.3	1.2	8.3		479.0	89.9	
2000	(93.9)	94.5	90	417.1	1.2	8.3		519.9	91.8	
TOTALS	(625.2)	898.9	1229.3	6923.9	33.8	169.5	7991.3	1535.8		

SOURCES: ^{1/} Main Report p. 69 Annex V Chapter 13, ^{2/} Main Report P. 94 ff, Annex IV, Chapter 9, ^{3/} Main Report P 71 ff, Annex VI, Chapter 12, ^{4/} Main Report Annex VII, Relevant Chapters.

- ^{a/} Includes maintenance that goes from L.E. 14.0 million in 1981 to L.E. 49.1 million in 2000; bus intercity replacement and renewal from L.E. 20.8 million in 1981 to L.E. 73 million in 2000. and L.E. 215 million per year throughout the period for truck renewal and replacement
- ^{b/} Pipeline data indicate no facility expansion 1981-87 (see Main Report); some expansion thereafter but no amount given. Of L.E. 218.8 million allocated to the transport/distribution component within the petroleum/natural gas sector, about L.E. 109 million is not allocated to specific projects (to be specified in the second half of the 1978-82 Five Year Plan. The remainder (also in the Five Year Plan 1978-82 and not in transport sector) are described in Annex VII p. 2.

TABLE B-11

Financial Costs & Balances ^{1/}
(1979)

	Total			Freight			Passengers	
	Rail	Road	Water	Rail	Road	Water	Rail	Road
Fin. costs of trans ^{2/}	167.2	725.4	13.35	55.6	452.6	13.35	111.6	272.8
Fin. cost infrastruc ^{3/}	4.9	44.7	1.96	1.6	30.9	1.96	3.3	13.8
TOTAL financial costs	172.1	770.1	15.31	57.2	483.5	15.31	114.9	286.6
Revenue	59.0	725.4	11.36	17.8	452.6	11.36	41.2	272.8
TOTAL Financial Deficit	113.1	44.7	3.95	39.4	30.9	3.95	73.7	13.8
% Revenue/Total Finan. Cost	34	94	74	31	94	74	36	95

^{1/} Source: Main Report, NEDECO, p.154

^{2/} Costs of Transportation include fleet additions and operating costs of vehicles per ton-kilometer or passenger-kilometer for estimated loads and passenger movement.

^{3/} Cost of Infrastructure include fixed and variable maintenance and rehabilitation of networks plus new investments in capacity.

Because of the subsidies involved, relative to the opportunity cost of materials and labor, there are substantial differences between financial and economic costs^{1/}. The economic costs in 1979 which are equivalent to the financial costs in Table B-11 are shown in Table B-12.

TABLE B-12

Economic Costs & Balances

	Total			Freight			Passengers	
	Rail	Road	Water	Rail	Road	Water	Rail	Road
Econ. cost of transport	218.8	891.6	20.19	73.4	593.6	20.19	145.4	298.0
Econ. cost of infrastruc.	4.9	63.7	2.10	1.6	44.1	2.10	3.3	19.6
Total economic cost	223.7	955.3	22.29	75.0	637.7	22.29	148.7	317.6
Revenue	59.0	725.4	11.36	17.8	458.4	11.36	41.2	272.0
"Economic" deficit	164.7	229.9	10.93	57.2	185.3	10.93	107.5	44.6
% Revenue/Total econ. cost	26	76	51	24	71	51	28	86

SOURCE: Main Report, NEDECO, p.154

It is worth noting that economic costs for transportation are 24.8% higher than financial costs and that economic costs exceed financial costs for infrastructure by 37%. Overall, economic costs are 25% higher than financial costs. Revenue covers about 66% of economic costs under current transportation policies and about 83% of financial costs. Under current practices the railroads are more heavily subsidized than road and water.

^{1/} Financial costs are costs incurred in Egyptian Pounds. Economic costs are those which would be incurred if all inputs were valued at their market value—generally at international market prices.

The NUPS team used NEDECO's estimates of unit operating costs and their estimates of volumes at origins and destinations to calculate operating costs for both passenger movement and freight in 2000. These figures in L.E. millions are:

Freight	2,125
Passengers	1,521
Total	<u>3,646</u>

From Table II, total operating costs in L.E. million in 1979 were:

Freight	522
Passengers	384
Total	<u>906</u>

Since NEDECO's total recommended investment to 2000 was L.E. 7,992 million, it can be said that, from their parameters, it takes an investment of L.E. 2.19 between now and 2000 to provide L.E. 1.00 of total operating capacity in the year 2000. This constant has been used to estimate capital requirements from operating costs for the alternatives^{1/}.

The NUPS team used NEDECO data to calculate year 2000 per capita ton-kilometer and passenger-kilometer costs. These per capita figures are derived from NEDECO's assumed spatial distribution of population and economic activity, based largely upon trend patterns of growth. The national derived freight cost/capita is L.E. 57.05 and the passenger cost/capita is L.E. 40.84 (1979 prices).

Detailed freight and passenger costs per capita by major settlements in each zone were used to provide indicative operating costs for each of the four major alternative settlement patterns in the First Round Alternative Working Paper. The indicative operating costs using this procedure probably underestimate the differences between the alternatives because the successful pursuit of more decentralized strategies would increase passenger flows, average trip distances, and ton-kilometers of freight beyond the figures implied by this

^{1/} These capital costs should be treated as very rough approximations. The NEDECO data on individual elements of the proposed networks were insufficiently detailed for the NUPS team to make a network analysis of each alternative. Consequently, overall parameters derived from NEDECO data are used in these estimates.

procedure.^{1/} Nevertheless, the cost-differences are substantial as shown below. The implied investment costs for each alternative are shown assuming the same proportion between 1981-2000 investments and 2000 operating costs in the NEDECO Report (i.e. L.E. 2.19 in investments between 1981 and 2000 for each L.E. of operating cost).

TABLE B-13

Operating & Investment Costs for Alternative Settlement Strategies
(in L.E. millions at 1979 prices)

<u>Alternative:</u>	<u>A</u>	<u>NEDECO</u>	<u>B1 Efficiency</u>	<u>B2 Efficiency</u>	<u>C</u>
<u>Operating Cost</u>					
Total 2000	3,388	3,646	3,831	3,826	4,172
Per Capita	90.96	97.89	102.86	102.73	112.01
<u>1981-2000</u>					
Investment Cost (L.E. Million)	7,427	7,993	8,398	8,386	9,145
Ratio of Costs to Cost of Alternative A	1.00	1.08	1.13	1.13	1.23

If we assume that operating costs grow at a uniform annual rate from 1979-2000 ^{2/} and that investment costs grow at rates indicated by the time-phasing of investment in Table B-10, the annual operating and investment costs by NUPS alternative are as shown in Table B-14

^{1/} The detailed calculations from the NEDECO Origin and Destination tables are shown in Table B-16

^{2/} This rate is calculated for each alternative as the rate required to go from NEDECO's 1979 operating cost estimate to the 2000 operating cost estimate for each alternative. That is, the annual rate of growth in operating costs is different for each alternative because of different population distributions.

Table B-14

Operating & Investment Costs

(1981-2000)

In L.E. millions

ALTER-NATIVE YEAR	A		B ₁ Efficiency		B ₂ Efficiency		C	
	Operating Cost	Investment	Operating Cost	Investment	Operating Cost	Investment	Operating Cost	Investment
1981	1079	283	1092	321	1092	320	1110	349
1982	1146	308	1166	348	1166	347	1181	379
1983	1217	313	1246	354	1246	354	1266	386
1984	1293	372	1331	420	1331	420	1358	458
1985	1373	319	1422	361	1421	360	1457	393
1986	1458	834	1519	377	1518	377	1563	411
1987	1549	350	1623	396	1622	395	1676	431
1988	1645	351	1734	397	1733	397	1798	433
1989	1747	349	1852	394	1851	394	1929	429
1990	1855	366	1979	413	1977	413	2069	450
1991	1970	375	2114	424	2112	423	2219	461
1992	2093	374	2258	423	2256	423	2381	461
1993	2223	372	2417	420	2410	420	2553	458
1994	2361	380	2577	429	2575	429	2739	468
1995	2507	400	2753	452	2750	451	2938	492
1996	2663	398	2941	450	2938	449	3151	490
1997	2828	409	3142	462	3139	462	3380	503
1998	3004	447	3357	506	3353	505	3626	551
1999	3189	445	3586	503	3582	503	3889	548
2000	3388	483	3831	546	3826	545	4172	595
TOTAL	40588	7928	43917	8396	43898	8387	46452	9146
GRAND TOTAL	48 516		52313		52285		55588	

SOURCE: Nups Calculations. Investment totals may not add to totals in Table IV due to rounding.

In order to facilitate combining these figures with the intra-urban investment and operating costs in the First Round Alternatives, they are summarized in Table B-15, in 5 year increments.

Table B-15

Summary of Cumulative Operating & Investment Costs
(L.E. millions, 1979 Prices)

<u>Alternative:</u>	<u>A</u>	<u>B₁</u>	<u>B₂</u>	<u>C</u>
<u>1981-85</u>				
Operating Cost	6108	6257	6256	6372
Investment Cost	<u>1595</u>	<u>1804</u>	<u>1801</u>	<u>1965</u>
TOTAL	7703	8061	8057	8290
<u>1986-90</u>				
Operating Cost	8254	8707	8701	9035
Investment Cost	<u>2250</u>	<u>1977</u>	<u>1976</u>	<u>2144</u>
TOTAL	10504	10684	10677	11179
<u>1991-95</u>				
Operating Cost	11,154	12,114	12,103	12,830
Investment Cost	<u>1,901</u>	<u>2,148</u>	<u>2,146</u>	<u>2,340</u>
TOTAL	13,055	14,262	14,249	15,170
<u>1996-2000</u>				
Operating Cost	15,072	16,839	16,838	18,215
Investment Cost	<u>2,182</u>	<u>2,467</u>	<u>2,464</u>	<u>2,687</u>
TOTAL	17,250	19,306	19,302	20,902

Source: NUPS Calculations

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Inter-regional transportation costs are mainly borne by the users of the various transportation networks and the national Government (see Table B-11 and B-12 for data on cost recovery through transport sector revenues). Consequently, the operating and investment costs associated with different alternatives are summarized for the country as a whole rather than being assigned as costs to particular settlement zones as was done for intra-urban investment costs. That is, unrecovered inter-urban transportation costs result in a reduction in the total investment pool available.

B-16CALCULATED OPERATING COSTS PER CAPITA

<u>NUPS SETTLEMENT ZONES</u>	<u>PASSENGER COST PER CAPITA</u>	<u>FREIGHT COST PER CAPITA</u>	<u>TOTAL TRANSPORT COST PER CAPITA</u>
<u>CAIRO</u>	31.70	23.77	55.47
<u>ALEXANDRIA</u>	31.97	71.51	103.48
<u>DELTA</u>			
Zagazig	36.10	35.37	71.47
Benha	66.58	32.48	99.06
Mansoura	42.52	46.24	88.76
Damietta	107.31	61.38	168.39
Shebin El Kom	68.85	51.86	120.71
Tanta	54.51	61.55	116.06
Kafr El Sheikh	45.59	22.13	67.12
Damanhour	43.91	61.55	105.46
<u>CANAL</u>			
Port Said	120.24	91.30	211.54
Ismailia	80.70	56.88	137.58
Suez	56.61	261.85	318.46
<u>NORTH UPPER EGYPT</u>			
Fayoum	48.89	42.82	91.71
Beni Suef	39.78	37.11	76.89
Minia	27.61	45.93	73.54
<u>SOUTH UPPER EGYPT</u>			
Assiut	40.33	73.53	113.86
Sohag	39.50	35.31	74.81
Qena	40.67	104.21	144.88
Aswan	45.04	201.89	246.93
<u>RED SEA</u>	100.53	370.51	471.04
<u>WESTERN DESERT</u>	78.21	1150.50	1228.71

INTER-REGIONAL CAPITAL AND OPERATING COSTS OF ELECTRICAL POWER SECTOR

I. Introduction.

The nationwide electrical power system is composed of major hydroelectric power generation plants located at Aswan and 26 petroleum or natural gas fired thermal power generation plants located mainly in the NUPS Greater Cairo, Alexandria, Delta and Canal Zones. All of these plants are interlinked by the Unified Power Grid, a high and medium voltage grid of transmission lines linking major load centers with power generation sources. In addition to the power plants interlinked via the National Power Grid, smaller thermal power generation plants also exist in the Remote areas and Port Said.

The generation and bulk distribution of power is the responsibility of the Egyptian Electrical Authority (EEA) which sells power to large industrial users and to seven power distribution companies. The distribution companies sell power to medium and small consumers. The construction of electrical power facilities is the responsibility of EEA (bulk power facilities on a nationwide basis) while the Rural Electric Authority (REA) is responsible for planning and constructing power facilities within urban and rural areas.

The Unified Power system had a total installed capacity of 4,491 megawatts (MW) in 1979 of which 54 percent was located in the hydroelectric power plants in Aswan. During 1979, the sector's total gross generation was 16,803 million kilowatt hours (GWh) and gross sales were 14,675 GWh ^{1/}. Losses accounted for the remaining 12 percent of gross generation. Although the system's total installed capacity was 4,491 MW, its total available capacity was 3,404 MW due to dual use of hydro facilities for irrigation and power generation, derating of plants due to age and deterioration and system stability limits over the 550 KV transmission network. In 1979, the system had a total

^{1/} These power statistics exclude small generation plants not connected to the Unified Power Grid, but include Port Said plants.

peak demand capacity of 2,814 MW due to reserve capacity requirements of 21 percent and a load factor of 67 percent. Administratively, the system is divided into five transmission zones by the EEA. These are: Greater Cairo, Alexandria, Delta or Lower Egypt, Canal and Upper Egypt 1/.

