I. GENERAL

The present status of water supply in the Sharqiya Governorate is summarized below:

Popluation

1) The total population in the Sharqiya Governorate is estimated at 3,048,000 in 1983. It is divided into 692,000 (22.7 %) distributed in the urban area (cities/town) and 2,356,000 (77.3 %) in the rural area (villages).

2) The number of administrative municipalities (cities, town and villages) is 473 in the entire Sharqiya Governorate.

3) The population of one city or town is between 257,000 in the largest and 22,000 in the smallest, averaging 53,250. The population of one village is 5,120 on the average.

Public Water Supply

4) All the urban municipalities (12 cities + 1 town) are supplied by public water supply, either city-owned system or the Abbasa Regional Water Supply System. As to the villages, among 460 with 2,356,000 population in all, 429 (93.3 %) with 2,296,000 population (97.4 %) are supplied by either the Abbasa Regional Water Supply System or the Housing Department's supply systems.

5) The public water supply systems in the Governorate are classified into the following three categories:

(i) City-owned Water Supply Systems,
(ii) Housing Department's Water Supply Systems, and
(iii) Abbasa Regional Water Supply Systems

6) The water sources of the public water supply are:

(i)	City-owned systems	:	Canal water plus groundwater or groundwater only
(ii)	Housing Department's systems	:	Groundwater
(iii)	Abbasa system	:	Canal water plus groundwater

7) The service areas covered by the systems are:

(i)	City-owned systems	:	9 cities with 607,000 people
(ii)	Housing Department's systems	:	189 villages with 802,000 people
(iii)	Abbasa system	:	3 cities, 1 town and 240 villages with 1,549,000 people in total

Brief History of Systems

8) Among the above three kinds of the public water supply systems, historically, the city-owned systems are oldest in development. The oldest system was constructed in 1909 in Zagazig City, with Muweis Canal water treated by plain sedimentation, and the second oldest ones were installed in 1928 both in Bilbeis City with Ismailia Canal water without treatment and in Minyet el Qamh City with groundwater. In 1954, Diarb Nigm City, the latest, commenced supply with groundwater, thus making 9 cities have their own public water supply systems. The remaining 4 urban municipalities (3 cities and one town) were supplied in 1959 by the Abbasa Regional Water Supply System upon completion.

9) In the years from 1950 to 1956, the Housing Department's Water Supply Systems were constructed to supply to local villages. The water source was the groundwater available locally. Therefore, the area served by the Housing Department's systems was limited to the southern part of the Governorate, since in the northern part the groundwater was not potable due to salinity. The systems supply 189 villages in 7 Markazes.

10) In 1959, the Abbasa Regional Water Supply System was completed. This system was intended to cover a wide area which had been left without public water supply. To this end, one large treatment plant named " Abbasa Water Treatment Plant " was constructed in Abbasa of Abu Hammad Markaz, at a site along Ismailia Canal. The plant has been treating the surface water of the canal by rapid sand filtration process with chlorination afterwards. The treated water was 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 later years, to supplement the production capacity, groundwater stations and so-called compact nits treating canal water were added to the system. They are located in the middle and/or at the end of the service area.

Production

11) The city-owned systems supply 84,976 m^3/day to 607,000 people in 9 cities. The per capita production is estimated at 140 liters/day.

12) The Housing Department's systems, containing 82 groundwater stations, supply 27,211 m^3/day to 802,000 people in 189 villages. The per capita production is 34 liters/day.

13) The Abbasa system, consisting of one treatment plant, 14 groundwater stations and 5 compact units, supplies 14,739 m^3/day to 1,548,520 people in 244 municipalities (3 cities, 1 town and 240 villages) in the Sharqiya Governorate. The per capita production of the system is 74 liters/day.

14) Total production = 84,976 + 27,211 + 114,739 : 226,926 m^3/day
Total population
in the served area = 607,000 + 802,000 + 1,549,000 : 2,958,000 persons
Per capita production = 226,926 ÷ 2,958,000 : 77 liters/day

Problems

15) 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 so in the urban areas. The people are forced to endure the present scarcity, it seems.

16) Deterioration of Facilities
Many facilities of the water supply systems, such as the mechanical/electrical equipments and some pipelines, have been deteriorated due to the age, especially in the city-owned systems.

17) Lack of Budget
The annual budget for water supply systems 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 preparation is needed for it and under the situation, almost no special projects can be expected for realization.

18) The number of personnel working for water supply is considered enough, or more than enough. However, the number of qualified, specialized, skilled technicians, operaters, labors is seriously in shortage.

Tables of Summary

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

Table 1-1 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 1-1 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 1-1 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 1-1 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

II. ABBASA REGIONAL WATER SUPPLY SYSTEM

1. General

Abbasa water supply system, consisting of Abbasa treatment plant, 5 booster stations, 18 elevated tanks and distribution mains, started its service to Sharqiya Governorate in 1959, as one of GOPW's major regional water supply systems in Egypt. The system aimed to supply municipalities which had no public water supply system or no own water sources, or which fell in severe water shortage, especially in the northern part of the governorate where groundwater was not potable due to salinity. Some large municipalities had already supplied water with their own sources of irrigation canals surface water or groundwater, as seen in the cities of Zagazig and Faqus.

Water demand in the area had been increasing naturally year by year, exceeding the original supply capacity of the system, and Abbasa system ceased to supply water to remote areas eventually. Almost all of the elevated tank in the system were not filled due to lack of enough water and low pressure and the booster stations were put out of operation, as the water from Abbasa could not reach there.

To solve the situation, many groundwater pumping stations drawing well water and several so-called "compact units" treating nearby canal water were hastily constructed, along the distribution pipelines route, as supplementary supply sources.

Besides the before mentioned sources, the system comprises; transmission pipelines (600 - 250 mm in diameter and 28.5 km in total length), distribution pipelines (800 - 100 mm in diameter and 2,100 km in total length), 18 elevated tanks and 5 booster pumping stations. The location of major components are shown in Fig.2-1.

The system which started with 400 l/sec supply capacity of water produced by Abbasa Plant in 1959 is capable of supplying 1,448 l/sec (114,739 m^3/day) now, owing to increased production of the plant and supplementary sources mentioned above. The current supply capacity is broken down as shown below.

Table 2-1 Production of the Abbasa System

	Facilities	Production
1)	Abbasa Plant (surface water plus groundwater)	750 l/sec
2)	14 Groundwater Stations (except station in the Abbasa Plant)	642 l/sec
3)	5 Compact units	56 l/sec
	Total = 1,448 l/sec = 125,107 m^3/day	

Out of the above production of 125,107 m^3/day, 10,368 m^3/day is transmitted and supplied to the Ismailia Governorate, and 114,739 m^3/day (125,107 - 10,107) is distributed in the Sharqiya Governorate. The Abbasa System supplies to about 1,689,000 persons (1,549,000 in Sharqiya Governorate and 140,000 in Ismailia Governorate), making the estimated consumption as 74 liters per capita per day on the average.

The following table shows municipalities in the Sharqiya Governorate which obtain public water from the Abbasa System and supply capacity together with population.

Table 2-2 Water Distribution of the Abbasa System
(Sharqiya Governorate)

Municipalities	Capacity Supplied	Population
Rural Area		
1) Villages in Bilbeis Markaz	6,664 m^3/day	100,769
2) " " Zagazig "	16,786 "	222,734
3) " " Hihya "	7,438 "	86,248
4) " " Faqus "	16,991 "	270,408
5) " " Abu Kebir "	13,876 "	131,948
6) " " Abu Hammad "	24,598 "	201,356
7) " " Ibrahimiya "	4,790 "	51,564
8) " " Kafr Saqr "	10,419 "	216,758
9) " " Huseiniya "	7,903 "	181,735
Sub Total (Rural Area)	109,465 "	1,463,520
Urban Area		
10) Abu Hammad City	1,500 m^3/day	22,000
11) Qeneyat Town	1,674 "	28,000
12) Kafr Saqr City	1,500 "	17,000
13) Huseiniya City	600 "	18,000
Sub Total (Urban Area)	5,274 "	85,000
Total	114,739 m^3/day	1,548,520

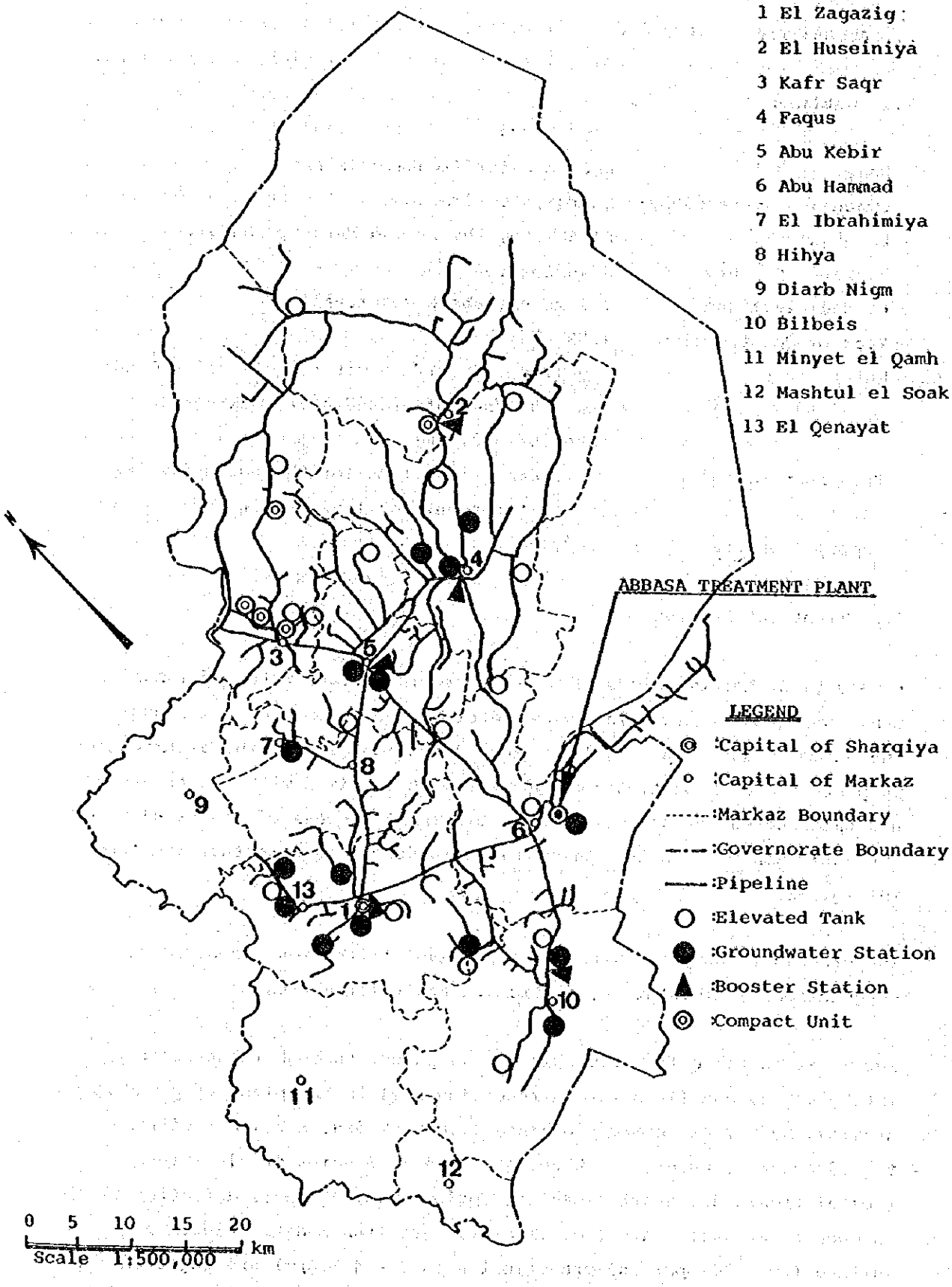

Fig. 2-1 GENERAL PLAN OF ABBASA SYSTEM

2. Abbasa Treatment Plant

2.1 Outlines

- Name	:	Abbasa Water Treatment Plant
- Owned and Operated by	:	Sharqiya Governorate
- Location	:	El Abbasa, Abu Hammad Markaz, Sharqiya Governorate
- Ground Elevation	:	+ 9 meters above sea level
- Year of Construction	:	1959
- Water Source	:	750 l/sec of surface water of Ismailia Canal and 100 l/sec of groundwater, making the total of 850 l/sec
- Treatment Method	:	Rapid sand filtration for the surface water and no treatment for the groundwater
- Supply Capacity	:	750 ℓ/sec

2.2 Treatment Process

Abbasa Plant has two kinds of water source: surface water of Ismailia Canal and groundwater. The groundwater, pumped from deep wells sunk in the Abbasa Plant compound, flows into a suction well of the distribution pump station without treatment and there it is mixed with the treated and chlorinated surface water. The treatment process of the canal water currently employed in the Abbasa Plant is described hereafter and shown in Fig.2-2.

