FEASIBILITY STUDY
ON
SHARQIYA WATER SUPPLY SYSTEM
IN
THE ARAB REPUBLIC OF EGYPT

EXECUTIVE SUMMARY

DECEMBER 1984

JAPAN INTERNATIONAL COOPERATION AGENCY

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P R E F A C E

In response to the request of the Government of the Arab Republic of Egypt, the Japanese Government decided to conduct a feasibility study on Sharqiya Water Supply System Project and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Egypt a preliminary survey team headed by Dr. Keiji GOTOH, Professor of Toyo University, from February to March, 1983.

The team had a series of discussions with the officials concerned of the Government of Egypt, and in particular with those of the National Organization for Potable Water and Sanitary Drainage (NOPWASD), thereby completing the Scope of Work for the Study.

After preliminary survey, the study team led by Mr. Osamu WAKAMOTO, Nihon Suido Consultant Co. Ltd., organized by JICA, made further field survey and data analyses based upon the Scope of Work, from July 1983 to December 1984, and the present report has been prepared.

I hope that this report will serve for the development of the Project and thereby contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Arab Republic of Egypt for their close cooperation extended to the team.

December, 1984

Keisuke Arita

Keisuke ARITA
President
Japan International Cooperation Agency

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Abbreviation

km	:	kilometer
m	:	meter
cm	:	centimeter
mm	:	millimeter
km2	:	square kilometer
ha	:	hectare
m2	:	square meter
cm2	:	square centimeter
m3	:	cubic meter
l	:	liter
ml	:	milliliter
cm3	:	cubic centimeter
ft	:	foot, feet
in or "	:	inch
lb	:	pound
kV	:	kilo volt
V	:	volt
kA	:	kilo ampere
A	:	ampere
MVA	:	mega volt ampere
kVA	:	kilo volt ampere
kW	:	kilo watt
kWh	:	kilo watt hour
Hz	:	hertz
a.c.	:	alternating current
d.c.	:	direct current
WL	:	Water Level
HWL	:	High Water Level
MWL	:	Mean Water Level
LWL	:	Low Water Level
Fig	:	Figure
No.	:	Number
DIP	:	Ductile iron pipe
SP	:	Steel pipe
PVC	:	Polyvinyl chloride pipe
ACP	:	Asbestos cement pipe
NOPWASD	:	National Organization for Potable Water and Sanitary Drainage, which was unified and organized with GOPW and GOSSD described below in 1981.
CAPMAS	:	Central Agency for Public Mobilization and Statistics
GOPW	:	General Organization for Potable Water
GOSSD	:	General Organization for Sewerage and Sanitary Drainage
JICA	:	Japan International Cooperation Agency

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The population of Sharqiya Governorate which was about 2.6 million in 1976 is estimated as about 3 million at present. Together with a rapid population growth, increasing water demand and superannuated supply systems with their limited capacity have resulted in a severe shortage of the potable water. In addition the groundwater is not fit for drinking purpose in the northern part of the Governorate due to salinity.

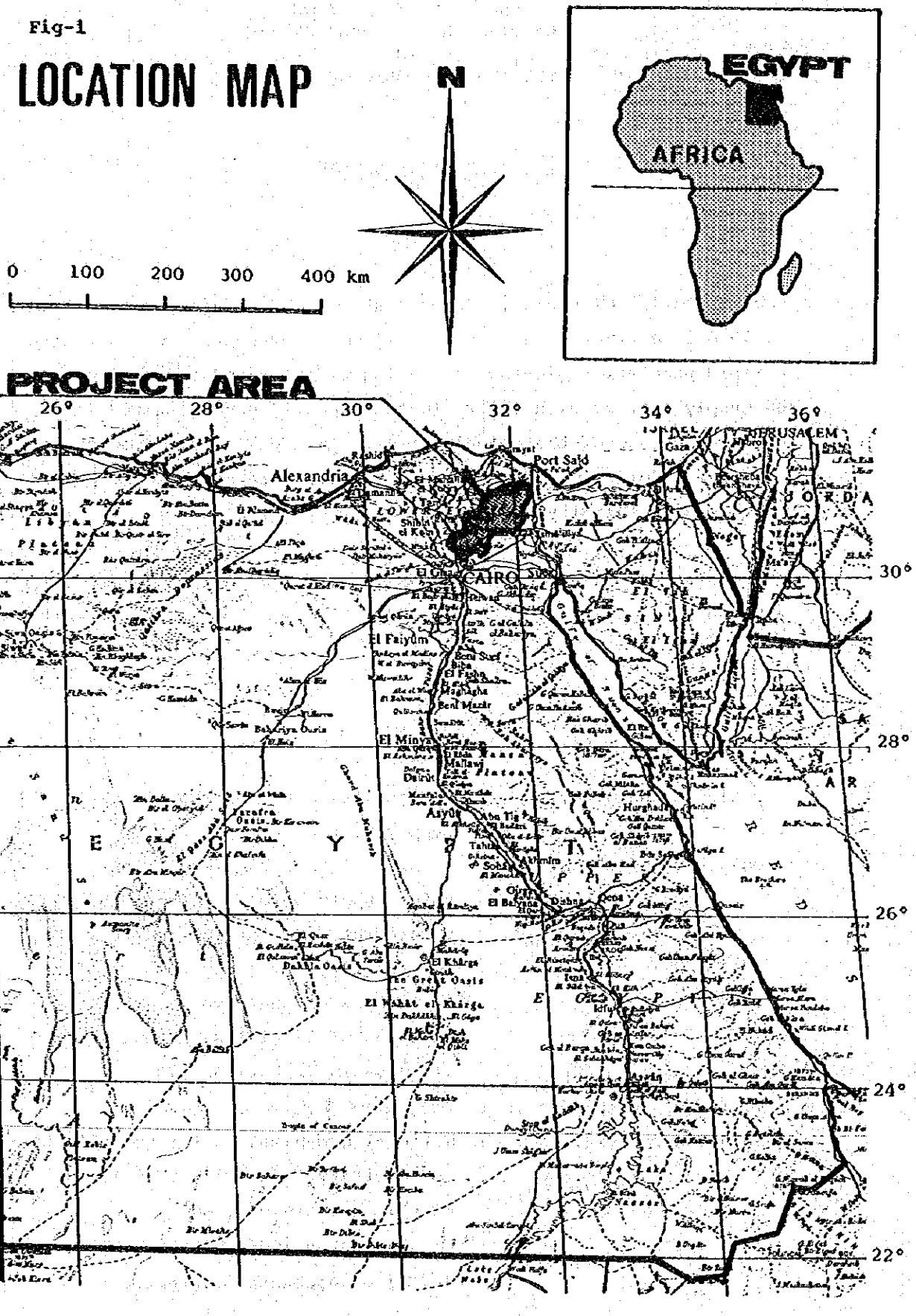
The present Study is planned to improve such severe condition from a broad standpoint.

I. General

Title of the Study	:	Feasibility Study on Sharqiya Water Supply System
Objective of the Study	:	To prepare the long term program for water supply development in Sharqiya Governorate and the feasibility study for the first priority phase program
Study Area	:	Whole area of Sharqiya Governorate, composed of 12 cities, 1 town and 460 villages in 12 Marakaz
Period of the Study	:	July 1983 - December 1984
Agencies Concerned	:	National Organization for Potable water and Sanitary Drainage (NOPWASD) of Egyptian Government, and Japan International Cooperation Agency (JICA) of Japanese Government

Fig-1

LOCATION MAP



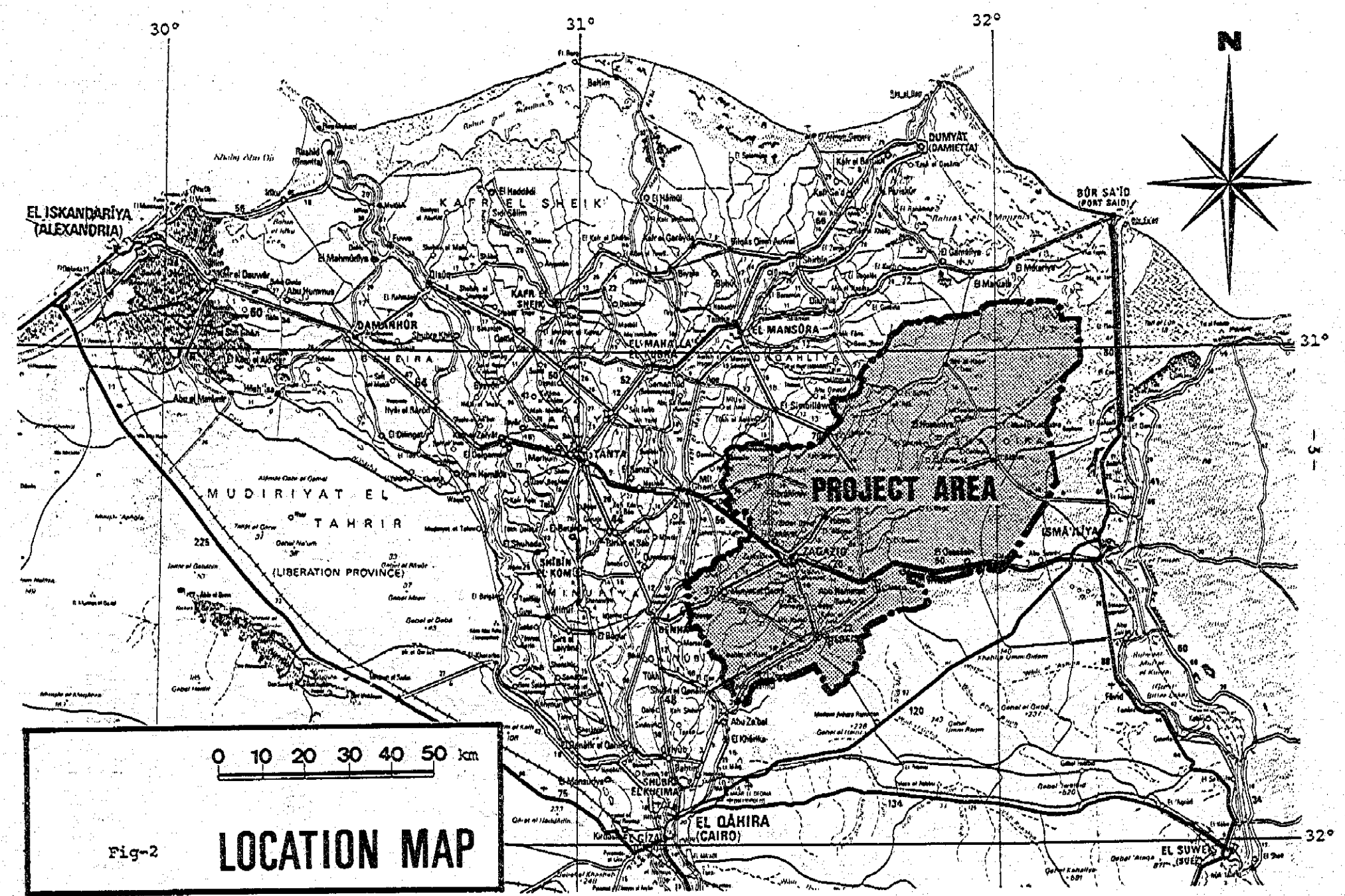


Fig-2 **LOCATION MAP**

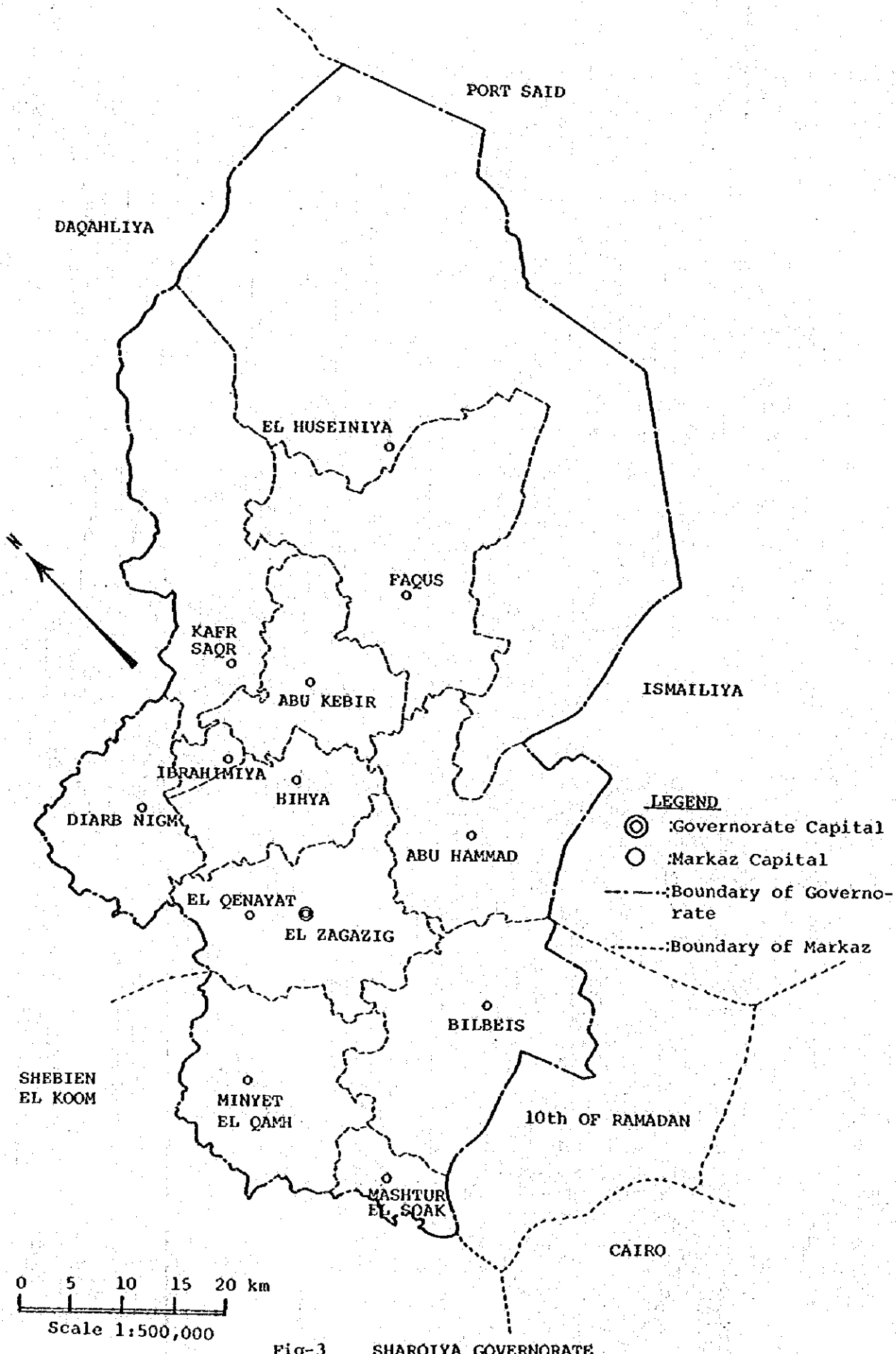


Fig-3 SHARQIYA GOVERNORATE

II. Long Term Program

1. Present Conditions of the Study Area

1.1 Natural Conditions

- Location and Topography : In the eastern part of the Nile Delta.
  4,000 km2 of area (about 100 km long and 40 km wide), consisting of 2,960 km2 of cultivated land, 240 km2 of residential area and 800 km2 of desert.
  3 m to 10 m above sea water level in ground elevation.
  Capital of the Governorate: Zagazig City, located 80 km northeast of Cairo.
- Climate : Hot and dry climate, with two distinct seasons of summer and winter.

  Average maximum temperature = 32.5°C (summer), or 18.6°C (winter)

  Average minimum temperature = 19.8°C (summer), or 7.9°C (winter)

  Average rainfall = 13.8 mm/year

  Average humudity = 54% - 60%

1.2 Socioeconomic Conditions

- Land : Agricultural land fertilized by deposit formed by the Nile River
- Population : 3,048,000 people, as of year 1983, in total,divided into 692,000 (23%) in urban areas and 2,356,000 (77%) in rural areas
- Economic Activity : Agriculture is most predominant and followed by some manufacturing industries.
- Employment : Agriculture, followed by employment in the government sector.
- Household Income : LE 100 - LE 200 per month on average
- Electrification : About 90% of urban people by public electricity, and 70% in rural areas
- Water Supply : All of urban municipalities (12 cities and 1 town) and 429 villages out of 460 in total are supplied with public water supply systems nominally, although current conditions are deemed unsatisfatory.
- Sanitary Sewerage : Existing both in Zagazig City and Faqus City

1.3 Population

- Population Record by National Census:

Year	Male	Female	Total
1882	227,768	229,663	457,431
1897	367,615	367,270	734,885
1907	435,076	437,397	872,473
1917	462,884	475,108	937,992
1927	521,377	550,752	1,072,129
1937	575,412	597,046	1,173,458
1947	668,072	693,591	1,361,663
1960	913,878	905,920	1,819,798
1966	1,058,803	1,049,168	2,107,971
1976	1,334,860	1,283,078	2,617,938

- Rate of Population Increase: 2.30% per annum (1960 - 1976)

2. Existing Water Supply

2.1 General

The oldest water supply system in Sharqiya Governorate is Zagazig City-owned system which was constructed in 1909 with Muweis Canal water treated by sedimentation/filtration. The treated water was supplied to the central area of the city through cast iron pipelines which are presently still utilized as distribution mains.

Successively the second oldest systems were installed in 1928 in Bilbeis City with Ismailiya Canal water and in Minyet el Qamh City with groundwater. Currently, 9 cities have their own public water supply systems, and 3 cities and 1 town are supplied from Abbasa Regional Water Supply System which was started in operation in 1959.

In order to supply local villages in line with the national policy, a number of the Housing Department's water supply systems were constructed in the years from 1950 to 1956. The water source was the groundwater available locally. The area served by the Housing Department System was limited to the southern part of the Governorate, since in the northern part the groundwater was not potable due to salinity. Nowadays such systems operated by the Housing Department have come to serve 189 villages in 7 Marakaz.

For the purpose of supplying drinking water to the area which had been left unserved by the city-owned and Housing Department systems and had no public water supply, Abbasa Regional Water Supply System was completed in 1959. To this end, one large treatment plant named Abbasa Water Treatment Plant was constructed at Abbasa in Abu Hammad Markaz,at a site along Ismailiya Canal.

The plant has been treating the surface water of the canal by rapid sand filtration process with chlorination afterwards. The treated water is

supplied to the northern area of the Governorate as well as the southern area, through long-distance transmission, helped by the distribution pumps in the plant and booster pumps on the way of transmission. In latter years, to supplement the production capacity, groundwater stations and so-called compact units treating canal water were added to the system.

The public water supply systems are classified into three types: 1) City-owned systems, 2) Housing Department's systems, and 3) Abbasa system.

Table-1 OUTLINE OF THE SYSTEMS

(Year 1983)

System	Water Source	Served Area	Production (m3/day)	Population in Served Area
1) City-owned	Canal water & groundwater or groundwater only	9 cities	84,976	607,000
2) Housing Dep.	Groundwater	189 villages	27,211	802,000
3) Abbasa	Canal water & groundwater	3 cities, 1 town and 240 villages	114,739	1,549,000
Total		12 cities, 1 town and 429 villages	226,926	2,958,000

2.2 Present Status

The basic data and figures on the existing water supply systems are summarized and tabulated in the following pages.

Table -2 Summary of Water Supply Status (1) Year: 1983

(Sharqiya Governorate)

Water Supply System	Organization Belonging to:	Year of Commencement of Water Supply	Water Source	Number of Water Station	Production
1) City-owned Water Supply System	Each city office	1909 - 1954	Canal water plus ground water, or ground-water only	Treatment plant = 2 Ground-water station = 43	84,976 m^3/day
2) Housing Department's Water Supply System	Sharqiya Governorate	1950 - 1956	Ground-water	Ground-water station = 82	27,211 m^3/day
3) Abbasa Regional Water Supply System	Sharqiya Governorate	1959	Canal water plus ground water	Treatment plant = 1 Ground-water station = 14 Compact unit = 5	114,739 1/ m^3/day
Total				Treatment plant = 3 Ground-water station = 139 Compact unit = 5	226,926 m^3/day

Note: 1/ Out of 125,107 m^3/d of total production of the Abbasa System, 10,368 m^3/d is supplied to Ismilia Governorate.
(125,107 - 10,368 = 114,739 m^3/d)

Table -2 Summary of Water Supply Status (2) Year: 1983

(Sharqiya Governorate)

Water Supply System	Main Pipelines	Number of Personnel Engaged in Water Supply Job	Area Served by System	Total Population in Served Area	Per Capita Production
1) City -owned Water Supply System	217.8 km (24"-2")	811 persons	9 cities	670,000 persons	140 liters/day
2) Housing Department's Water Supply System	294.7 km (150 mm - 50 mm, ACP/SP)	554 persons	189 villages	801,873 persons	34 liters/day
3) Abbasa Regional Water Supply System	2,129.5 km (800 mm - 100 mm, CIP/ACP/SP)	450 persons	3 cities, 1 town and 240 villages	1,548,520 persons	74 liters/day
Total		1,815 persons	12 cities, 1 town and 429 villages	2,957,393 persons	77 liters/day

Table-2 Summary of Water Supply Status (3) Year: 1983

(Sharqiya Governorate)

Classification	Markaz	1983 Total Population	Water Supply System		
			Abbasa System	Housing Dept. System	City owned System
Urban Area (City/Town)	1) Zagazig City	257,000	-	-	Yes
	2) Huseiniya City	18,000	Yes	-	-
	3) Kafr Saqr City	17,000	Yes	-	-
	4) Faqus City	49,000	-	-	Yes
	5) Abu Kebir City	67,000	-	-	Yes
	6) Abu Hammad City	22,000	Yes	-	-
	7) Ibrahimiya City	23,000	-	-	Yes
	8) Hihya City	28,000	-	-	Yes
	9) Diarb Nigm City	27,000	-	-	Yes
	10) Bilbeis City	87,000	-	-	Yes
	11) Minyet el Qamh City	42,000	-	-	Yes
	12) Mashtul el Souk City	27,000	-	-	Yes
	13) Qenayat Town	28,000	Yes	-	-
	Total of Urban Population	692,000			
Rural Area (Villages)	1) Zagazig	356,000	Yes	Yes	-
	2) Huseiniya	211,000	Yes	-	-
	3) Kafr Saqr	219,000	Yes	-	-
	4) Faqus	287,000	Yes	-	-
	5) Abu Kebir	132,000	Yes	-	-
	6) Abu Hammad	206,000	Yes	-	-
	7) Ibrahimiya	60,000	Yes	Yes	-
	8) Hihya	99,000	Yes	Yes	-
	9) Diarb Nigm	185,000	-	Yes	-
	10) Bilbeis	238,000	Yes	Yes	-
	11) Minyet el Qamh	304,000	-	Yes	-
	12) Mashtul el Souk	59,000	-	Yes	-
	Total of Rural Population	2,356,000			
Grand Total of Population		3,048,000			

Table -3 Summary of Water Supply Status (4)