During the period 1969 to 1979, the electrical power sector achieved an annual average growth rate in gross generation of 10 percent. The EEA forecasts that gross generation will increase to approximately 105,000 GWh by the year 2000 at an annual average growth rate of 9.1 percent 2/. These aggregate electricity load projections are based on total demand of five economic sectors (industry, agriculture, transportation, public utilities, residential and other military, government and public sector organizations). The basis of these projections was developed by the 1977 Power Sector Study prepared for the Ministry of Electricity and International Bank for Reconstruction and is updated periodically to reflect changes in sectorial demand and growth rates in other economic sectors 3/. Since these aggregated demand forecasts reflect GDP growth rates similar to NUPS projections, and were the basis for EEA's least

1/ Power sector Statistical Data, 1969-1979, from the Egyptian Electrical Authority. April 1980.

2/ Unpublished Statistics of the Egyptian Electricity Authority, "Actual and Forecast sales by Consumer Categories 1978-2000, (April 1980)

3/ Sanderson and Porter "Power Sector Survey. Phase 1. Diagnostic Report and System Planning. "Prepared for Bank for Reconstruction and Ministry of Electricity and Energy. 1977.

cost' investment program (least cost in that the model EEA uses to determine its program aims at seeking locations for new installations which minimize overall investment requirements as well as operating expense), they were used to project future capital and operating cost requirements for the electrical sector in the NUPS alternative settlement strategies 1/.

The Egyptian electrical system presently has wide regional variations in the generation and end consumption of electrical power. The present regional generation and end consumption of electrical power is shown in Table B-14. This regional pattern of electrical power distribution results from the location of major power generation facilities in Upper Egypt and major load centers in Greater Cairo and Alexandria necessitating the transmission of power from one zone to another. In 1979, roughly 41 percent total power generated was transmitted from power surplus zones to load centers in power deficit zones.

1/ The US Department of Energy in conjunction with officials from the Ministry of Electricity and Energy, the Ministry of Planning and the National Planning Institute conducted an energy assessment of Egypt's present and future energy requirements in 1979 (U.S. Department of Energy. "Joint Egypt/United States Report on Egypt/United States Cooperative Energy Assessment". Executive summary, Main Report and Appendices." April 1979). This joint Egyptian/American assessment concluded that although the projected growth rate for electricity demand is greater than total energy demand (9.9 percent vs. 5.3 percent per year) the total demand for energy, including electrical energy, can be met through conventional fuels using conventional technologies through the year 2000. The assessment did point out that Egypt's projected reliance on electrical energy is greater than many developed countries (notably France and the United States).

However they found EEA's projections consistent with overall energy projections and with likely energy demands required by projected GDP growth rates. The EEA forecasts used for costing power requirements for the alternatives vary somewhat from forecasts used in the energy assessment but do not differ substantially from either the Power Sector Survey or with a projection conducted by Aoki Consultants (to the EEA) which used assumed and achievable energy/GNP ratios as a basis for electricity load projections (these are available from the EEA).

REGIONAL GENERATION OF THERMAL AND HYDRO POWER
 BY TRANSMISSION ZONE AND DISTRIBUTION COMPANY-
 -1979-

TRANSMISSION ZONE	ELECTRICAL DISTRIBUTION COMPANY	GENERATOR STATION	TYPE OF GENERATION PLANT	POWER GENERATED (Gwh)	TOTAL POWER GENERATED IN ZONE	POWER DISTRIBUTED ON OTHER ZONES		POWER RECEIVED FROM OTHER ZONES		TOTAL END CONSUMPTION IN ZONE (Gwh)	PERCENT OF END CONSUMPTION WHICH IS HYDRO POWER
						ZONE	(Gwh)	ZONE	(Gwh)		
CAIRO	CAIRO	WEST CAIRO	THERMAL	1314.6	3385.6	CANAL	(881.6)	UPPER EGYPT	2993.2	5671.7	52.6
		SOUTH CAIRO	"	1201.1							
		NORTH CAIRO	"	529.0							
		EAST CAIRO	"	59.4							
		EL TEBIN I	"	208.5							
		EL TEBIN	"	73.0							
		SHOUBRA EL KHEIMA 4/	"	-							
ALEXANDRIA	ALEXANDRIA	EL SIOUF	"	325.0	697.9	-	-	HIGH DAM	820.0	1943.4	42.2
		KARMOUZ	"	197.1							
		EL MAZ	"	91.3							
		ABOU EL MATAMIR	"	28.7							
		KAFR EL DANAR	"	55.8							
LOWER EGYPT/	BEHEIRA DELTA	DAHANOUR	"	1,083.7	1,833.7	ALEXANDRIA	(425.5)	UPPER EGYPT	985.9	2665.3	37.0
		TALKHA THERMAL	"	728.4							
		TALKHA GAZ	"	21.6							
CANAL 2/	CANAL	SUEZ THERMAL	"	357.1	466.4	LOWER EGYPT	(445.7)	CAIRO	6816.6	902.3	-
		SUEZ GAS	"	32.2							
		ISHAILIA	"	77.1							
UPPER EGYPT 3/	NORTHERN UPPER EGYPT	ASSIUT	"	367.2	367.2	CAIRO	(2993.2)	-	-	-	-
		SOUTHERN UPPER EGYPT	NAGA HAMADI	HYDRO							
	ASWAN DAM	"	1,639.0								
	HIGH DAM	"	7,969.3								
TOTALS				16,359.1	9,608.3	(6,726.4)	6,726.4	5176.4 5/	16359.1	7.1	58.7

SOURCE: "Annual Report: Electricity Statistics", Egyptian Electrical Authority (1981).

1/ Power stations in Marsa Matrouh not connected to the Grid are excluded.

2/ Power stations in Port Said, the Sinai and Red Sea not connected to the Grid are excluded.

3/ Power stations in Fayoum, and the Western Desert are not included.

4/ Shoubra El Kheima power station will not be commissioned until 1982.

5/ This total consumption includes major industrial consumers who purchase power directly from the EEA in addition to the distribution companies

2. Estimates of Electrical Power Requirements: Methodology.

The total power requirements of the settlement zones were estimated for the alternatives by using EEA nationwide forecasts for settlements connected to the Unified Power Grid, and estimating power requirements for the Remote areas based on master plan projections. In the first case, electrical power was distributed among the major transmission zones 1/ connected to the Unified Power Grid by : (1) calculating the average per capita consumption of power using the urban populations of the 40 largest settlements; then (2) the average per capita consumption was either increased in zones being emphasized in a particular alternative, i.e., in Alternative C, the average per capita consumption standard was increased 125 percent to provide more power resources in the Canal and North and South Upper Egypt Zones. The consumption standards for other non-priority zones were calculated as residuals resulting from subtracting total consumption of priority zones plus the 1985 forecast consumption of the large industrial power users in South Upper Egypt 2/ from the total Unified Power Grid consumption. These consumption standards are summarized in Table B-18

The average existing consumption of electrical power in the Remote Areas is 850. KWh/capita 3/. This consumption rate was used to forecast demand until 1985. After 1985, the existing estimated consumption rate of the Red Sea Governorate, 1878 KWh/capita 4/ was used to project Remote area power demands in all the alternatives except Alternative C. This consumption rate is more than double the existing consumption in the other Remote Areas. The average consumption rate of the Red Sea Governorate regional plan and the regional plan for the Northwest Coast was used to forecast consumption in the Remote Areas in Alternative C. The total forecast consumption by zone and settlement Alternatives are shown in Table B-19

1/The EEA power transmission zones were adjusted as follows so that they conform to the NUPS zones: Sharkia was added to the Delta zone rather than the Canal zone, the NUPS North and South Upper Egypt zones were combined to conform to the EEA Upper Egypt transmission zone.

2/ Sanderson and Porter, Incl. "Power Sector Survey. Phase 1. Diagnostic Report and System Planning." Vol. 1 Table I-1 1977.

3/ Source: Red Sea Governorate Regional Plan, Interim Report. Regional Infrastructure. 1980, and Regional Plan for the Coastal Zone of the Western Desert. Final Report. Vol. IV. 1976.

4/ Red Sea Governorate Regional Plan. Draft Final Report. Vol 1. Main Report. Vol. 1. Main Report. (1980).

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TABLE B-18

ELECTRICAL POWER CONSUMPTION STANDARDS OF THE SETTLEMENT ALTERNATIVES

ALTERNATIVE	GREATER CAIRO ZONE		ALEXANDRIA ZONE		DELTA ZONE		CANAL ZONE		UPPER EGYPT ZONE		AVERAGE UN- IFIED GRID	REMOTE AREAS		
		KWh/CAPITA		KWh/CAPITA		KWh/CAPITA		KWh/CAPITA		KWh/CAPITA ^{1/}	KWh/CAPITA		KWh/CAPITA	
TREND	1980-1985	-	1233.4	-	1320.4	-	1646.9	-	1791.5	-	7652.7	1762.1		650
A	1986-1990	Average	2279.1	Average	2279.1	Residual	1261.3	Residual	1261.3	Residual	1261.3	2279.1	Same as	1261.3
	1991-1995		2822.2		2822.2		1927.1		1927.1		1927.1	2822.2	Residual	1878.0
	1996-2000		3344.4		3344.4		2562.2		2562.2		2562.2	3344.4		1878.0
B ₁ EFFICIENCY	1986-1990	90% of	2071.9	Average	2279.1	Residual	1428.8	Average	2279.1	Residual	1428.8	2279.1	Existing	1878.0
	1991-1995	Alexandria	2540.4		2794.4		2291.9		2794.4		2291.9	2794.4		1878.0
	1996-2000		3039.2		3343.1		2970.6		3343.1		2970.6	3343.1		1878.0
B ₁ EQUITY	1986-1990	Residual	1815.5	Residual	1815.5	Residual	1815.5	115% of	2624.0	115% of	2624.0	2281.7	Existing	1878.0
	1991-1995		2387.9		2387.9		2387.9	Average	3251.6	Average	3251.6	2827.5		1878.0
	1996-2000		2919.8		2919.8		2919.8		3855.1		3855.1	3352.3		1878.0
B ₂ EFFICIENCY	1986-1990	88% of	2011.5	Residual	2011.5	Residual	1428.8	Average	2279.1	Average	2279.1	2279.1	Existing	1878.0
	1991-1995	Average	2576.8	Average	2576.8		2184.3		2834.5		2834.5	2834.5		1878.0
	1996-2000		3057.6		3057.6		3079.3		3363.4		3363.4	3363.4		1878.0
B ₂ EQUITY	1986-1990	Residual	1849.5	Residual	1849.5	Residual	1849.5	115% of	2627.1	115% of	2627.1	2284.5	Existing	1878.0
	1991-1995		2394.5		2394.5		2394.5	Average	3262.7	Average	3262.7	2837.1		1878.0
	1996-2000		2946.2		2946.2		2946.2		3874.9		3874.9	3369.5		1878.0
C	1986-1990	Residual	1795.8	Residual	1795.8	Residual	1795.8	125% of	2770.5	125% of	2770.5	2216.4	Master Plan	2060
	1991-1995		2359.5		2359.5		2359.5	Average	3590.4	Average	3590.4	2872.3		2060
	1996-2000		2944.5		2944.5		2944.5		4323.1		4323.1	3458.5		2060
SOURCE: NUPS Analysis.														
1/ Excludes consumption of Naga Hamadi Aluminum Plant and Kima Fertilizer Plant. However that consumption was included in projections of total costs of the electrical power sector.														