The process is complied with the rapid sand filtration, composed of coagulation, sedimentation, filtration and chlorination.

Raw water is taken from Ismailia Canal, passes through intake screen/ intake gates, and flows into a receiving well in the plant compound by gravity, by way of intake pipelines (1,000 mm dia. x 2 lines of reinforced concrete made). It then is pumped to 3 units of clarifiers (coagulation/sedimentation basins, upflow type, $3\frac{1}{2}$ hours detention time) through a raw water main (800 mm dia., cast iron made). Aluminum sulfate (20 - 30 ppm) and pre-chlorine (3.0 - 4.5 ppm) are injected into

the raw water main. After sedimentation, the settled water is transferred to sand filters (48 m^2 x 16 units) for rapid filtration. The filtrated water goes to the underground reservoirs (2 units; 4 hours detention time) for storage via a filtrated water main (800 mm dia, cast iron made), on the way of which aluminum ammonia (50% of post-chlorine dosage) and post-chlorine (1.5 - 2.5 ppm) are injected. The finished water is conveyed to a suction well of the distribution pump station and there it is mixed with the groundwater, as described before. The distribution pumps (4 units x 60 m head) feed it to the distribtuion mains for public supply.

The measurement of water flow is made by Venturi-meters for raw water (800 mm of cast iron made pipeline), filtrated water (800 mm of cast iron made pipeline) and distributed water (800 mm CIP main and not 600 mm main). In addition, each of intake pumps, filtrated water pipes and distribution pumps is equipped with a Venturi-meter, though some of them are not working presently.

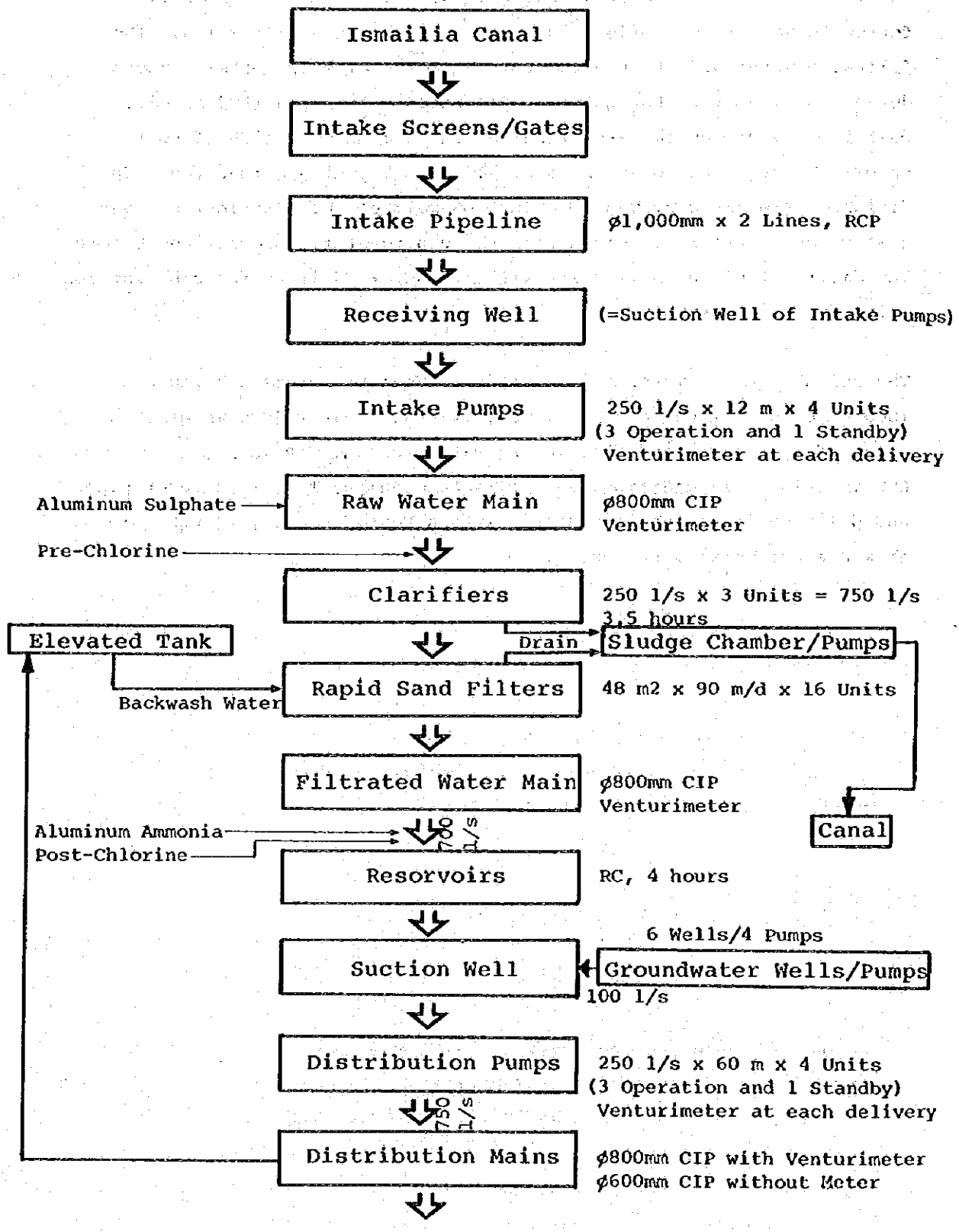

Fig. 2-2 FLOW DIAGRAM OF ABBASA TREATMENT PLANT

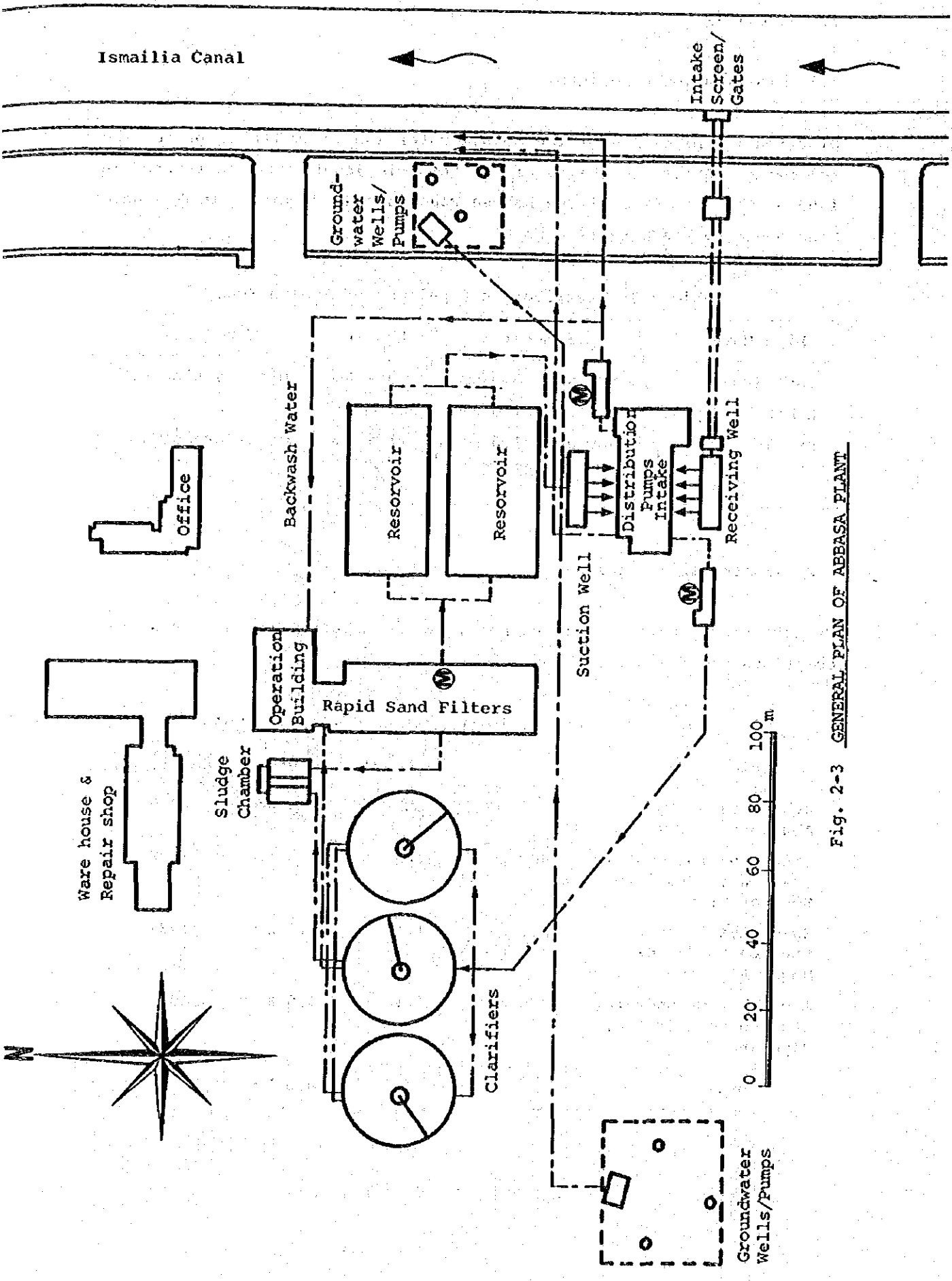

Fig. 2-3 GENERAL PLAN OF ABBASA PLANT

3. Pipelines

3.1 Distribution Pipelines

Distribution pipelines of the Abbasa water supply system comprises the following. About two-thirds of the total in length was constructed in 1959 at the same time of the Abbasa Plant's construction. Others have been added by the extension work.