Population in Rural Areas (Villages) and Water Supply

In Year 1983

Markaz Villages	No. of Villages	Total Population in all Villages	No. of Villages Supplied by:			Total Population in Villages Supplied by:		
			Abbasa	Housing Department	Total	Abbasa	Housing Department	Total
1) Zagazig	70	356,000	28	26	54	222,734	118,573	341,307
2) Huseiniya	24	211,000	24	-	24	211,000	-	211,000
3) Kafr Saqr	41	219,000	40	-	40	216,758	-	216,758
4) Faqus	47	287,000	41	-	41	270,408	-	270,408
5) Abu Kebir	26	132,000	26	-	26	132,000	-	132,000
6) Abu Hammad	29	206,000	29	-	29	206,000	-	206,000
7) Ibrahimiya	17	60,000	14	1	15	51,564	5,847	57,411
8) Hihya	24	99,000	20	2	22	86,248	5,557	91,805
9) Diarb Nigm	42	185,000	-	42	42	-	185,000	185,000
10) Bilbeis	47	238,000	18	29	47	88,831	149,169	238,000
11) Minyet el Qamh	79	304,000	-	75	75	-	287,491	287,491
12) Mashtul el Souk	14	59,000	-	14	14	-	59,000	59,000
Total	460	2,356,000	240	189	429	1,485,543	810,637	2,296,180

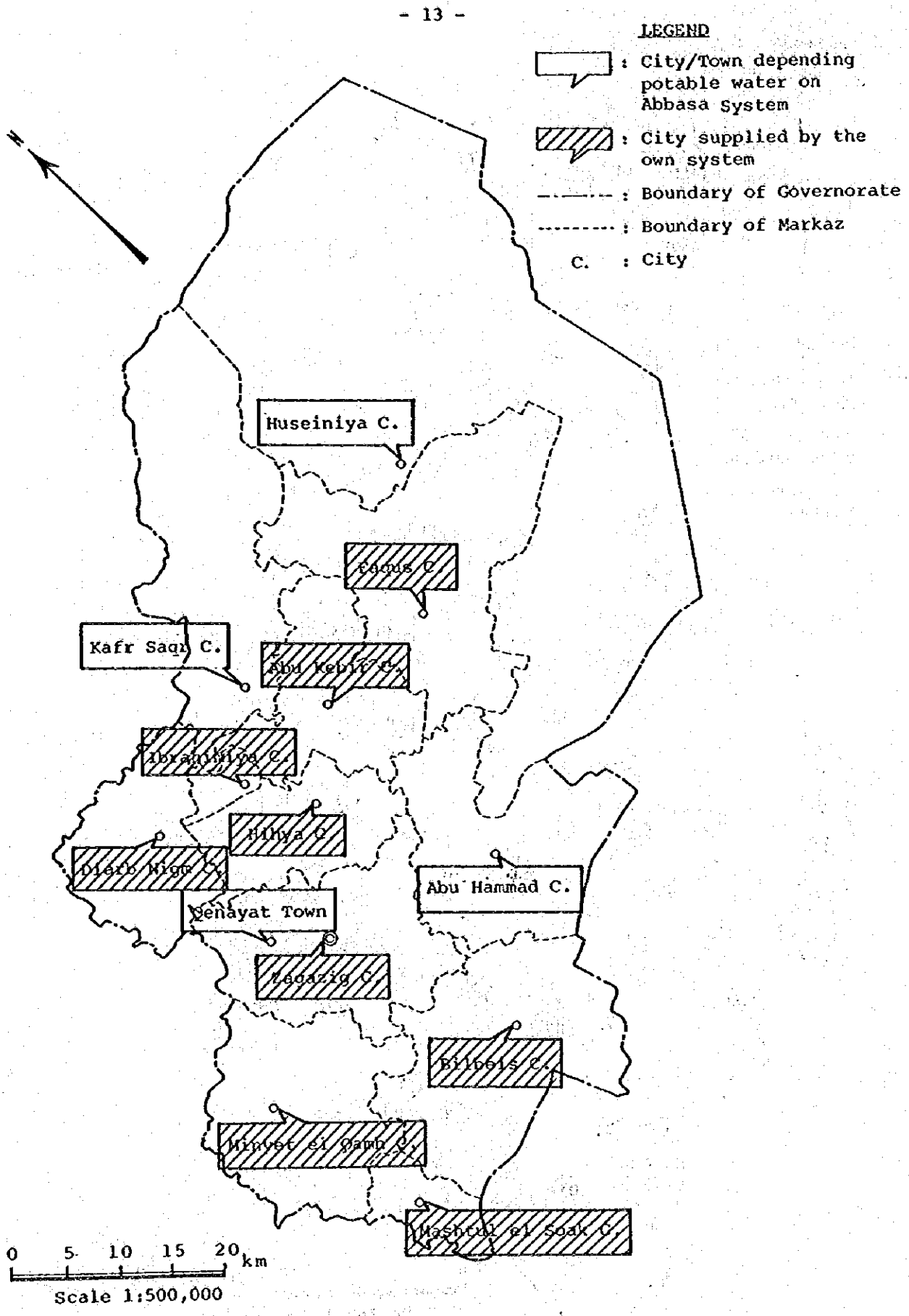


Fig -4 CITY/TOWN CATEGORIZED BY SUPPLY SOURCE

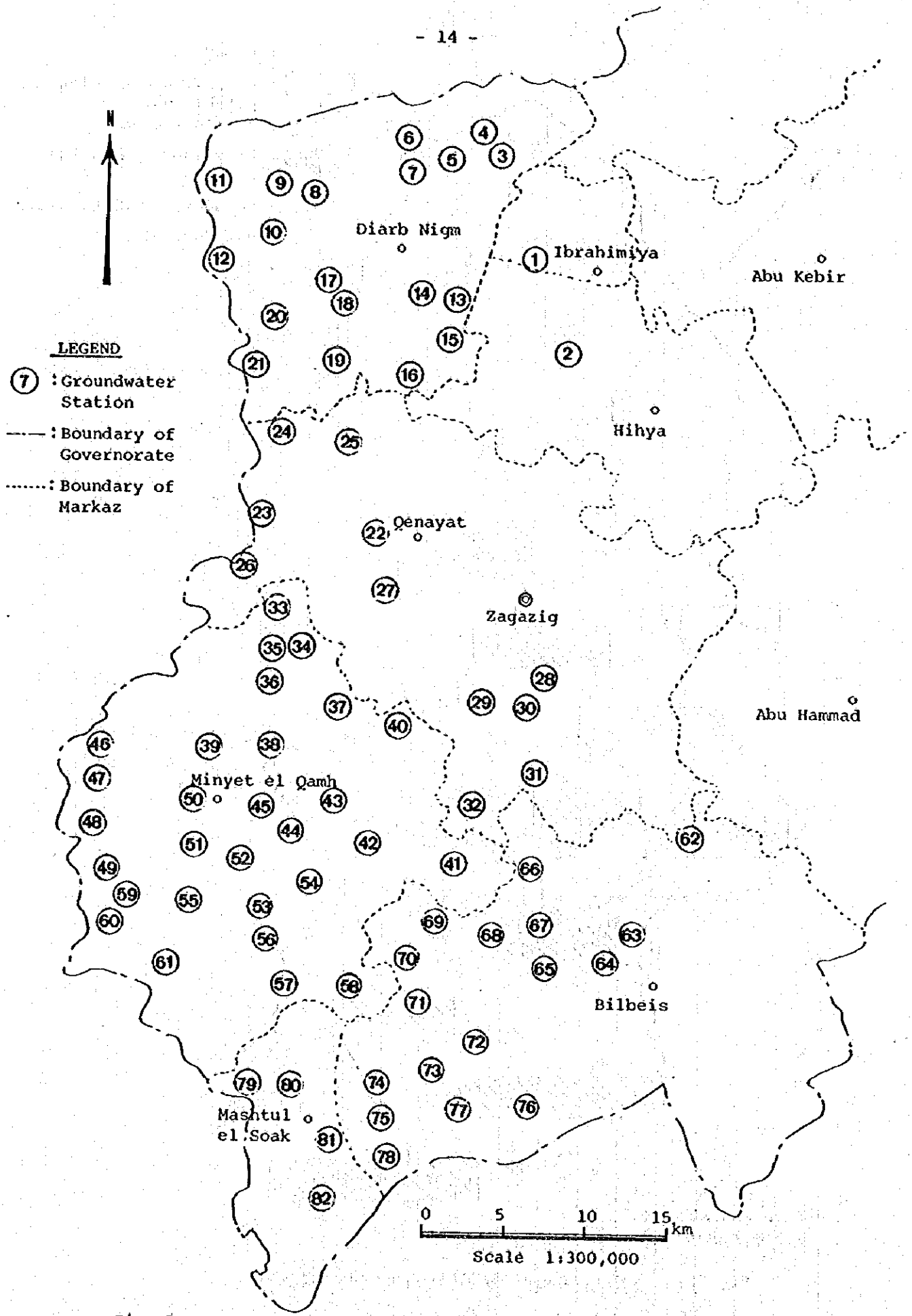


Fig -5 GROUNDWATER STATIONS OF HOUSING DEPERTMENT SYSTEMS

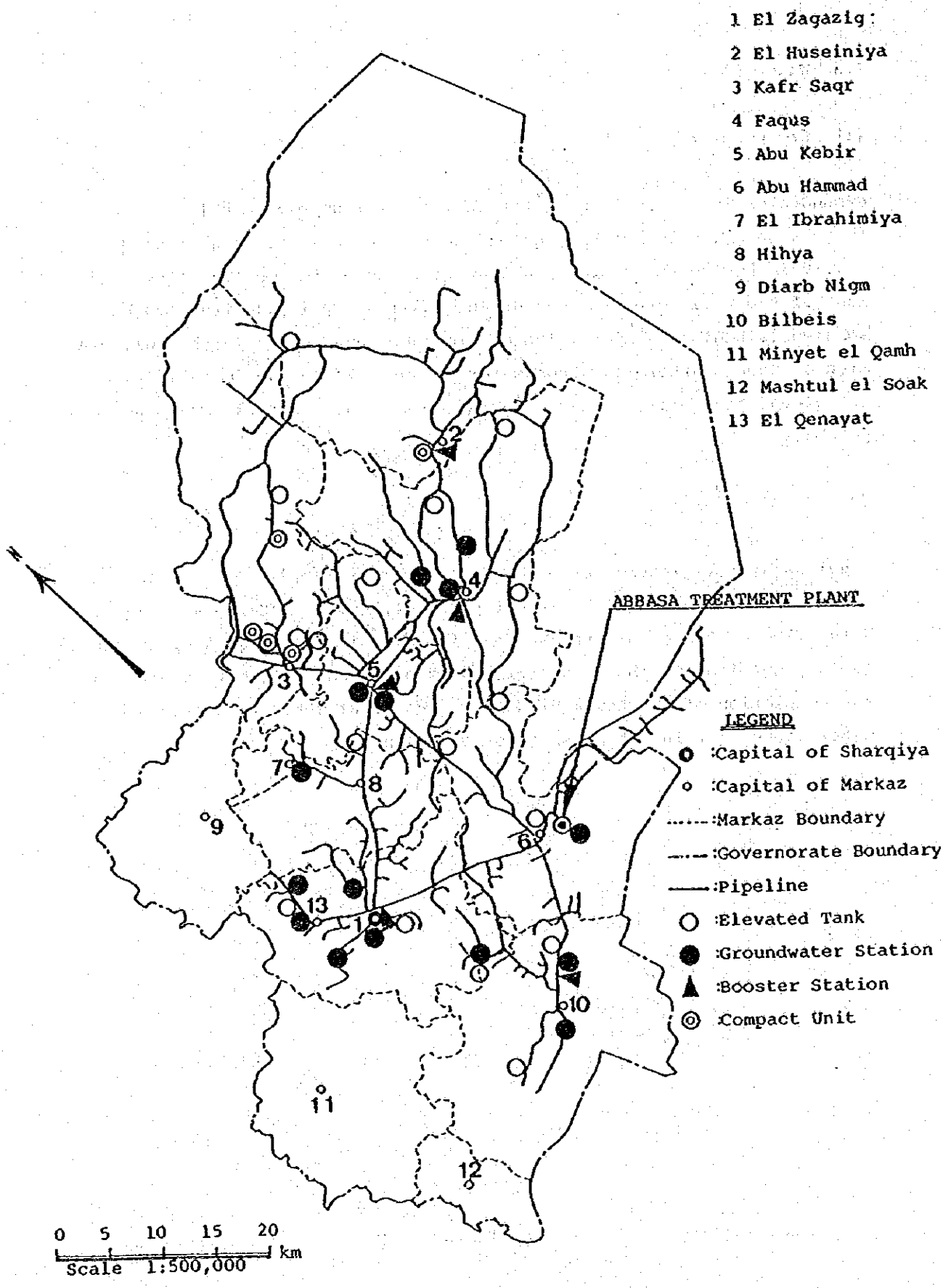


Fig-6 GENERAL PLAN OF ABBASA SYSTEM

2.3 Water Sources

(1) Groundwater

Groundwater is currently used for public water supply in all systems to a large extent. Existing groundwater deep wells are distributed mostly in the southern area and central parts of the Governorate. Most of the well water is considered satisfactory in quality though some wells contain a high value of iron and manganese. In the nprthern area of the Governorate, groundwater is not potable due to salinity. The groundwater will be used even in the future to a full extent where potable.

(2) Canal Water

Canal water, originating from the Nile River, is used as the water source of three existing treatment plant of Abbasa, Zagazig and Faqus. Water flow of the canals is abundant in general and the quality is satisfactory chemically, though overgrouth of algae has been noticeable since the completion of the Aswan High Dam. The canal water is a promising water source for future water treatment plants.

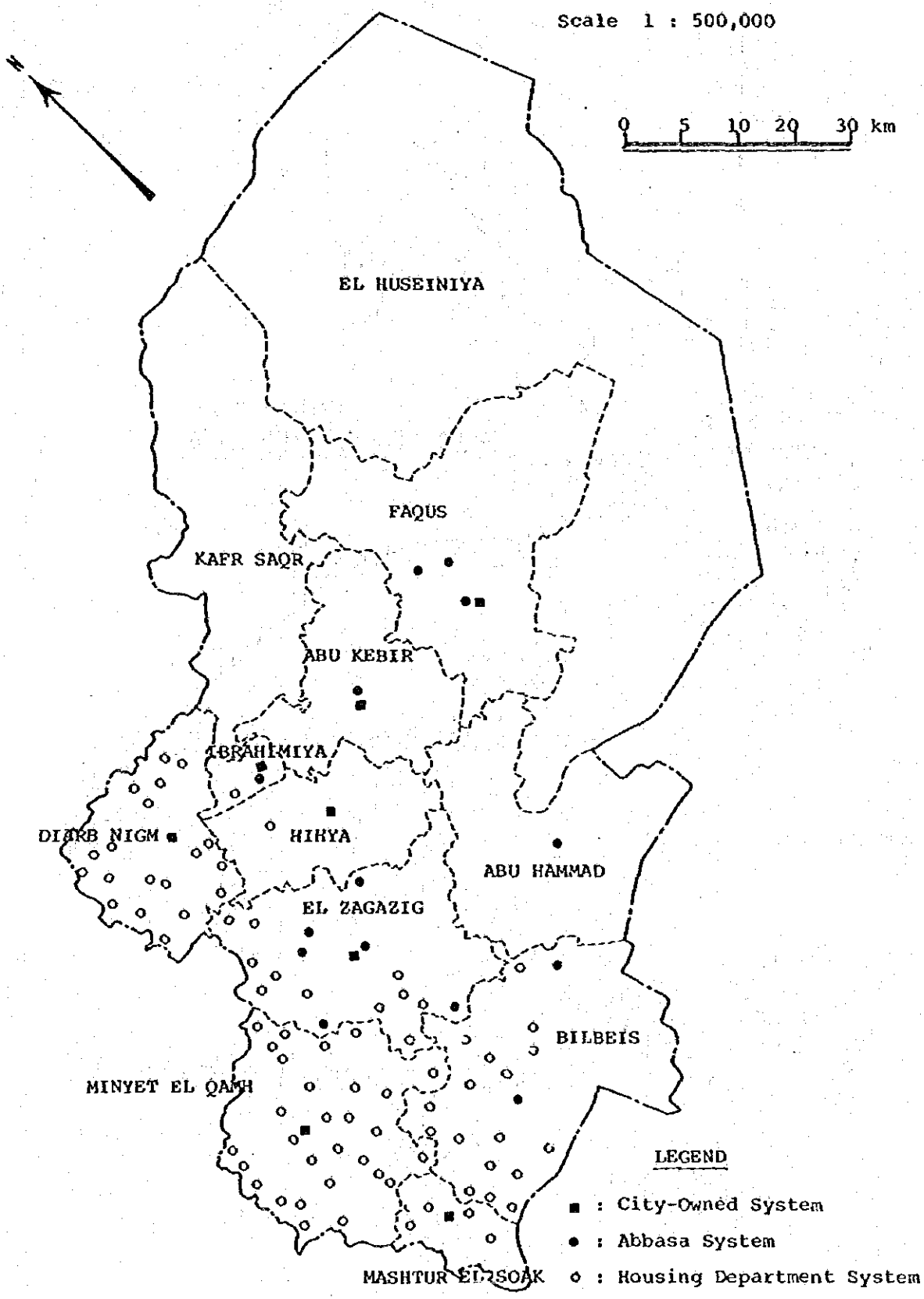


Fig -7 EXISTING GROUNDWATER STATIONS

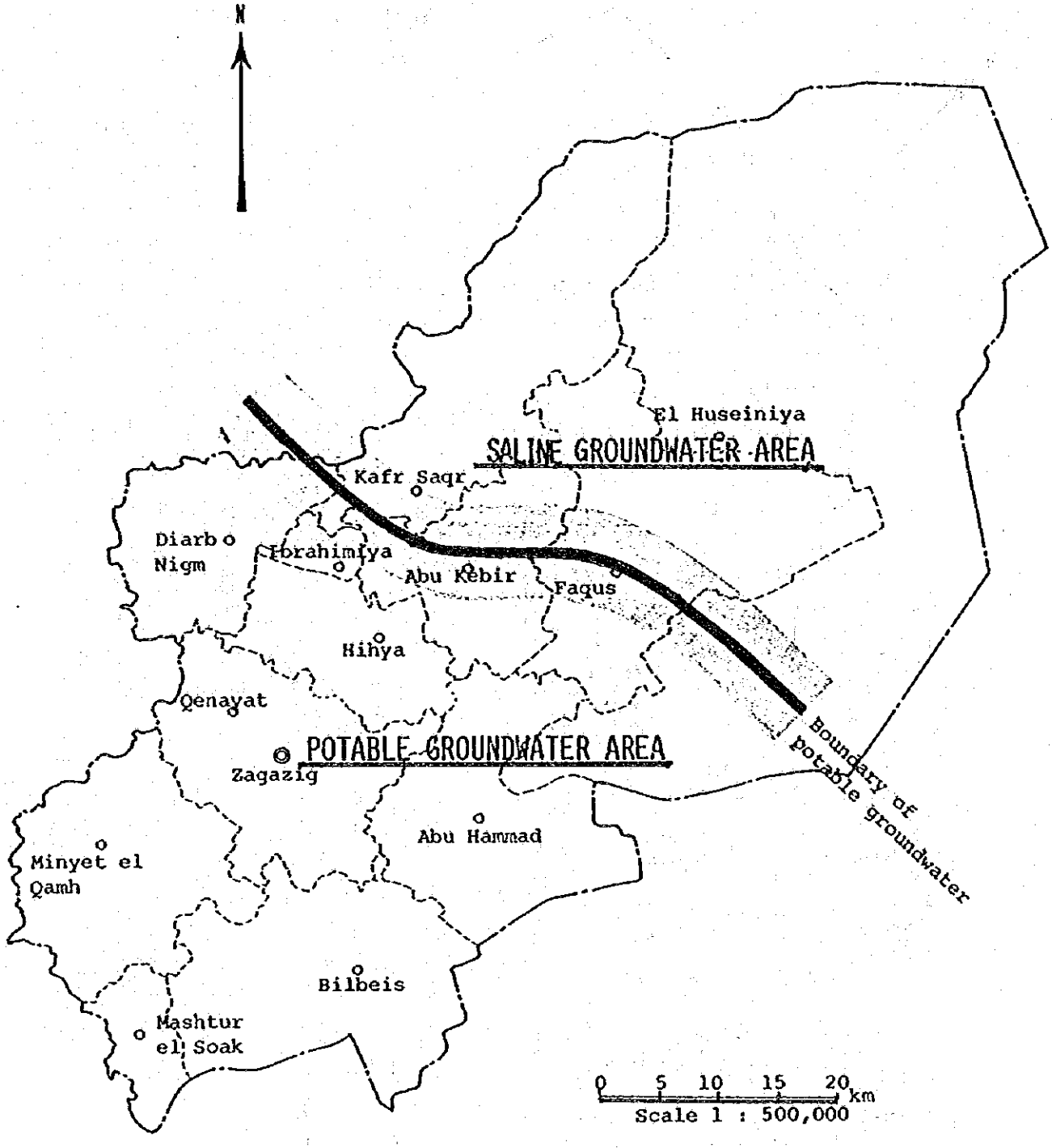


Fig-8 AREA OF POTABLE GROUNDWATER

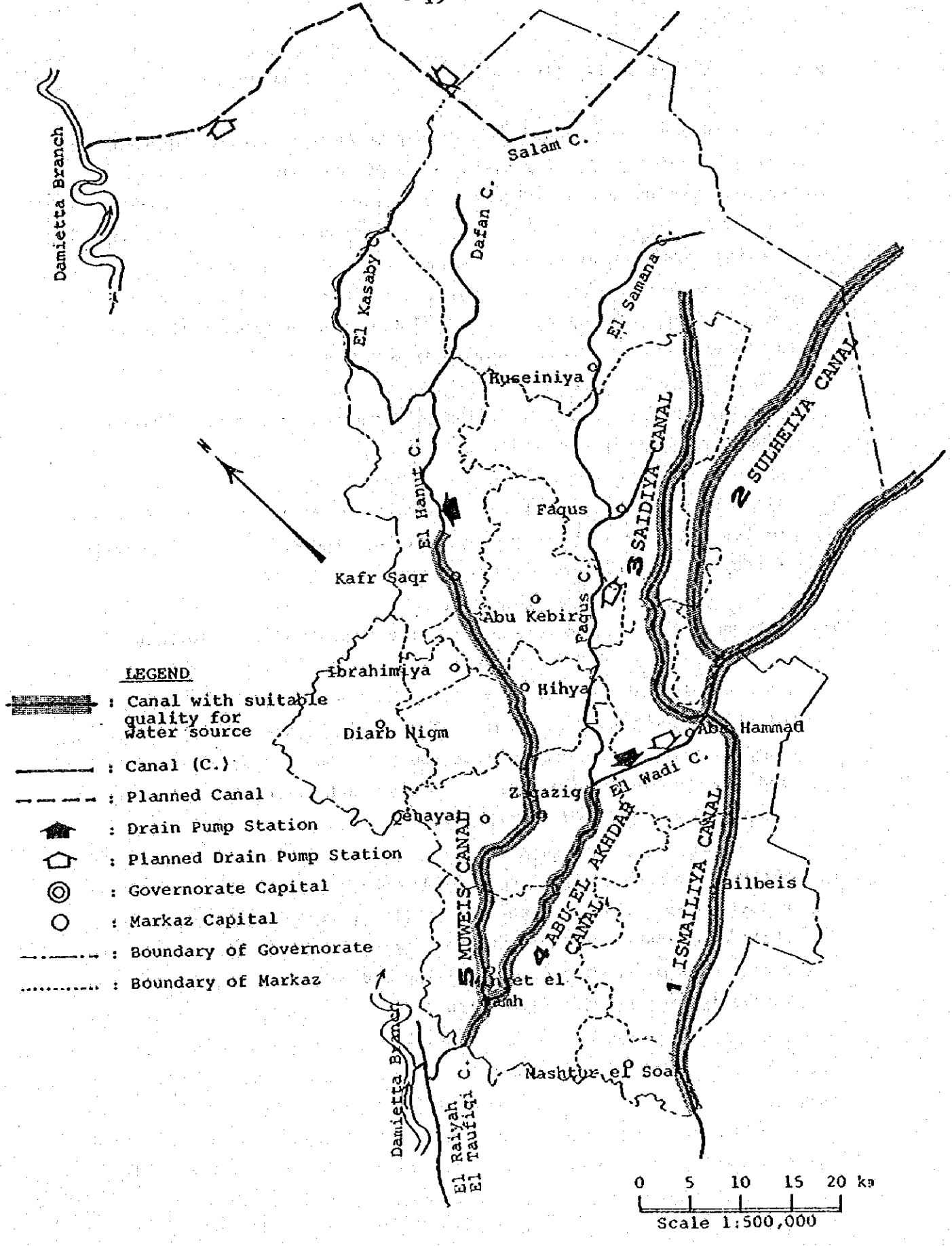


Fig -9 CANALS WITH SUITABLE QUALITIY FOR WATER SOURCE

2.4 Leakage of Pipelines and Service Installations

The field surveys were conducted from May to August 1984, at eight sites including two of Zagazig City system, two of the Housing Department system and four of Abbasa systems.