TOTAL CONSUMPTION OF ELECTRICAL POWER BY SETTLEMENT ZONE

	GREATER CAIRO		ALEXANDRIA		DELTA		CANAL		NORTH & SOUTH		TOTAL UNIFIED POWER		REMOTE AREAS		TOTAL
	GWh	%	GWh	%	GWh	%	GWh	%	GWh	%	GWh	%	GWh	%	GWh
TREND 1985	1,172.3	34.4	401.7	11.8	550.9	16.2	186.5	5.5	106.98	31.4	3,381.2	99.4	193	0.6	3,460.9
A. 1990	26,111.6	51.3	8,681.1	16.9	4,864.7	9.5	1,497.2	2.9	9,779.5	19.0	50,934.0	99.2	300.2	0.6	51,342.0
1995	38,776.8	51.5	13,329.3	17.7	8,610.3	11.4	2,636.3	3.5	11,483.3	25.2	74,836.0	99.4	477.0	0.6	75,313.0
2000	54,911.2	52.1	19,337.1	18.3	13,251.7	12.6	4,040.6	3.8	13,422.3	12.7	104,963.0	99.5	508.9	0.5	105,472.0
B ₁ EFFICIENCY															
1990	22,927.7	44.6	8,813.3	17.2	5,326.5	16.3	3,701.3	7.2	10,165.2	19.8	50,934.0	99.1	448.8	0.9	51,383.0
1995	32,768.6	43.5	12,966.0	17.2	9,740.6	12.9	7,125.7	9.5	12,235.0	16.2	74,836.0	99.4	467.6	0.6	75,303.6
2000	45,584.7	43.2	17,578.0	16.7	14,449.2	13.7	13,369.91	12.7	13,982.0	13.3	104,496.3	99.5	475.1	0.5	104,971.4
B ₁ EQUITY															
1990	20,123.1	39.1	6,613.7	12.9	6,799.2	13.2	4,261.4	8.3	13,136.6	25.5	50,934.0	99.0	508.9	1.0	51,443.0
1995	30,801.5	40.8	10,155.7	13.3	10,155.7	13.5	8,291.6	11.0	15,581.6	20.7	74,836.0	99.2	584.1	0.8	75,420.1
2000	43,800.1	41.5	13,518.7	12.8	14,216.6	13.5	15,415.5	14.6	18,011.0	17.1	104,963.0	99.4	640.4	0.6	105,603.4
B ₂ EFFICIENCY															
1990	22,358.0	43.4	6,919.5	13.4	5,388.0	10.5	3,379.9	6.6	12,888.5	25.0	50,934.0	98.9	546.5	1.1	51,480.5
1995	33,467.5	44.2	10,023.8	13.2	9,512.5	12.6	5,674.7	7.5	16,157.5	21.3	74,836.0	98.7	678.0	0.9	75,514.5
2000	46,476.1	43.9	13,453.4	12.7	15,738.4	14.9	8,731.4	8.3	20,561.4	19.4	104,961.0	99.2	822.6	0.8	105,783.6
B ₂ EQUITY															
1990	20,557.2	39.9	5,362.3	12.4	6,974.5	13.5	3,896.1	7.6	13,143.8	25.5	50,934.0	98.9	576.4	1.1	51,510.4
1995	31,123.6	41.2	9,314.1	12.3	10,408.9	13.8	6,032.7	8.0	17,956.2	23.8	74,836.0	99.0	751.2	1.0	75,587.2
2000	44,782.0	42.3	12,963.2	12.2	15,063.9	14.2	9,075.0	8.6	23,076.8	21.8	104,961.0	99.1	942.8	0.9	105,903.8
C. 1990	19,805.9	38.3	6,177.6	11.9	6,764.8	13.1	3,828.8	7.4	14,356.9	27.7	50,934.0	98.4	810.0	1.6	51,744.0
1995	30,347.5	39.8	9,235.0	12.1	10,096.2	13.2	6,322.7	8.3	18,834.6	24.7	74,836.0	98.1	1,448.0	1.9	76,284.0
2000	44,167.1	41.1	12,952.9	12.0	14,313.2	13.0	9,359.5	8.7	24,168.5	22.5	104,961.0	97.6	2,600.0	2.4	107,561.0

1/ EEA FORECAST: GROSS GENERATION. (Unpublished Statistics), April 1980.

SOURCE: NUPS Analysis.

Financial and Economic Costs of Electrical Power Generation

The financial and economic costs of bulk generation and transmission of electrical power generation were calculated for both thermal and hydroelectric power generation 1/. The financial costs of hydroelectric power generation were estimated by subtracting the fuel costs of operating thermal plants from EEA's total 1979 operations budget (BAB 1 plus BAB 2) and dividing the remainder by the 1979 gross generation. The extra/financial costs of operating thermal plants were estimated by dividing the financial costs of fuel by the total power generation of thermal plants. This was then added to the average financial operating costs to illustrate the additional costs of thermal power generation.

The "economic costs" of generating electrical power were estimated by costing petroleum products used in thermal plants at their 1979 international prices. The "economic" operating costs of hydroelectric plants are similar to financial costs as the primary subsidized inputs to electrical power sector are petroleum products 2/

1/ In a financial sense the electrical power sector largely operates without subsidies in that the general policy is to charge users the financial costs of power generation. The EEA's two largest consumers, the Kima Fertilizer Plant in Aswan and the Aluminum complex at Naga Hamadi, are however exceptions as they are charged tariffs which are substantially lower than EEA's cost of supply of roughly, 5.07 millimes/KWh (55 and 65 percent respectively). However, the sector enjoys large economic subsidies due to the pricing of petroleum products in Egypt well below international prices. For example, EEA purchased fuel for operation of thermal plants at L.E. 7.50 per ton in 1979 while the international price was L.E. 122 per ton. Thus at international prices, the average economic cost of power generation in Egypt would have been approximately 21 millimes/KWh in 1979.

2/ Full assessment of the impacts of the economy of hydroelectric power generation and detailed technical appraisal of existing plant and operations which would be required to assess the exact economic costs of hydroelectric power generation would require specialized study outside the scope of this study.

The financial and economic costs of power generation in the Remote areas were estimated similarly to costs in other regions except that the salary component of power generation costs was increased by 100 percent to reflect incentives required to attract trained personnel to Remote Areas 1/.

As mentioned in the introduction to this section, seven regional power distribution companies are responsible for selling electrical power to medium and small consumers. Therefore their 1979 operating costs (BAB 1 and BAB 2) were added to the operating costs of bulk generation and transmission of electrical power.2/ In the North and South Upper Egypt Zone a

weighted average distribution cost was estimated for each period due to the large proportion of electrical power which is sold directly to large industrial users in these zones. This weighted average was estimated by increasing the salary portion of bulk distribution costs by 100 percent to reflect regional wage incentives and adding that amount to the operating costs of the North and South Upper Egypt distribution companies. Since the composition of power consumption changes in each period due to increases in population and consumption rates, these average distribution costs were calculated for each period (See Table B-21).

1/ Relatively little experience exists about the types and sizes of incentives needed to attract labor to remote areas. However in a recent salary survey of construction companies and petroleum companies operating in the Red Sea, it was found that these companies offer Egyptian personnel incentives and bonuses amounting 100 percent of base salaries to compensate their workers for harder working conditions found in the Red Sea Governorate. Discussions with personnel of the Aswan High Dam Authority indicate that the combination of hardship incentives, housing and travel allowances can increase their salaries by as much as 87 percent over the amounts that they would receive if they were located in Cairo.

2/ Since the distribution companies were only established in 1979 and electricity statistics for the budget year 1980/81 are not available estimates of only one period were made.

Capital Costs of New Electrical Power Generation and Transmission

The capital costs of new power generation plants and transmission facilities were estimated for each five year period of the alternatives using the demand forecasts shown in Table B-19. Generally, it was assumed that the demand for additional capacity would be met first by existing zonal plant capacity (especially in the Upper Egypt Zone) to reduce transmission losses and thus increase system efficiency. Further, since after 1985 Upper Egypt zonal demand forecasts indicate that there will be no surplus hydroelectric power in the zone, construction of new capacity in other zones will be necessary in any event 1/.

Since both the EEA 1980-1987 investment program and the Joint Egypt/ United States Energy Assessment forecast that existing fossil fuels and conventional technologies will be adequate to meet Egypt's electrical needs to the year 2000, no provisions for nuclear plants were made. Furthermore, since the Quattarra Depression Project is only expected to have an additional 640 MW of power commissioned by the year 2000 (assuming the project is proven feasible), its construction costs were also excluded. The base costs of construction of new electrical power generation plants and bulk transmission were derived from EEA's 1980-1987 planned investment program.

1/ Total 1980 hydroelectric capacity is 1,645 MW. This is projected to increase by 561 MW by increasing capacity at Aswan and developing smaller plants in other locations in Upper Egypt.

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Regional variations in construction costs were reflected by multiplying these average costs time a regional index developed from 1980 unpublished statistics of the Ministry of Planning showing regional construction output due to the electrical sector and CEA information about plant capacity under construction. Since load centers are closely linked in the Greater Cairo, Alexandria, Delta and Canal Zones thus allowing construction of new plant in lower cost regions, single weighted index of their zonal indexes was constructed. Costs in other zones were then expressed as a factor of the weighted index of the Lower Egypt Zones.

ZONE	ZONAL INDEX (L.E. Additional MW)	WEIGHTED INDEX
GREATER CAIRO	19.77	
ALEXANDRIA	21.94	
DELTA *	8.77	
CANAL	22.35	
TOTAL LOWER EGYPT **	23.57	1.00
ASWAN (EXPANSION OF EXISTING HYDROELECTRIC FACILITIES)	5.84	1.00
ASSIUT (THERMAL)	46.33	1.97
RED SEA	17.50	4.51 ***

* Consists of expansion of existing facilities at Talkha.

** Since the Delta construction is not of new facilities, its index was not included in the Lower Egypt Index.

*** Since only a very small thermal package plant is being installed in the Red Sea Governorate (20 MW), its index is not comparable to the larger plants being constructed in other regions. Therefore, the general Remote Area construction index shown on page 63 of the First Round Alternatives Working Paper was used to reflect likely higher construction costs in remote areas.

TOTAL OPERATING AND CAPITAL COSTS OF ELECTRICAL POWER GENERATION

A summary of the total projected operating and capital costs of the electrical power system (excluding of intra-urban operating costs) are presented for each of the alternatives in Table B-20. The total financial costs range from L.E. 39,396 million in Alternative A to L.E. 44,240.2 in Alternative C or a percent increase over the Alternative A of 12 percent. Since the pattern of population and thus load centers, in Alternative B₁ Efficiency is similar to that of Alternative A, its financial and economic costs are also relatively similar. However if demand for power (represented by per capita power consumption) within the four Lower Egypt Zones shifted more substantially towards the Canal Zone than already projected in Alternative B₁ Efficiency, both the operating and capital costs of power generation could be expected to increase as the Canal Zone has higher unit costs than other areas in Lower Egypt.

The higher costs of Alternatives B₁ Equity through C largely result from increasing demand in Upper Egypt Zones to the point where existing and potential hydroelectric capacity is not adequate to meet those demands. Thus greater investment in construction and operations of thermal plants is necessary.

Issues in Electrical Power Sector

The impact which the price subsidy on the internal sale of petroleum products has on operating costs and by inference on revenues lost to the electrical power sector and the economy as a whole are illustrated by the difference between the sum of 1980-2000 financial and economics costs shown in Table 4. As petroleum products become increasingly scarce this difference can be expected to become more pronounced.

A related issue to petroleum pricing is the conservation of electrical power. As pointed out by the Egypt/United States Cooperative Energy Assessment, Egypt is projected to have a much higher year 2000 percentage consumption of electrical energy to total energy consumption (20 percent) than industrialized nations such as France and the United States have ^{1/}, thus overall, a more capital intensive, less efficient use of energy. Highly subsidized inputs to electricity generation tend to discourage conservation and exacerbate the problem.

It should be noted that the Government of Egypt has recognized this problem and in 1980 developed a block tariff structure for small and medium consumers of electricity which increases tariffs for large consumers and provides subsidies for small low income consumers. It also developed tariffs for large consumers which have foreign currency equity participation which more closely reflects the international price of fuel used in electrical power generation.

1/ Ibid pp. C-38

2/ A more complete discussion of electricity tariffs is presented in Volume IV of the Urban Growth and Data Report.

A third issue affecting electrical power costs is the choice of technology for power generation. As discussed earlier, the costs presented in Table B-20, do not include construction of nuclear facilities. The Egypt/United States Cooperative Energy Assessment indicates that the costs of operating nuclear power plants compare favorably with those of petroleum fueled thermal plants, 5/KWh vs. 15 Milliemes/KWh). However, adequate nuclear fuel deposits have not yet been identified in Egypt and the construction of nuclear plants incurs higher capital costs than conventional plants and require longer construction periods.

Alternative technologies could reduce electrical power consumption by the year 2000 by as much as 19 percent over current trend projections. Much of this savings could be realized in the industrial sector through modifying existing plant to be more efficient or to utilize other sources of power directly 2/

1/ Ibid PP. E+7

2/ Ibid. PP. F-15-F-23

TABLE B-20

SUMMARY TABLE OF ELECTRICAL POWER CAPITAL AND OPERATING COSTS
(L.E. MILLIONS - 1979 PRICES)

ALTERNATIVE	CAPITAL COSTS				TOTAL	1980 - 1985	OPERATING COSTS			TOTAL OPERATING COSTS (1960 - 2000)	TOTAL 1980 - 2000	PERCENT INCREASE FROM ALTERNATIVE A (%)
	1980 - 1985	1986 - 1990	1991 - 1995	1996 - 2000			1986 - 1990	1991 - 1995	1996 - 2000			
A	3286.3	3234.4	4584.8	5935.1	17,040.6	3675.6	4128.2	6017.3	8534.4	22,355.5	39,396.1	
- FINANCIAL						8340.0	11,560.9	17839.7	26,024.1	63,764.7	80,805.3	
- ECONOMIC												
B ₁ EFFICIENCY	3286.3	3352.6	4101.2	6086.6	16,826.7	3675.6	4108.4	6150.7	8742.5	22,677.2	39,503.9	0.3
- FINANCIAL						8340.0	11,501.1	17,986.4	26,258.6	64,086.1	80,912.8	0.1
- ECONOMIC												
B ₁ EQUITY	3286.3	3481.9	4962.0	5297.8	18,028.8	3675.6	4168.8	6213.1	8843.5	22,901.0	40,928.8	3.9
- FINANCIAL						8340.0	11,532.0	18051.8	28,547.2	66,471.0	84,499.8	4.6
- ECONOMIC												
B ₂ EFFICIENCY	3286.3	3431.7	5288.4	6850.0	18,856.4	3675.6	3154.0	6165.5	8775.5	22,772.6	41,629.0	5.7
- FINANCIAL						8339.9	11,563.7	17663.0	26,346.9	63,913.5	82,769.9	2.4
- ECONOMIC												
B ₂ EQUITY	3286.3	3487.0	4006.2	6943.2	17,722.7	3675.6	4166.2	6206.9	8820.4	22,869.1	40,591.8	3.0
- FINANCIAL						8339.9	11,557.2	18,133.8	26,395.2	64,426.1	82,148.8	1.7
- ECONOMIC												
C	3286.3	3989.3	5919.7	7860.6	21,055.9	3675.6	4209.1	6297.2	9003.4	23,184.3	44,240.2	12.3
- FINANCIAL						8339.9	11,634.5	18,309.0	26,888.6	65,172.0	86,227.9	6.7
- ECONOMIC												