Table 2-3 Distribution Pipelines of Abbasa System

Pipe Material	Diameter	Length	Remarks
Cast Iron	800 mm - 350 mm	100 km	Distribution mains
Asbestos Cement	600 mm - 100 mm	2,000 km	"
Steel	600 mm - 100 mm	1 km	Canal crossing
Total		2,101 km	

3.2 Transmission Pipelines

Transmission pipelines defined here, of the Abbasa water supply system, comprises the following:

Table 2-4 Transmission Pipelines of Abbasa System

Place	Diameter	Material	Length	Year of Installation
Abbasa Plant to Abu Hammad City	600 mm	ACP	4.0 km	1976
Didamoon Groundwater Station to Huseiniya Booster Station	400 mm	ACP	18.5 km	1982
Huseiniya Booster Station to San El Hagar Pipeline	250 mm	ACP	2.0 km	1981
Abu Kebir Groundwater Station to Kafr Saqr Pipeline	400 mm	ACP	4.0 km	1973
Total			28.5 km	

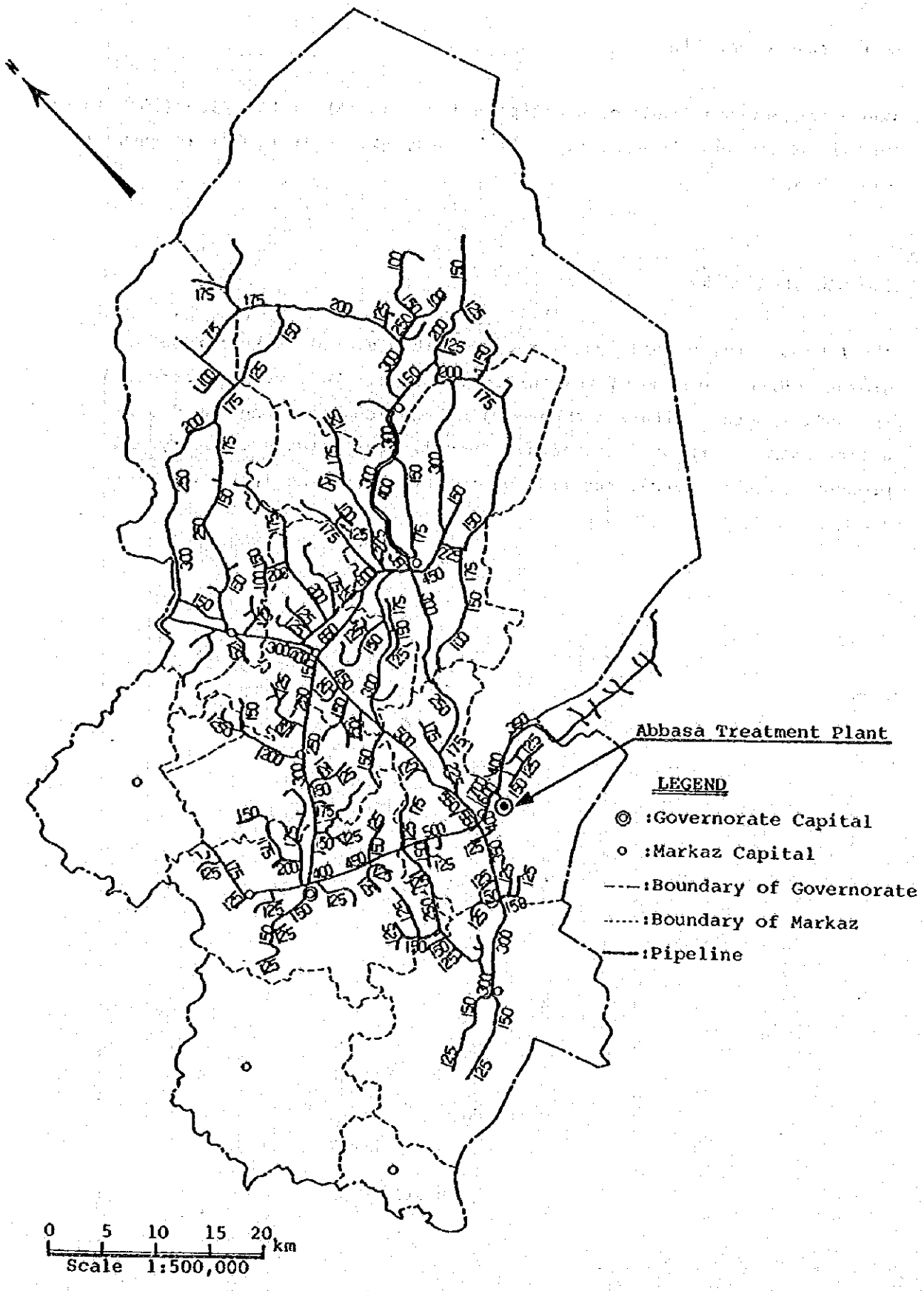

Fig. 2-4 PIPELINE NETWORK

3.3 House Connection

House connections, made of steel pipe (50 - 13 mm) or PVC pipe (50 - 13 mm), numbers about 53,000 presently. Its yearly growth in number is shown in Table 2-5.

4. Elevated Tanks

The Abbasa water supply system includes 18 elevated tanks for supply storage which are made of reinforced concrete. They were constructed in 1959, together with the Abbasa Plant and located along the distribution mains in the service area. Insufficient service capacity and pressure hinders normal function of the storage. The tanks are listed in Table 2-6.

Table 2-5 Number of House Connections
(Abbasa System)

	Markaz	1976	1977	1978	1979	1980	1981	1882	1983
1)	El Zagazig	358	727	739	1,032	1,085	1,452	1,709	2,155
2)	El Huseiniya	83	129	409	235	306	361	210	355
3)	Kafr Saqr	81	112	142	240	502	486	644	1,013
4)	Faqus	251	417	631	794	810	880	1,073	1,358
5)	Abu Kebir	123	169	288	365	923	1,057	1,308	1,505
6)	Abu Hammad	173	438	427	1,090	1,566	2,351	3,019	2,914
7)	El Ibrahimiya	54	62	153	312	255	301	528	802
8)	Hihya	53	50	56	108	157	202	507	507
9)	Bilbeis	51	213	167	250	187	305	182	806
10)	El Qenayat	89	173	152	158	277	450	502	590
	Total	1,316	2,490	3,164	4,584	6,068	7,845	9,682	12,005
*11)	El Tell El Kabir	45	130	82	128	379	460	553	600
	Total	1,361	2,620	3,246	4,712	6,447	8,305	10,235	12,605

* Belonging to Ismailia Governorate.

Table 2-6 Elevated Tanks of Abbasa System

	Location City/Village	Markaz	Volume	Height above ground
1)	San El Hagar	Huseiniya	300 m^3	25 m
2)	Tell Rak	Kafr Saqr	300 m^3	25 m
3)	Kafr Saqr	"	400 m^3	20 m
4)	Natora	"	400 m^3	20 m
5)	Kahboona	Faqus	1,000 m^3	25 m
6)	Kanteer	"	500 m^3	25 m
7)	El Fadadna	"	500 m^3	38 m
8)	El Roda	"	400 m^3	32 m
9)	El Sakakra (Soobieh)	Hihya	400 m^3	25 m
10)	Tel Moftah	Abu Hammad	500 m^3	33 m
11)	Korean	"	400 m^3	32 m
12)	Abu Hammad	"	500 m^3	33 m
13)	Farsis	El Zagazig	400 m^3	25 m
14)	Shobec Basta	"	500 m^3	33 m
15)	Kafr Abaza	"	400 m^3	30 m
16)	Saadat	Bilbeis	400 m^3	20 m
17)	Tel Rosen	"	300 m^3	20 m
18)	Kassasin 1/	El Tell El Kebier	400 m^3	27 m
	Total		8,000 m^3	

Note: 1/ Ismailia Governorate.

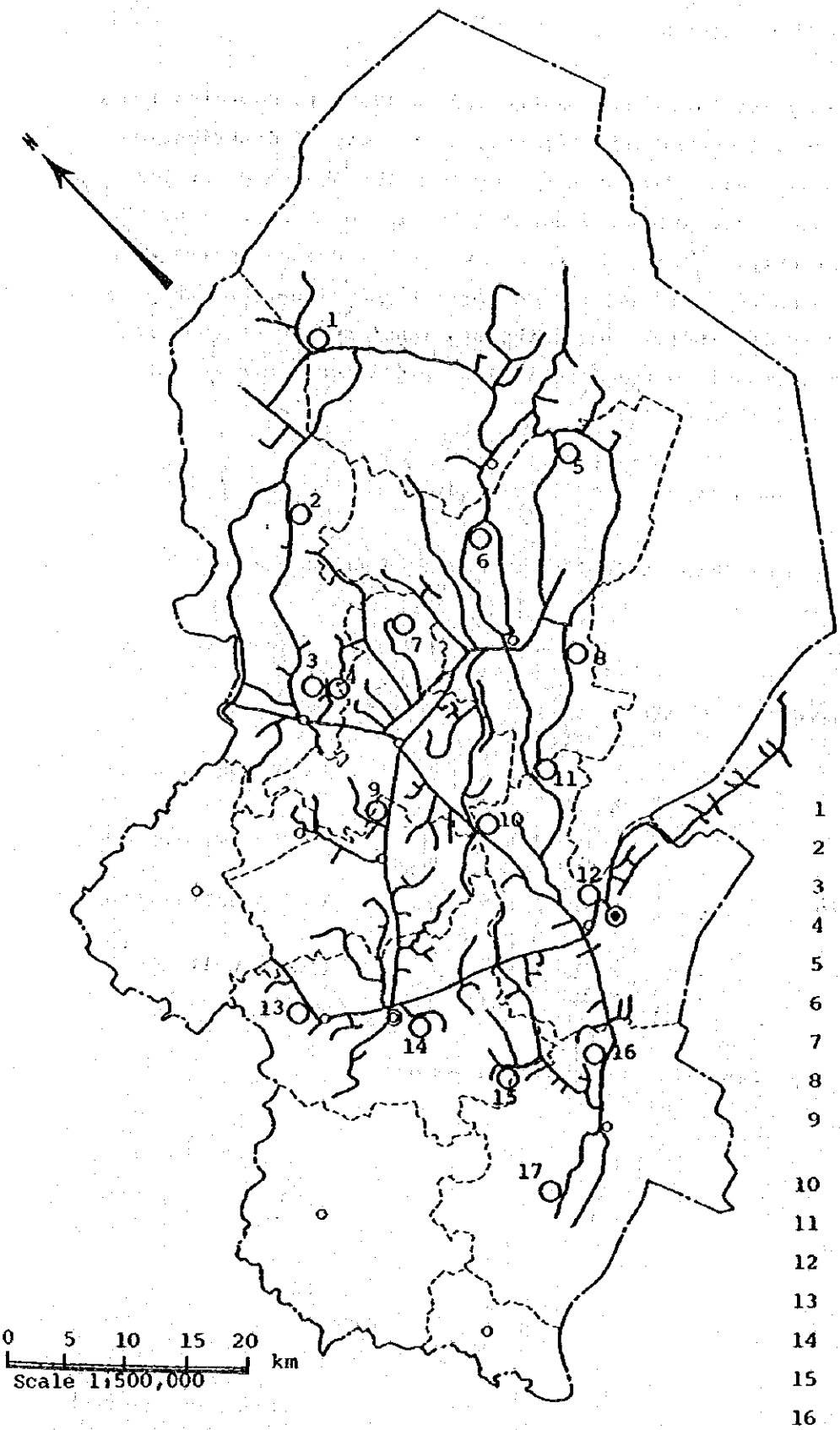

Fig. 2-5 ELEVATED TANKS

5. Booster Pumping Stations

5 booster pumping stations were constructed in 1959, in coordination with the Abbasa Plant and distribution system, on the way of distribution pipelines to add pressure to water coming from the Abbasa Plant for distributing to closeby areas and sending to distant areas. They are not in use currently, because the Abbasa water has ceased to reach the stations due to shortage of water. To correct the situation, deep wells have been constructed in and around the stations' compounds and ground-water has been supplied to the distribution pipelines, in place of the originally planned Abbasa water.