The findings are as follows:

- the loss of water by way of incompletely closed faucets at the households is substantial and it is a wastage,

- the leakage loss of water in the public pipelines seems to be less than anticipated,

- the overall loss of water due to the above mentioned causes is more or less than 60 % of the production, the figure found in the leakage survey of Beheira Governorate,

The recommendable means to correct the situation will be as follows:

- forming a party and assigning it to the task of reducing the pipelines leakage is necessary. They shall be well equipped with good tools, devices and machines essential to the works execution and a systematic preparation of the documents, records, materials and staff members is indispensable,

- The wastage problem shall be considered a matter of the consumers relationship. The management of public service department/division shall coordinate and integrate the works of wastage prevention with other works of reading meter, billing and collecting the tariff and installing the service facilities.

2.5 Institution and Management

(1) Organization Framework

The present organization responsible for the development of all provincial water supply systems is National Organization for Potable Water and Sanitary Drainage (NOPWASD) established in 1981 by President Decree No.197, 1981; and its headquaters is in Cairo, under the Ministry of Housing, Reconstruction and Land Reclamation.

As to operation and maintenance of existing water supply systems in Sharqiya Governorate, 1) Abbasa System is carried out by Abbasa Regional Water Supply Sub-Division in Housing Department of Sharqiya Governorate, 2) Housing Department System by Mechanical and Electrical Division in Housing Department of the Governorate, and 3) City-owned systems by Engineering Department of each city.

Above organizations are illustrated in the organization charts

(2) Financial Status

Abbasa System had been under direct financial control of NOPWASD of the central government until the recent national decentralization which has alienated the Abbasa water supply organization from the control of NOPWASD. Housing Department System had also been under the control of the central government, Ministry of Housing. The two water supply systems in addition to the city-owned water supply systems are presently under the control of Sharqiya Governorate which was given extended budgetary power and use of financial resorces by Local Government Decree No.43, 1979.

In general the expenditure and revenue are dealt separately without concerns for the normally practiced accounting procedures to consolidate the revenue and expenditure in one accounting system. Their revenue can not be used for their own expenditure but are reverted to general treasury of Ministry of Finance and in return their expenditure are subsidized by fund from the central government providing, however, within the limit of the

approved budget. It is apparent that the local entities have not been provided sufficient fund allocation for the required renewal and maintenance of the facilities due to scarce resources of the central government and its restriction for subsidy allocations.

(3) Water Rates

Present water rates are shown below. The prevailing water rate in the Governorate is 2.0 Piasters per cubic meter.

Water Rate Table

(1984)

System	Water Rate (per m3)
1) City-owned System	
- Zagazig City	Pts 2.5
- Huseiniya City	2.5
- Kafr Saqr City	2.0
- Faqus City	2.5
- Abu Kebir City	2.0
- Abu Hammad City	2.0
- Ibrahimiya City	2.0
- Hihiya City	2.0
- Diarb Nigm City	2.5
- Bilbeis City	2.0
- Minyet el Qamh City	2.0
- Mashtul el Souk City	2.0
2) Housing Department System	Pts 2.0
3) Abbasa System	Pts 2.0 for domestic use and commerce/shops, Pts 1.0 for hospitals and government buildings, Pts 0.5 for gymnasium and youth clubs, and Pts 1.0 for bulk water supply.

Note: Pts = Piasters (Pts 100 = LE 1.0)

Note: Water from standpipes maintained by Housing Department System and Abbasa System is free of charge.

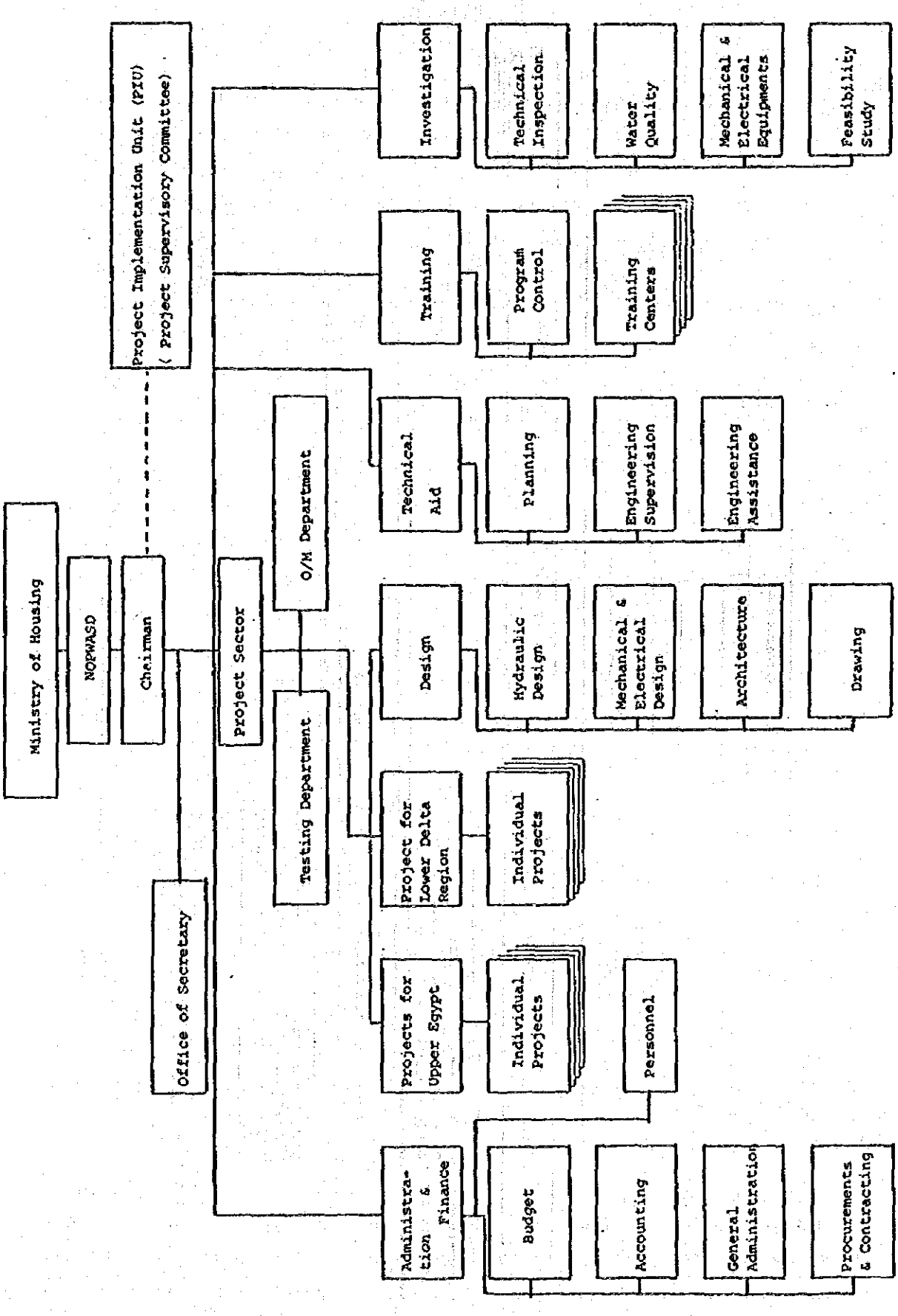


Fig -10 ORGANIZATION CHART OF NOPWASD

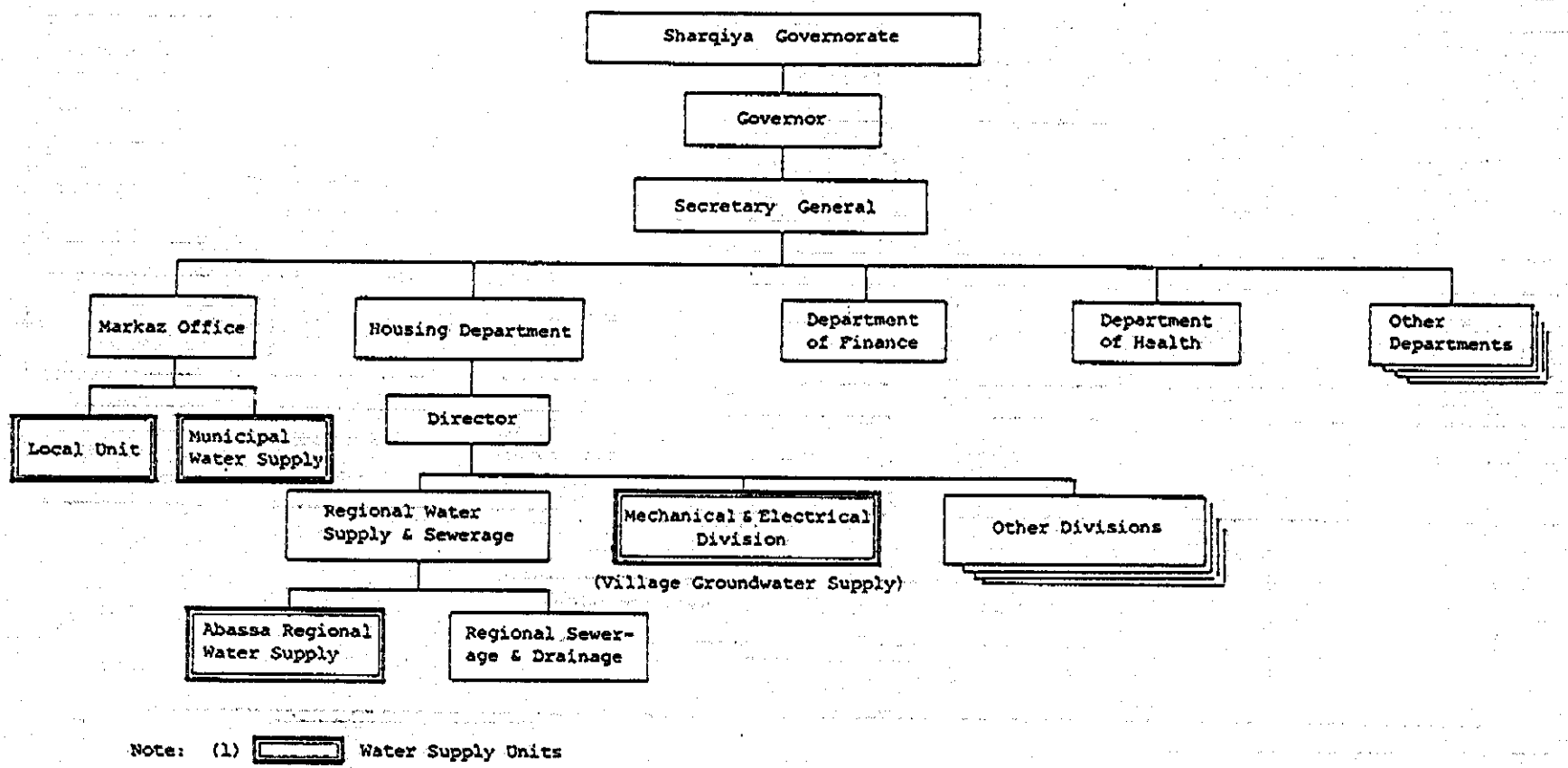


Fig-11 WATER SUPPLY ORGANIZATION OF SHARQIYA GOVERNORATE

2.6 Evaluation

Owing to the national policy which has been in effect so far to cover all of the Sharqiya Governorate area with potable water services, the service ratio is comparatively high, although the supply condition is not always sufficient. Incidentally the service ratio at urban areas of the Governorate is estimated at 87% in 1983, and at rural areas 73%.

Most facilities of the water supply systems are well designed and operated satisfactorily in spite of many difficulties to be solved as urgently as possible. Following are the evaluations of the existing systems from the standpoints of thechnical and managerial aspects.

- Shortage of Water Production and Delivery:
The quantity of water produced and delivered by the public supplies, is obviously short of the people's actual demands, especially in the urban areas. The people are forced to endure the present scarcity, it seems.

- Deterioration of Facilities:
Many facilities of the water supply systems, such as the mechanical/electrical equipment have deteriorated due to age, especially in the city-owned systems.

- Lack of Monitoring System:
No adequate monitoring system with sufficient communication media and transportation have been provided for early detection of troubles and routine maintenance of water supply facilities.

- Shortage of Skilled Manpower:
The number of personnel working for water supply is considered enough, or more than enough. However, the number of qualified, specialized, and skilled technicians, operaters, and laborers is seriously in shortage.

- Shortage of Budget:
The annual budget for water supply system is usually compiled for the regular works of operation and maintenance only and not for new works of construction and replacement. Considerable difficulties are found in constructing new systems for extending water supply. Special budgetary prepa-

ration is needed for it and under this situation, almost no special projects can be expected for realization.

- Dislocation of Resposibilities:

The existing water supply systems are operated by three separate entities. The distinction of the operative responsibilities among such entities is not clear and functions are sometimes tangled and fragmented to likely cause blaming the responsibilities on others. Such fragmentation of responsibilities prevents efficient and economical operation of the systems and well coordinated system planning.

- Deficiency of Required Functions:

The present activities of entities are mainly limited to day-to-day operation and maintenance of the system and no coordinated planning for the future development is effected. Exchanging technical informations and operational records has been seldom made each other. Further present entities maintain no satisfactory administrative functions to control the personnel and financial matters. Specific organizational units will therefore be required to reinforce the systematic operation.

- Low Wage:

The present wage level of the working staff is being kept low under strict government control and no incentive system is available. Under such practice, the morale of the working staff is not enhanced and they are not motivated to manage the quantity and quality of the work.

3. Plan for Long Term Program

3.1 General

- Target Year : 2005
- Served Area : Whole administrative area of Sharqiya Governorate, Excluding the area of 10th of Ramadan.

The population of Sharqiya Governorate estimated at about 3.0 million in 1983 will increase to 4.9 million in 2005. Together with the population increase, the rising living standard causes severe shortage of water. The future demand in 2005 will be 687,000 m3/day which is about 3 times the existing supply capacity of the systems, 227,000 m3/day.

Characteristics between urban and rural areas are greatly different in magnitude of water demand and water sources of water supply system.

The rural area is to be supplied by groundwater due to limited water demand and isolation of the area. The urban area will be covered by treated canal water because of comparatively concentrated and large capacity of water demand. The northern part of the Governorate including the rural area will be supplied with treated canal water due to its salinity of groundwater.

In principle, existing groundwater stations and treatment plants will be used continuously in future with periodical rehabilitation and/or replacement work.

The capacity to be expanded will be 309,000 m3/day by canal water with four new treatment plants, and 151,000 m3/day by groundwater which will be obtained from groundwater statiions scattered mainly in the southern area of the Governorate. In addition the existing system 227,000 m3/day will be maintained with rehabilitation.

Four new treatment plants, planned from the technical and economical feasibleness fit for the lacality and dispersion of unforeseeable risks, will be constructed by 2005. The construction cost is estimated at LE 430.0 million at 1984 prices, including the rehabilitation and/or replacement cost of existing groundwater stations and pipelines.

3.2 Projection of Population and Water Demand

Year	Total Population	Served Population	Water Demand
1983	3,048,000	2,322,000	330,606 m3/day
1985	3,184,000	2,486,000	366,595 "
1990	3,550,000	2,927,000	465,782 "
1995	3,948,000	3,455,000	495,454 "
2000	4,391,000	4,203,000	614,451 "
2005	4,885,000	4,885,000	687,018 "

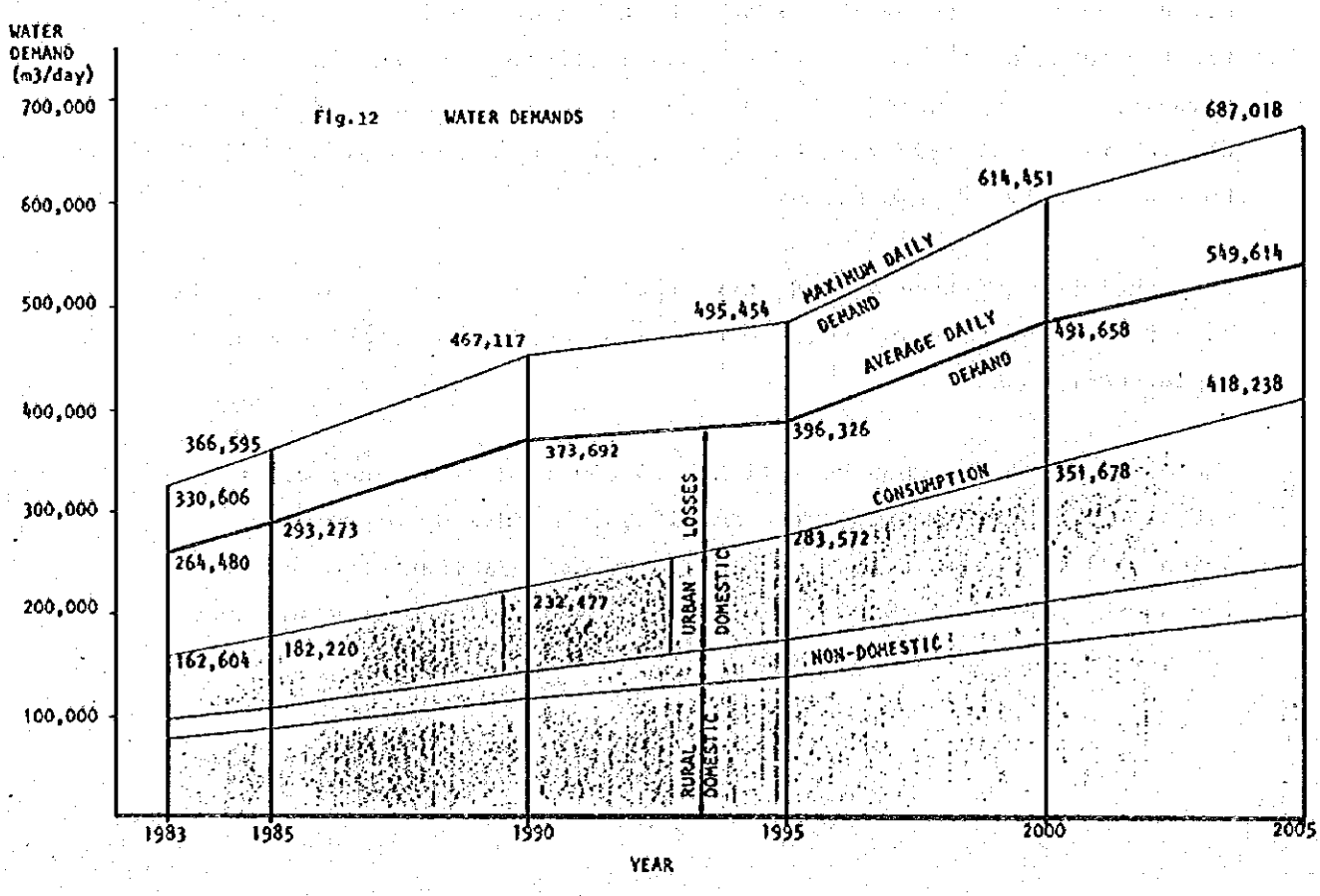


Fig.12 WATER DEMANDS

3.3 New Requirement of Supply Capacity

Total water demand in the whole area, on a daily maximum basis, will be:

- 495,400 m3/day in 1995, and
- 687,000 m3/day in 2005.

On the other hand, existing supply capacity is:

- 226,900 m3/day.

Therefore, in the future, the water requirement to be newly developed is:

- 268,500 m3/day by 1995, or
- 460,100 m3/day by 2005.

3.4 Planning of Water Supply System

(1) Concept of Future Development Plan

Between the urban area and rural area, characteristics of the water supply system such as the magnitude of water demand and water sources differ greatly; therefore, a development plan will be made separately.

The rural area will be categorized into four: A) By groundwater of the Housing Department System, B) From the existing Abbasa Plant, C) By groundwater of the Abbasa System, and D) From the new treatment plant.

The urban area into four: K) From the existing Abbasa Plant, L) By groundwater development, M) From the new treatment plant together with the city-owned water source, and N) From the new treatment plant.

The above concepts and categories are illustrated in the following figures.