SOURCE: NUPS Analysis

TABLE B-21

PROJECTED YEAR 2000 UNIT OPERATING COSTS OF BULK POWER GENERATION & TRANSMISSION

(Millimes/Kwh)

ZONE	ALTERNATIVE A		ALTERNATIVE B ₁ , EFFICIENCY		ALTERNATIVE B ₂ , EQUITY		ALTERNATIVE B ₂ , EFFICIENCY		ALTERNATIVE B ₂ , EQUITY		ALTERNATIVE C	
	FINANCIAL	ECONOMIC	FINANCIAL	ECONOMIC	FINANCIAL	ECONOMIC	FINANCIAL	ECONOMIC	FINANCIAL	ECONOMIC	FINANCIAL	ECONOMIC
<u>CAIRO</u>												
Generation & Transmission	6.6	45.5	6.6	45.5	6.6	45.5	6.6	45.5	6.6	45.5	6.6	45.5
Distribution	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
TOTAL	16.3	55.2	16.7	55.2	16.3	55.2	16.3	55.2	16.3	55.2	16.3	55.2
<u>ALEXANDRIA</u>												
Generation & Transmission	6.6	45.5	6.6	45.5	6.6	45.5	6.6	45.5	6.6	45.5	6.6	45.5
Distribution	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
TOTAL	17.3	56.2	17.3	56.2	17.3	56.2	17.3	56.3	17.3	56.2	17.3	56.2
<u>DELTA</u>												
Generation & Transmission	6.6	45.5	6.6	45.5	6.6	45.5	6.6	45.5	6.6	45.5	6.6	45.5
Distribution	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7
TOTAL	18.3	57.2	18.3	57.2	18.3	57.2	18.3	57.2	18.3	57.2	18.3	57.2
<u>CAHAL</u>												
Generation & Transmssion	6.6	45.5	6.6	45.5	6.6	45.5	6.6	45.4	6.6	45.5	6.6	45.5
Distribution	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6
TOTAL	20.2	59.1	20.2	59.1	20.2	59.1	20.2	59.1	20.2	59.1	20.2	59.1
<u>UPPER EGYPT</u>												
Generation & Transmission	4.2	40.5	4.3	8.1	4.8	16.5	5.0	20.1	5.2	22.9	5.0	23.9
Distribution	10.3	10.3	10.5	10.5	11.1	11.1	11.3	11.3	11.5	11.5	11.6	11.6
TOTAL	14.5	50.8	14.8	18.6	15.9	27.6	16.3	31.4	16.7	34.4	16.9	35.5
<u>REMOTE AREAS</u>												
Generation & Transmission	7.4	46.3	7.4	46.3	7.4	46.3	7.4	46.3	7.4	46.3	7.4	46.3
Distribution	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6
TOTAL	21.0	59.9	21.0	59.9	21.0	59.9	21.0	59.9	21.0	59.9	21.0	59.9

Source: NUPS Analysis.

BULK WATER REQUIREMENTS OF THE SETTLEMENT ALTERNATIVES

Bulk water (defined as water requirements which must be 'imported' from other regions via pipelines or canals) requirements were reviewed in three of the settlement zones: Greater Cairo, Canal and Remote Areas Zones. The analysis was limited to these zones because the other zones have access to either ground water or surface water (usually in the form of Nile water) within their regional boundaries. Within the Greater Cairo Zone, bulk water will be necessary for development of some of the new towns as they lie outside the service area of the Greater Cairo Water Utility.

GREATER CAIRO ZONE

In the Greater Cairo Zone bulk water is required to supply the new towns and satellite cities with water as they are outside the service area of the Greater Cairo Water Utility. The costs of bulk water supplies have been derived from either actual tender cost estimates or master plans. In all cases these expenditures have already been made or will be made during the 1980 - 1985 period. Thus the capital requirements for bulk water supplies in the Zone will not affect variations in the total investment costs of the Alternatives. These investment requirements are presented below in Table B-22.

TABLE B-22
BULK WATER INVESTMENT REQUIREMENTS OF THE GREATER CAIRO ZONE

SETTLEMENT	INVESTMENT (L.E. MILLIONS)	REMARKS
10th of Ramadan	23.2	Pipeline under construction
Sadat City	N.A.	
El Abour*	N.A.	
El Amal*	N.A.	
6th of October	17.0	Pipeline under construction
15th of May	--	served by Greater Cairo Water Utility
Total	40.2	

N.A. Not Available

* Still in Master Plan preparation stage.

CANAL SETTLEMENT ZONE

The bulk water requirements of the Canal Zone settlements are now met by the Sweetwater Canal and the Abbassa Canal. Review of masterplan requirements for the major settlements of the zone indicates that total projected requirements can be met by these existing canals provided that they are adequately maintained ^{1/}. Although the alternatives have different zone population totals, the highest total aggregate demand does not differ significantly from the master plan estimates. Therefore, no additional investment in bulk water supplies should be required.

Throughout the period, maintenance of the canals will be required to maintain adequate flows. However, as urban uses comprise only a portion of the total end use of water from the canal -agricultural and transport are also major users of bulk water from the canal- costs maintenance of the canals were not included in total bulk water operating cost requirements.

REMOTE AREAS

Since 1960, there has been active investigation and development of ground water resources within the New Valley. As the result of these investigations the fresh water storage within the region has been estimated at 2,300 milliard m³. Currently, nearly 250 million m³/year of water is provided from wells in the oases of Kharga and Kakhla.

^{1/} NUPS Working Paper. "Water Resources As Related to Urban Development in Egypt to Year 2000 " (Jack Scheliga). July 1981. pp. 47-49

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Several studies have been conducted to determine the recharge rate of the aquifers and thus the feasible time which wells in the in the oases could be utilized at different production rates. Some of the studies indicate feasible production periods as short as 50 years. However, other studies are proceeding to determine optimum basin management and use rates to insure much longer life of the resources.

New Valley urbanization is largely dependant upon stabilizing urban requirements with demand for agricultural practices. However, the total populations projected by the different settlement alternatives could probably be met by ground water resources in the New Valley. Therefore, no estimates of bulk water requirements were made.

Currently, water resources in the Sinai are being studied by the "Sinai Development Study". Preliminary findings indicate that the potential exists for further development of ground water resources in the northern sector of the Sinai. However, reliable supplies of ground water resources large enough to support large urban settlements in other sectors have not been identified. The potential exists for importing water from the Suez Canal region to areas adjacent to the Canal region and in the southern and western areas of the Sinai, but as the feasibility of constructing conveyance systems is still under study, no costs of constructing them has been included in the bulk water requirements of the NUPS settlements alternatives.

RED SEA GOVERNORATE BULK WATER REQUIREMENTS

Urban development within the Red Sea Governorate is expected to rely entirely on imported water from the Nile via pipelines from Qena as is the case now. The existing pipeline which serves Safaga, Hurghada and Quseir delivers an estimated 4,300 m³/day. This capacity is being increased to 13,000 m³/day through construction of an additional pipeline from Qena. Due to the requirement to lift water over the Red Sea Mountain Range, ^{1/} construction costs tend to be higher than

^{1/} Estimated by the manager of Qena Water Supply Plant to be 7000 meters high.

in other areas requiring bulk water supplies. Therefore, due to the unique nature of the region, future investment costs were estimated by using costs estimated by Provincial Water Supplies Project, i.e., L.E. 2,777/m³/day of additional capacity.

Due to fuel requirements and the height over which water must be lifted the current cost of supplying water to users in the Red Sea Governorate is L.E. 0.55/m³. ^{1/} . This rate corresponds closely with the projected operations and maintenance costs of water conveyance systems projected by the Regional Plan for the Red Sea Governorate (page 155 of Volume 1). Therefore, it was used to estimate future operating costs of bulk water supplies of the settlement alternatives.

NORTHWEST COAST BULK WATER REQUIREMENTS

Currently, major urban settlements in the Northwest Coast Region are served with bulk water supplies via canals from the Nile. Although limited potential exists for development of ground water and surface water resources these are not deemed sufficient to support large urban populations ^{2/}. Therefore future urban water requirements will have to be met through pipelines from the Nile. A pipeline with a capacity of 32,400 m³/day was estimated by the Provincial Water Supplies Project to cost roughly L.E. 1,282 per additional m³/day. This capacity will be adequate to supply to region with water for urban uses to the year 2000 in all of the settlement alternatives except B₂ Equity and C. By the year 2000, these will require additional capacities of 2.4 to 82.5 m³/day.

Operating costs for bulk water conveyance were estimated using unit rates which were derived from the costs obtained from the Red Sea Governorate.

^{1/} Source: Planning department of the Red Sea Governorate.

^{2/} NUPS Working Paper. "Water Resources as Related to Urban Development in Egypt to Year 2000" (Jack Scheliga). July 1981. pp. 27-34

TABLE B-23

BULK WATER REQUIREMENTS OF RED SEA GOVERNORATE &
MATROUH GOVERNORATE 1985-2000

GOVERNORATE/ PERIOD		A	B ₁ EFFICIENCY	B ₁ EQUITY	B ₂ EFFICIENCY	B ₂ EQUITY	C
1985 Expected capacity due to projects under construction ^{1/}							
Red Sea ^{1/}	(10 ³ M ³ /d)	13.0	13.0	13.0	13.0	13.0	13.0
Matrouh	(10 ³ M ³ /d)	32.4	32.4	32.4	32.4	32.4	32.4
1990							
Red Sea	Population (1 000's)	79.5	79.0	93.5	99.0	106.0	142.8
	Demand (10 ³ m ³ /d)	13.3	13.3	22.2	16.5	25.1	42.8
	Deficit (10 ³ m ³ /d)	-	-	4.9	3.5	12.1	29.8
Matrouh	Population (000's)	68.0	69.0	77.3	84.0	89.0	117.3
	Demand (10 ³ m ³ /d)	11.4	11.5	18.3	14.0	21.1	35.2
	Deficit (10 ³ m ³ /d)	-	-	-	-	-	2.8
1995							
Red Sea	Population (000's)	83.5	81.0	109.5	123.0	139.0	263.8
	Demand (10 ³ M ³ /d)	13.5	13.5	26.0	20.5	32.9	79.1
	Deficit (10 ³ M ³ /d)	-	-	13.0	7.5	19.9	66.1
Matrouh	Population (000's)	74.0	73.0	89.0	106.0	117.0	212.3
	Demand (10 ³ m ³ /d)	-	-	-	17.7	27.7	63.7
	Deficit (10 ³ M ³ /d)	-	-	-	-	-	31.3
2000							
Red Sea	Population (000's)	88.5	81.0	121.5	150.0	178.0	482.0
	Demand (10 ³ M ³ /d)	14.5	13.5	28.8	25.1	42.2	144.6
	Deficit (10 ³ M ³ /d)	1.5	-	2.8	12.1	29.2	101.6
Matrouh	Population (000's)	80.0	75.0	93.3	130.0	147.0	383.0
	Demand (10 ³ M ³ /d)	13.3	12.5	23.3	21.7	34.8	114.9
	Deficit (10 ³ M ³ /d)	-	-	-	-	2.4	82.5

^{1/} Water Plant Manager, Oona (In charge of operation of Oona-Safana Line)

TOTAL INVESTMENT AND OPERATIONS AND MAINTENANCE COSTS OF BULK WATER

The total costs of bulk water requirements of Red Sea and Northwest Coast urban settlements were estimated for the alternatives by projecting total urban demand for water by five year period using the standards shown in Appendix II-C of the First Round Alternative Report. Since the populations of the remote areas are relatively small in Alternatives A and B, Efficiency, no further investment in bulk water supplies other than projects now under construction will be required to meet total urban demand. In the other alternatives, additional investment in bulk water conveyance systems will be required to meet expected demand. These investments have been phased so that construction of additional conveyance systems occurs in advance of expected bulk water demand in later periods. These total investment requirements are shown in Table B-24.

The much higher costs of bulk water conveyance systems in Alternative C result from the higher consumption standards projected for the Alternative (300 l/c/d in Alternative C vs. 167 l/c/d in Alternative A) and the higher masterplan population targets set for the alternative.

The estimated operations costs of bulk water systems for the Remote areas are shown by five year period in Table B-25. As mentioned, these operations costs have been projected at unit rates which are now experienced in operations of the bulk water systems in the Red Sea Governorate. The total operations costs for the period 1981-2000 range from L.E. 264 million in Alternative A to L.E. 996 million in Alternative C. These total operations cost variations result from increased populations, and higher consumption standards in the more decentralized settlement alternatives such as Alternative C.