The booster pumping stations are listed below:

Table 2-7 Booster Pumping Stations of Abbasa System

Station	Pumps 1/	Remarks
1) Huseiniya	75 KVA x 380 V x 1 Units 50 " x 380 " x 2 "	
2) Faqus	75 " x 380 " x 2 " 50 " x 380 " x 2 "	7 deep wells added
3) Abu Kebir	100 " x 380 " x 2 " 50 " x 380 " x 2 "	7 deep wells added
4) Zagazig	75 " x 380 " x 2 " 50 " x 380 " x 2 "	3 deep wells added
5) Saadat	50 " x 380 " x 2 " 35 " x 380 " x 2 "	1 deep well added

Note: 1/ Centrifugal horizontal pump

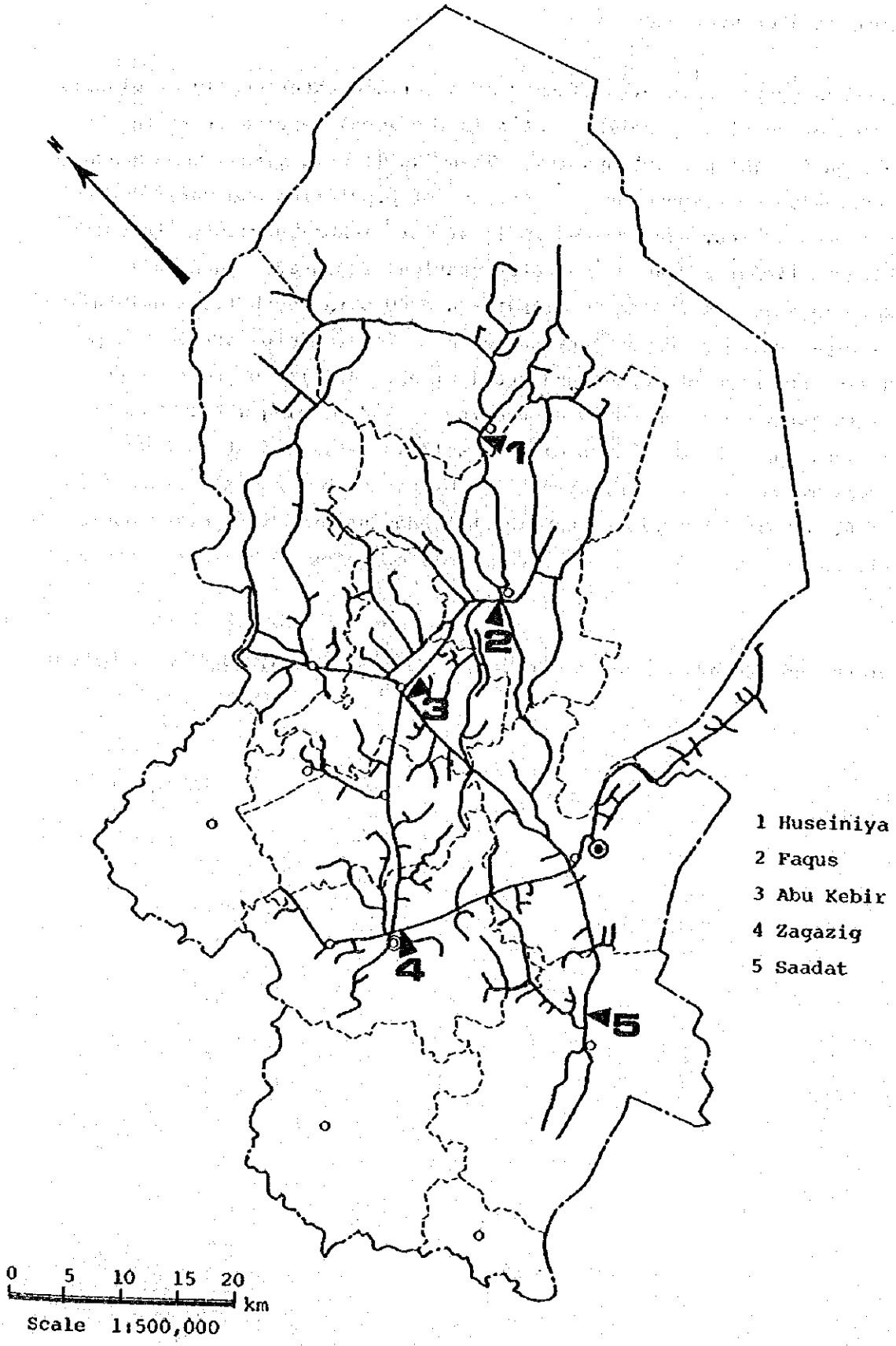

Fig. 2-6 BOOSTER STATIONS

6. Groundwater Stations

The Abbasa system which was planned as a surface water supply originally, now depends on 48 deep wells located in the local service areas in supplementing the supply capacity. These wells have been constructed successively, corresponding the increase of population and water demand of the areas. They are located in 15 sites: 1-Abbasa Plant, 4-booster pumping stations, and 10-groundwater stations isolated. Each well in average is sized of 250 mm in diameter and 60 m in depth (40 m galvanized steel pipe casing at upper part and 20 m perforated pipe screen wrapped with fine net made of copper and steel wire). Statistic groundwater level is ranged 3 - 6 m below ground level; and pumping water level is 10 - 15 m. Average discharge of each well is estimated at 25 l/sec. The well water is pumped by about 50 m by either horizontal volute pump (35 - 45 HP) or submersible pump (25 KW) and injected into distribution pipelines without chlorination. Each well operates 16 hours in average a day.

Location and numbers of the groundwater wells are tabulated in Table 2-8.

Table 2-8 Groundwater Stations in Abbasa Water Supply System (1983)

Groundwater Station	Number of Well	Pumps and Capacity
1) Mollemien Groundwater St.	1 Well	1 Pump x 25 l/sec x 16 hours = 17 l/sec
2) Didamoon " "	8 "	4 " x 40 " x " = 107 "
3) Faqus Booster Station	7 "	6 " x 25 " x " = 100 "
4) Abu Kebir Groundwater St.	5 "	5 " x 25 " x " = 83 "
5) Abu Kebir Booster Station	7 "	7 " x 25 " x " = 117 "
6) Ibrahimiya Groundwater St.	2 "	2 " x 25 " x " = 33 "
7) Bichet-Kayed " "	1 "	1 " x 25 " x " = 17 "
8) Bahnabai " "	1 "	1 " x 25 " x " = 17 "
9) Qenayat " "	2 "	1 " x 25 " x " = 17 "
10) Zanklon " "	1 "	1 " x 25 " x " = 17 "
11) Zagazig Booster Station	3 "	3 " x 25 " x " = 50 "
12) Abbasa Treatment Plant	6 "	2 " x 75 " x " = 100 "
13) Bourdien Groundwater St.	2 "	2 " x 25 " x " = 33 "
14) Saadat Booster Station	1 "	1 " x 25 " x " = 17 "
15) Ghita Groundwater St.	1 "	1 " x 25 " x " = 17 "
Total	48 Wells	38 pumps x 16 hours = 742 l/sec ($64,109\ m^3$/day)

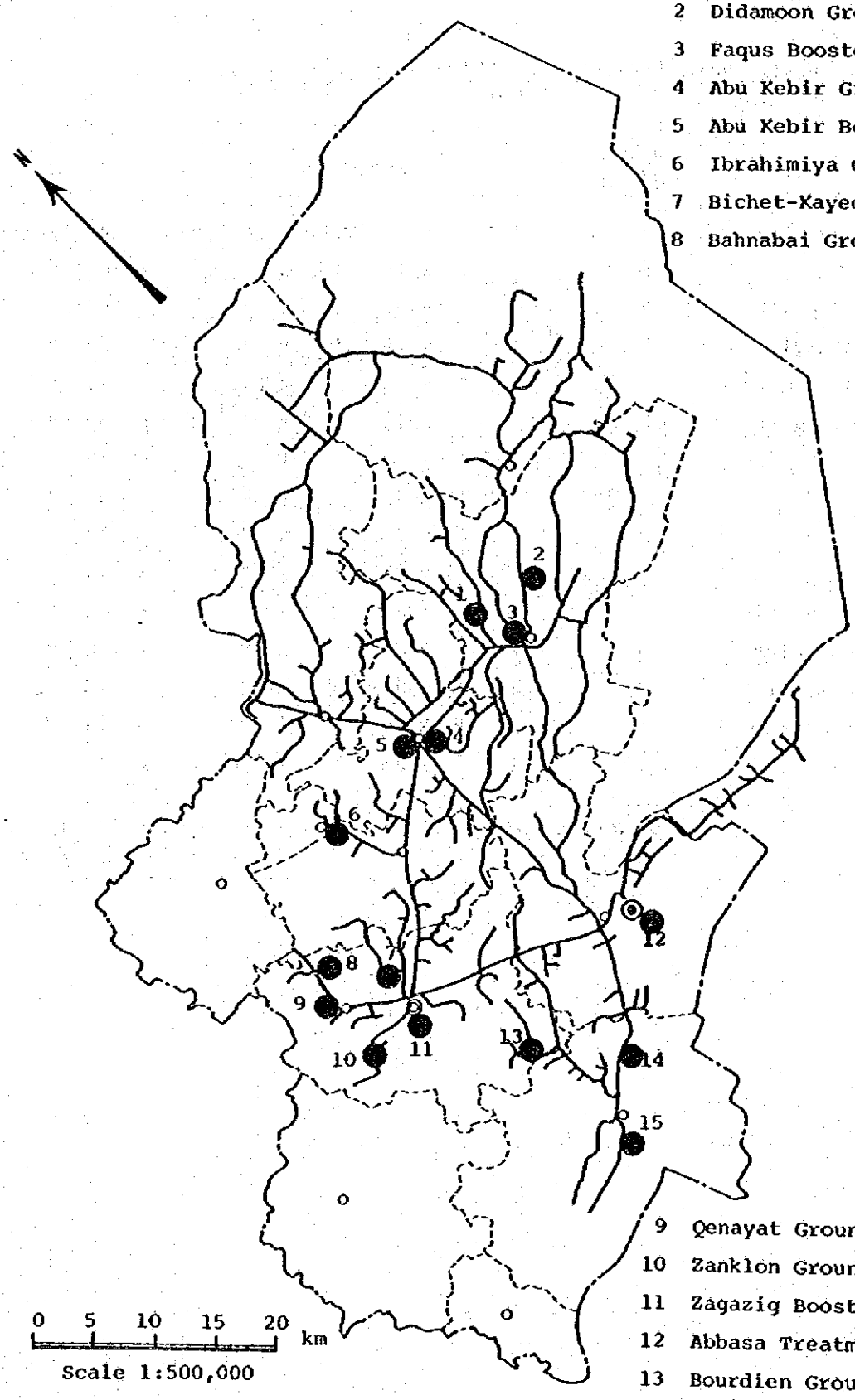

Fig. 2-7 GROUNDWATER STATIONS

7. Compact Units

The Abbasa water supply system has been supplemented with "Compact Units" in both Markaz of El Huseiniya and Kafr Saqr where water shortage has been serious and potable groundwater is not available.

The compact unit is an equipment to treat surface water by rather simple process: a kind of rapid sand filtration with high rate sedimentation. The equipment is of above-ground type steel structure and it is assembled at construction site.

Capacity of each unit is standardized to be of 100 m^3/hour (= 28 l/sec) which enable to supply to 10,000 people.
Present status of the units is summarized below:

Table 2-9 Compact Units of Abbasa System

Location/ Markaz	Water Source (Canal)	Service Area	Year of Instal-lation	Supply Capacity
1) Huseiniya	Samana Canal	Huseiniya City	1981	Not in operation
2) Kawasem No.1, Kafr Saqr	Muweis Canal	Kafr Saqr City and surrounding villages	1981	28 l/s x 12 hours
3) Citty, Kafr Saqr	Muweis Canal	Villages	1983	-ditto- =
4) Tell Rack, Kafr Saqr	Tell Rack Canal	Villages	1983	-ditto- =
5) Kawacem No.2, Kafr Saqr	Muweis Canal	Kafr Saqr City	1984	-ditto- =
Total				= 56 l/sec = 4,838 m^3/day