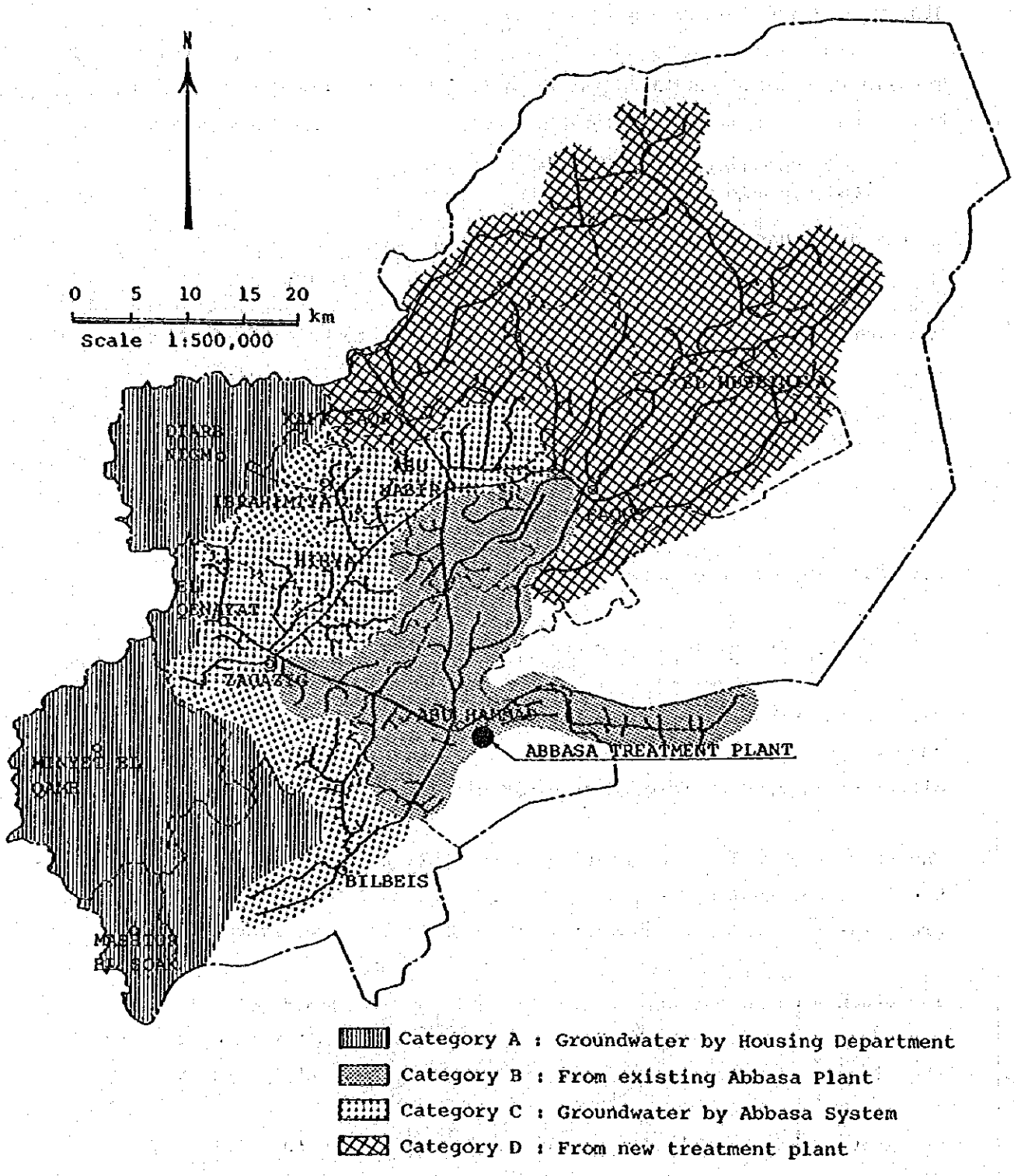


Fig -13 FUTURE WATER SUPPLY DEVELOPMENT PLAN OF RURAL AREA

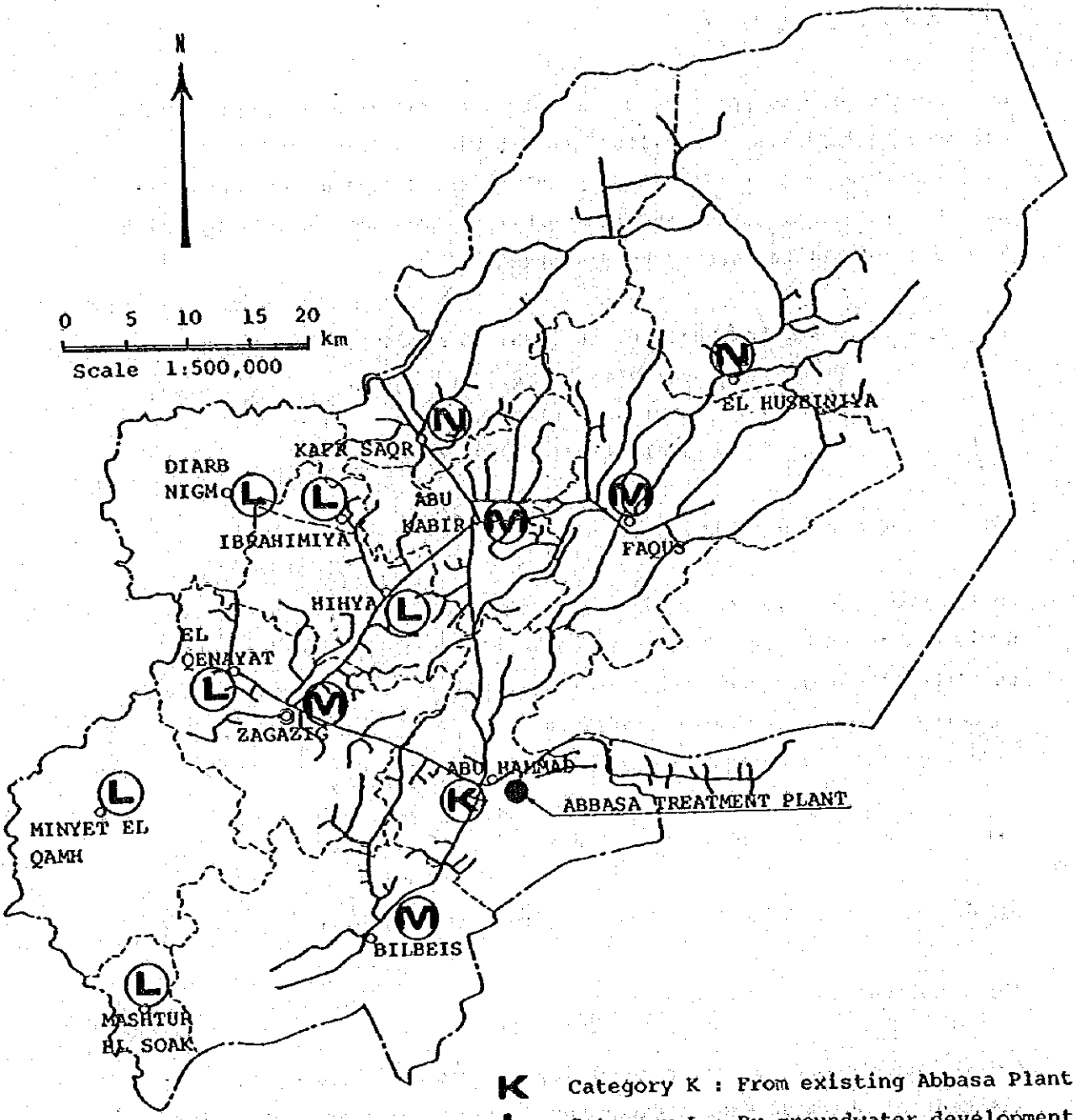


Fig -14 FUTURE WATER SUPPLY DEVELOPMENT PLAN OF URBAN MUNICIPALITIES

(2) New Treatment Plants

As a result of a comparative study for seven alternative plans of the new treatment plants, so-called Case B-5 Plan was selected as the most feasible plan from the standpoint of the construction and operation & maintenance costs, and the number of treatment plants by which unforeseeable risks were to be dispersed.

They are : New Northeast Plant (88,800 m3/day),
New Kafr Saqr Plant (59,600 "),
New Zagazig Plant (129,300 "), and
New Bilbeis Plant (31,300 ").

(3) Development of Groundwater

In the whole Sharqiya Governorate, by the year 2005, production to be newly developed by groundwater is estimated at 151,200 m3/day. To this end, about 117 new groundwater stations will be constucted (Ref. Capacity of one groundwater station = 30 l/sec x 12 hours = 1,296 m3/day on the average).

(4) Implementation Program

Please refer to the table and the figure attached.

(5) Institution and Management

For the development of water supply systems in the future, the establishment of Sharqiya Public Water Company (PWC) is proposed. Please refer to the organization charts.

(6) Construction Cost

Cost of construction for the long term program will be LE 430.0 million (LE = Egyptian Pounds; LE 0.82 = US$ 1.00) at 1984 price level.

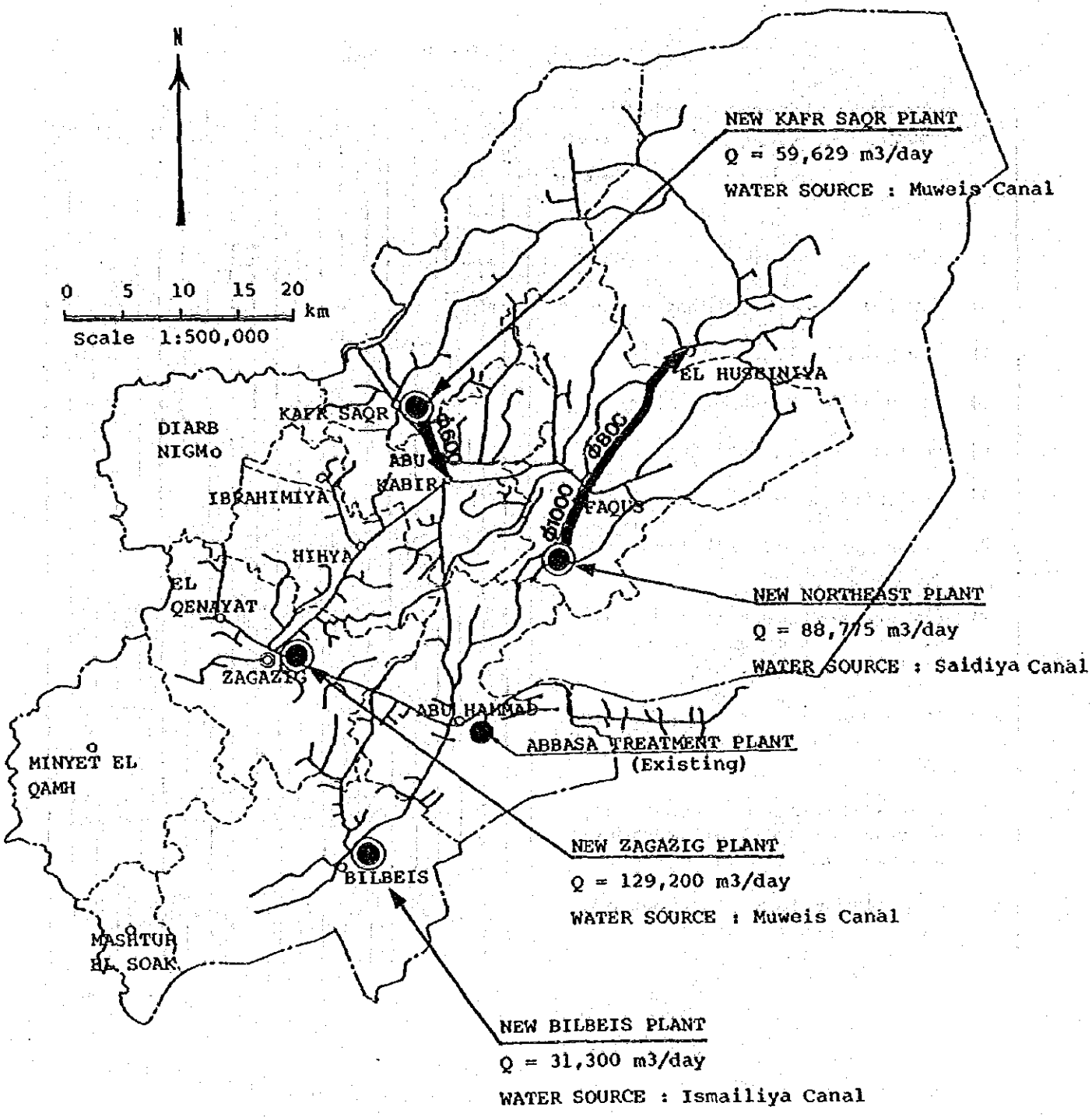
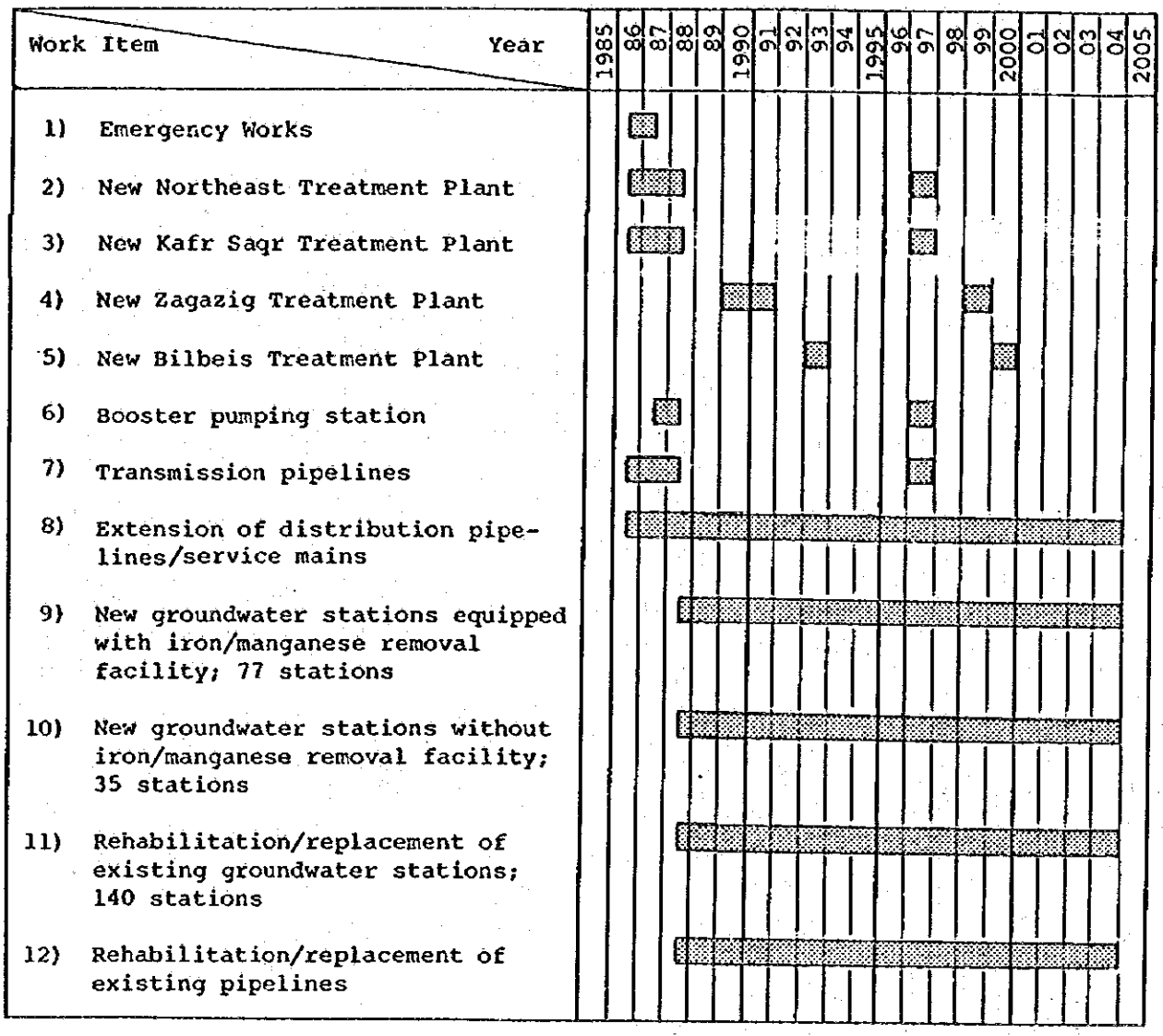


Fig -15 ALTERNATIVE PLAN OF NEW TREATMENT PLANT, B-5

Table -4 IMPLEMENTATION PROGRAM



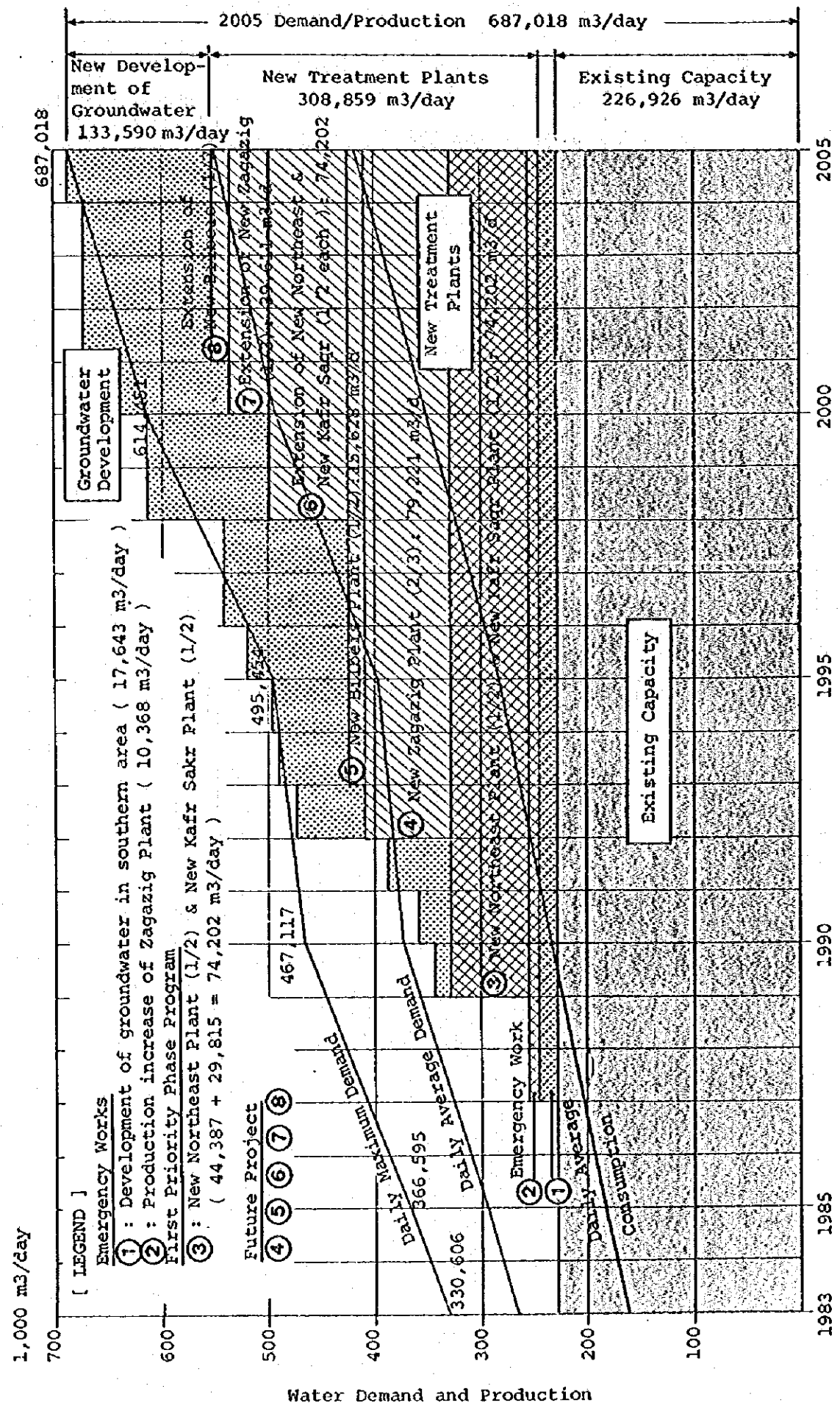


Fig-16 WATER SUPPLY DEVELOPMENT SCHEDULE

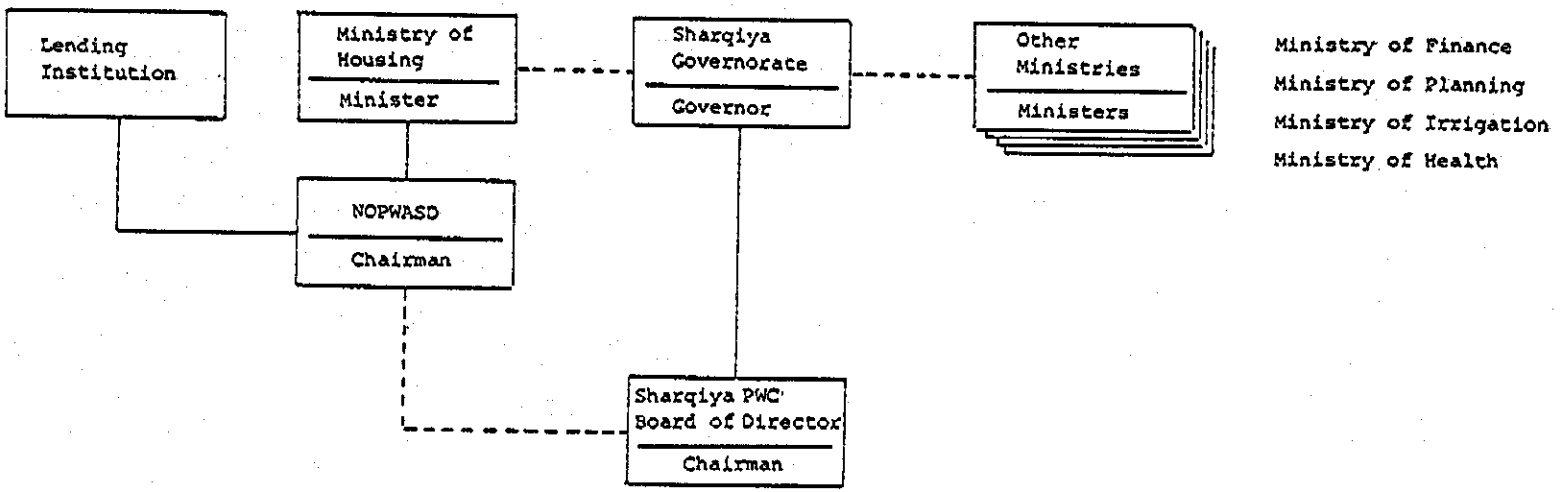


Fig -17 PROPOSED ORGANIZATION FRAMEWORK (1)

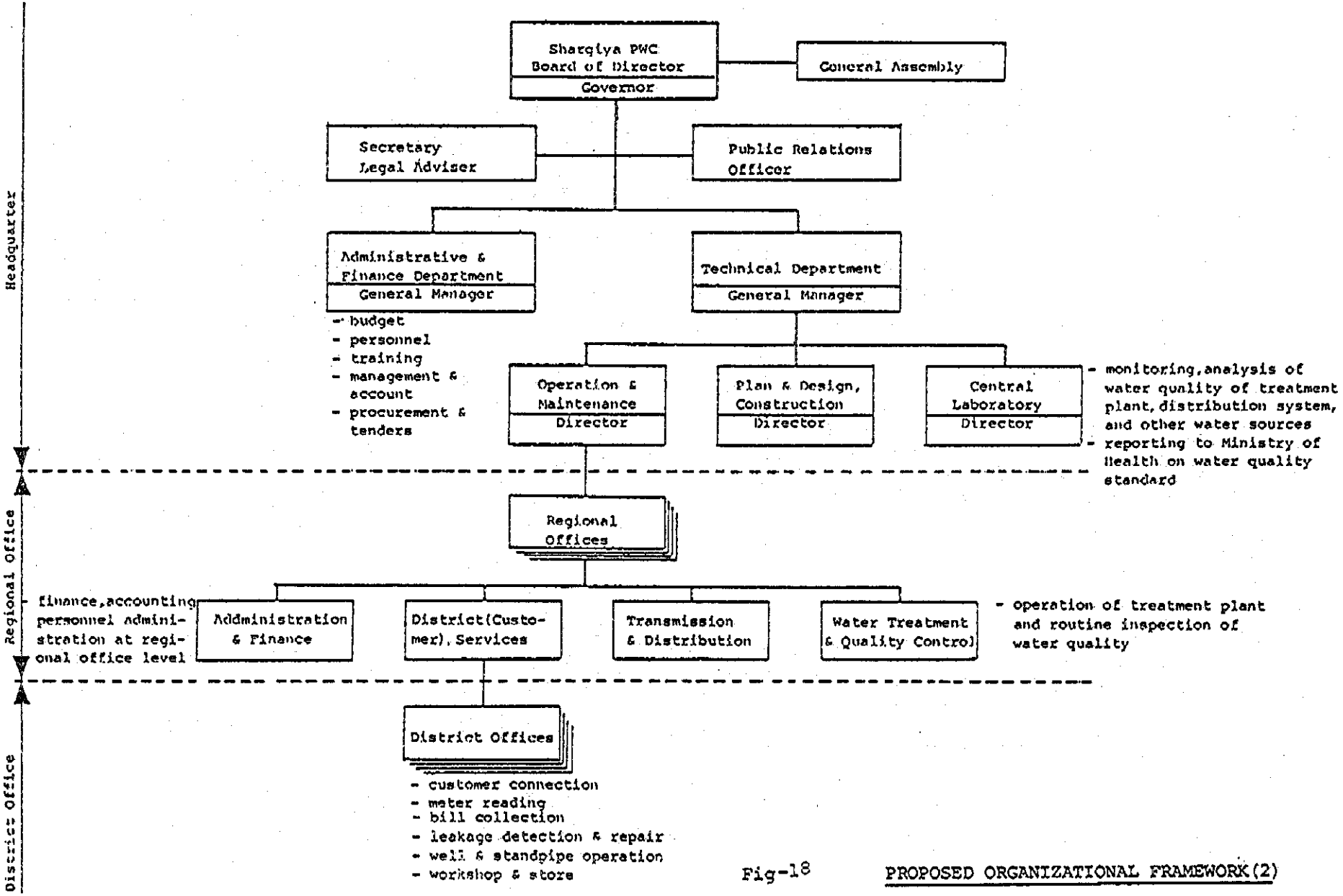


Fig-18 PROPOSED ORGANIZATIONAL FRAMEWORK(2)

4. Project Identification

Among a number of serial construction/rehabilitation works to be involved in the long term program, the project which shall be implemented in the earlier stage as the First-Phase Project will be identified.