TABLE B-24
BULK WATER INVESTMENT 1985-2000 (L.E.MILLIONS)

PERIOD	GOVERNORATE	A	B ₁ EFFICIENCY	B ₁ EQUITY	B ₂ EFFICIENCY	B ₂ EQUITY	C
1980 - 1985	RED SEA	20.0	20.0	20.0	20.0	20.0	20.0
	MATROUH	41.5	41.5	41.5	41.5	41.5	41.5
	TOTAL	61.5	61.5	61.5	61.5	61.5	61.5
1986 - 1990	RED SEA	-	-	34.4	26.1	31.8	64.9
	MATROUH	-	-	-	-	-	40.1
	TOTAL	-	-	34.4	-	31.8	105.0
1991 - 1995	RED SEA	-	-	-	-	31.8	79.0
	MATROUH	-	-	-	-	-	65.6
	TOTAL	-	-	-	-	31.8	144.6
1996 - 2000	RED SEA	-	-	-	-	-	142.6
	MATROUH	-	-	-	-	-	-
	TOTAL	-	-	-	-	-	142.6
TOTALS 1986 - 2000	RED SEA	-	-	34.4	26.1	63.6	364.2
	MATROUH	-	-	-	-	-	105.7
	TOTAL	-	-	34.4	26.1	63.6	469.9
TOTALS 1981 - 2000		61.5	61.5	95.9	87.6	125.1	531.4

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TABLE B-25
OPERATIONS OF BULK WATER SYSTEMS

PERIOD	GOVERNORATE	A	B ₁		B ₂		C
			EFFICIENCY	EQUITY	EFFICIENCY	EQUITY	
1981 - 1985	RED SEA	21.3	21.3	21.3	21.3	21.3	21.3
	MATROUH	29.9	29.9	29.9	29.9	29.9	29.9
	TOTAL	51.2	51.2	51.2	51.2	51.2	51.2
1986 - 1990	RED SEA	36.6	36.6	46.5	39.9	49.7	67.5
	MATROUH	31.4	30.0	38.1	33.1	41.1	55.2
	TOTAL	68.0	66.0	84.6	73.0	90.8	122.7
1991 - 1995	RED SEA	37.8	36.8	65.9	50.4	78.8	159.8
	MATROUH	32.6	32.5	53.9	43.2	66.3	130.8
	TOTAL	70.4	69.3	119.8	93.6	145.1	290.6
1996 - 2000	RED SEA	39.0	37.1	75.1	62.2	102.2	295.5
	MATROUH	35.3	33.9	60.9	53.8	85.2	263.3
	TOTAL	74.3	71.0	136.0	116.0	187.4	531.7
TOTAL 1981 - 2000		263.9	257.5	391.6	333.8	474.5	996.2

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TABLE B-26
Summary of Ground Water Model Studies in Western Desert

Area of Study	Model Type	Agency/Date/ Reference	Method Applied	Model Results		
				Simulated Extractions Development Plans (106m ³ /year)	Predicted Pressure Drop at the End of Simula- ted Time (m)	Simu- lated Time (years)
Kharga-Dakhla Oases	R-C Analogue Model	Industropro- ject - Yugos- lavia 1968/(11)	R-C Electrical Analogy	Kharga: 263.17 Dakhla: 467.57	80 56	1968 - 2010
Western Desret	Regional Digital Model	Ezzat, 1976, (12)	ECAP Program	Recharge to sandstone aquifer system: Eastern Desert: 18.92 Sudan Bonder: 193.7 Gilf El-Kebir: 449.50		1960 - 1970
Kharga-Dakhla Oases with Abu Tartur phosphate field	Semi-detailed Digital Model	Ezzat, 1976, (12)	ECAP Program	Kharga: 79.49 Dakhla: 153.71 extractions +Abu Tartur: 30.00	54 1970 25 25.8	1970 - 2070
Kharga-Dakhla Oases	Detailed Digital Model	F.A.O./1976, (13)	Integrated Finite Differ- ence	Kharga: 156.2 Dakhla: 509.3 Abu Tartur: 30.0	87 30-60 34.39	1975 - 2025
South Qattara Oases Areas(Siwa-Baharia- Farafra)	Regional Digital Model	Ezzat et al., 1977 (14)	ECAP Program	Siwa: 140.00 Bahariya: 182.00 Farafra: 364.00	60 185 194	1960 - 2010

SOURCE: NUPS Working Paper

Paper."Water Resources as Related to Urban Development in Egypt
to Year 2000. (Jack Scheliga). July 1981. p. 110.

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ANNEX B-c

OPERATIONS & MAINTENANCE COSTS OF INTRA-URBAN INFRASTRUCTURE

1. Introduction

The operations and maintenance of intra-urban infrastructure require large ongoing investments to, first, operate the systems and, secondly to provide adequate levels of maintenance to keep service levels up to their design capacities. Over the life of the infrastructure, these investments generally exceed the initial capital invested. However, projections of total requirements for operations and maintenance are fairly complex as largely independent variables are involved such as estimates of costs of actual operations of the systems (largely salaries and intermediate inputs), the size of the population served, the construction standards of initial installations, the standards of maintenance (lower levels of maintenance generally result in higher operations costs due to lost efficiencies within the system), and finally the degree cost recovery.

Higher degrees of cost recovery affect operations costs in two ways: (i) reductions in demand for infrastructure services generally result since users are more aware of the actual costs of the service and tend to reduce wastage and conserve on use of the service, and (ii) public authorities mandated with operations of the systems generally have greater resources which can be used to maintain levels of the systems.

For the NUPS settlement alternatives two sets of projections of total operations and maintenance have been made. The first shows projections of existing trends with some improvements in salaries to encourage special objectives such as decentralization. The second shows future operations and maintenance if higher levels of maintenance are built into projections of total operations and maintenance costs.

The Egyptian budgetary system divides operations and maintenance (marginal or variable) costs into two major components: (i) salaries of governmental personnel involved in operating urban infrastructure (BAB 1), and (ii) current expenses (BAB 2) including expenses for intermediate inputs such

as fuel and chemicals for operating a water treatment plant, routine maintenance (requirements for major rehabilitation and replacement of equipment have been treated as an investment expense and are included in NUPS estimates of intra-urban infrastructure costs), taxes and fees paid to other departments of government, travel expenses, etc. The public utilities (identified in the budget as economic authorities or service authorities) which operate on a capital budgeting basis also include provisions for debt servicing and depreciation in their current expenses. However as the revenues generated by most of the local public utilities are smaller than their requirements for operations and maintenance expense, these deficits are normally met by budgetary grants or subsidies from the central government budget. Other components of intra-urban infrastructure also rely on revenues from beneficiaries of services provided, such as charges for health services, but these constitute only a small portion of total revenues required to meet their marginal costs. The bulk of those marginal costs are met through budgetary grants from central government or other local government revenues sources not tied directly to the provision of intra-urban infrastructure services.

Eight major components of operating and maintenance expense of intra-urban infrastructure were considered to project future trends of operations and maintenance costs: water supply, sanitation, transport, housing (consists of salaries of personnel charged with oversight of publicly owned housing under local government jurisdiction and routine maintenance), health, education, social affairs and other local government expenses (intra-urban electricity operations and maintenance costs have been included in the appendix on electrical power). The major component of the "other local government expenses" is the headquarters budget which has a variety of subcategories such as transport and communications (a separate fund for public transport not directly covered by special transport authorities, and routine maintenance of roads and bridges), industry (comprised of slaughter houses and markets), electricity for street lighting and traffic signals, public utilities (including fees paid to public utilities by local

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TABLE B-27.

PER CAPITA INVESTMENT IN TOTAL OPERATIONS & MAINTENANCE IN URBAN INFRASTRUCTURE

SETTLEMENT	PER CAPITA EXPENDITURES IN OPERATIONS & MAINTENANCE (BAB 1 + BAB 2)								
	1980 POPULATION	WATER	SEWERAGE	TRANSPORT	HOUSING	HEALTH	EDUCATION	SOCIAL AFFAIRS	ALL OTHER LOCAL EXP.
CAIRO ^{1/}	5643	2.37 ^{2/}	2.05	7.20 ^{2/}	0.17	6.40	9.27	0.52	4.39
ALEXANDRIA ^{1/}	2,578.5	4.886 ^{2/}	1.57	2.576 ^{2/}	0.37	5.77	9.68	0.36	4.80
PORT SAID ^{1/}	345.0	3.98	2.04	NA	1.14	6.68	16.93	1.88	45.02
ISMAILIA ^{1/}	370.3	8.02	2.70	NA	0.90	5.40	10.45	0.78	14.33
SUEZ ^{1/}	260.0	2.77 ^{3/}	1.14 ^{3/}	NA	0.91	6.87	9.52	0.87	14.36
AVERAGE		4.41	1.90	4.87	0.70	6.22	11.17	0.88	9.47
EL MAHALLA ^{4/}	332	NA	NA	0.05	NA	4.46	10.59	0.27	NA
TANTA ^{4/}	317	0.63	0.55	0.29	NA	16.92	17.03	0.34	NA
ASSIUT ^{4/}	243	0.26	0.19	0.80	NA	8.55	36.85	0.10	NA
BENT SUEF ^{4/}	131	0.35	0.50	0.10	NA	17.29	30.01	1.96	NA
QENA ^{4/}	106	0.62	-	-	NA	3.06	32.79	-	-
AVERAGE		0.41	0.41	0.31		10.06	25.45	0.67	
10 SETTLEMENTS COMBINED									
AVERAGE		2.65	1.34	1.84		8.14	18.31	0.79	

^{1/} Budgetary data from 1980/81 National Budget & NUPS analysis.

^{2/} Water, and transport budgets are from 1980/81 budgets of water, sewerage and transport authorities, for Greater Cairo and Alexandria. For these components, Greater Cairo population was used to calculate per capita costs.

^{3/} Suez water and sewerage per capita costs derived from 1980/81 budgetary data supplied by the Planning Department of the Suez Governorate.

^{4/} Budgetary data from local council or governorate planning departments.

government), cleanliness and refuse collection and municipal establishments; public services and other special expenditures.

Historical data of operations and maintenance costs were derived from budgetary data supplied by the planning departments of local councils or governorates, central government budgets (for the urban governorates only) 1/, the management tariff studies for water and sewerage utilities in Cairo, Alexandria, and the Canal Cities and data from the "Health Profile of Egypt" 2/.

2. GROWTH IN PER CAPITA OPERATIONS & MAINTENANCE

There are significant variations in per capita expenditures on operations and maintenance of intra-urban infrastructure among different settlements. For example, the average per capita investment in operations of water supply in the urban governorates is projected to be L.E. 3.34 while it averages only L.E.0.41 in other settlements of rural governorates (see Table B-27) While the standards of service levels and population size somewhat explain these differences, e.g. settlements with larger populations and higher service levels such as Cairo and Alexandria have larger requirements for operations and maintenance than smaller settlements with lower standards, differences also exist between settlements with similar populations and standards. For example, while the water supply standards of Tanta and Suez are roughly similar, the per capita investment in water supply running costs in Suez is more than four times that of Tanta. Per capita costs of operations of social infrastructure tends to follow a somewhat different pattern in that average expenditures are higher in the five non-urban governorate settlements than they are in the urban governments.

1/ The project is greatly indebted to the governorate and local councils of Gharbia (Tanta & Mehalla), Suez, Beni Suef, Assiut, and Qena (the city of Qena & Naga Hamadi) for providing NUPS with detailed time series data about local council budgets. NUPS also received data from the governorate of Sharkyia (Zagazig) regarding industrial and service functions of Zagazig.

2/ Arab Republic of Egypt. Ministry of Health. "Health Profile of Egypt" "Study on Financing & Expenditures in Egypt" Publication No.10. April 1980. Since no data is available for private health expenditure which contributes a major portion of health expenditure for the Curative Organizations for Cairo and Alexandria, the General Organization for Health Insurance, and it was assumed that the proportionate share of total health expenditure of these organizations met by the private sector was more or less constant and thus could be used to project total 1980-81 budgets for which only public sector data is available.

Relatively little provision is made in most intra-urban infrastructure for non-wages and salaries portions of current expenditures. Furthermore, generally more is spent on intermediate inputs and routine maintenance in physical infrastructure than in social infrastructure as is shown below in Table B-28. For example, in the urban governorates, roughly 84% of total water system current expenses are devoted to non-wages and salaries expenditures (BAB 2). However current expenditures in health, education, and social affairs current expenditures are mainly salaries. In all other settlements, the trend towards devoting large portions of current expenditures in payment of salaries is even more pronounced. For example, 51% of current expenditure on water supplies is salaries while almost 94% of average expenditures on education are devoted to salaries.

TABLE B-28

EXPENDITURE ON SALARIES & WAGES AS A PROPORTION OF TOTAL EXPENDITURE ON INTRA-URBAN INFRASTRUCTURE OPERATIONS & MAINTENANCE.

<u>Infrastructure Component</u>	<u>Average Proportion of Operations & Maintenance Expended on Salaries & Wages</u>	
	<u>Urban Governorates</u>	<u>Other Settlements</u>
	<u>%</u>	<u>%</u>
Water	16.0	51.4
Sewerage	33.0	62.0
Transport	47.0	69.9
Health	73.0	75.4
Education	89.2	93.5
Social Affairs	74.1	71.5
Other Local Government Administrative Expenditures	54.1	n/a

SOURCE: Central Government Budgets (1976, 1980/81). Planning Departments of various Local Councils & Governorates (1981) and NUPS analysis.

The low level of expenditure on non-wage and salary current expenses results in relatively little provision being made for routine maintenance as much of the remaining available current expenditure must be devoted to purchase of intermediate inputs for actual operations. As a result, the useful life of much of the infrastructure stock is shortened and a much greater provision for replacement of existing infrastructure stock must be made in the capital expenditures portion of the budget (BAB 3) 1/ .