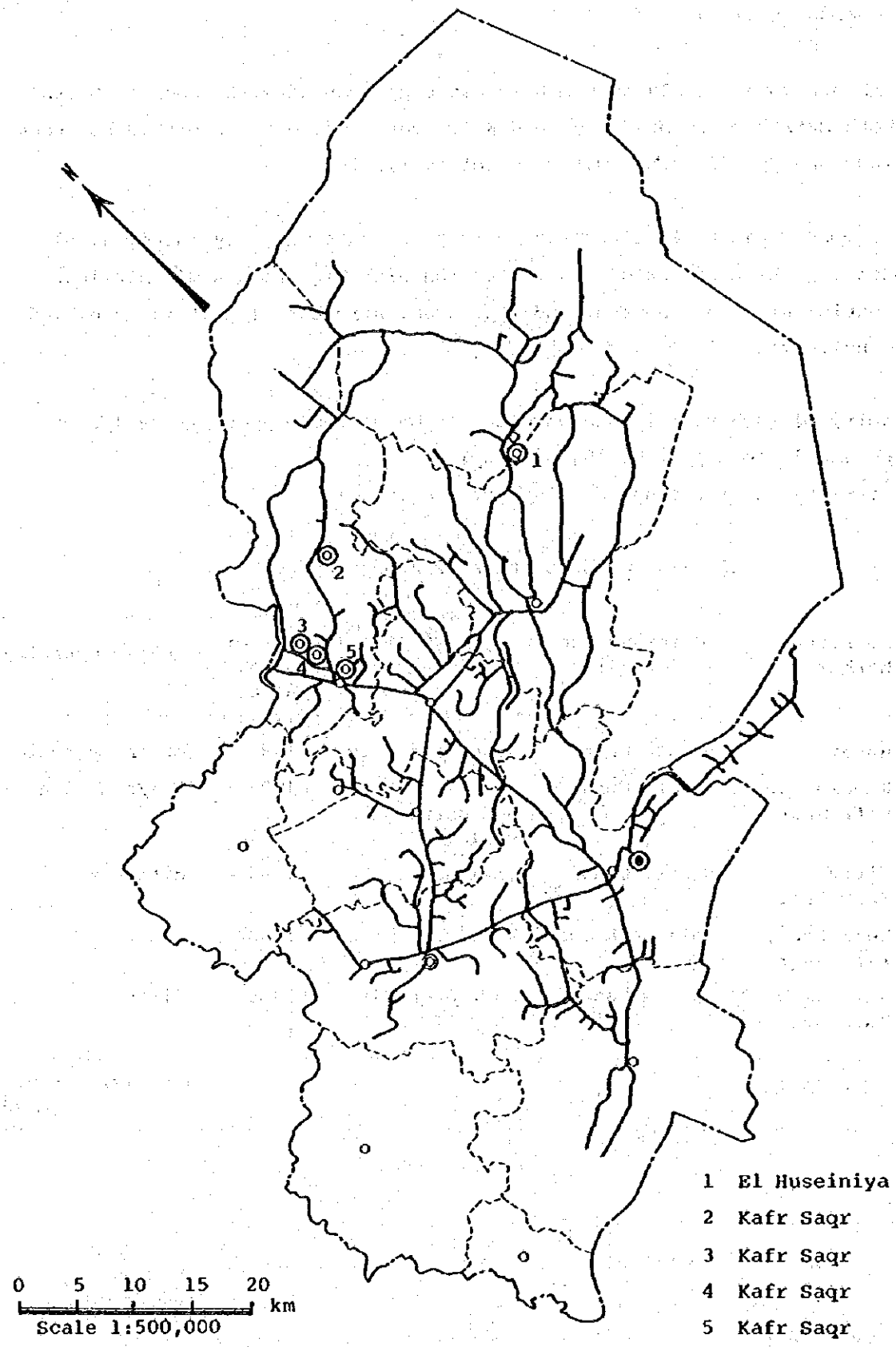

Fig. 2-8 COMPACT UNITS

8. Operation and Maintenance of Pipelines

The maintenance of all pipelines of Abbasa System has been carried out by the Technical Division headed by Sub-Director as shown below in the organization chart.

Organization of Abbasa System

General Director of Abbasa System
- Administration & Accounting Division
- Maintenance Division (Procurement of Material, Maintenance of Booster and Groundwater Stations)
- Technical Division (Planning and Design, Construction, Maintenance of Plant and Distribution System, Delivery of Material)

The maintenance of pipelines of Abbasa System has been operated by the following maintenance groups stationed at Markazes:

Number of Groups Stationed at Markazes

Abbasa Plant	4 groups
Zagazig Markaz	1 group
Faqus "	1 "
Abu Kebir "	1 "
Huseiniya "	1 "
Bilbeis "	1 "
Ibrahimiya "	1 "
Hihya "	1 "
Total	11 groups

These maintenance groups consist of a technican, a skilled pipe worker, two of assistant pipe workers and two - six of labors for digging, backfill and other works. The specialized maintenance groups for cast iron

pipeline are usually in Abbasa Plant and they are to be dispatched when the necessity arises. The groups engage in 1) New house connection works which are approximately composed of 20 connections a day at present in the Governorate, 2) Repair of pipeline leakage, and 3) Repair of free taps. The repair works have been carried out not only on the basis of their own findings but also in response to information from the people.

The responsible limit for repair is up to the meter of a house connection. The reduce any happening of leakage between distribution pipe and house meter and make sure of pipe installation works, the following measures are taken by the Governorate.

1) All necessary materials of new house connections have to be bought from designated shops by applicants themselves at their expense in conformity with standards/instructions of the Governorate.
2) For all obtained materials from the shops the applicants have to get an approval of the Governorate as to the quality of materials prior to the installation.
3) The installation work between distribution pipe and house meter has to be carried out by the above-mentioned maintenance groups of the Governorate.

For the purpose of minimizing the pipeline leakage, the Governorate has taken the undermentioned countermeasures taking into consideration the lifetime of the distribution facilities.

Railway Crossing – For the protection of crossing railways, concrete pipes, in which distribution main is installed, are set with two valves of both sides of the crossings. Nowadays the Governorate is planning and executing to install pipelines in parallel with the crossings as far as the budget is available considering the lifetime. Recently a leakage was found from one of such crossing works of Distribution Main for Ismailiya (Distribution main: Ø300 SP; Sheath Pipe: Ø600 reinforced concrete pipe), and the leakage was repaired with a delivery of arranged fittings which are produced at local manufacturer.

Canal Crossing – The pipelines sometimes cross canals/rivers with bridges or invert siphons. In case of invert siphons employed for main pipelines, same idea as the above-named railway crossing is carried out as follows:

1) Pipeline installed in parallel with original crossings if they are considered as almost their lifetime.

2) Two valves set at both sides of newly installed crossing work.

9. Evaluation

The Abbasa water supply system appears that it was designed well and had been operated in satisfactory conditions in the years of commencement of the system; however, it has been deteriorated due to obsoletion of equipment and pipelines, and water shortage. The major problems which the current system faces to are summarized hereafter.

- Shortage of water:

The Abbasa Plant water has not reached remote Markaz such as Kafr Saqr and Huseiniya which are located far from the Plant. The above mentioned two Markaz, unfortunately have no groundwater suitable for drinking owing to salinity; and people living there, about 236,000 and 229,000 respectively, are suffering from water shortage seriously. People in Kafr Saqr Markaz are forced to buy costly drinking water through private water vender carrying water by way of water tankers from Abu Kebir Groundwater Station.

- Low service pressure:

Simultaneously with and because of the shortage of water, water pressure in distribution pipelines especially in areas remote from the Abbasa Plant is considerably low. The existing elevated tanks scattered in the service area are currently inoperable due to insufficient water and low pressure; nor the existing booster pumping stations.

- Deterioration of Equipment /Materials:

The Abbasa Plant was constructed a quater century ago and no significant work of replacement has been made so far, because of insufficient monetary budget for the system and lack of spare parts of machinery/equipment, and it makes proper operation difficult. Specially, mechanical equipment/devices such as meters, valves, chemical dosing equipment are required to be replaced or repaired. In addition, distribution pipelines have been deteriorated to some extent due to the age.

- Lack of Spare Parts:

The Abbasa Plant, constructed in 1959, is seriously in short of spare parts, since the existing facilities are of outdated models and the equipments installed were imported from West Germany.

- Wastage and Leakage:

There exists a considerable amount of waste at standpipes (free-charged taps) in addition to the leakage from the distribution pipelines caused by lack of proper and regular maintenance of the pipelines.

- Lack of Literature:

The plant does not keep sufficient literature detailing the layout of existing systems, flow charts, water level diagram, design drawings, operation manuals and so on; which must be needed in routine operation and expansion planning.

- Non-Technology Transfer:

The Abbasa Plant is currently the largest and much-experienced treatment plant in the Sharqiya Governorate and naturally it has deeper knowledge and technology. However, such technology has not been applied or transferred to other treatment facilities such as compact units which were recently constructed and other existing treatment plants in Zagazig and Faqs.

III. HOUSING DEPARTMENT'S WATER SUPPLY SYSTEM

1. General

The water supply systems under the authority of Housing Department of the Sharqiya Governorate was formed and constructed in the beginning and middle of 1950s, financed by the national budget, before the construction of Abbasa Regional Water Supply System.

Prior to the systems' introduction, rural villages in the area used to depend generally on small and nearby groundwater wells which were insufficient in quantity and unsafe in quality as the wells were not always well-protected from the surroundings. In almost all cases, supply was made for common use at the well site and there was no distribution pipeline.

The Housing Department presently owns and operates 82 groundwater stations in seven Markazes in the southern part of the Governorate. The present supply capacity of 27,211 m3/day in total and 801,873 population living in 189 villages covered by the systems leads to the per capita consumption of 34 liter per day. Present status of the Housing Departments system is summarized in Table 3-1.

2. Features of System

All of 82 stations have a similar type of water supply system, consisting of wells, pumps, elevated tanks and distribution pipelines. The wells, numbering from one to several for a station, vary from 4 to 10 inches in the diameter with 52 to 60 m depth. All stations use both of electric and diesel pumps including at least one set of standby for each type. The pumps are 6 to 50 l/sec in the discharge and 15 HP to 50 HP in the rating. They are operated for 2 to 9 hours. The elevated tanks are made of reinforced concrete with the capacity of 21 to 200 m3 (average 54.4 m3) and height of 9 to 30 m (average 14.4 m). In total, 160 wells and 89 elevated tanks are placed in the 82 stations.

Table 3-1 Summary of Housing Department's Water Supply System

(Sharqiya Governorate; 1983)

Markaz	Number of Ground-water station	Number of Wells	Production (m3/day)	Number of Villages Served	Population Served	Per Capita Consumption (lcpd)	Elevated Tanks Number	Elevated Tanks Volume
1) Ibrahimiya	1	1	228	1	5,847	49	1	30
2) Hihya	1	1	288	2	5,557	52	1	40
3) Diarb Nigm	19	39	5,382	42	186,660	29	21	1,170
4) Zagazig	11	21	3,798	26	118,573	32	14	1,010
5) Minyet el Qamh	29	58	11,380	75	287,491	39	31	1,780
6) Bilbeis	17	33	4,671	29	149,169	31	17	601
7) Mashtul el Soak	4	7	1,404	14	48,576	29	4	210
Total	82	160	27,211	189	801,873	34	89	4,841

The sites of groundwater station and the details of wells and elevated tanks are listed on the attached tables.

The lifted groundwater is delivered to the village people, without chlorination, by either house connections or standpipes.
Population-wise, about 10 % is the user of house connection delivery while the rest, an overwhelming majority of 90 %, has to depend on the standpipes supply.

In most cases, a groundwater station supplies water to several villages through the distribution pipelines. Inter connecting with different stations by transmission pipelines is not practiced however.

The production capacity of the stations varies from 22 to 756 m3/day (average 330 m3/day), and one station covers a population of 1,600 to 21,200 (average 4,240).

3. Pipelines

Each station has its own distribution network to supply to villages in the territory. Summarized pipeline length for different sizes and material is shown below:

Diameter	Material	Total Length	Remarks
6"	Asbestos cement (ACP)	27 km	Distribution mains
5"	"	45 km	"
4"	"	188 km	"
3"	"	25 km	"
2"	"	9 km	"
5"	Steel (SP)	0.7 km	Canal crossing
Total	=	294.7 km	

4. Water Tariff and Expenditure

The current water tariff is 2 piasters per cubic meter and it is charged to and paid by the house connection users only while the standpipe users are supplied free of charge. Notable here is the fact that in the rural areas supplied by the Department's systems, 90 % of users are non-paying while only 10 % is paying population-wise.

In 1982/1983 fiscal year, the annual expenditure was LE 26,135 for operation and maintenance. It excludes the salary of personal and the cost of new construction and/or expansion works. For 1983/1984 fiscal year, refer to Table 3-3.

5. Operation and Maintenance

The manager of Housing Department, additionaly titled the chief engineer, is responsible for the management of water supply systems including the operation and maintenance.

The engineer/manager of the Mechanical and Electrical Division, under the chief engineer, controls five maintenance centers located in Zagazig, Bilbeis, Diarb Nigm, Minyet el Qamh and Mashtul el Souk Markazes which cover the area of seven Markazes where 82 stations are distributed.