Considering the urgent necessity of water supply and the present situation of water shortage in the northern area of the Governorate, the priority of project implementation will be placed on new construction of the Northeast and Kafr Saqr Treatment Plants and their transmission /distribution pipelines, and urgently necessitated works for existing systems which are called as "Emergency Works" in the report and composed of items described below.

4.1 Construction of New Treatment Plants

In the frame of the First-Phase Project, one half of the capacity of each plant will be constructed. Because their capacities to be newly developed by 1995 are about a half of the 2005 capacity according to the water demand study. Their outline is as follows :

1) New Northeast Plant (90,000 m3/day x 1/2 = 45,000 m3/day), supplying to Faqus City, Huseiniya City, villages in Faqus Markaz and villages in Huseiniya Markaz, and
2) New Kafr Saqr Plant (60,000 m3/day x 1/2 = 30,000 m3/day), supplying to Abu Kebir City, Kafr Saqr City and villages in Kafr Saqr Markaz.

Simultaneously with construction of the two new plants, transmission pipelines to the above areas will be installed and booster pumping stations on the way of the transmission pipelines will be constructed. In addition, distribution pipelines and elevated tanks will be expanded supplemented to the existing system.

4.2 Emergency Works

1) Production Increase of Zagazig Treatment Plant :
In order to relieve present poor water supply conditions in Zagazig City, the existing treatment plant (200 l/sec = 17,280 m3/day) will be expanded by 120 l/sec (= 10,368 m3/day).

2) Rehabilitation of Existing Treatment Plants :
All of the existing treatment plants will be rehabilitated on mechanical and electrical equipment in order to recover the original design capacity. They are Abbasa Plant, Zagazig Plant and Faqus Plant.

3) Development of Groundwater in Southern Area :
The existing systems in southern area of Bilbeis City, Ibrahimiya City Hihya City, Diarb Nigm City, Mashtul el Souk City, Minyet el Qamh City and the Housing Department System will be expanded/rehabilitated to some extent in the emergency works.

4) Procurement of Machines/Vehicles for Maintenance :
For execution of proper maintenance for the existing water supply systems, some machines/vehicles will be procured.

4.3 Project Cost

The project cost for implementation of the First -Phase Project including the emergency works will be LE 126.0 million, consisting of construction cost, engineering services, a physical contingency and a price contingency.

The total cost of LE 126.0 million will be broken down into the foreign currency portion (LE 54.3 million = US$ 66.2 million : 43 % of the total cost) and the local currency portion (LE 71.7 million : 57 % of the total cost).

III. First Priority-Phase Program

1. General

The most urgently necessitated project identified in the preceding chapter consists of a) Northeast Plant and Kafr Saqr Plant Systems which are to supply the northern part of the Governorate aiming at 1995, and b) imminent rehabilitation for existing plants and strengthening works for the southern area and densely populated Zagazig city which are called Emergency Works collectively. Major works of the study are as follows :

a) Preliminary Design
On the basis of the estimated population and water demand, two water supply systems supplying the northern Governorate are planned together with their distribution system and the emergency works. The construction cost for each of the stated above is estimated.

b) Implementation Program
The yearly disbursement schedule is planned from the planned implementation schedule, and the project cost is estimated on each of the local and foreign currency.

c) Institution, Organization and Financial Feasibility
Necessary setup of institutional and organizational matters for managing the Sharqiya Water Supply is proposed and a financial plan, involving the funding arrangement such as equity and water tariff is presented.

2. Preliminary Design

2.1 Distribution System

(1) Design Criteria

The design criteria employed for the distribution systems are as follows :

a) Minimum residual pressure : 10 m for rural areas
20 m for urban areas

b) Distribution pipelines consist of :
- Trunk mains : Transmission/distribution mains
- Service mains : Distribution mains within cities and villages.

c) Peak factors :
Daily max. demands = 1.25 x Daily average demands
Peak hour demands = 1.20 x Daily maximum demands

d) Distribution method : Direct pumping system

e) Capacity of pipeline :
The trunk mains for the present project will be one of the following :
- Existing mains meeting the 1995 demands,
- Existing plus proposed mains meeting the 2005 demands, or
- Proposed mains meeting the 2005 demands.

f) Elevated tanks :
- Capacity : 300 m3 x Depth 4 m x 25 m above ground
- Purpose : Backstopping supply at power failure to meet 1 hr equivalent of the daily maximum demands.

(2) Service Area and Water Demands

The service area of the present project includes :

a) New Northeast System :
Huseiniya Markaz (city and rural area), Facus City, and Part of Faqus Markaz (rural area).

b) New Kafr Saqr System :
Kafr Saqr Markaz (city and rural area), Part of Abukebir City, and One village of Faqus Markaz.

Water demands are tabulated areawise in the following table, and the service area and schematic plan are shown below.

Table-5 Water Demands

(m3/day)

Area		FIRST PRIORITY-PHASE PROGRAM AVG	MAX	PEAK	LONG-TERM PROGRAM AVG	MAX	PEAK
New Northeast System							
Huseiniya	U	3,106	3,883	4,660	5,913	7,391	8,869
	R	14,022	17,527	21,032	25,292	31,616	37,939
	T	17,128	21,410	25,692	31,205	29,007	46,808
Faqus	U	9,142	11,428	13,714	19,269	24,086	28,903
	R *1	16,379	20,474	24,569	29,417	36,771	44,125
	T	25,521	31,902	38,283	48,686	60,857	73,028
Sub-Total		42,649	53,312	63,975	79,891	99,864	119,836
New Kafr Saqr System							
Kafr Saqr	U	2,790	3,487	4,184	5,256	6,570	7,884
	R	13,748	17,185	20,622	25,637	32,047	38,456
	T	16,538	20,672	24,806	30,893	38,617	46,340
Abu Kebir	U	11,850	14,813	17,776	24,243	30,304	36,365
Faqus	R *2	268	335	402	510	638	766
Sub-Total		28,656	35,820	42,984	55,646	69,559	83,471
Total		54,177	89,132	106,959	135,537	169,423	203,307
Existing Facilities							
Faqus City		9,504	9,504	9,504	10,000	10,000	10,000
Abu Kebir City		5,103	5,103	5,103	10,000	10,000	10,000

*1 (Faqus Rural Demands) x 87 % - (*2)

*2 Kafr El-Ashgam Village.

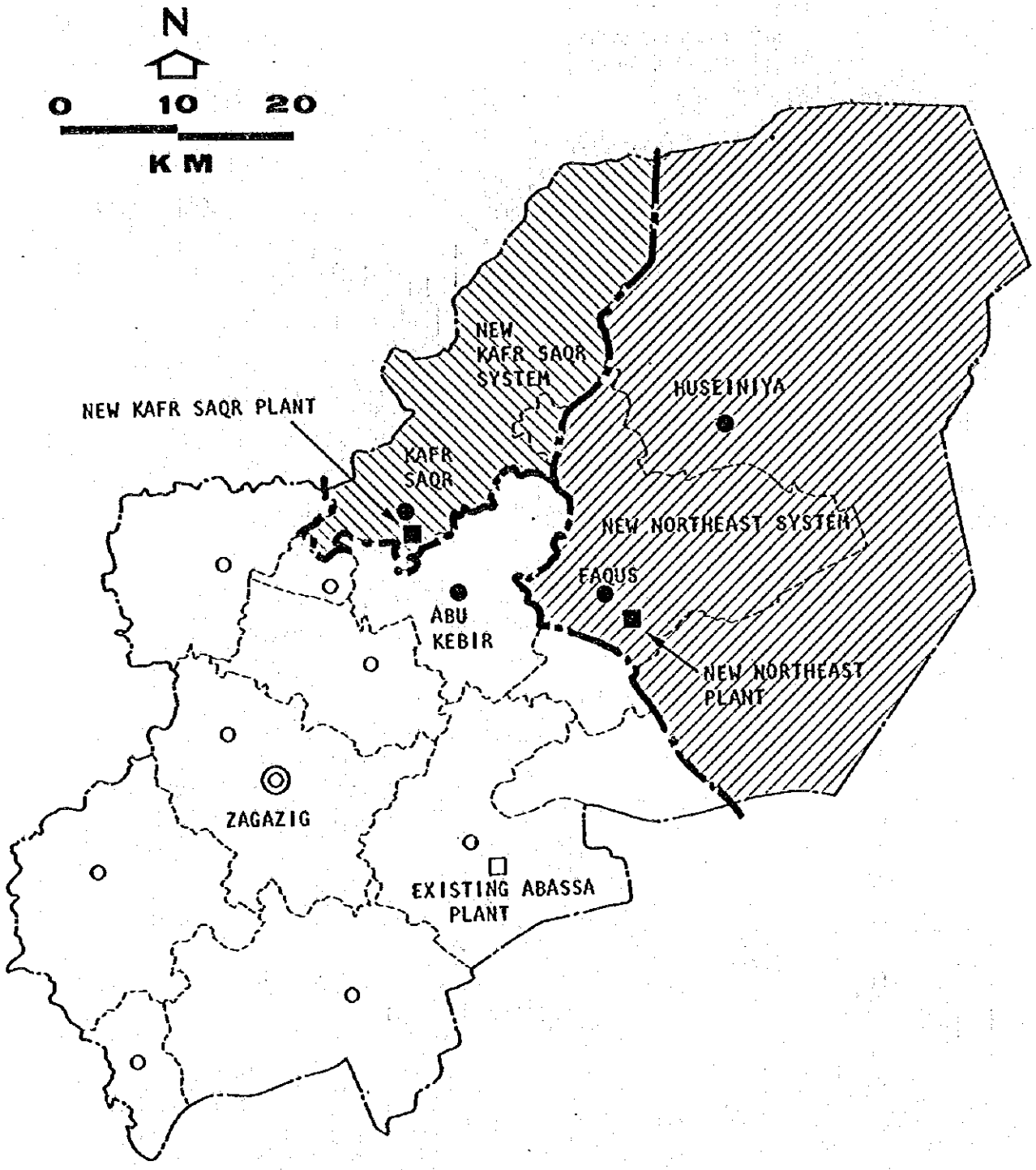


Fig-19 Proposed Service Areas

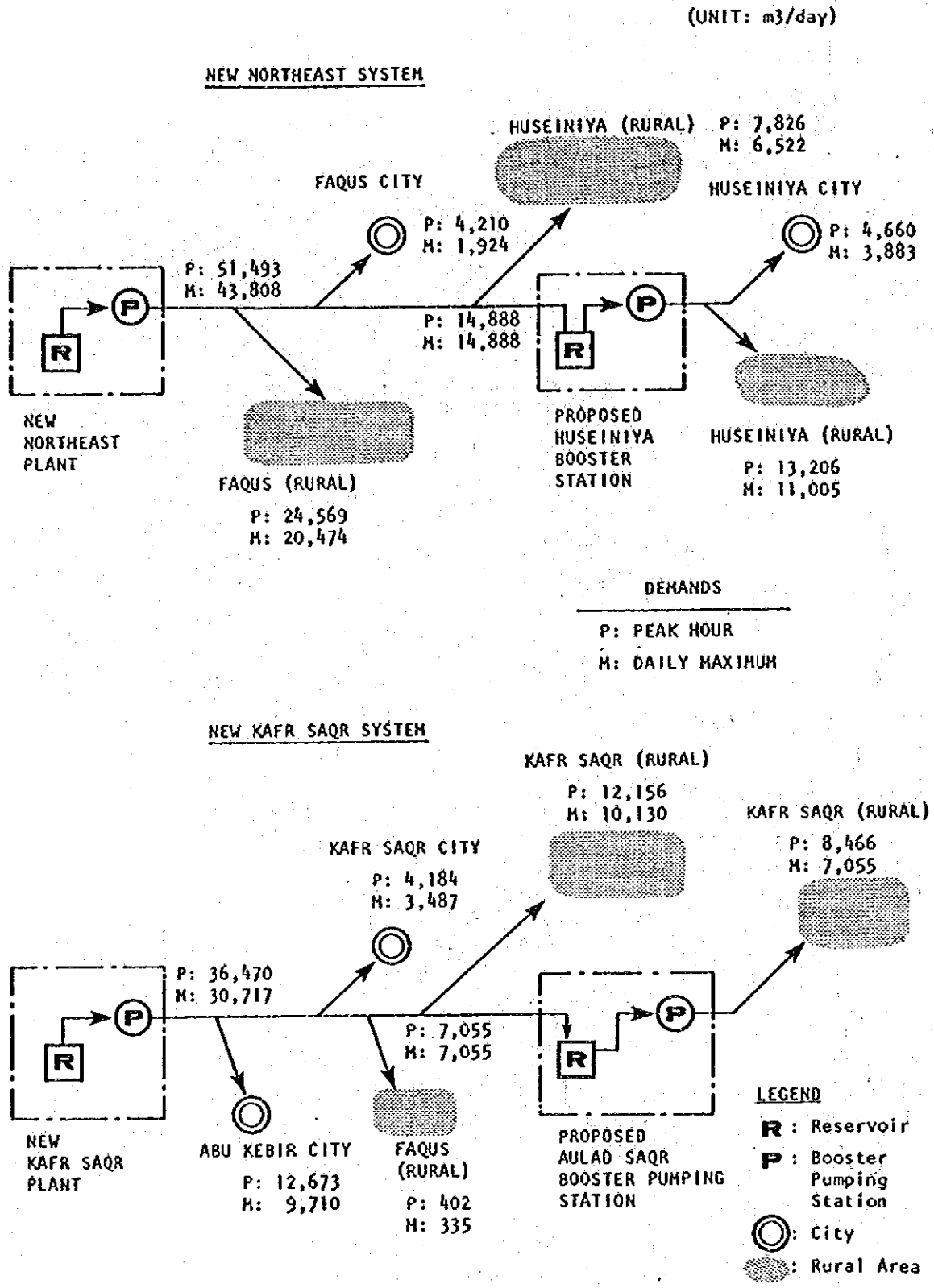


Fig-20 Schematic Plans of Distribution Systems

(3) Trunk Mains

The existing mains are to be used for the project to full extent. Proposed trunk mains will give capacities to meet the 2005 peak hour demands.

a) New Northeast System : Ø1,100 - Ø100 x 123 km

b) New Kafr Saqr System : Ø 900 - Ø150 x 110 km

The proposed trunk main plan is shown in the attached drawing.

(4) Booster Pumping Stations

a) Huseiniya station.....Pumps		:	Q 7.5 m3/min x 2 sets
(New Northeast System)			Q 4.0 m3/min x 2 sets
	Reservoir	:	3,500 m3
	Pump House	:	300 m2
b) Aulad Saqr station....Pumps		:	Q 4.0 m3/min x 2 sets
(New Kafr Saqr System)			Q 2.0 m3/min x 2 sets
	Reservoir	:	1,800 m3
	Pump House	:	200 m2

(5) Elevated Tanks

The existing and proposed tanks are listed below.

(6) Service Mains

a) New Northeast System : Ø250 - Ø150 x 96 km

b) New Kafr Saqr System : Ø250 - Ø150 x 60 km

Table-6 Existing Elevated Tanks

Location		Volume	Height above gound
City/Village	Markaz		
1) San El Hagar	Huseiniya	300 m3	25 m
2) Tell Rak	Kafr Saqr	300 m3	25 m
3) Kafr Saqr City*	"	400 m3	20 m
4) Natora	"	400 m3	20 m
5) Kahboona	Faqus	1,000 m3	25 m
6) Kanteer	"	500 m3	25 m
7) Faqus City	"	350 m3	**
8) El Roda	"	400 m3	32 m
9) Abu Kebir City	Abu Kebir	100 m3	**
10) Hanut	Kafr Saqr	400 m3	**
11) Aulad Saqr	"	400 m3	**
Total Capacity		4,550 m3	

* Operated by the present Abbasa System

** Data unavailable

Table-7 Elevated Tanks Construction Program

Area	No. of tanks to be constructed		Present capacity
	By 1995	By 2005	(m3)
Huseiniya City	1	-	-
Kafr Saqr City	-	-	400 *
Faqus City	1	1	350
Abu Kebir City	3	3	100
Rural Area	-	3	3,700
Total	5	7	4,550

* Operated by the present Abbasa System

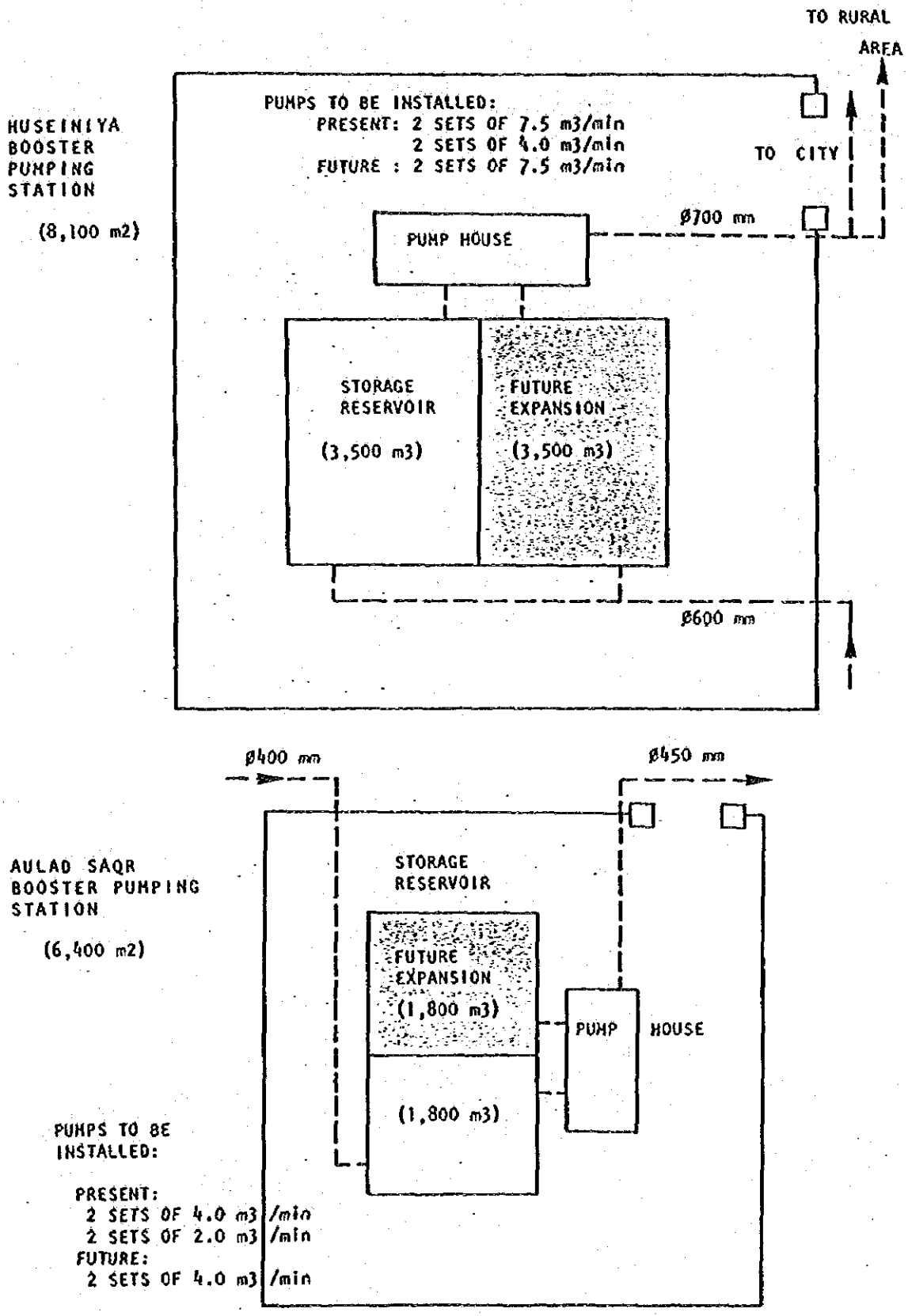
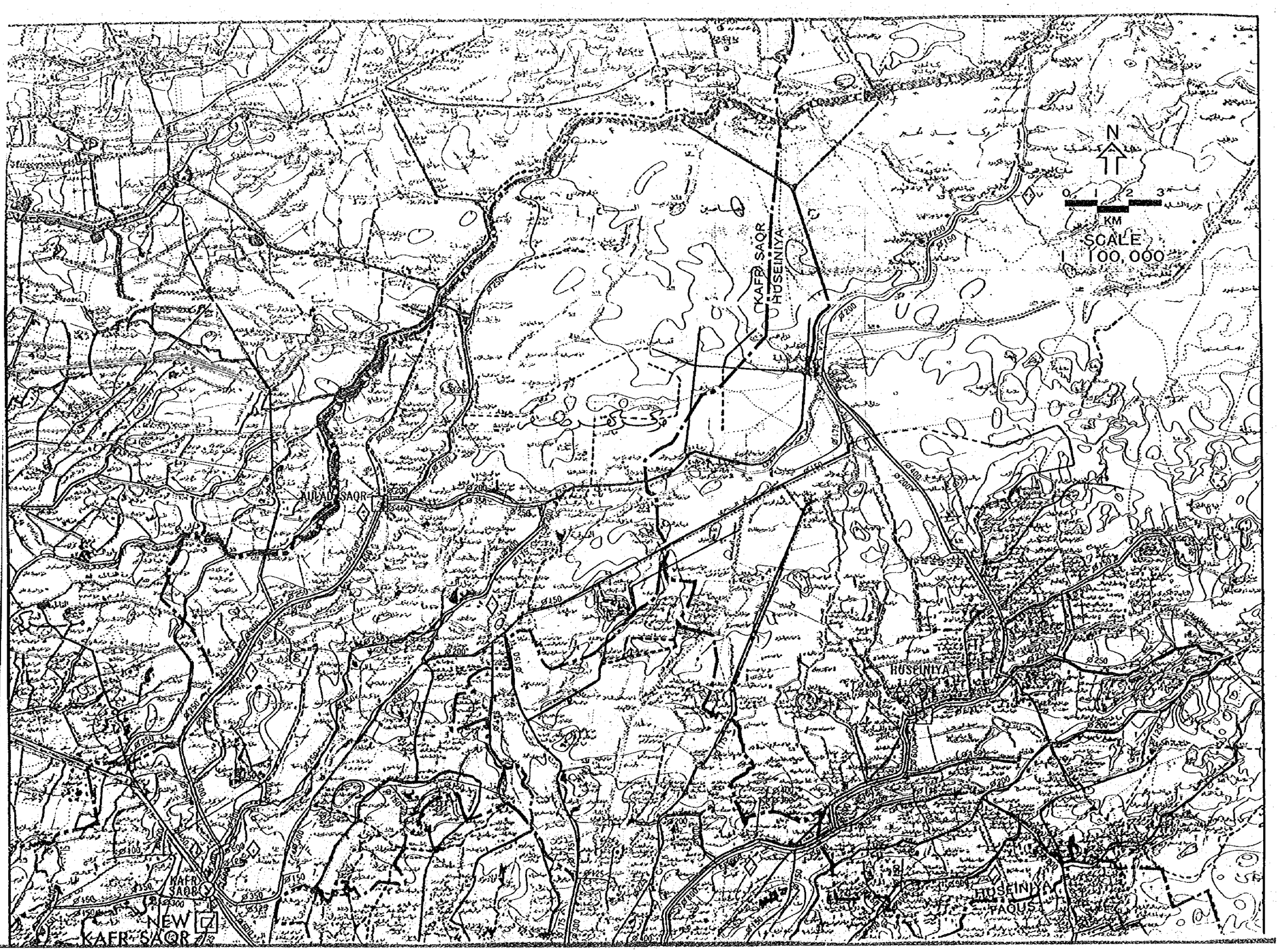