The rate at which investment in total operations and maintenance grows in comparison to total urban population growth is an important indicator of the adequacy of that investment. If total operations and maintenance expenditure is growing at rates which are much slower than population growth rates, service levels of infrastructure are likely to suffer as an increasing share of available resources must be spent first on salaries, and secondly on intermediate inputs. Maintenance requirements can only then be met by the remaining, declining residual. Thus over time, as necessary maintenance is delayed due to lack of adequate financial resources, the condition of infrastructure declines and eventually service levels decline. In settlements with rapidly expanding populations, public authorities in charge of operations of infrastructure must make hard choices between expenditure on rehabilitation of existing stock or expansion of the infrastructure system to meet new demands as their resources are not adequate to finance both.

1/ A more thorough discussion of the impact of low levels of expenditure on routine maintenance can be found in the following:

Management Tariff Studies Relative to Water Sewerage Systems. (Various volumes) prepared for the Ministry of Development & New Communities by BVI-ATK Associates with Sabbout Associates, 1979.

and

Provincial Water Supplies Project. Vol. 1, 2, 4 and 5. Prepared for the Ministry of Housing by Binnie & Partners & John Taylor & Sons,

A comparison of the growth rates in total operations and maintenance (BAB 1 and 2) and settlement populations growth rates is presented in Table B-29. Generally, rates of growth in operations and maintenance have exceeded population growth rates in the urban governorates by much wider margins than they have in settlements in rural governorates. However, in all cases, the growth rates of social infrastructure marginal costs have exceeded population growth rates by much wider margins than have physical infrastructure. This has been true of settlements in both urban and rural governorates. This much more rapid rate of growth has largely been due to increases in wages and salaries rather than in utilization of intermediate inputs or maintenance (See Table B-30).

TABLE B-29

RATIOS OF EXISTING PER CAPITA GROWTH RATES IN TOTAL OPERATIONS
AND MAINTENANCE (BIB 1 & 2) TO SETTLEMENT POPULATION GROWTH
RATES (1976-1980)

SETTLEMENT	POPULATION GROWTH RATES (1976-1980)	WATER	SEWERAGE	TRANSPORT	HOUSING	HEALTH	EDUCATION	SOCIAL AFFAIRS	OTHER LOCAL ADMINISTRATION
CAIRO	3.57 ^{1/} 3.64 ^{2/}	2.16	4.48	1.71					
ALEXANDRIA	2.69	7.5	5.80	6.51	3.45	10.27	5.15	7.99	4.17
PORT SAID	7.06 ^{3/}	1.69	3.67	N.A	5.50	2.25	2.24	2.79	5.80
ISMAILIA	7.75 ^{4/}	2.04	0.81	N.A	3.00	2.85	2.39	5.47	6.52
SUEZ	7.60 ^{4/}	0.14	0.15	N.A	1.57	2.34	2.99	4.80	3.74
AVERAGE		2.71	2.98	4.11	4.168	6.20	3.51	2.63	2.18
EL MAHAKLA	3.2 ^{5/}	N.A	N.A	0.78	N.A	3.93	4.19	1.39	N.A
TANTA	2.75 ^{5/}	2.12	0.91	1.80	N.A	0.79	1.89	0.90	N.A
ASSIUT	3.29 ^{5/}	0.66	0.50	0.99	N.A	0.97	1.24	0.43	N.A
BENI SUEF	2.56 ^{5/}	1.26	1.62	1.95	N.A	0.96	2.04	0.72	N.A
QENA	3.15 ^{5/}	0.21	-	N.A	N.A	0.96	1.97	N.A	N.A
AVERAGE		1.06	1.01	1.38		1.52	2.27	0.86	N.A
10 SETTLEMENT COMBINED			1.74						
AVERAGE	1.29	1.98	2.24	2.29		3.86	2.89	3.91	

^{1/} Greater Cairo Population growth rate.

^{2/} Cairo governorate population growth rate.

^{3/} Growth rates based on 1976 national census and 1980 Port Said census.

^{4/} Based on 1976 national census and data supplied from Planning Divisions of Ismailia and Suez Governorates.

TABLE B-30

PER CAPITA GROWTH RATES IN OPERATIONS AND MAINTENANCE OF EXISTING SETTLEMENTS (1976-1987)

SETTLEMENT	POPULATION 1980 (000's)	GROWTH RATE (1960-1976)	BUDGETARY ITEM	WATER	SANITATION	TRANSPORT	HEALTH	EDUCATION	SOCIAL AFFAIRS
EL MAHALLA	331.6		SALARIES	13.6	12.9	11.9	25.1	23.2	14.0
			O & M	N.A.	N.A.	(24.0)	108.5	209.0	-
			TOTAL	N.A.	N.A.	8.0	40.3	42.9	14.2
TANTA	317	2.75%	SALARIES	7.9	15.0	6.5	5.7	14.3	8.3
			O & M	17.6	(1)	21.8	23.4	16.1	(15.9)
			TOTAL	10.7	5.7	11.2	6.0	14.3	6.9
SUEZ	260	8.2 *	SALARIES	4.2	19.7	-	2.3	6.6	13.9
			O & M	8.7	11.9	-	5.0	25.0	-
			TOTAL	7.7	16.9	-	3.0	8.9	9.5
ASSIUT	243	3.29	SALARIES	(0.2)	(2.0)	(1.7)	9.2	13.3	12.6
			O & M	(31.1)	32.1	69.6	12.4	19.7	(4.0)
			TOTAL	(7.1)	5.4	10.6	10.5	13.4	(4.7)
BENI SUEF	131	2.56	SALARIES	7.3	9.5	17.1	7.7	13.3	12.6
			O & M	8.7	13.2	(60.1)	4.0	19.7	(4.0)
			TOTAL	8.2	10.6	(12.8)	6.3	13.4	4.7
QENA	106	3.12	SALARIES	3.7	-	40.9	3.4	22.2	N.A.
			O & M	(9.6)	-	N.A.	(78.5)	(1.0)	N.A.
			TOTAL	(2.1)	-	N.A.	(9.4)	19.4	N.A.
URDAN GOVERNORATES CAIRO	564.3	3.57	SALARIES	— HOUSING —			19.6	12.9	31.3
			O & M				9.9	24.4	4.3
			TOTAL				16.7	16.9	21.1
ALEXANDRIA	257.9	2.69	SALARIES				23.5	12.1	15.3
			O & M				12.5	25.5	(1.8)
			TOTAL				19.7	20.7	7.5
PORT SAID	345	7.06 *	SALARIES	41.0			16.7	14.6	56.5
			O & M				14.0	33.9	6.4
			TOTAL	38.5			15.9	15.8	38.4
ISHAILIA GOVERNORATE	370		SALARIES	24.3			20.6	15.8	41.4
			O & M	7.5			26.8	47.4	28.8
			TOTAL	23.3			22.1	18.5	37.2

* GROWTH RATE BETWEEN 1976-1980 BASED ON POPULATION DATA SUPPLIED BY SUEZ & PORT SAID GOVERNORATES.

SOURCE: NUPS Analysis of El Mahalla, Tanta, Suez, Assiut, Beni Suef and Qena from data supplied by governorates others from central governorate budgets.

Several of the settlements with very high population growth rates have not been able to fund operations and maintenance at levels which have been adequate to keep pace with their growing populations. This has been especially true of Suez. These rates of increase have also been generally lower than average urban governorate per capita marginal costs growth rates and in some infrastructure have been lower than average growth rates in marginal costs of the 10 settlements shown in Table B-29. Continued low levels of funding of operations and maintenance of infrastructure will seriously hamper future expansion of Suez making it less attractive to future private development and posing a serious constraint to Suez achieving its year 2000 master plan targets or its becoming a counter magnet to Cairo and Alexandria.

Tariff studies for water, sewerage and electricity master plans projected future requirements for operations and maintenance. However, since future resources for operations and maintenance generally depend on the degree to which individual infrastructure utilities are able to finance their own operations through revenues generated from user charges, these masterplans have assumed that full cost recovery of operations and maintenance expense (including provisions for depreciation and debt servicing) are necessary to provide adequate financial resources to maintain existing infrastructure and provide for future requirements. To accomplish this objective, the masterplans have assumed that most of the increase in operations and maintenance requirements, and therefore demand for revenues, must come in initial periods of their twenty year planning periods so that adequate resources can be built to finance future expansion. As shown in Table B-31, while the average growth rates in per capita operations and maintenance expenditures are roughly 9.5 percent per annum, the average growth rates of per capita expenditures in the first five period averages 24 percent, a rate which is six times the average population growth rate. Thus, substantial increases in tariffs implemented over a short period of time are necessary to provide adequate revenue bases for these increased expenditures. So far, these very rapid increases in tariffs have not proven politically feasible and have not been implemented.

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TABLE B-31
 PROJECTED ANNUAL RATES OF INCREASE IN OPERATIONS AND MAINTENANCE OF GREATER CAIRO,
 ALEXANDRIA AND THE CANAL CITIES (1980-2000)

SETTLEMENT	1980-1985 GROWTH RATES			1985-1990 GROWTH RATES			1991-2000 GROWTH RATES			1980-2000 GROWTH RATES		
	TOTAL OPERATING EXPENSE	POPULATION GROWTH	PER CAPITA OPERATING EXPENSE	TOTAL OPERATING EXPENSE	POPULATION GROWTH	PER CAPITA OPERATING EXPENSE	TOTAL OPERATING EXPENSE	POPULATION GROWTH	PER CAPITA OPERATING EXPENSE	TOTAL OPERATING EXPENSE	POPULATION GROWTH	PER CAPITA OPERATING EXPENSE
<u>GREATER CAIRO</u>												
WATER	16.6	2.95	13.2	10.8	3.2	7.3	11.3	3.53	5.3	11.3	3.30	7.7
SEWERAGE	26.8	2.95	23.1	9.6	3.2	6.2	8.1	3.53	4.4	17.9	3.30	9.2
<u>ALEXANDRIA</u>												
WATER	12.9	1.79	10.7	7.8	2.25	5.5	9.9	4.14	5.6	10.2	3.12	6.8
SEWERAGE	35.9	1.79	33.5	16.9	2.93	13.6	4.9	2.93	1.9	15.0	2.64	12.0
<u>PORT SAID</u>												
WATER	20.0	3.82	15.6	14.1	3.86	9.9	8.7	3.84	4.6	12.8	3.84	8.6
SEWERAGE	33.7	3.82	28.9	10.4	3.86	6.3	6.9	3.84	2.9	14.0	3.84	9.8
<u>ISMAILIA</u>												
WATER	20.0	4.35	19.9	14.1	3.98	8.1	8.7	4.51	5.94	12.8	4.34	9.8
SEWERAGE	39.6	4.35	33.8	11.9	4.32	7.2	9.2	4.32	4.67	16.8	4.33	12.0
<u>SUEZ</u>												
WATER	30.7	7.08	22.0	12.4	7.06	5.0	11.8	7.07	4.4	16.4	7.07	8.7
SEWERAGE	48.8	7.08	38.9	14.6	7.06	7.2	6.3	7.07	(0.76)	17.8	7.07	10.0
AVERAGE			24.0			7.6			3.9			9.5

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SOURCE: Ibid, Management Tariff Studies Relative to Water Sewerage Systems. Water and Sewerage Utilities Volumes.

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3. PROJECTIONS OF FUTURE OPERATIONS AND MAINTENANCE COSTS OF INTRA-URBAN INFRASTRUCTURE

Two sets of projections of operations and maintenance costs illustrate the order of magnitude range of total future operations and maintenance costs. The first shows rates of increase in operations and maintenance costs if average rates of increase experienced between 1976 and 1980 continue over the twenty year planning period. The second shows rates of increase in operations and maintenance costs if the average growth rates projected by masterplans are achieved. Both projections illustrate the increase in operations and maintenance costs which might be necessary to provide incentives to skilled workers to induce them to migrate to more remote regions. In both projections, operations and maintenance expenditures rise at a faster rate than is projected for Gross Domestic Product (GDP). As a result, the share of these intra-urban infrastructure expenditures in GDP rises from seven percent in the 1970's to between thirteen and seventeen percent in the 1990's.

The first set of projections is based on per capita operations and maintenance costs shown in Table 1 for the 1980/81 budget period. Growth rates in per capita operations and maintenance were projected using the ratios of per capita operations and maintenance to population growth rates experienced between 1976 and 1980. Longer term time series data was not used due to distortions during war years. The ratios used are shown in Table B-29. Since incentives may be necessary to attract skilled workers away from the metropolitan areas to other areas of the country receiving special emphasis, the salaries components of the per capita operations and maintenance expenditures were increased by 100 percent to reflect both wage and non-wage compensation which must be paid to workers 1/. Table B-32 shows the standards used to estimate operations and maintenance costs for the alternatives.

1/ See Footnote 1 on page B-28 of Appendix B for discussion of the source of data for this level of incentive payment.

The second set of projections of operations and maintenance costs follow the methodology used for the first projection, however the average ratios of growth in per capita operations and maintenance to population growth rates projected by water and sewerage master plans for the 1980-2000 period were used to proportionately increase the rates in which operations and maintenance growth rates exceed population growth rates. These modifications are shown in Table B-32.