Each maintenance center is staffed with a chief engineer, several engineers and sub-engineers, skilled labors for operation. Maintenance and repairing machines, motors, cars and pipelines are, in all, cared by them. Ordinary labor work as guards, sweepers and porters. Each maintenance center has stores for spare parts of machines, motors, cars, pipes and valves.

Each maintenance center controls all groundwater stations in its territory. For instance, the center in Zagazig Markaz controls the stations in the Markazes of Zagazig, Hihya and Ibrahimiya.

Table 3-3 Financial Budget for Housing Department's Water Supply System in the Fiscal Year 1983/1984
(1st July 1983 - 30th June 1984)

Expenditure

- Construction of new elevated tanks	: LE	50,000-
- Construction of new wells	: LE	50,000-
- Power cost	: LE	25,000-
- Installation of mechanical/electrical equipment	: LE	40,000-
- Regular maintenance including repair of pipelines	: LE	35,000-
Total	: LE	200,000-

Note: Aboves do not include salary of personnel.

Table 3-4 Number of Personnel of Housing Department's Water Supply System (1983)

Maintenance Center	Administrative Staff	Operation and Maintenance Staff					
		Chief Eng.	Engineer	Co-Eng.	Technicians	Labors	Total
1) Zagazig	40	1	4	43	60	25	173
2) Bilbeis	10	-	-	4	15	70	99
3) Diarb Nigm	10	1	2	4	20	60	97
4) Minyet el Qamh	2	1	1	2	30	120	156
5) Mashtul el Souk	5	1	-	2	8	12	28
Total	67	4	7	55	133	287	553

Each groundwater station is staffed by a number of mechanics and skilled labors working for operation and maintenance with common labors guarding the facility. (See Table 3-4).

6. Figure and Table

The attached Fig. 3-1 shows the location of groundwater stations.

Also attached are 25 sheets of Table 3-5 showing the groundwater stations' location, details of wells and elevated tanks, population, percapita consumption etc.

7. Present Problem and Future Program

Present Problems

1) Due to the shortage of budget, the systems have deteriorated without major rehabilitation works in the past many years and the situation still continues. Both of the maintenance works which are to prevent further deterioration and the rehabilitation works which are to resotre and improve the existing conditions will need a substantial amount of fund which exceeds the allocated ordinary annual budget greatly.

2) To meet the increasing demand of drinking water, construction of new facilities and the back-up of finance is desperately wanted.

3) The shortage of technically-trained labors is felt strongly. In many stations, a less-skilled operator has to operate the equipments singly. Besides, the machines such as motors, diesel engines, pumps etc., are overtaxed in spite of detectable faults and consequently are led to a complete damage.

4) In case of Minyet el Qamh, no well-accommodated housing is prepared for the staffs. The engineers, sub-engineers and labors have to share a small room. Moreover, no car is provided to them. The situation makes the operation/maintenance staffs to carry out the works unsatisfactorily.

5) The decentralization policy of the country has given the local control units, a sub-division of the Governorate delegated with a partial power of administration, an authority to implement some new projects as they like. As it often happens, without their decision causes unrecoverable results. Some cases are to be quoted here:

   a) In a groundwater station compound, some buildings were built and it prevented construction of new, additional wells.

   b) An elevated tank of large capacity (200 m3) was constructed at a location of less necessity, instead of a place where it was needed strongly and the effectiveness was certainly high, in a Markaz.

   c) Some distribution pipelines were installed with a covering depth of the earth, as shallow as 30 cm, and after being damaged by traffic, they have ended in complete uselessness.

Future Program

1) Extension of Service Area:
   Extension works involving new construction of elevated tanks with 200 m3 average capacity, additional installment of pumps in the existing stations and extension of the existing pipelines are wanted to supply the villages which, despite of closeness to the area covered by the Housing Department's systems, have no public water supply presently.

2) Replacement of Deteriorated Facilities:
   The age of the systems is approaching to almost 30 years old and some of facilities became deteriorated. They should be repaired or replaced one by one and year by year under successive plan.

Table 3-5 Groundwater Stations and Population Served by the Housing Department (1)

(1983)

Ibrahimiya

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
1	Ibrahimiya	Mebaasher	1	8"	20 l/s x 4 h = 288 m^3/d	30	10	- Mebaasher	4,717	49
								- Ezbet el Sawy	182	49
								- Ezbet Ibrahim Habib	72	49
								- Ezbet el Abaziah	138	49
								- Ezbet Mazhar	88	49
								- Ezbet Abo Khashabah	69	49
								- Ezbet Gado	580	49
								Total	5,847	49
Total	Ibrahimiya Markaz				288 m^3/day	30			5,847	49

h = Operation hours per day

HD

Table 3-5 Groundwater Stations and Population Served by the Housing Department (2)

(1983)

Hihya

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
2	Hihya	Manzel Hayian	1	8"	20 l/s x 4 h = 288 m^3/d	40	12	- Manzel Hayian - Kafr el Aayed	5,049 508	52 52
								Total	5,557	52
Total	Hihya Markaz				288 m^3/day	40			5,557	52

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (3)

(1983)

Diarb Nigm - 1

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
3	Diarb Nigm	Gemezet Bany Amr	1 1	6" 8"	25 l/s x 3 h = 270 m^3/d	40	15	- Gemezet Bany Amr	9,081	30
								Total	9,081	30
4	"	El Saniah	1	8"	25 l/s x 2 h = 180 m^3/d	40	12	- El Saniah - El Sewainy - Ezbet Yousef - Ezbet Hamad Salem - Ezbet Yaabees	6,518 3,814 143	17 17 17
								Total	10,475	17
5	"	El Asaayed	1 1 2	6" 8" 10"	25 l/s x 5 h = 450 m^3/d	60 200	15 30	- El Asaayed - Ekrash - El Manahreet - Kafr el Hag Hassan - Kawishah - Ezbet el Ramly - Ezbet Khourshid - Kafr el Hamadan - Tall Abdoh	4,439 5,400 5,455 2,938 2,422 274 308	21 21 21 21 21 21 21
								Total	21,236	21

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (4)

(1983)

Diarb Nigm - 2

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
6	Diarb Nigm	Debeeg	1 1	4" 8"	25 l/s x 2.5 h = 225 m3/d	40	12	- Debeeg - El Myiaah - Ezbet Ibrahim Afandy - Ezbet Abbas Hamdy	4,756 2,028 245	31 31 31
								Total	7,300	31
7	"	Baramkeim	1 1	4" 8"	25 l/s x 2 h = 180 m^3/d	40	12	- Baramkeim - Manshaat Kasem - Manshaat Keshik	3,252 1,768 1,772	27 27 27
								Total	6,792	27
8	"	Diarb el Souk	1 1	6" 8"	15 l/s x 5 h = 270 m^3/d	40	15	- Diarb el Souk - El Gawashnah - Kafr Abo Berry	4,559 2,330 2,283	29 29 29
								Total	9,172	29
9	"	Safour	1 2	8" 10"	30 l/s x 2 h = 216 m^3/d	40 200	12 25	- Safour - El Mana Safour - Kafr Ata Allah	8,398 7,451 76	13 13 13
								Total	16,015	13

h = Operation hours per day

HD

Table 3-5 Groundwater Stations and Population Served by the Housing Department (5)

(1983)

Diarb Nigm - 3

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
10	Diarb Nigm	Manshaat Sahbarah	1 1	6" 8"	20 l/s x 3 h = 216 m^3/d	40	12	- Manshaat Sahbarah - Sahbarah - Abo Eed	6,166 2,802 2,120	19 19 19
								Total	11,088	19
11	"	Taha el Marg	1 1	6" 8"	25 l/s x 3 h = 270 m^3/d	40	12	- Taha el Marg	9,535	28
								Total	9,535	28
12	"	Hesset el Rohban	1 1	4" 8"	15 l/s x 3.5 h = 189 m3/d	40	12	- Hesset el Rohban - Karmout Sahbarah	1,838 4,263	31 31
								Total	6,101	31
13	"	Kafr el Genydy	1	4"	20 l/s x 5 h = 360 m^3/d	40	12	- Kafr el Genydy - El Shoubak	3,303 3,669	52 52
								Total	6,972	52
14	"	Saft Zereik	1 1	4" 8"	20 l/s x 8 h = 576 m^3/d	30	10	- Saft Zereik - El Kataya - Ezbet el Arab - Ezbet el Amin - Ezbet el Shoura	8,630 2,885 72 238 482	47 47 47 47 47

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (6)

(1983)

Diarb Nigm - 4

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
								Total	12,307	47
15	Diarb Nigm	El Megaffaf	1 1	4" 8"	25 l/s x 1.5 h = 135 m3/d	30	10	- El Magaffaf	5,831	23
								Total	5,831	23
16	"	Equah	1 1	4" 8"	15 l/s x 3 h = 162 m^3/d	30	10	- Equah - Kafr el Basha - Ezbet Zaza - Ezbet Moh Farid - Ezbet Abo Gharbiah	6,024 1,821	21 21
								Total	7,845	21
17	"	El Hawaber	1 1	6" 8"	20 l/s x 5 h = 360 m^3/d	40	12	- El Hawaber	5,360	67
								Total	5,360	67
18	"	Shembaret-Mankalla	1 1	4" 8"	25 l/s x 2 h = 180 m^3/d	40	12	- Shembaret Mankalla - Ezbet Abo Abd Allah - Ezbet el Wakf - Manshaat Safwat	5,962 43 54 1,333	24 24 24 24

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (7)

(1983)

Diarb Nigm - 5

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
								Total	7,392	24
19	Diarb Nigm	Karadees	1 1	6" 8"	25 l/s x 2.5 h = 225 m3/d	60	20	- Karadees - Faraghan - Abo Metanna - Ezbet el Azab Hammed - Ezbet Abo Noaman	5,425 4,357 3,768 1,062 193	15 15 15 15 15
								Total	14,805	15
20	"	Kafr el Okl	1	8"	25 l/s x 7 h = 630 m^3/d	40	12	- Kafr el Okl - Kafr el Leba - Shobra Sorah - Ezbet Habalanah & Fodah	4,528 2,488 4,494 202	54 54 54 54
								Total	11,712	54
21	"	Bahnia	1 1	6" 8"	20 l/s x 4 h = 288 m^3/d	40	12	- Bahnia - Ezbet Aly Mohamad	7,681	37
								Total	7,681	37
Total	Diarb Nigm Markaz				5,382 m^3/day	1,170			186,660	29

h = Operation hours per day

HD

Table 3-5 Groundwater Stations and Population Served by the Housing Department (8)

(1983)

Zagazig - 1

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
22	Zagazig	El Nakhaas	1	8"	20 l/s x 4 h = 288 m^3/d	40	12	- El Nakhaas	9,606	30
								Total	9,606	30
23	"	El Bayoum	2	6"&8"	20 l/s x 7 h = 504 m^3/d	60	20	- El Bayoum	3,292	38
								- El Ryiad	1,918	38
								- Hood el Tarfah	2,855	38
								- Kafr el Halaby	1,268	38
								- Kafr el Ashraaf	3,880	38
								- Kafr Atallah Soliman		
								- Kafr Abo Hegazy		
								- Ezbet Hamad		
								Total	13,213	38
24	"	Meet Abo Araby	2	6"&8"	15 l/s x 4 h = 216 m^3/d	40	12	- Meet Abo Araby	5,478	37
								- Kafr Abdel Malek Mansour	438	37
								Total	5,916	37
25	"	Dewaidah	2	8"	20 l/s x 7 h = 504 m^3/d	60	15	- Dewaidah	3,878	36
			1	10"		200	30	- Om el Zein	4,768	36
								- Bany Abbaad	5,246	36
								Total	13,892	36

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (9)

(1983)