Fig-21 Schematic Layouts of Booster Pumping Stations


N
0 1 2 3
KM
SCALE
1 100,000
KAFR SAQR
HUSEINIYA
HUSEINIYA
FAQUS
KAFR SAQR
NEW
KAFR SAQR

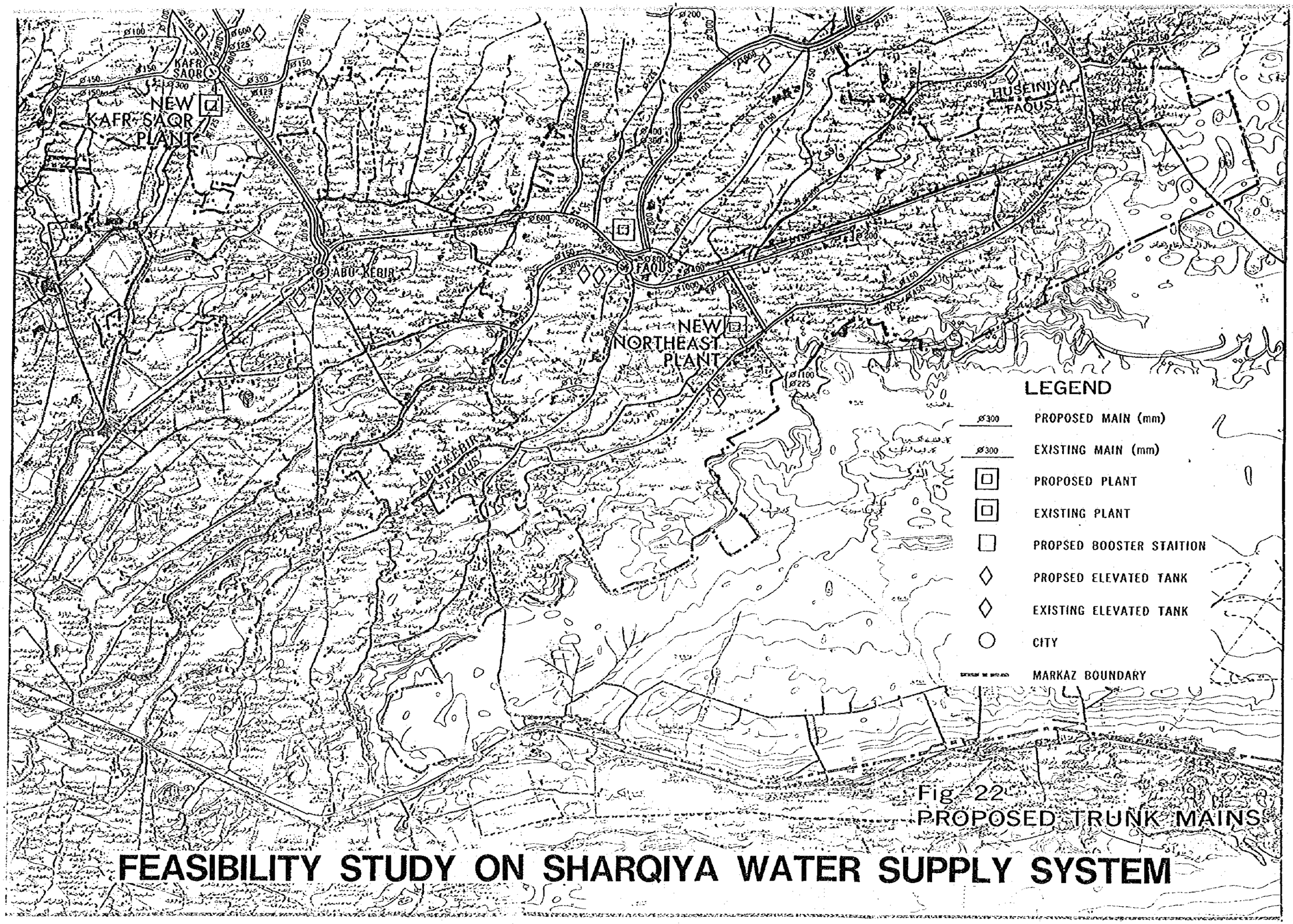


Fig 22
PROPOSED TRUNK MAINS

FEASIBILITY STUDY ON SHARQIYA WATER SUPPLY SYSTEM

2.2 Treatment Plant

(1) General

- Capacity:

  New Northeast Plant = 90,000 m3/d (Final) x 1/2 = 45,000 m3/d (First Stage)

  New Kafr Saqr Plant = 60,000 m3/d (") x 1/2 = 30,000 m3/d (" ")

- Water Source: : Canal water

- Plant Site:

  New Northeast Plant : Left bank of Saidiya Canal; 1 km upstream of the Abu Shalabi Gate.

  New Kafr Saqr Plant : Right bank of Muweis Canal; 1 km upstream of Kafr Saqr City.

- Treatment Process : Rapid sand filtration method.

(2) Method to be Employed

- Rapid mixing : Hydraulic waterfall mixing.
- Flocculation : Hydraulic type flocculation.
- Sedimentation basin : Horizontal flow type basin.
- Sludge treatment : Natural-drying treatment method.

(3) Plant Layout and Proposed Facilities

Refer to drawings and tables.

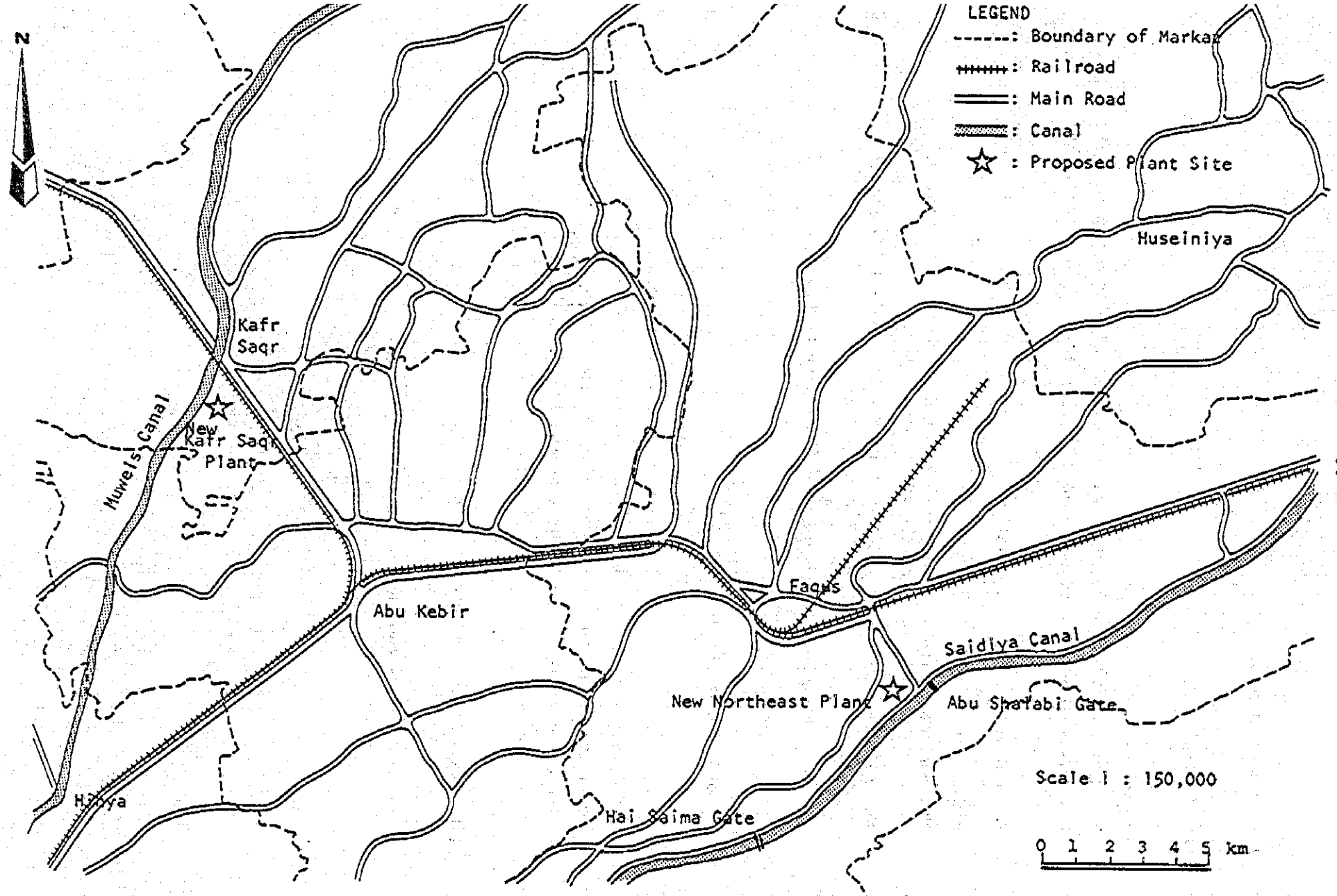


Fig -23 LOCATION PLAN OF PROPOSED PLANT SITES

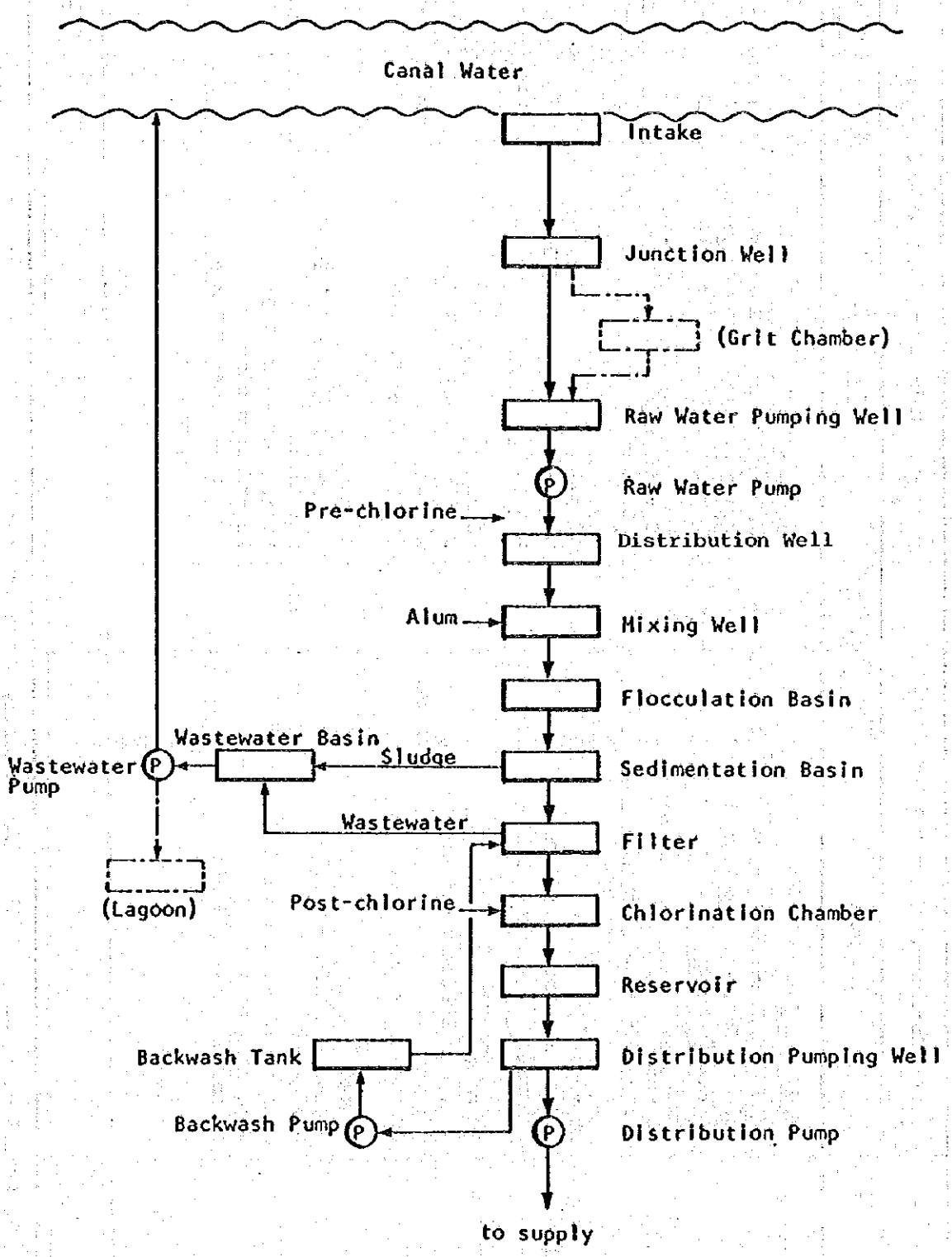


Fig -24 FLOW DIAGRAM OF TREATMENT PROCESS

Table -8 PROPOSED TREATMENT FACILITIES

Treatment Plant / Item	New Northeast Plant (90,000 m3/d) Description	First* Stage	Second* Stage	New Kafr Saqr Plant (60,000 m3/d) * Description	First Stage	Second** Stage
1. Intake facilities	Intake gate W 0.8m x H 1.2m x 2 units Screen, Concrete block, and Intake conduit	2 units LS	- -	Intake gate W 0.6m x H 1.2m x 2 units Screen, Flash board, Concrete block, and Intake conduit	2 units LS	- -
2. Junction well	RC made W 4.0m x L 4.0m x H3.0m x 1 unit	1 unit	-	RC made W 3.3m x L3.3m x H3.0m x 1 unit	1 unit	-
3. Raw water pumping well	RC made W 3.0m x L 30.0m x H 3.0m x 1 unit	1 unit	-	RC made W 3.0m x L 30.0m x H 3.0m x 1 unit	1 unit	-
4. Distribution Well	RC made W 6.0m x L 9.0m x H 4.4m x 1 unit Breadth of weir: 12.8m	1 unit	-	RC made W 5.0m x L 8.0m x H 4.4m x 1 unit Breadth of weir: 9.8m	1 unit	-
5. Mixing well	RC made W 4.5m x L 8.2m x H 3.5m x 2 units Breadth of weir: 9.0m Waterfall mixing Detention time: 3.8 min	1 unit	1 unit	RC made W 3.5m x L 7.4m x H 3.5m x 2 units Breadth of weir: 7.0m Waterfall mixing Detention time: 4.0 min	1 unit	1 unit

(Note): * First Stage: Stage of the first priority phase program
Northeast Plant: 45,000 m3/d, Kafr Saqr Plant: 30,000 m3/d

** Second Stage: Stage of the succeeding programs to meet the demand of the year 2005.

Treatment Plant / Item	New Northeast Plant			New Kafr Saqr Plant		
	Description	First Stage	Second Stage	Description	First Stage	Second Stage
6. Flocculation basin	RC made Baffled channel type (340 m3, H3.0m) x 4 units Detention time: 20 min	2units	2units	RC made Baffled channel type (230 m3, H3.0m) x 4 units Detention time: 30 min.	2units	2units
7. Sedimentation basin	RC made Rectilinear flow type W16.4m x L72.0m x H3.5m x 4 units Bridge type travelling sludge scraper Detention time: 4 hrs Velocity: 30cm/min Overflow rate: 21 m/d Effluent Trough: 309 m3/d/m	2units	2units	RC made Rectilinear flow type W11.0m x L72.0m x H3.5m x 4 units Bridge type travelling sludge scraper Detention time: 4 hrs Velocity: 30 cm/min Overflow rate: 21 m/d Effluent Trough: 330 m3/d/m	2units	2units
8. Filter	RC made Gravity type Rapid sand filtration 70 m2/unit x 12 units Thickness of sand layer: 60 cm Thickness of gravel layer: 70cm Perforated pipe underdrain system Backwashing and surface washing Constant flow rate control	6units	6units	RC made Gravity type Rapid sand filtration 50 m2/unit x 12 units Thickness of sand layer: 60cm Thickness of gravel layer: 70cm Perforated pipe underdrain system Backwashing and surface washing Constant flow rate control	6units	6units
9. Chlorination chamber	RC made W 4 m x L8.3m x H4.0m x 1 unit	1unit	-	RC made W4.3m x L8.6m x H4.0m x 1 unit	1unit	-

Treatment Plant / Item	New Northeast Plant			New Kafr Saqr Plant		
	Description	First Stage	Second Stage	Description	First Stage	Second Stage
10. Reservoir	RC made Storage capacity: 15,600m3 (6 hrs of max day demand) W40.9m x L50.1m x H4.0m x 2 units	1unit	1unit	RC made Storage capacity: 11,600m3 (6 hrs of max day demand) W28.0m x L56.5 x H4.0m x 2 units	1unit	1unit
11. Pump station	1,000m2			1,000m2		
	Raw water pump: Horizontal Sprit-case double suction volute pump ø400mm x 17m3/min x 15m x 75kW x 980rpm x 380V x 6 units	3units	3units	Raw water pump: Horizontal Sprit-case double suction volute pump ø350mm x 11.5m3/min x 15m x 45kW x 980rpm x 380V x 6 units	3units	3units
	Distribution pump: Horizontal Sprit-case double suction volute pump ø400mm x 18m3/min x 60m x 260kW x 980rpm x 3,300V x 5 units	3units	2units	Distribution pump: Horizontal Sprit-case double suction volute pump ø300mm x 12.5m3/min x 60m x 190kW x 980rpm x 3,300V x 5 units	3units	2units
	ø300mm x 9m3/min x 60m x 150kW x 1,450rpm x 3,300V x 2 units	2units	-	ø250mm x 7m3/min x 60m x 132kW x 1,450rpm x 3,300V x 2 units	2units	-
	Backwash pump: Horizontal Sprit-case double suction volute pump ø300mm x 9.8m3/min x 15m x 37kW x 1,450rpm x 380V x 2units	2units	-	Backwash pump: Horizontal Sprit-case double suction volute pump ø300mm x 9.5m3/min x 15m x 37kW x 1,450rpm x 380V x 2 units	2units	-

Treatment Plant / Item	New Northeast Plant			New Kafr Saqr Plant		
	Description	First Stage	Second Stage	Description	First Stage	Second Stage
	Surface wash pump: Horizontal Sprit-case double suction volute pump ø350mm x 14m3/min x 20m x 75kW x 1,450rpm x 380V x 2 units	2units	-	Surface wash pump: Horizontal Sprit-case double suction volute pump ø300mm x 10m3/min x 20m x 55kW x 1,450rpm x 380V x 2 units	2units	-
12. Distribution pumping well	RC made W3.0m x L50.0m x H4.0m x 1 unit	1 unit	-	RC made W3.0m x L50.0m x H4.0m x 1 unit	1 unit	-
13. Backwash tank	RC made Storage capacity: Backwash amount for 1 filter unit x 1.3 (Allowance): 400m3 W14.2m x L14.2m x H2.0m x 1 unit	1 unit	-	RC made Storage capacity: Backwash amount for 1 filter unit x 1.3 (Allowance): 300m3 W12.2m x L12.2m x H2.0m x 1 unit	1 unit	-
14. Wastewater basin	RC made W8.0m x L16.6m x H3.0m x 2 units	2units	-	RC made W8.0m x L12.5m x H3.0m x 2 units	2units	-
	Vertical agitator Wastewater pump: Sludge pump ø200mm x 7.5m3/min x 7m x 18.5kW x 4 units	4units	-	Vertical agitator Wastewater pump: Sludge pump ø200mm x 5m3/min x 6m x 11kW x 4 units	4units	-
15. Office	2,750m2 Office and Laboractory	LS	-	1,650m2 Office and Laboratory	LS	-

Treatment / Item	New Northest Plant			New Kafr Saqr Plant		
	Description	First Stage	Second Stage	Description	First Stage	Second Stage
16. Chemical building	1,200m2 Alum building and Chlorine building	LS	-	895m2 Alum building and Chlorine building	LS	-