The projections of operations and maintenance costs follow trends already established by the capital costs of intra-urban infrastructure of the six settlement alternatives. The more concentrated alternative A has total operations and maintenance costs which are 25 percent lower than the more decentralized alternative C. This variation results from the higher per capita costs of operations and maintenance due to the need to offer special incentives to skilled workers to encourage them to migrate away from the metropolitan areas to settlements in Upper Egypt and the Remote Areas. It is highly likely that this variation is fairly conservative, as data about routine maintenance and intermediate inputs was not disaggregated enough to allow estimates of regional variations in those costs. These projections are shown on Table B-33.

These projections also illustrate the likely higher requirement for greater administrative costs in developing a new major metropolitan area to act as competitor to Cairo and Alexandria. The costs of B₁ Efficiency, the alternative which proposed development of a countermagnet in the Canal Zone, are roughly 14 percent higher than alternative A in the 1986/2000 period. Again, this variation results from increased operations and maintenance due to incentives. It is also due to the more rapid population growth rates which would be experienced in the Canal zone if year 2000 population targets are to be reached. These more rapid population growth rates necessitate more rapid increases in operations and maintenance costs than would be encountered in Alternative A to accommodate the rapidly increasing population. In last five year period, using master plan projected ratios of per capita operations and maintenance to population growth rates, the increase in B₁ Efficiency

TABLE B-32

TABLE B: OPERATIONS AND MAINTENANCE PACKAGES AND PACKAGES USED TO COST OPERATIONS AND MAINTENANCE FOR SETTLEMENT ALTERNATIVES

OPERATIONS AND MAINTENANCE PACKAGES	PARAMETERS							PACKAGES USED TO COST OPERATIONS AND MAINTENANCE IN ALTERNATIVES							REMARKS
	WATER	SEWERAGE	TRANSPORT	HEALTH	EDUCATION	SOCIAL AFFAIRS	OTHERS	CAIRO ZONE	ALEXANDRIA ZONE	DELTA ZONE	CANAL ZONE	NORTH UPPER EGYPT ZONE	SOUTH UPPER EGYPT ZONE	REMOTE AREAS ZONE	
I. URBAN CONCENTRATE SETTLEMENTS															
- PER CAPITA (L.E.)	4.14	1.90	4.89	6.22	11.17	0.84	10.17								
- EXISTING RATIO OF PER CAPITA O & M TO POPULATION GROWTH RATES	2.71	2.98	4.11	6.20	3.51	4.74	4.48	A	A		A				
- MASTERPLAN RATIOS OF PER CAPITA O & M TO POPULATION GROWTH RATES	3.63	3.99	5.51	7.25	4.11	5.54	5.24	B1EFF. B1EQU. B2EFF. B2EQU. C	B1EFF. B1EQU. B2EFF. B2EQU. C						
II. URBAN CONCENTRATE SETTLEMENTS WITH SPECIAL EMPHASIS															
- PER CAPITA (L.E.)	5.12	2.53	7.10	9.53	21.11	1.53	14.50								
- EXISTING RATIO OF PER CAPITA O & M TO POPULATION GROWTH RATES	2.71	2.98	4.11	6.20	3.51	4.74	4.48				B1EFF. B1EQU. B2EFF. B2EQU. C				
- MASTERPLAN RATIOS OF PER CAPITA O & M TO POPULATION GROWTH RATES	3.63	3.99	5.51	7.25	4.11	5.54	5.24								
III. OTHER SETTLEMENTS: NO EMPHASIS															
- PER CAPITA (L.E.)	2.65	1.34	1.84	8.14	18.37	0.79	4.74								
- EXISTING RATIO OF PER CAPITA O & M TO POPULATION GROWTH RATES	1.98	2.24	2.29	3.84	2.89	3.91	4.48			A		A	A	A	
- MASTERPLAN RATIOS OF PER CAPITA O & M TO POPULATION GROWTH RATES	2.65	3.00	3.07	4.52	3.38	5.23	5.24			B1EFF. B1EQU. B2EFF. B2EQU.		B1EFF. B1EQU.	B1EFF. B1EQU.		
IV. OTHER SETTLEMENTS: SPECIAL EMPHASIS															
- PER CAPITA (L.E.)	4.01	2.17	3.13	14.25	35.43	1.35	7.29								
- EXISTING RATIO OF PER CAPITA O & M TO POPULATION GROWTH RATES	1.98	2.24	2.29	3.84	2.89	3.91	4.48					B2EFF. B2EQU. C	B2EFF. B2EQU. C	B2EFF. B2EQU. C	
- MASTERPLAN RATIOS OF PER CAPITA O & M TO POPULATION GROWTH RATES	2.65	3.00	3.07	4.52	3.38	5.23	5.24								

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TABLE B-33

SUMMARY OF INTRA-URBAN TOTAL OPERATIONS AND MAINTENANCE COSTS BY SETTLEMENT ALTERNATIVES (1986-2000)

(L.E. MILLIONS)

SETTLEMENT ZONE	A*		B ₁ EFFICIENCY *		B ₁ EQUITY *		B ₂ EFFICIENCY *		B ₂ EQUITY *		C*	
	EXISTING GROWTH RATES	MASTER PLAN GROWTH RATES	EXISTING GROWTH RATES	MASTER PLAN GROWTH RATES	EXISTING GROWTH RATES	MASTER PLAN GROWTH RATES	EXISTING GROWTH RATES	MASTER PLAN GROWTH RATES	EXISTING GROWTH RATES	MASTER PLAN GROWTH RATES	EXISTING GROWTH RATES	MASTER PLAN GROWTH RATES
1986 - 1990												
GREATER CAIRO	4449	4788	4188	4506	4188	4506	4220	4541	4220	4541	4163	4480
ALEXANDRIA	1522	1638	1562	1682	1403	1510	1274	1370	1271	1370	1274	1370
CANAL	687	475	1192	1282	1192	1282	1015	1091	930	1000	896	963
DELTA	1294	1339	1220	1262	1029	1269	1244	1288	1242	1285	2226	2294
NORTH UPPER EGYPT	227	235	233	242	275	285	583	601	610	629	608	641
SOUTH UPPER EGYPT	423	438	434	450	503	521	1073	1106	1137	1160	1138	1174
REMOTE	74	77	75	77	93	95	189	195	209	215	361	350
TOTAL	8679	8993	8907	9503	8686	9471	9600	10195	9625	10204	10069	11274
1991 - 1995												
GREATER CAIRO	7879	8848	7025	7888	7025	7888	7119	7993	7119	7993	7011	7872
ALEXANDRIA	2872	3225	2658		2235	2510	2009	2256	2009	2256	2043	2294
CANAL	1132	820	3642	086	3642	4086	2189	2454	1919	2148	1740	1950
DELTA	2065	2180	1913	2020	1907	2013	2005	2117	1998	2110	3433	3600
NORTH UPPER EGYPT	324	342	301	318	412	435	1079	1131	1174	1232	1104	1157
SOUTH UPPER EGYPT	599	632	568	599	746	787	1981	2078	1986	2214	1906	2083
REMOTE	102	107	95	101	141	149	337	354	405	425	1291	1354
TOTAL	14977	16158	16206	17999	16112	17871	16722	18385	16614	18380	18611	20313
1996 - 2000												
GREATER CAIRO	13775	16151.555	11699	13715.	11705	13722	12041	14117	12041	14117	11794	13827
ALEXANDRIA	5168	6061.366	3821	4479	3140	3681	3181	3729	3181	3729	3125	3663
CANAL	1864	1408.161	11054	12936	11054	12936.1	4741	4959	3581	4187	3054	3570
DELTA	3300	3553.225	2998.	3228	3003	3234	3374	3633	3396	3657	5270	5606
NORTH UPPER EGYPT	456	491.203	373.	402	544	586.	1870	1995	2040	2177	2129	1951
SOUTH UPPER EGYPT	869	936.591	702.	755.	980	1055.	3458.	3684.	3642	3886	3244	3460
REMOTE	136	146.431	112.	121.	186	201.	568.	606.	715	752.	498	5326
TOTAL	25571	28758.532	30761.	35638.	30615.	35417.	28737.	32726	28600	32507	33608	37407
TOTAL 1986 - 2000	49,228.	53,901.	55,874	63,140	55,413	62,759	55,059	61,306	54,839	61,391	52,869	68,994

* TOTAL MAY NOT ADD DUE TO ROUNDING

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operations and maintenance costs over alternative A becomes even more pronounced as it increases to 24 percent. This much more rapid increase in operations and maintenance results from the very high population growth rates, in excess of nine percent, needed in the Canal Zone to achieve year 2000 target populations. Such very dramatic resource requirements in one zone would very likely cause resource constraints throughout the entire settlement system if adequate resources are allocated to the Canal Zone to establish a counter magnet in Suez at the size suggested in B₁ Efficiency.

4. COST RECOVERY OF OPERATIONS AND MAINTENANCE COSTS OF INTRA-URBAN INFRASTRUCTURE

The discussion of operations of intra-urban infrastructure has so far focused on only one side of infrastructure financing, current expenditures. The other side of the recurrent financing of intra-urban infrastructure is the revenues which might be available to finance both operations and maintenance of infrastructure and requirements for expansion of infrastructure systems to serve new populations. As pointed out in the NUPS First Round Alternatives Working Paper (page 64), "the net amount of capital the government requires to finance infrastructure depends on the amount of capital investment which can be recovered from beneficiaries. Higher levels of cost recovery reduce future capital requirements as returns on investments from earlier periods can be used to finance development in later periods."

As the First Round Alternatives Working Paper (pages 64-74) provides a discussion of both direct and indirect cost recovery and projects additional capital requirements to finance infrastructure under both current and modified cost recovery policies, separate projections of total future revenue requirements for financing the settlement alternatives were not made. Current cost recovery policies result in deficits which are of such a magnitude that revenues would have to increase by 123 percent to meet current revenue requirements of intra-urban infrastructure in Greater Cairo, Alexandria, and the

Canal Cities 1/. This revenue increase would only provide financial resources for existing operations, it would not provide public utilities with a rate of return on their investment, nor would it provide a cash reserve which could be used to partially finance future expansion of infrastructure systems.

Variations in revenue requirements for settlement alternatives would follow trends already established by projections of operations and maintenance costs. The only major increases in revenue requirements over operations and maintenance would result from provisions for a rate of return on capital investment in infrastructure and possible increases in debt servicing requirements. Based on various master plan projections, this additional requirement would increase revenues over operations and maintenance costs of water, sewerage and transport systems by an average of six to eight percent.

1/ Table III-4, Page 68 of the NUPS First Round Alternatives Working Paper . 1981.

APPENDIX CMETHODOLOGY FOR ESTIMATING DIRECT INVESTMENT COSTS

Although much has been written about the causes of regional investment cost variations, the Study Team is unaware of any previous attempt to specify the effects of regional cost differences on investment requirements in a quantitative macroeconomic planning framework. The methodology developed by NUPS was outlined in the Working Paper on First Round Alternatives. In this section it is more fully described in order to provide a point of departure and framework for continuing regional economic analysis by the government. In the analysis undertaken by the Study Team, it was necessary to rely on a more limited number of variables than would have been desirable. Collection of regional economic data and follow-up evaluations of investment projects by government agencies in the future could improve the precision of the parameter estimates.

The estimation of direct investment costs was done in two stages. First, investment, employment and output relationships were examined using a national data. Historical data and the 1980-1984 Development Plan were analyzed to estimate the quantitative relationships between investment and both output and employment. From these the Study Team derived estimates of the average cost per new job by sector. The average cost per job by sector for the period 1986- 1990 is shown below:

Average Cost per Job. 1986-1990

	<u>Average Job Cost (1979 prices)</u>
Agriculture	LE 10,000
Mining, Manufacturing & Construction	7,400
Petroleum	333,000
Housing & Infrastructure	50,000
Services	4,400

The second stage in the methodology involved adjusting the average cost per job and total investment cost to account for the effects of regional cost

variations and differences in the spatial allocation of investment. Comprehensive city-specific data that might indicate the presence and extent of agglomeration economies was not available for the forty urban areas included in the study. As a measure of the current extent of agglomeration economies, the Study Team selected the ratio of mining, manufacturing and construction employment to total employment from the 1976 Census. The larger the share of employment in mining, manufacturing and construction the greater the agglomeration economies.

After extending the basic 1976 employment data to 1985 using a trend line projection, an index of regional cost variation in the average cost per industrial and service job was calculated from equation (1).

$$\text{Regional Cost Variation Index (RCVI)} = .5 \left(1 - \frac{\text{EMPMMCI}}{\text{TOTEMP}_i} \right) / \frac{\text{EMPMMC}}{\text{TOTEMP}_{\text{Cairo}}} \quad (1)$$

where:

EMPMMCI = employment in mining, manufacturing, and construction in city i

EMPMMC = employment in mining, manufacturing, and construction in Cairo.

TOTEMP = total employment in city i.

TOTEMP Cairo = total employment in Cairo.

The index value for a city measures the percentage deviation of the city average cost per job from the national average cost per job.

The element other than regional cost variation which determines the average cost per job is the growth management cost. Here, again, the Study Team could not locate either previous estimates of this cost or data from which it could be estimated. The functional form and parameter value used in the equation reflect a plausible relationship and value of average costs over a reasonable range of settlement growth rates.