Zagazig - 2

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
26	Zagazig	Shembaret-el Maymonah	2 1	10" 8"	20 l/s x 9 h = 648 m^3/d	200 60	30 15	- Shembaret el Maymonah	9,254	34
								- El Maymonah	2,749	34
								- Bany Korish	3,169	34
								- Kafr Abo Nagaah	3,640	34
								- Kafr el Tememy	496	34
								Total	19,306	34
27	"	Tall Hawin	2	8"	25 l/s x 3 h = 270 m^3/d	30 100	10 25	- Tall Hawin	5,689	17
								- Tall Mossmar	1,923	17
								- Bany Shebl	8,317	17
								Total	15,929	17
28	"	El Aslougy	2	6"&8"	20 l/s x 2.5 h = 180 m3/d	60	15	- El Aslougy	9,916	18
								Total	9,916	18
29	"	Tarout	1	8"	20 l/s x 2 h = 144 m^3/d	30	10	- Tarout	5,097	28
								Total	5,097	28
30	"	Meet Abo Aly	1	8"	20 l/s x 2 h = 144 m^3/d	30	10	- Meet Abo Aly	4,202	34
								Total	4,202	34

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (10)

(1983)

Zagazig - 3

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
31	Zagazig	Tahlet Bordin	2	6"& 8"	20 l/s x 2 h = 144 m^3/d	40	15	- Tahlet Bordin	5,611	26
								Total	5,611	26
32	"	Nishwah	1 1	6" 8"	30 l/s x 7 h = 756 m^3/d	60	20	- Neshwar	5,593	48
								- Kafr Neshwar	1,729	48
								- Kafr Ateek	738	48
								- Sefeetah	3,975	48
								- Kahlet el Gebalah	1,246	48
								- Kafr el Arab	1,733	48
								- Kafr el Refaeyen	344	48
								- Kafr Abo Kamel	525	48
								Total	15,883	48
Total	Zagazig Markaz				3,798 m^3/day	1,010			118,573	32

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (11)

(1983)

Minyet el Qamh - 1

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
33	Minyet el Qamh	El Kobbah	1 1	6" 8"	20 l/s x 9 h = 648 m^3/d	40	12	- El Kobbah	2,795	141
								- Kafr Ragab Fanous		
								- Kafr Mousa Shawish	1,606	141
								- Kafr Saleib Rizk	204	141
								Total	4,605	141
34	"	El Okdah	1 1	6" 8"	20 l/s x 6 h = 432 m^3/d	30	10	- El Okdah	2,684	133
								- Khelwet el Sharawy	553	133
								- Kafr Nawar Hanna		
								- Ezbet Gergess		
								Total	3,237	133
35	"	Abo Towalah	1 1	6" 8"	20 l/s x 5 h = 360 m^3/d	30	10	- Abo Towalah	4,138	45
								- El Senitah	823	45
								- Kafr el Dair	2,998	45
								Total	7,959	45
36	"	EL Tallin	2	8"	30 l/s x 4 h = 432 m^3/d	40	12	- El Tallin	8,894	33
								- El Robomaiah	2,456	33
								- Kafr Badran	1,692	33
								Total	13,042	33

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (12)

(1983)

Minyet el Qamh - 2

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
37	Minyet el Qamh	Banadf	1 1	6" 8"	20 l/s x 3 h = 216 m^3/d	40	12	- Banadf - Kafr Bakfor Saad	7,395 107	29 29
								Total	7,502	29
38	"	El Godidah	1 1	6" 8"	20 l/s x 4 h = 288 m^3/d	40	12	- El Godidah - El Masadah - Kafr Meet Bashar	6,810 2,230 2,004	26 26 26
								Total	11,044	26
39	"	Malamiss	1 1	6" 8"	20 l/s x 4 h = 288 m^3/d	40	12	- Malamiss - Kafr Abd Allah Shenfass - Ezbet el Mohandiss - Ezbet Ahmad Mousa	7,258 1,479 784	30 30 30
								Total	9,521	30
40	"	Meet Rabia el Dolalah	1	8"	20 l/s x 6 h = 432 m^3/d	40	15	- Meet Rabeia el Dolalah - El Karakrah - Ezbet Hassan Okashah - Kafr Mohamed Shawish - Kafr Gobraan	3,027 4,554 1,426 987	43 43 43 43

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (13)

(1983)

Minyet el Qamh - 3

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
								Total	9,994	43
41	Minyet el Qamh	Beishet Aamer	1 1	6" 8"	20 l/s x 2.5 h = 180 m3/d	30	10	- Beishet Aamer	8,168	22
								Total	8,168	22
42	"	Bany Helal	1 1 2	6" 8" 10"	30 l/s x 4 h = 432 m^3/d	60 200	15 30	- Bany Helal - Telbanah - El Hood el Taweel - Kafr Abd Allah Azizah - Kafr Salamah Bisharah - Ezbet Tawfik - Ezbet Badawy	6,709 5,887 2,778 349 178	25 25 25 25 25
								Total	17,293	25
43	"	Meet Bashaar	1 1	6" 8"	20 l/s x 7 h = 504 m^3/d	60	20	- Meet Bashaar - El Maaly - Manshat Shafik - Ezbet Hassan Nada - Ezbet Gorge Sorial - Ezbet Abd el Razek - Ezbet el Gharaby - Kafr Badawy Rizk	11,494 2,611 2,466 826 61	29 29 29 29 29

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (14)

(1983)

Minyet el Qamh - 4

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
								Total	17,458	29
44	Minyet el Qamh	Shalshalamoon	1 1	6" 8"	20 l/s x 6 h = 432 m^3/d	40	12	- Shalshalamoon - Kafr Omar Mostafa - Kafr Shaban - Ezbet el Lebeidy	12,614 1,838 1,102	28 28 28
								Total	15,554	28
45	"	Kafr Sahlsha-lamoon	1 1	6" 8"	20 l/s x 6 h = 432 m^3/d	40	12	- Kafr Shalshalamoon	6,984	62
								Total	6,984	62
46	"	Kafr Hassan el Tobgy	2	8"	30 l/s x 3 h = 324 m^3/d	100	25	- Kafr el Hassan el Tobgy - Shobraa Kommoss - Kafr el Ghatwary - Ezbet Ibrahim Iskander - Ezbet Mohamad Salem - Kafr el Sheikh Khalifah - Kafr Hassan Ata Allah	430 2,840 561 1,264 582	56 56 56 56 56
								Total	5,744	56

h = Operation hours per day

HD

Table 3-5 Groundwater Stations and Population Served by the Housing Department (15)

(1983)

Minyet el Qamh - 5

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
47	Minyet el Qamh	El Mohamadiah	1 1	6" 8"	20 l/s x 7 h = 504 m^3/d	30	10	- El Mohadiah - Kafr Mohamad Ahmad - Kafr el Saiydah	3,319 1,238 1,232	87 87 87
								Total	5,789	87
48	"	El Walaga	1 1	6" 8"	20 l/s x 2.5 h = 180 m3/d	60	15	- El Walaga - Kardidah - Tall Abo Sandour - Ezbet Seleim Nassar - Ezbet Ibrahim Aamer - Kafr Mohamed Abd Allah	8,884 3,650 369 344 516 837	12 12 12 12 12 12
								Total	14,600	12
49	"	El Aziziya	2 2	8" 10"	30 l/s x 6 h = 648 m^3/d	60 200	15 15	- El Aziziya	17,711	37
								Total	17,711	37
50	"	Kafr el Seeydy	1 1	8" 10"	30 l/s x 5 h = 540 m^3/d	60	20	- Kafr el Seeydy - Kafr Farag Gergess - Kafr Mohamad Farid - Kafr Baskharon (Badawy) - Ezbet el Gebaaly	2,205 4,854 85 307 325	69 69 69 69 69

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (16)

(1983)

Minyet el Qamh - 6

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
								Total	7,776	69
51	Minyet el Qamh	Kafr el Ghonemy	1 1	6" 8"	20 l/s x 6 h = 432 m^3/d	40	12	- Kafr el Ghonemy - Koom Hellein	3,850 3,945	55 55
								Total	7,795	55
52	"	El Hamediah	1	8"	6 l/s x 6 h = 130 m^3/d	40	12	- El Hamediah	2,634	49
								Total	2,634	49
53	"	El Saadeien	2	8"	20 l/s x 9 h = 648 m^3/d	100	25	- El Saadeien	6,883	94
								Total	6,883	94
54	"	El Aaraas	1 1	6" 8"	20 l/s x 2.5 h = 180 m3/d	60	20	- El Aaraas - El Naamnah - Ezbet el Gaar	3,454 10,473 224	13 13 13
								Total	14,151	13
55	"	Sanhout	1 1	8" 10"	30 l/s x 3 h = 324 m^3/d	60	15	- Sanhout - Kafr Yousef Semry	12,548 516	25 25
								Total	13,064	25

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (17)

(1983)

Minyet el Qamh - 7

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
56	Minyet el Qamh	Shobra el Enab	1 1	6" 8"	20 l/s x 3 h = 216 m^3/d	40	12	- Shobra el Enab - Kafr Salamah Ibrahim - Kafr Aioub Awad - Ezbet Shaaker	6,200 2,325 487 116	24 24 24 24
								Total	9,128	24
57	"	Senahwa	1	8"	20 l/s x 7 h = 504 m^3/d	40	12	- Senawah - Kafr Abo Dakn - Ezbet el Manshiah	8,654 1,259	51 51
								Total	9,913	51
58	"	Meet Seheil	1 1	6" 8"	30 l/s x 5 h = 540 m^3/d	40	15	- Meet Seheil - Kafr Meet Seheil - Bany Saleh - El Ezbah el Kabirah - Kafr Mostafa Afandy - Kafr Othman Effat - Kafr Masoad Hegazy - Ezbet Sharaf - Ezbet Abo Aaiesh - Ezbet el Maraghy	7,665 1,279 2,995 1,654 553 643 83 751 667	33 33 33 33 33 33 33 33 33
								Total	16,290	33

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (18)

(1983)

Minyet el Qamh - 8

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
59	Minyet el Qamh	Kamaronah	1 1	6" 8"	20 l/s x 4 h = 288 m^3/d	30	10	- Kamaronah	3,774	76
								Total	3,774	76
60	"	El Sanafein	1 1	6" 8"	30 l/s x 4.5 h = 486 m3/d	60	15	- El Sanafein - Kafr el Shaarwah - Ezbet Yehia Basha Ibrahim	13,733 572 185	34 34 34
								Total	14,490	34
61	"	Zahr Shorb	1	8"	20 l/s x 5 h = 360 m^3/d	30	10	- Zahr Shorb - Bany Hessein - Ezbet el Sheikh - Ezbet Atwah Khattab - Ezbet el Meet Kenany	4,243 945 47 153	67 67 67 67
								Total	5,388	67
Total	Minyet el Qamh Markaz				11,380 m^3/day	1,780			287,491	40

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (19)

(1983)

Bilbeis - 1

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
62	Bilbeis	Inshaas el Khasah	1 1	4" 8"	6 l/s x 7 h = 151 m^3/d	30	10	- Inshas el Khaasah	13,391	9
								- El Ahmadiah	708	9
								- Ezbet Ewees	226	9
								- Ezbet Kamel	222	9
								- Ezbet Abo Haif	771	9
								- Ezbet Dawar el Gabal	457	9
								- Ezbet el Ensha	895	9
								- Ezbet Zaky	282	9
								Total	16,952	9
63	"	Meet Rabiaa el Bida	1 1	4" 8"	15 l/s x 2 h = 108 m^3/d	30	10	- Meet Rabiaa el Bida	4,618	23
								Total	4,618	23
64	"	Meet Hamal	1	8"	12 l/s x 7 h = 302 m^3/d	30	10	- Meet Hamal	8,432	35
								- Ezbet Bakr	105	35
								Total	8,537	35
65	"	El Gousak	1 1	4" 8"	20 l/s x 2 h = 144 m^3/d	30	10	- El Gousak	5,597	20
								- El Ebsy	1,567	20
								Total	7,164	20

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (20)

(1983)