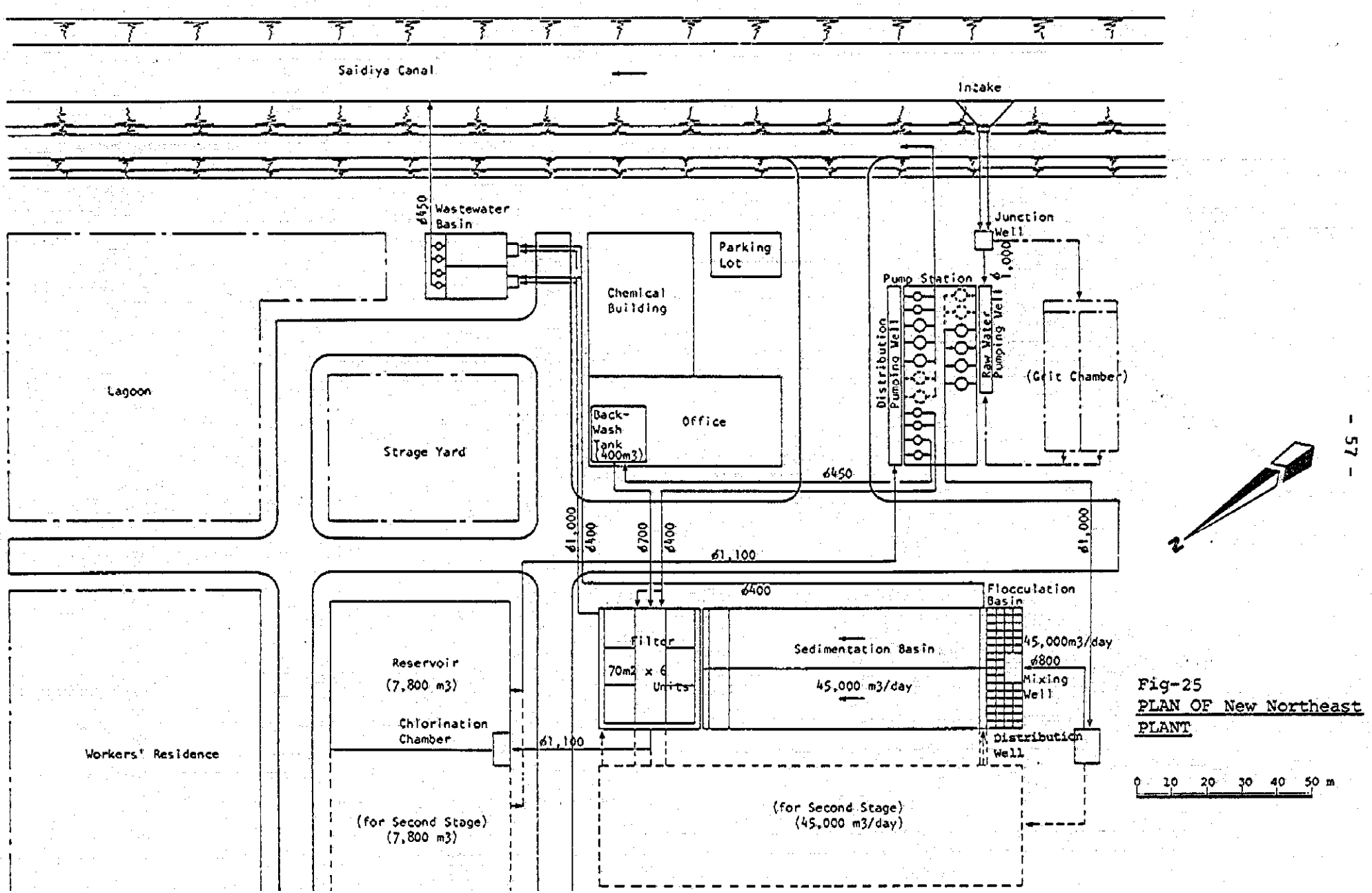


Fig-25
PLAN OF New Northeast PLANT

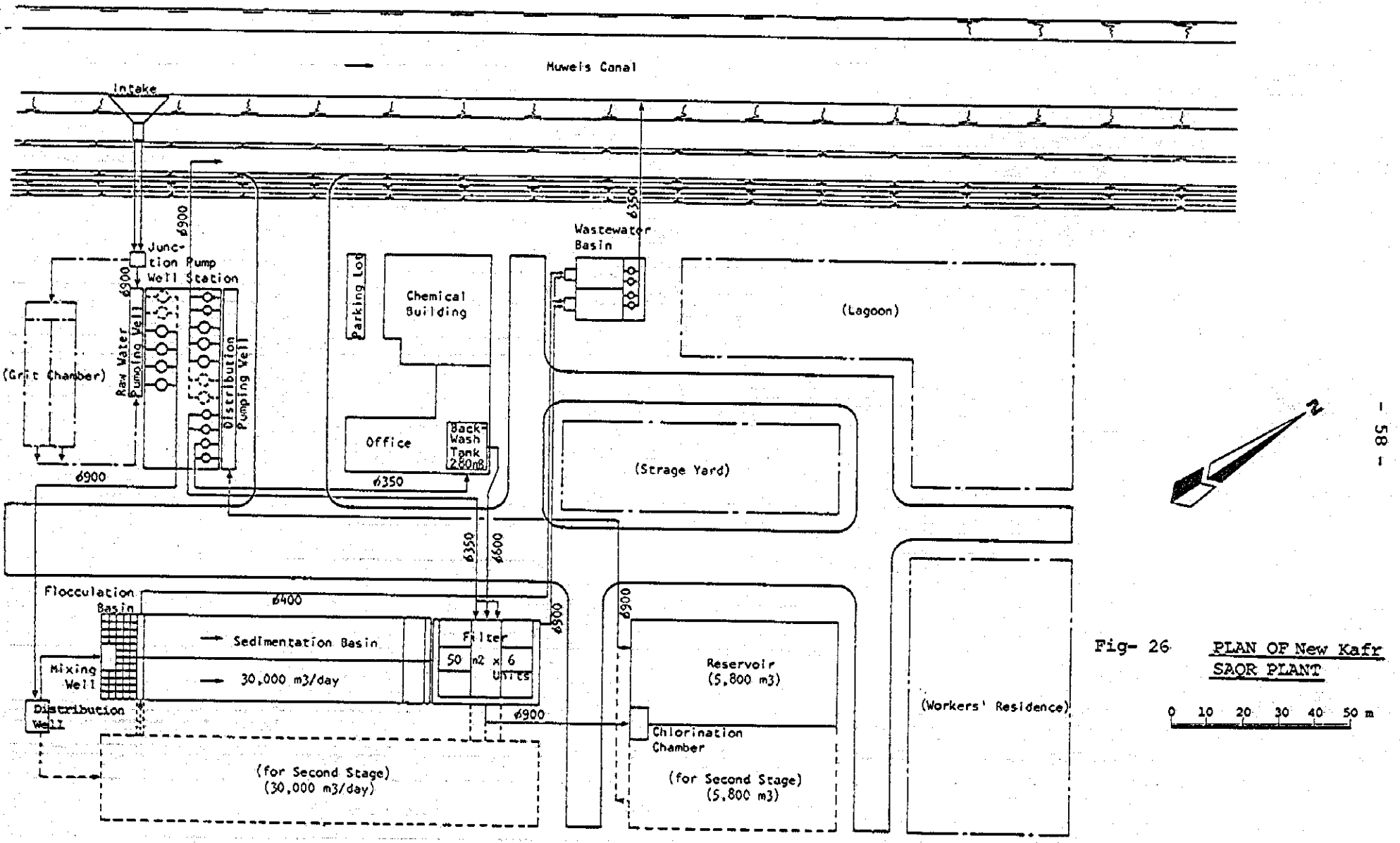


Fig- 26 PLAN OF New Kafr SAQR PLANT

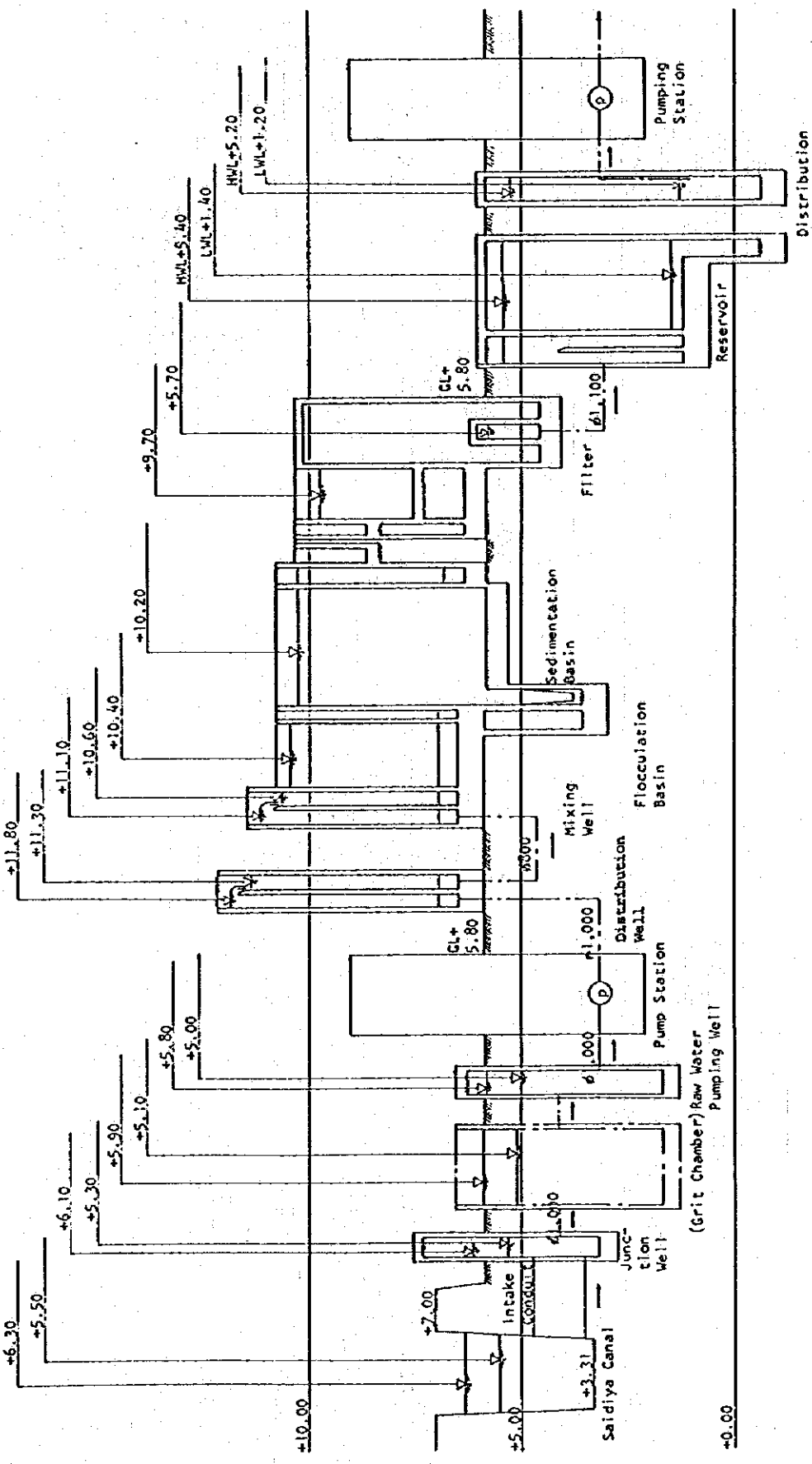


Fig- 27 WATER LEVEL DIAGRAM OF New Northeast Plant

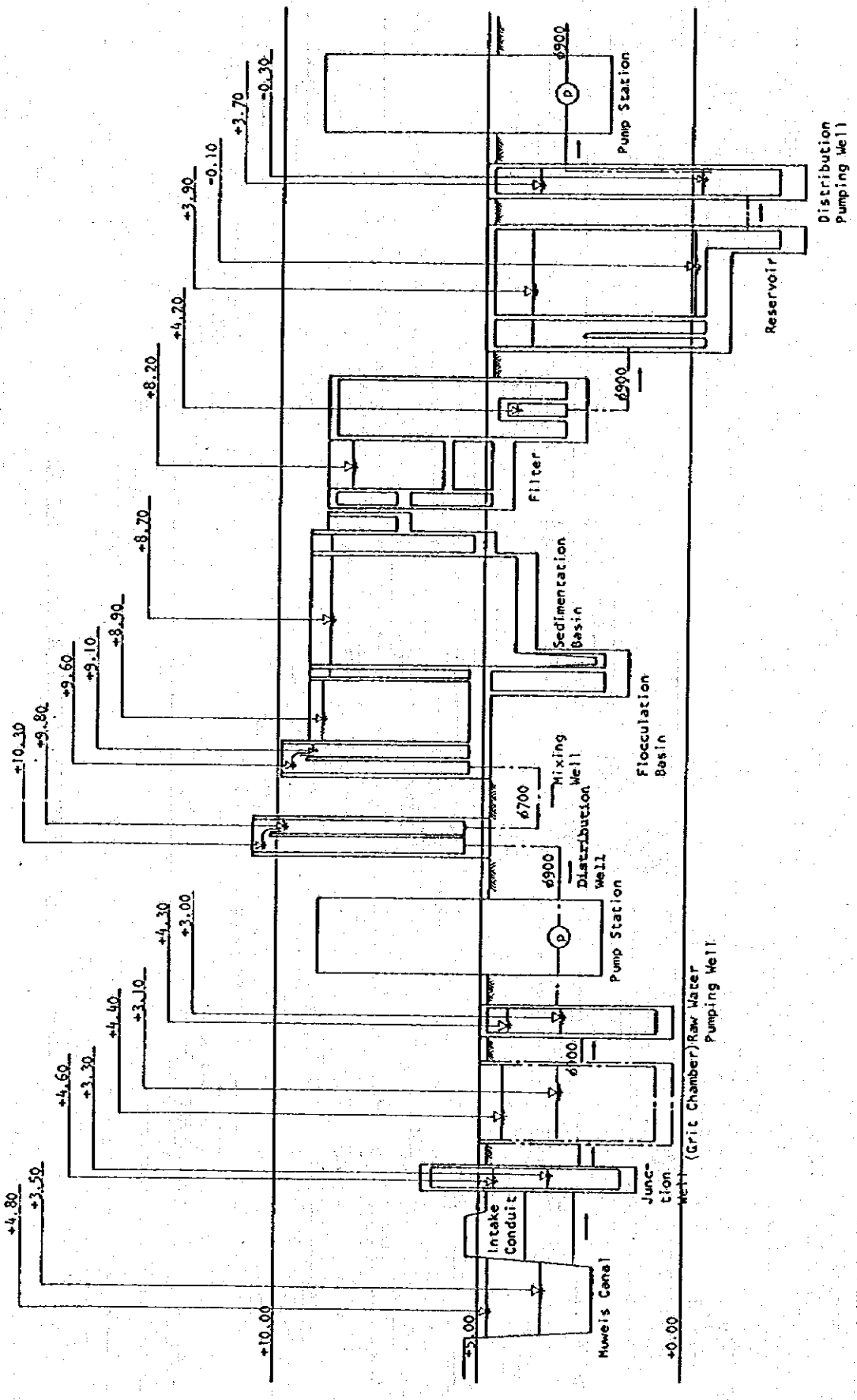


Fig-28 WATER LEVEL DIAGRAM OF New Kafr Saqr Plant

2.3 Emergency Works

The Emergency Works are planned to relieve the present poor conditions of water supply to a certain extent, and consist of strengthening works for densely populated Zagazig City and for the southern area of the Governorate, rehabilitation of the existing plants and procurement of machines/vehicles for maintenance.

(1) Production Increase of Zagazig Treatment Plant

The existing Zagazig Plant (200 l/sec) will be expanded by additional 120 l/sec, making total capacity of 320 l/sec, with Muweis Canal water of water source to be treated by rapid sand filtration method.

Facilities to be constructed or replaced are:

- Flocculation/sedimentation basins,
- Filters,
- Mixing well,
- Reservoirs,
- Chlorination chamber,
- Intake facility,
- Raw water pumps/house,
- Distribution pumps/house,
- Surface wash pumps, and
- Electric facility.

Refer to the following drawing.

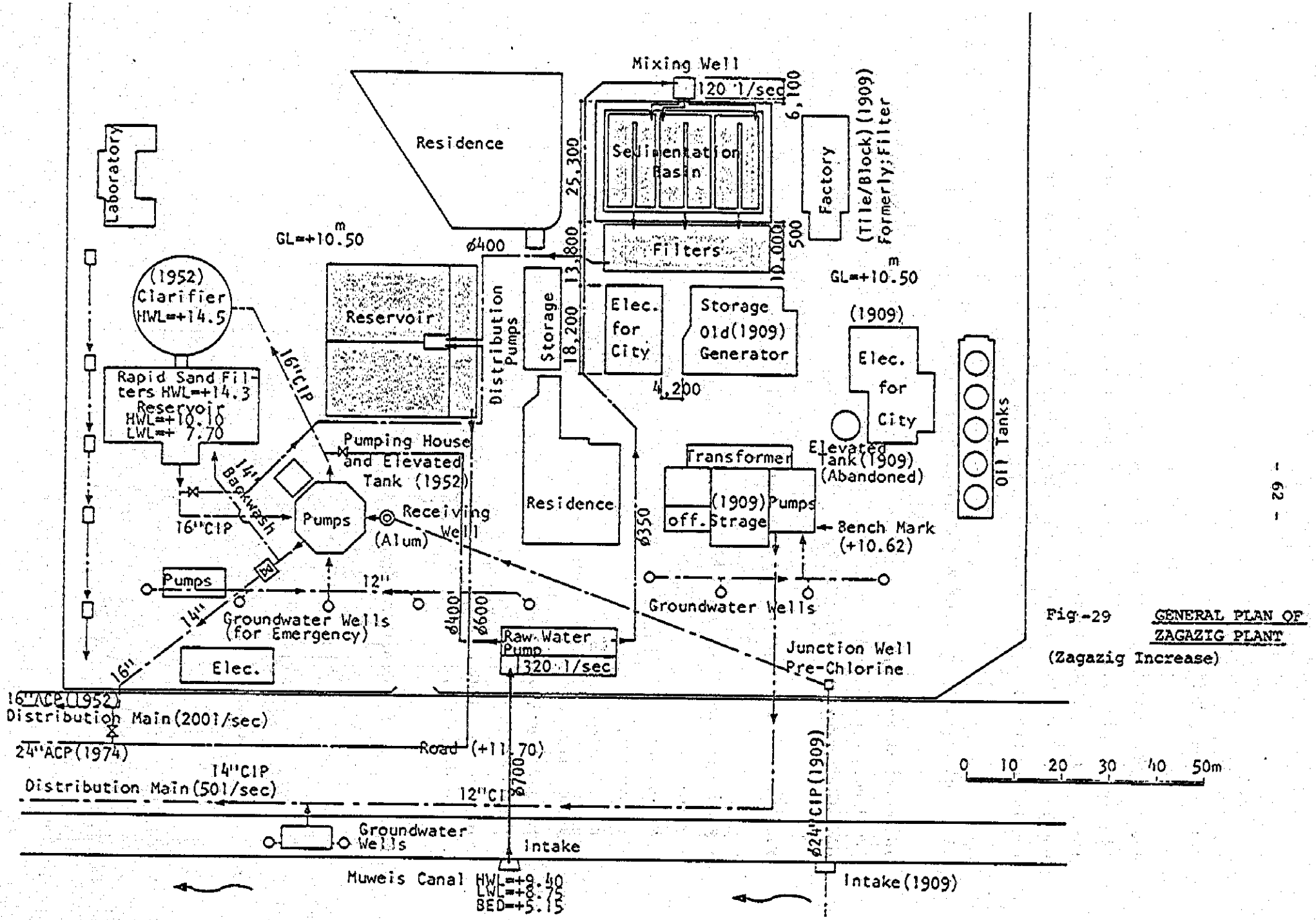


Fig-29 GENERAL PLAN OF ZAGAZIG PLANT
(Zagazig Increase)

(2) Rehabilitation of Existing Treatment Plants

The all of three existing treatment plants will be rehabilitated in order to recover original design capacity.

Components of the rehabilitation work will be:

- For Abbasa Treatment Plant:
Filters and filter control, alum feed system and chlorination system including chlorine gas neutralization facility.

- For Faqus Treatment Plant:
Pump facilities, alum feed system, chlorination system including chlorine gas neutralization facility, and electric facility.

- For Existing Zagazig Treatment Plant:
Alum feed system & chlorination system including chlorine gas neutralization facility.

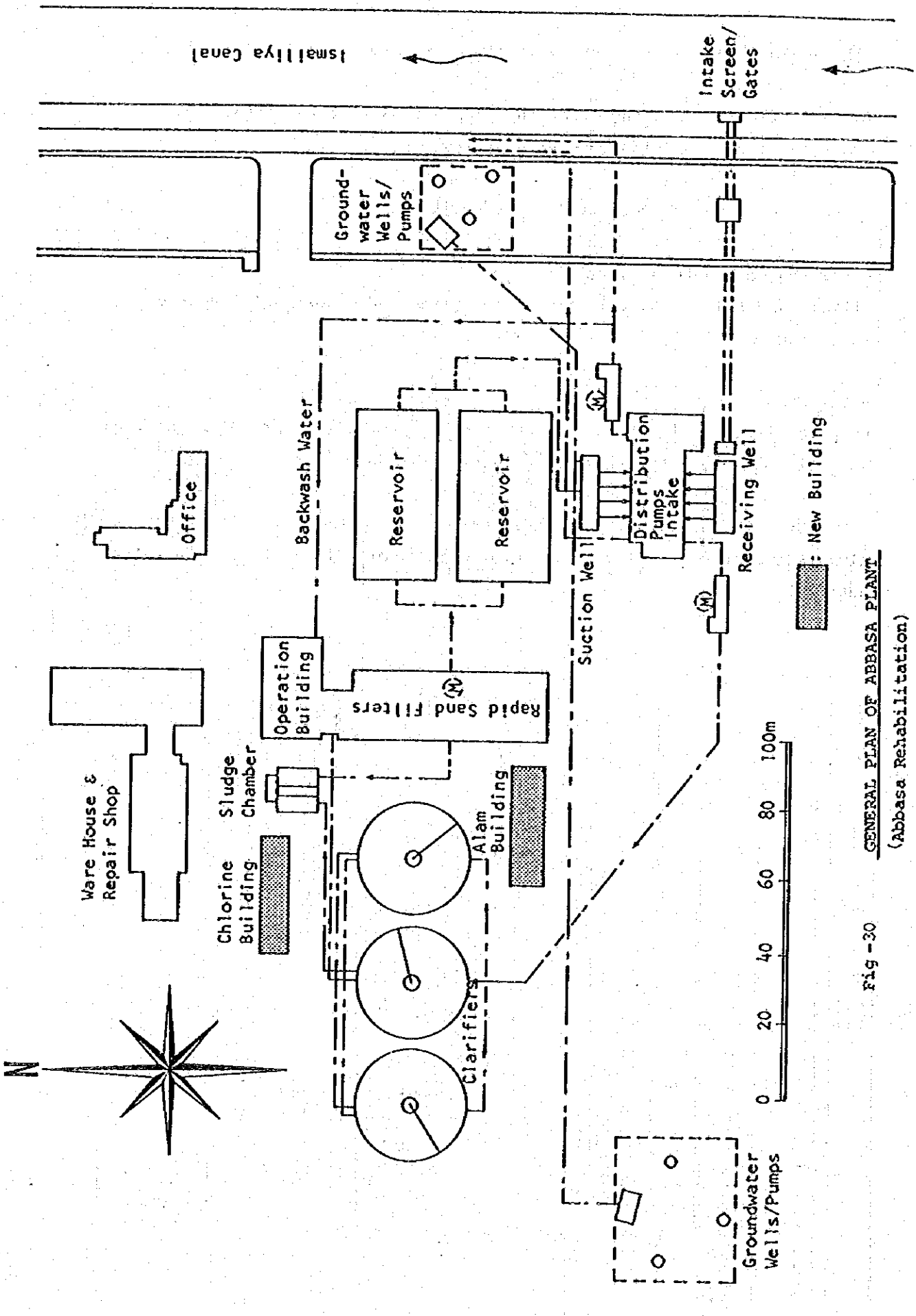


Fig -30 GENERAL PLAN OF ABBASA PLANT
(Abbasa Rehabilitation)

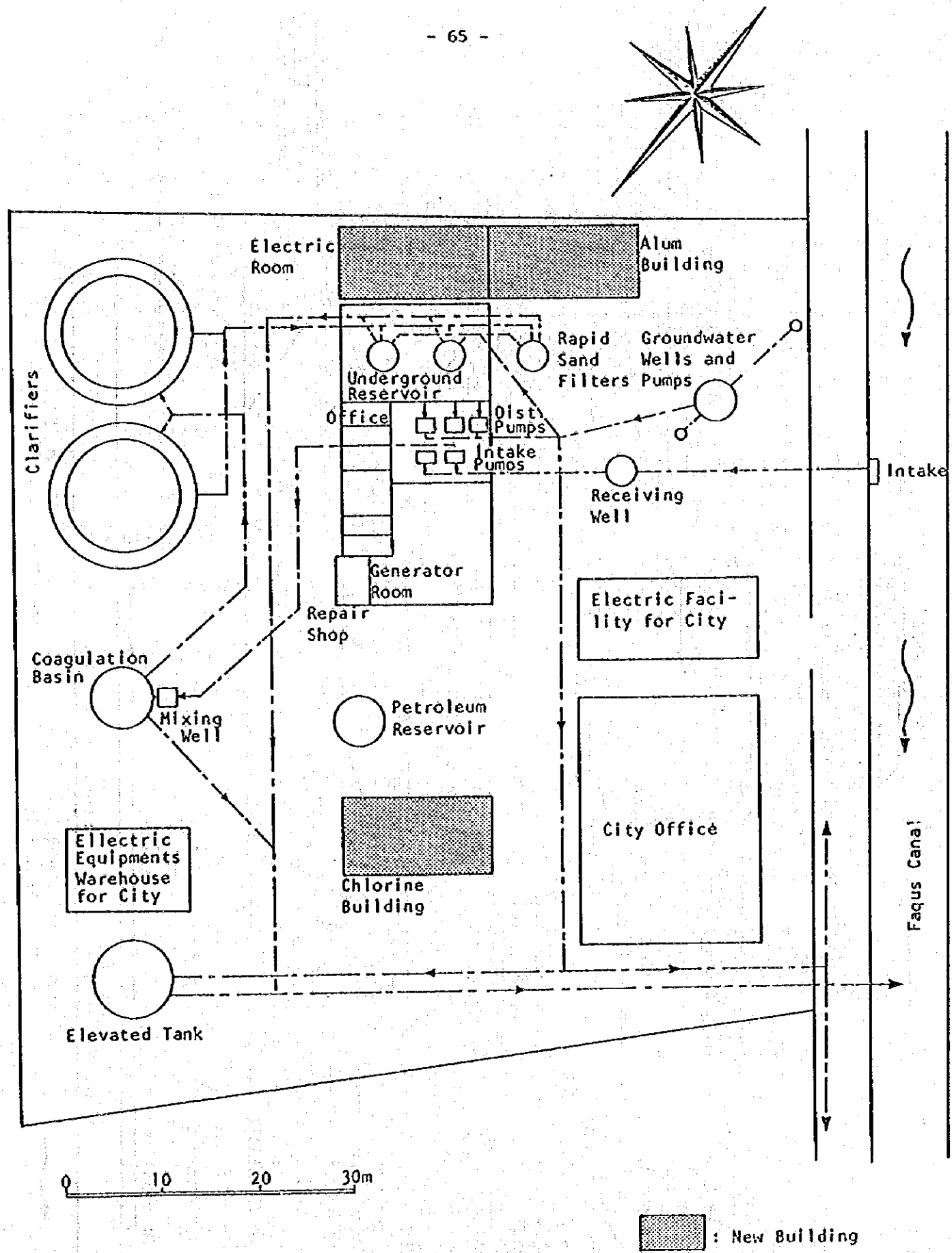


Fig -31 GENERAL PLAN OF FAQUS PLANT
(Faqus Rehabilitation)