The city-specific average cost per job formula is equation (2).

$$\text{Average Cost} = A g^4 \quad (2)$$

where:

g = city annual employment growth factor (eg 1.03 for 3%)

A = $\frac{\text{national average cost per job} \times (1 + \text{RCVI})}{(\text{national average annual employment growth factor})^4}$

The forty city-specific average cost curves form the basis by the calculation of total direct investment cost. The total direct investment cost calculation of the settlement alternatives that follow from population constraints and equal per capita allocations of new employment (B1 Equity, B2 Equity, and C) are straight-forward. From the 1985 employment base and the amount of new employment in the 1986-1990 period in each city (ΔL), the annual employment growth rate is calculated. The required investment in any city, for the five-year period, is $\Delta L \times Ag^4$. The total cost of the alternative for the five-year period is the sum of the forty city investment costs.

The settlement alternatives based on the least-cost principle (A, B1 Efficiency, and B2 Efficiency) require a different procedure. The least cost solution obtains when the marginal cost of job creation is the same in all areas receiving an investment allocation. Equation (3) is the city marginal cost curve (i.e. the change in total investment cost of adding or subtracting a unit of employment).

$$\text{Marginal Cost} = 5Ag^4 - 4Ag^3. \quad (3)$$

The solution procedure is to find the set of city employment growth rates that simultaneously equalize the forty marginal costs and allocate the target amount of employment growth. Figure C-1 shows in graphic form, the relationship between average cost and marginal cost, and the least-cost solution at which the marginal costs of two cities are equal.

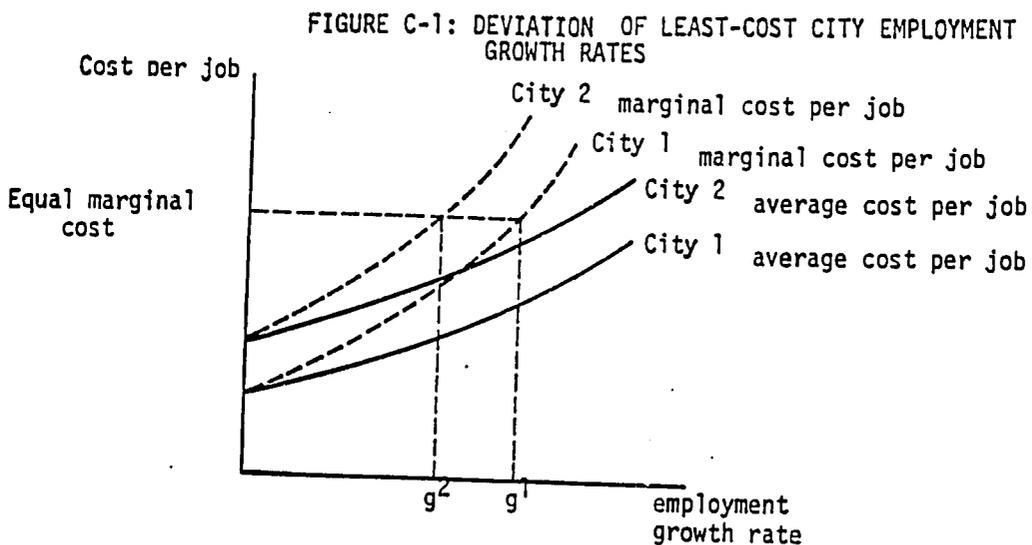
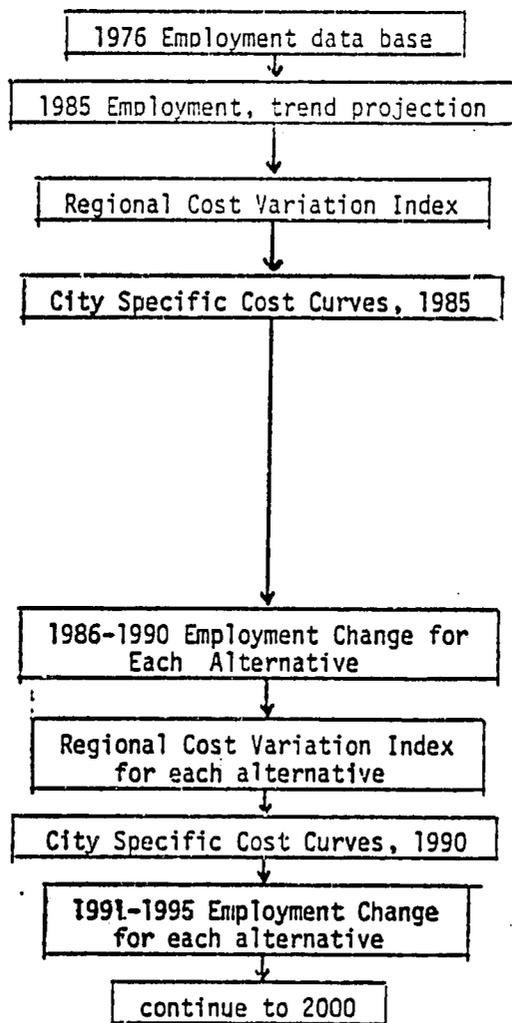


DIAGRAM C-1FLOW COST OF DIRECT INVESTMENT COST ESTIMATION

After completing the employment allocations for the period 1986-1990, a new regional cost variation index is calculated for each alternative. The procedure described above is then repeated for the 1991-1995 and 1996-2000 periods. Diagram C-1 illustrates the sequence of steps that leads to the direct investment cost estimates.

APPENDIX D

EVALUATION SUMMARIES OF ALTERNATIVES

This appendix provides summary evaluation information by alternative.
The tables show:

- (1) the criteria on which each alternative was most highly ranked;
- (2) the criteria on which each alternative ranks lowest; and
- (3) the distribution of ranks on all criteria for the alternative.

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TABLE D-1
ALTERNATIVE A

<u>CRITERIA ON WHICH ALTERNATIVE RANKS HIGHEST</u>	<u>AVERAGE RANK ^{1/}</u>	<u>CRITERIA ON WHICH ALTERNATIVE RANKS LOWEST</u>	<u>AVERAGE RANK ^{1/}</u>
1. Economic Efficiency	1.0	1. Reduction of Rural to Urban Migration	5.4
2. Least Risk of Exceeding Real Resource Constraints	1.0	2. Political Acceptability	5.3
3. Least Risk of Exceeding Financial Constraints	1.1	3. Least Environmental Risks	5.1
4. Encouragement of Private Investment	1.1	4. Least Social Disruption due to Migration & Maintenance of Cultural & Family Ties	4.6
5. Implies Sustainable Settlement Growth Rates	1.1	5. Inter-regional Equity	4.1

D-2

NUMBER OF CRITERIA FOR WHICH
AVERAGE RANK IS:

<u>BETWEEN</u>	<u>1 - 2</u>	<u>2 - 3</u>	<u>3 - 4</u>	<u>4 - 5</u>	<u>5 - 6</u>	<u>TOTAL</u>
<u>Number</u>	11	3	2	2	3	21
<u>Percent</u>	52.4	14.3	9.5	9.5	14.3	100.0

^{1/} A Rank of 1 is considered best and a rank of 6 is worst.

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TABLE D-2

ALTERNATIVE B₁ EFFICIENCY

<u>CRITERIA ON WHICH ALTERNATIVE RANKS HIGHEST</u>	<u>AVERAGE RANK 1/</u>	<u>CRITERIA ON WHICH ALTERNATIVE RANKS LOWEST</u>	<u>AVERAGE RANK 1/</u>
1. Minimize Intrusion on Arable Land	1.4	1. Inter-regional Equity	5.6
2. Encouragement of Private Investment	1.9	2. Flexibility in Shifting Spatial Priorities	4.4
3. Least Risk of Exceeding Managerial Constraints	1.4	3. Ability to absorb expected urban population at acceptable service levels	4.0
4. Economic Efficiency	2.1	4. Reduction of Rural to Urban Migration	3.6
5. Least Risk of Unemployment	2.3	5. Implies sustainable settlement growth rates	3.6

NUMBER OF CRITERIA FOR WHICH
AVERAGE RANK IS:

<u>BETWEEN</u>	<u>1 - 2</u>	<u>2 - 3</u>	<u>3 - 4</u>	<u>4 - 5</u>	<u>5 - 6</u>	<u>TOTAL</u>
<u>Number</u>	2	8	8	2	1	21
<u>Percent</u>	9.5	38.1	38.1	9.5	4.8	100.0

1/ A Rank of 1 is considered best and a rank of 6 is worst.

TABLE D-3

ALTERNATIVE B₁ EQUITY

<u>CRITERIA ON WHICH ALTERNATIVE RANKS HIGHEST</u>	<u>AVERAGE RANK 1/</u>	<u>CRITERIA ON WHICH ALTERNATIVE RANKS LOWEST</u>	<u>AVERAGE RANK 1/</u>
1. Minimize Intrusion on Arable Land	2.36	1. Flexibility in Shifting Spatial Priorities	4.50
2. Reduce Rural to Urban Migration	2.50	2. Least Social Disruption	4.29
3. Least Environmental Risks	2.93	3. Least Risk of Exceeding Financial Constraints	4.14
4. Least Risk of Unemployment	3.21	4. Administrative Cost Minimization	4.07
5. Social Cost Minimization	3.21	5. Flexibility in Project Choice	4.00

NUMBER OF CRITERIA FOR WHICH AVERAGE RANK IS:

<u>BETWEEN</u>	<u>1 - 2</u>	<u>2 - 3</u>	<u>3 - 4</u>	<u>4 - 5</u>	<u>5 - 6</u>	<u>TOTAL</u>
<u>Number</u>	0	3	12	6	0	21
<u>Percent</u>	0	14.3	57.1	28.6	0	100.0

1/ A Rank of 1 is considered best and a rank of 6 is worst.

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TABLE D-4

ALTERNATIVE B₂ EFFICIENCY

<u>CRITERIA ON WHICH ALTERNATIVE RANKS HIGHEST</u>	<u>AVERAGE RANK 1/</u>	<u>CRITERIA ON WHICH ALTERNATIVE RANKS LOWEST</u>	<u>AVERAGE RANK 1/</u>
1. Political Acceptability	1.79	1. Minimize Intrusion on Arable Land	4.29
2. Least Social Disruption	2.00	2. Encouragement of Private Investment	3.79
3. Flexibility in Shifting Spatial Priorities	2.00	3. Economic Efficiency	3.57
4. Social Cost Minimization	2.21	4. Ability to absorb Expected Urban Population at Acceptable service levels	3.43
5. Ability to attract Foreign Investment	2.43	5. Risk of Exceeding Managerial Constraints	3.43

D-5

NUMBER OF CRITERIA FOR WHICH AVERAGE RANK IS:

<u>BETWEEN</u>	<u>1 - 2</u>	<u>2 - 3</u>	<u>3 - 4</u>	<u>4 - 5</u>	<u>5 - 6</u>	<u>TOTAL</u>
<u>Number</u>	1	10	9	1	0	21
<u>Percent</u>	4.8	47.6	42.9	4.8	0	100.1

1/ A Rank of 1 is considered best and a rank of 6 is worst.

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TABLE D-5
ALTERNATIVE B₂ EQUITY

<u>CRITERIA ON WHICH ALTERNATIVE RANKS HIGHEST</u>	<u>AVERAGE RANK 1/</u>	<u>CRITERIA ON WHICH ALTERNATIVE RANKS LOWEST</u>	<u>AVERAGE RANK 1/</u>
1. Inter-regional Equity	1.86	1. Minimize Intrusion on Arable Land	5.21
2. Least Social Disruption	2.14	2. Economic Efficiency	5.00
3. Reduce Rural/Urban Migration	2.50	3. Encouragement of Private Investment	5.00
4. Flexibility in Shifting Spatial Priorities	2.57	4. Flexibility in Shifting Sectoral Priorities	4.50
5. Political Acceptability	2.64	5. Risk of Exceeding Real Resource Constraints	4.50

D-5

NUMBER OF CRITERIA FOR WHICH
AVERAGE RANK IS:

<u>BETWEEN</u>	<u>1 - 2</u>	<u>2 - 3</u>	<u>3 - 4</u>	<u>4 - 5</u>	<u>5 - 6</u>	<u>TOTAL</u>
<u>Number</u>	1	4	6	9	1	21
<u>Percent</u>	4.8	19.0	28.6	42.9	4.8	100.1

1/ A Rank of 1 is considered best and a rank of 6 is worst.

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TABLE D-6

ALTERNATIVE C

<u>CRITERIA ON WHICH ALTERNATIVE RANKS HIGHEST</u>	<u>AVERAGE RANK 1/</u>	<u>CRITERIA ON WHICH ALTERNATIVE RANKS LOWEST</u>	<u>AVERAGE RANK 1/</u>
1. Inter-Regional Equity	3.00	1. Inter-personal Equity	6.0
2. Least Environmental Risks	3.42	2. Economic Efficiency	6.0
3. Political Acceptability	3.79	3. Encouragement of Private Investment	6.0
4. Reduce Rural/Urban Migration	3.86	4. Flexibility in Shifting Sectoral Priorities	6.0
5. Least Social Disruption	4.00	5. Least Risk of Exceeding Real Resource Constraints	6.0
		6. Least Unemployment	6.0
		7. Sustainable Growth Rates	6.0

0-7

NUMBER OF CRITERIAL FOR WHICH AVERAGE RANK IS:

<u>BETWEEN</u>	<u>1 - 2</u>	<u>2 - 3</u>	<u>3 - 4</u>	<u>4 - 5</u>	<u>5 - 6</u>	<u>TOTAL</u>
<u>Number</u>	0	1	3	2	15	21
<u>Percent</u>	0	4.8	14.3	9.5	71.4	100.0

1/ A Rank of 1 is considered best and rank of 6 if worst.

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