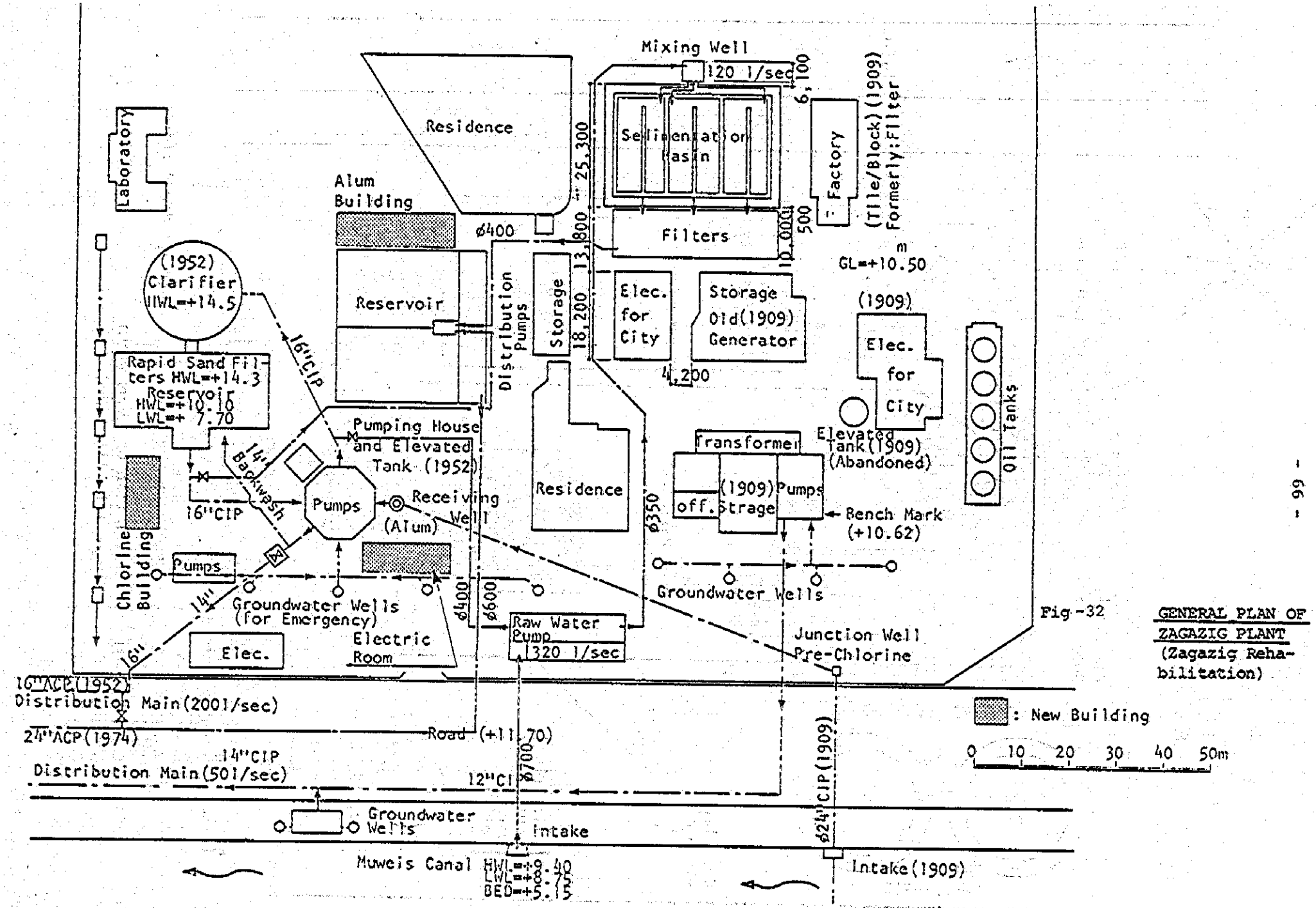


Fig -32 GENERAL PLAN OF ZAGAZIG PLANT (Zagazig Rehabilitation)

(3) Development of Groundwater in Southern Area

- City-owned System:

The existing systems of the cities of Bilbeis, Ibrahimiya, Hihya, Diarb Nigm, Mashtul el Souk, Minyet el Qamh are proposed to be developed by construction of additional groundwater stations.

- Housing Department System:

Among 82 existing groundwater stations of the Housing Department System, seven stations were selected to be reconstructed/expanded in the frame of the Emergency Works, considering their urgency.

(4) Procurement of Machines/Vehicles for Maintenance

The following machines/vehicles for maintenance will be procured:

Four-wheel-drive cars, trucks, backhoe, vibration rollers, generators, pipe cutters, drain pumps, rammers, water level detectors, portable chlorinators, box locators, leak detectors, spare parts.

2.4 Construction Cost

Total construction cost is estimated at LE 82,891,000- at 1984 price level. It is broken down into foreign currency portion of LE 38,220,000- and local currency portion of LE 44,671,000-.

(1984 price level)

Item	Construction Cost (x 1,000 LE)		
	Total	Foreign	Local
- Northeast Treatment Plant System	44,056.3	22,815.8	21,240.5
- Kafr Saqr Treatment Plant System	27,078.0	10,939.7	16,138.3
- Emergency Works (cf.Table-9)	11,757.6	4,464.5	7,293.1
Total	82,891.9	38,220.0	44,671.9

3. Implementation Program and Project Cost

3.1 Project Implementation Schedule

The project will be carried out in the following schedule:

1) Loan application ..... Early 1985 - Middle 1985 (1/2 year)
2) Detail design ..... Middle 1985 - Middle 1986 (one year)
3) Emergency works ..... Middle 1986 - Middle 1987 (one year)
4) Construction of New Northeast Plant system and New Kafr Saqr Plant system ..... Middle 1986 - Middle 1988 (two years)

3.2 Project Cost

The total cost for project implementation is estimated at LE 126,015,000-, composing of the construction works cost, emergency works, engineering service cost, physical contingency and price contingency.

a) Construction of New Northeast Plant system ...	LE	44,056,000-
b) Construction of New Kafr Saqr Plant system ...	LE	27,078,000-
c) Emergency works	LE	11,758,000-
d) Engineering services	LE	4,145,000-
e) Physical contingency	LE	8,704,000-
f) Price contingency	LE	30,274,000-
Total Project Cost	= LE	126,015,000-

The total project cost of LE 126,015,000- will be broken down into the foreign currency portion of LE 54,287,000- (Equivalent to US$ 66,230,000- at the changing rate: US$ 1.00 = LE 0.82); and the local currency portion of LE 71,728,000-.

3.3 Disbursement Schedule

The project will be commenced in 1985 and completed in 1988. The disbursement by each year will be made as shown in the table of " Disbursement Schedule" which is based on the implementation schedule.

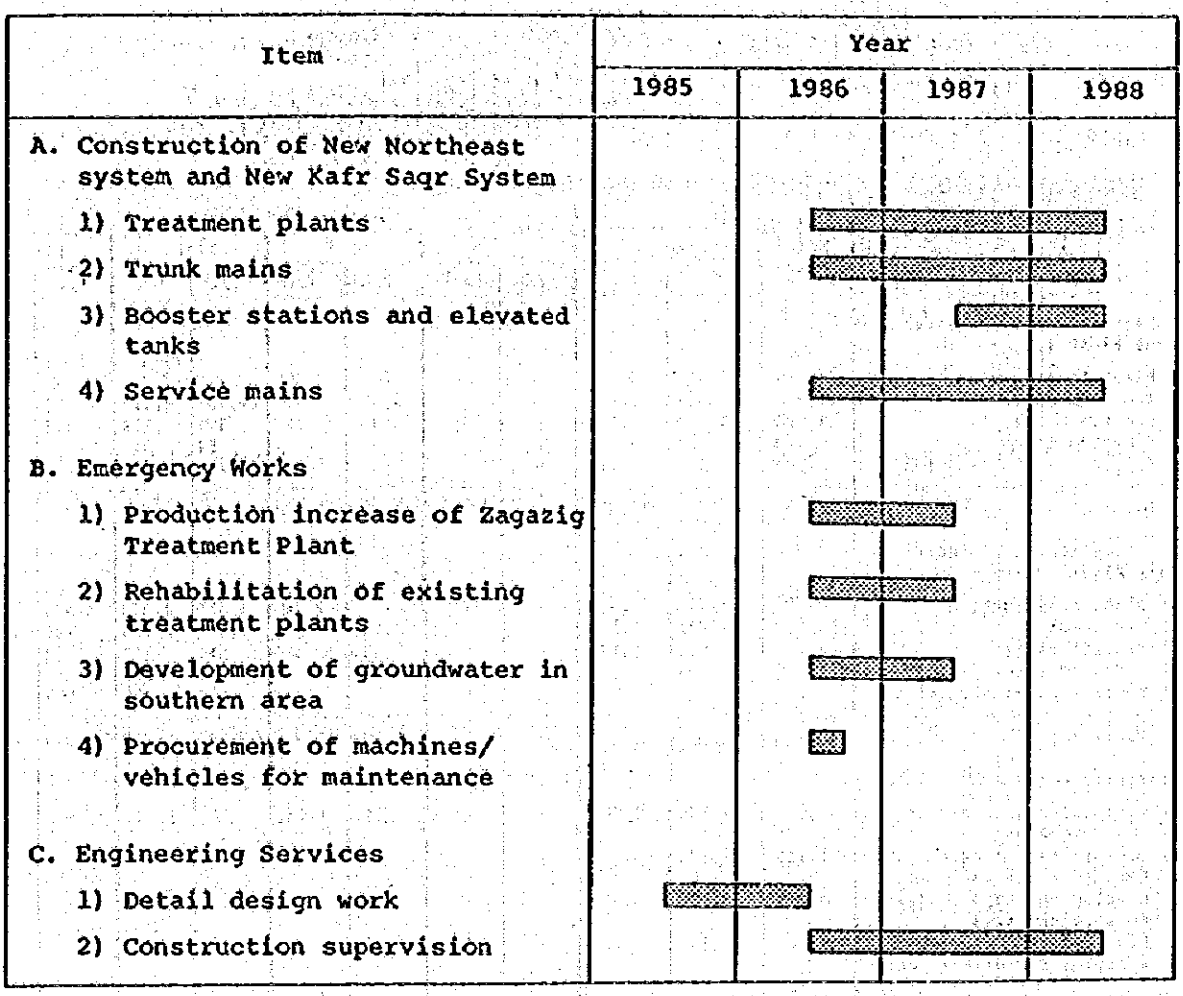


Fig-33 PROJECT IMPLEMENTATION SCHEDULE

Table -9 DISBURSEMENT SCHEDULE

Note: - Unit: One Thousand Egyptian Pounds = '000 LE
- F/C = Foreign Currency Component
- L/C = Local Currency Component
- Prices: As of Year 1984
- Foreign Exchange Rate: US$ 1.00 = LE 0.82
- Price Escalation Rate: 7 % annual for F/C,
12 % annual for L/C

(Unit: Thousand Egyptian Pounds)

Item	Cost			Yearly Disbursement							
	Total Cost	Breakdown		1985		1986		1987		1988	
		F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C
A. Construction of New North-east Plant system											
a) Plant construction	14,000	3,200	10,800	-	-	-	2,700	1,600	5,400	1,600	2,700
b) Trunk mains	25,753	17,925	7,828	-	-	5,378	783	10,755	4,697	1,792	2,348
c) Service mains	2,580	1,349	1,231	-	-	405	123	809	739	135	369
d) Elevated tanks	540	54	486	-	-	-	-	54	243	-	243
e) Booster pumping station	1,183	287	896	-	-	-	-	144	448	143	448
Total (A)	44,056	22,815	21,241	-	-	5,783	3,606	13,362	11,527	3,670	6,108
B. Construction of New Kafr Sakr Plant system											
a) Plant construction	10,700	2,300	8,400	-	-	-	2,100	1,150	4,200	1,150	2,100
b) Trunk mains	12,707	7,415	5,292	-	-	2,225	529	4,449	3,175	741	1,588
c) Service mains	2,126	930	1,196	-	-	279	120	558	717	93	359
d) Elevated tanks	810	81	729	-	-	-	-	81	365	-	364
e) Booster pumping station	735	214	521	-	-	-	-	107	261	107	260
Total (B)	27,078	10,940	16,138	-	-	2,504	2,749	6,345	8,718	2,091	4,671
C. Emergency Works											
a) Production increase of Zagazig Plant	3,600	1,500	2,100	-	-	750	1,050	750	1,050	-	-
b) Rehabilitation of existing treatment plants	3,515	1,541	1,974	-	-	770	987	771	987	-	-
c) Development of Groundwater in southern area	4,469	1,250	3,219	-	-	625	1,610	625	1,609	-	-
d) Procurement of machines/ Vehicles for maintenance	174	174	-	-	-	174	-	-	-	-	-
Total (C)	11,758	4,465	7,293	-	-	2,319	3,647	2,146	3,646	-	-
D. Engineering Services	4,145	2,487	1,568	684	456	963	642	560	373	280	187
Total (A+B+C+D)	87,037	40,707	46,330	684	456	11,569	10,644	22,413	24,264	6,041	10,966
E. Physical Contingency (10%)	8,704	4,071	4,633	69	46	1,157	1,064	2,241	2,426	604	1,097
Total (A+B+C+D+E)	95,741	44,778	50,963	753	502	12,726	11,708	24,654	26,690	6,645	12,063
F. Price Contingency	30,274	9,509	20,765	53	60	1,844	2,979	5,547	10,808	2,065	6,918
Total Project Cost	126,015	54,287 (43%)	71,728 (57%)	806	562	14,570	14,687	30,201	37,498	8,710	18,981

Note: - Foreign currency portion cost of LE 54,287 Thousand (43 % of total project cost):
Equivalent to US$ 66,230 Thousand.
Exchange Rate : LE 0.82 = US$ 1.00
US$ 1.00 = LE 1.22

4. Institution and Organization

A new organizational arrangement has been proposed to meet the immediate needs for the implementation of the First-Phase program within the framework of the Sharqiya Public Water Company (PWC) proposed in the Long Term Program. This new organization should be formed as a public company amalgamating three separate organizations related to water operation with the ultimate objective to achieve the managerial autonomy supported with the arrangements of ordinance and decree under the intensified guidance of NOPWASD.

The activities of the proposed PWC are to be located in the capital city of Zagazig for the central control of distributed districts offices and treatment plant operation, and the district offices in every Markaz for the operation and maintenance of the local water supply systems. (Refer to the organization chart.)

The followings are summarized staffing schedule indicating the number of staff for the priority-phase program made on the assumption that new project starts from 1986 after the detailed designing in 1985 and fully operates the schemed treatment plant from 1989.

	1985	1986	1987	1988	1989	1990
Staff in Headquarter	168	168	168	187	187	187
Staff for Treatment Plant	244	244	244	270	273	283
Staff in District Office	1,403	1,403	1,403	1,412	1,412	1,412
Total	1,815	1,815	1,815	1,869	1,872	1,822

The staffing of the proposed new organization is proposed based on the magnitude of the existing and newly planned water supply systems. Owing to the anticipated difficulties for the recruiting of the required and qualified personnels, the existing staffs are recommended to be employed to the full extent with intensified training to upgrade their present skills and technical knowledge.

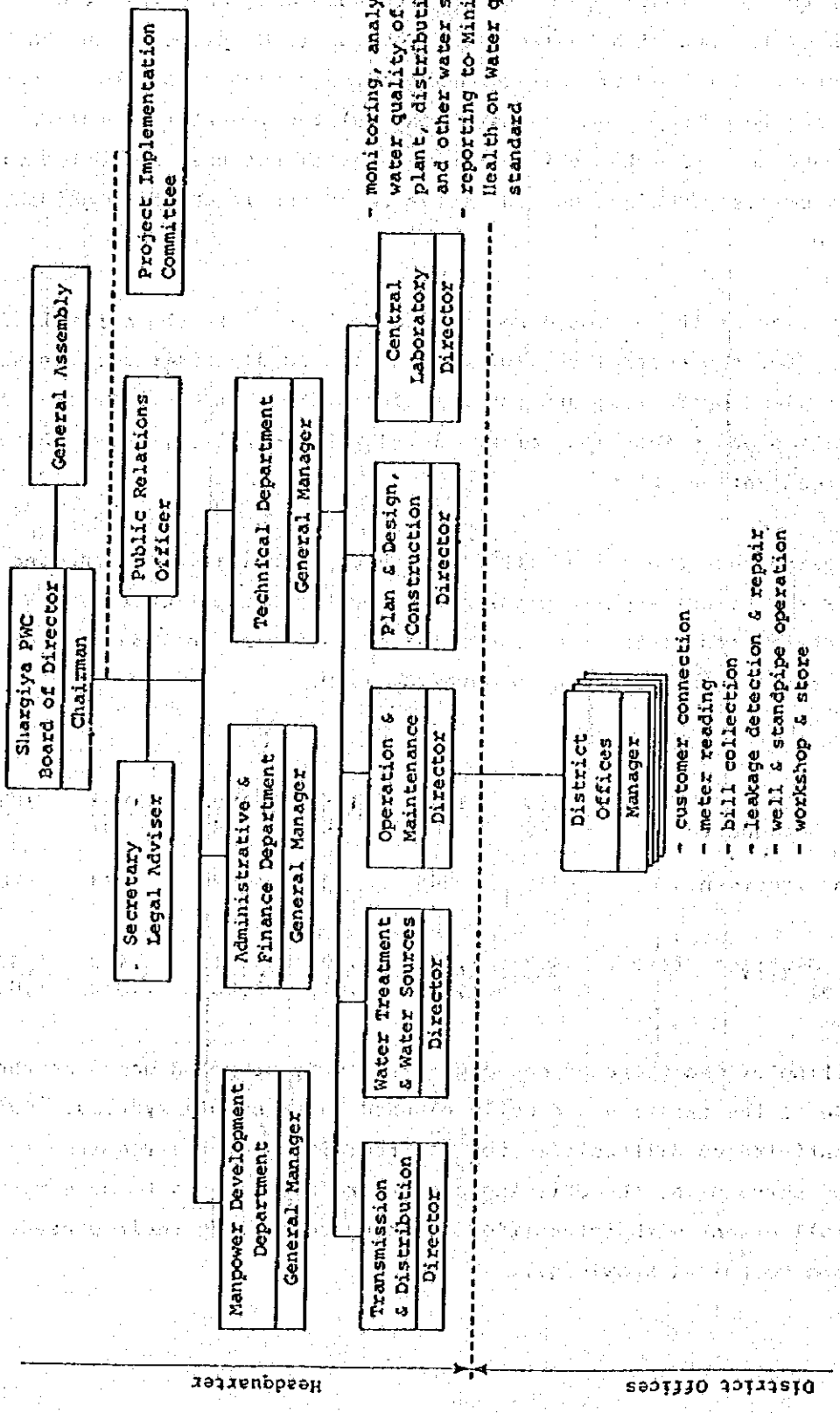


Fig-34 Proposed Organization Chart for First Priority-Phase Program

5. Financial Feasibility

The total investment cost of the First-Phase Program is LE 126 million including price contingency with foreign currency component of LE 54 million or US$ 66 million (43% of total cost) and local currency component of LE 72 million (57% of total cost).

In order to ensure the financial feasibility of the proposed project, the foreign currency portion is assumed to be funded by the foreign lending agency at the interest rate of 6 % per annum and 26 years repayment period including 6 years grace period and the local currency portion is assumed to be funded by the government subsidy. The more lenient foreign loan with low interest and extended repayment period would favor the financial feasibility of the project.

In order to recommend adequate water tariff schedule which can achieve financial feasibility of the project, a sensitivity analysis has been made assuming two alternative financial plans based on different water tariff schedules, i.e., Alternative-1: tariff revision and consumers ability to pay the charge and Alternative-2: higher level of water tariff to raise the sufficient water revenue in order to achieve the financial autonomy.

The major differences of above two alternatives are highlighted by the average water tariff per cubic meters (pts/m3) for the operation stage of the project from the year 1990 to 1996 as follows.

	1990	1991	1992	1993	1994	1995	1996
Alternative-1							
House-connected	11	13	15	15	15	15	15
Standpipe	5	5	5	7	7	7	7
Alternative-2							
House-connected	13	16	18	19	21	23	25
Standpipe	7	10	15	16	17	18	20

The Financial Internal Rate of Return (F.I.R.R.) calculated for above Alternative-1 and Alternative-2 are 5 % and 10 % respectively.

After comparison of two alternatives financial plans, Alternative-1 is recommended because the water tariff of Alternative-1 is more practicable and that of Alternative-2 exceeds the affordability of the water consumers to pay such charge.

The present low water tariff is therefore proposed to be raised gradually to the level as shown in previous paragraph in order to cover the operation and maintenance costs as well as debt service requirement. The financial rate of return (FIRR) of 5 % based on the above tariff schedule is considered positive and sufficient for the viability of the project and if the intangible socio-economic benefits are compounded, the figure of FIRR would increase remarkabley.

6. Project Evaluation

The magnitude of the total investment of LE 126 million broken down to foreign currency portion of LE 54 million and local currency portion of LE 72 million for the proposed project is considered adequate since this amount is estimated based on the least cost solution for the system expansion and rehabilitation to cope with the magnitude of the investment cost of similar project recently implemented in Beheira Governorate.

The local currency cost of LE 72 million is recommended to be fully funded by the government subsidy in order to enable the project financially viable under anticipated difficulty for the financial operation of the proposed executive agency of Sharqiya PWC at the burgeoning stage of the organizational development and less affordability of the water consumers to pay the water tariff.

The project investment is financially justified by the assessment of the Financial Internal Rate of Return (F.I.R.R.) which gives a measure for financial profitability of the water revenue derived from the investment. The F.I.R.R. calculated for the project is 5 % and considered sufficient to justify the investment.

In addition to the water tariff revenue, the various direct and indirect benefits can be expected to be derived from the implementation of the proposed project as summarized below.

1) Mitigation of present and anticipated severe shortage of water, expansion of the served area, increases of service pressure.
2) Health improvements by reduction of the waterborne diseases as amoebic dysentery and bilharzia presently prevalent by supplying sufficient water.
3) Better fire fighting capability by planned improvement of distribution systems and installation of fire hydrants thus resulting in reduced fire losses.
4) Relief from the laborious water carrying presently undertaken by women and children by providing sufficient house connections.
5) Contribution towards better use of products, materials, and human resources thus upgrading local construction industries and developing economic activities.