Bilbeis - 2

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
66	Bilbeis	Sandanhour	1 1	4" 8"	12 l/s x 4 h = 173 m^3/d	30	10	- Sandanhour - Ezbet el Manshiah - Ezbet el Barabrah - Ezbet Mamella - Ezbet Hassan Seleim	6,030 1,909 112 403 943	18 18 18 18 18
								Total	9,397	18
67	"	Meet Habib	1 1	4" 8"	12 l/s x 6 h = 260 m^3/d	40	15	- Meet Habib - El Shaghaniah - El Awady - El Berens - Kafr Equiad	2,448 3,138 187 560 2,405	30 30 30 30 30
								Total	8,738	30
68	"	Shobra el Naklah	1 1	6" 8"	20 l/s x 6 h = 432 m^3/d	40	12	- Shobra el Nakhlah - El Sobky - Ezbet Abo Hamed - Ezbet el Ahwany - Ezbet el Zahwy - Ezbet Abo Hagras	13,539 373 362 66 34 51	30 30 30 30 30 30
								Total	14,425	30

h = Operation hours per day

HD

Table 3-5 Groundwater Stations and Population Served by the Housing Department (21)

(1983)

Bilbeis - 3

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
69	Bilbeis	Meet Gaaber	1 1	4" 8"	25 l/s x 4 h = 360 m^3/d	30	10	- Meet Gaaber - El Saraia - Ezbet Darwish	6,418 1,406 231	45 45 45
								Total	8,055	45
70	"	El Balashoun	2	8"	15 l/s x 3 h = 163 m^3/d	30	10	- El Balashoun - Ezbet Salleh Khames - Ezbet Aaeshah Hanem - Ezbet el Galfy - Ezbet Seleim Hamad	11,584 375 204 580 47	13 13 13 13 13
								Total	12,790	13
71	"	Keremlah	1 1	6" 8"	20 l/s x 6 h = 432 m^3/d	40	12	- Keremlah - Hefna - Kafr Hefna - Kafr Abo Ghaly - El Kheshen	4,086 6,891 2,239 175 474	31 31 31 31 31
								Total	13,865	31
72	"	El Saeydiah	1 1	4" 8"	15 l/s x 5 h = 270 m^3/d	40	12	- El Saeydiah - Mandorah - El Nahhas	4,193 67 103	62 62 62

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (22)

(1983)

Bilbeis - 4

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
								Total	4,363	62
73	Bilbeis	Inshaas el Balad	1 1	6" 10"	30 l/s x 5 h = 540 m^3/d	40	12	- Inshaas el Balad - Tall el Garad - Shaheen Hammad - Ezbet Seleim - Ezbet Farag Afandy - Ezbet Laaz	 2,169 313 408 408 347	 148 148 148 148 148
								Total	3,645	148
74	"	Meet Mealla	1 1	6" 8"	20 l/s x 5 h = 360 m^3/d	60	20	- Meet Mealla - Dahmasha - Ezbet Abd el Rahman Zayed - Ezbet Ahmad Hegazy - Ezbet Habib Lito	2,927 6,697 59 18 244	36 36 36 36 36
								Total	9,945	36
75	"	Salamant	1 1	6" 8"	15 l/s x 3 h = 162 m^3/d	40	12	- Salamant - Meniat Salamant - Ezbet Abd el Aziz Amen	5,888 2,951 233	18 18 18
								Total	9,072	18

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (23)

(1983)

Bilbeis - 5

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
76	Bilbeis	Basatin Barakat	1 1	4" 8"	6 l/s x 1 h = 22 m^3/d	21	9	- Basatin Barakat	448	49
								Total	448	49
77	"	El Mania el Refaey	1 1	4" 6"	20 l/s x 4 h = 288 m^3/d	30	10	- El Manyia el Refaey - Abo Tahoun - El Moxavaa	1,146 428	181 181
								Total	1,587	181
78	"	El Zawamel	1 1	6" 8"	20 l/s x 7 h = 504 m^3/d	40	12	- El Zawamel - Abo Raas - Ezbet Abd el Naby - Ezbet Amin Amer - Ezbet Samahah	14,450 486 405 66 161	32 32 32 32 32
								Total	15,568	32
Total	Bilbeis Markaz				4,671 m^3/day	601			149,169	31

h = Operation hours per day

HD

Table 3-5 Groundwater Stations and Population Served by the Housing Department (24)

(1983)

Mashtul el Souk - 1

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
79	Mashtul el Souk	Kafr el Sharabiah	2	8"	15 l/s x 4 h = 216 m^3/d	60	20	- Kafr el Sharabiah	1,928	17
								- El Khoshah	2,380	17
								- El Manasrah	1,694	17
								- Kafr el Zagazig el Kibly	2,438	17
								- Kafr Aly Ghaly	2,083	17
								- Kafr Abd el Naby	2,355	17
								Total	12,878	17
80	"	Kafr Ebrash	2	8"	25 l/s x 8 h = 720 m^3/d	60	20	- Kafr Ebrash	8,028	49
								- Ebrash	4,205	49
								- Kafr Dabmasha	974	49
								- Ezbet Mandorah	67	49
								- Ezbet el Nahhas	103	49
								- Ezbet el Berkawy	749	49
								- Ezbet el Esslah	456	49
								Total	14,582	49
81	"	El Ghaffariah	1	8"	15 l/s x 2 h = 108 m^3/d	30	10	- El Ghaffariah	3,650	30
								Total	3,650	30

h = Operation hours per day

Table 3-5 Groundwater Stations and Population Served by the Housing Department (25)

(1983)

Mashtul el Souk - 2

Station No.	Markaz	Location of Groundwater Station	Well			Elevated Tank		Population Served		Per Capita Consumption (lcd)
			Number of Well	Dia.	Production	Volume (m^3)	Height (m)	Name of Villages	Population (1983)	
82	Mashtul el Souk	El Sahafah	2	8"	25 l/s x 4 h = 360 m^3/d	60	20	- El Sahafah - El Menyiar - Kashaa	3,699 11,330 2,437	21 21 21
								Total	17,466	21
Total	Mashtul el Souk Markaz				1,404 m^3/day	210			48,576	29

h = Operation hours per day

Table 3-6 Number of Registered House Connections

(Housing Department)

Markaz \ Year	1973	1977	1978	1979	1980	1981	1982	1983
1) Ibrahimiya	6	15	18	27	37	55	75	112
2) Hihya	3	9	12	17	43	74	101	137
3) Diarb Nigm	218	397	458	659	855	1,200	1,854	2,636
4) Zagazig	172	338	419	573	1,275	1,617	1,956	2,381
5) Minyet el Qamh	568	1,224	1,345	1,994	2,958	4,649	5,786	6,838
6) Bilbeis	218	453	518	738	1,259	2,120	2,775	3,561
7) Mashtul el Soak	167	307	357	378	402	622	835	1,332
Total	1,352	2,743	3,127	4,386	6,829	10,337	13,382	16,997

IV. CITY-OWNED WATER SUPPLY SYSTEMS

1. General

As of the year 1983, there exist 13 urban municipalities (city or town) in the Sharqiya Governorate, 12 cities and one town. All of 12 cities are capitals of each Markaz.

The urban municipalities are listed below, together with present population.

Table 4-1 List of City and Town

City/Town	Population (1983)	Water Source	
		City-owned Water Source	From Abbasa Regional Water Supply System
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 Population	692,000		

City

Among the above 13 municipalities, 9 cities (Zagazig, Faqus, Abu Kebir, Ibrahimiya, Hihya, Diarb Nigm, Bilbeis, Minyet el Qamh and Mashtul el Souk) have their own water sources and distribution pipeline networks within their administrative areas. The remaining 4 municipalities, which are rather smaller in population than others, are supplied with water by the Abbasa Regional Water Supply SYstem; and among them three cities (Huseiniya, Kafr Saqr and Abu Hammad) have their own distribution pipelines and maintain them bu their own staff; and the last municipality (Qenayat) is supplied by the Abbasa System and its distribution network is also maintained by the Abbasa System; however, establishing the organization of pipelines maintenance is planned now by the municipality, following the other cities' manner.

The total population of the above 13 municipalities is 692,000 (23 % of the whole Sharqiya Governorate with 3,048,000 people) in 1983. Among them, 607,000 people (88 % of urban population) live in the nine municipalities which have their own water supply systems; and 85,000 people (12 % of urban population) live in the remaining four municipalities which have no their own water sources and are supplied by the Abbasa System.

The cities which have their own system have rather long history of water supply. The system of Zagazig City, the capital of the Sharqiya Governorate started in 1909, the beginning of the 20th century, and Bilbeis City and Minyet el Qamh City commenced the public water supply service in 1928; and Faqus City in 1932. As to water sources, Zagazig City and Faqus City have treatment plants taking raw water from nearby canals' surface water, while the remaining cities depend on the groundwater source of deep wells of 50 - 70 meter depth.

Summary and details of water supply system of each city are presented in the following pages.

Table 4-2 Summary of City-Owned Water Supply Systems (1)

(1983; Sharqiya Governorate)

City/Town	(A) Total Population 1/	(B) Number of Service Connection	(C) Year of Service Commencement	(D) Number of Stations owned by the City: Treatment Plant	(E) Number of Stations owned by the City: Ground-Water Station	(F) Distribution Pipelines	
1) Zagazig	257,000	40,000	1909	1	18	24"-8"	25,850 m
2) Huseiniya	18,000	1,033	(1959 by Abbasa System)			7"-4"	25,800 m
3) Kafr Saqr	17,000	3,000	(1959 by Abbasa System)			10"-2½"	17,360 m
4) Faqus	49,000		1932	1	3	12"-3"	21,050 m
5) Abu Keibr	67,000	7,000	1945	-	4	4"-2"	3,500 m
6) Abu Hammad	22,000		(1959 by Abbasa System) 2/			6"-4"	22,240 m
7) Ibrahimiya	23,000	1,664	1948	-	3	8"-2"	11,970 m
8) Hihya	28,000	3,800	1948	-	3	12"-4"	13,006 m
9) Diarb Nigm	27,000		1954	-	3	8"-3"	14,970 m
10) Bilbeis	87,000	10,500	1928	-	4	12"-4"	20,954 m
11) Minyet el Qamh	42,000	12,160	1928	-	4	12"-3"	23,850 m
12) Mashtul el Souk	27,000	4,000	1948	-	1	8"-4"	17,228 m
13) Qenayat	28,000		(1959 by Abbasa System)			—	
Total	692,000			2	43	24"-2"	217,778 m

Note: 1/ Population in 1983 is estimated based on 1976 Census data.

2/ Abu Hammad City has one groundwater station in the city as standby.

Tabel 4-2 Summary of City-Owned Water Supply System (2)

(1983; Sharqiya Governorate)

City/Town	(G) Nominal Production (m^3/day)	(H) Actual Production Estimated (m^3/day)	(I) Rate of Productivety	(J) Per Capita Production (liter/day)	(K) Number of Personnel For Water Stations	(L) For Pipelines	(M) Total
1) Zagazig	50,976	40,867	80 %	159	200	75	275
2) Huseiniya	600 m^3/day from Abbasa system 1/			33	-	9	9
3) Kafr Saqr	1,500 m^3/day from Abbasa system 1/			88	-	10	10
4) Faqus	12,096	9,504	79 %	194	71	25	96
5) Abu Kebir	7,290	5,103	70 %	76	40	25	65
6) Abu Hammad	1,500 m^3/day from Abbasa system 1/			68	-	20	20
7) Ibrahimiya	2,376	1,663	70 %	72	11	11	22
8) Hihya	5,490	3.294	60 %	118	19	21	40
9) Diarb Nigm	5,256	3,679	70 %	136	25	33	58
10) Bilbeis	23,760	14,256	60 %	164	51	50	101
11) Minyet el Qamh	7,776	4,666	60 %	111	48	35	83
12) Mashtul el Souk	3,240	1,944	60 %	72	15	11	26
13) Qenayat	1,674 m^3/day from Abbasa system 2/			62	6	-	6
Total	118,260 3/	84,976 3/	72 %	140	486	325	811

Note: 1/ In the manner of bulk supply to the city.

2/ Supplied from Abbasa pipelines to individual house connections in the town.

3/ Not including Abbasa water, but city-owned water only.

2. Zagazig City Water Supply System

Zagazig City, the capital of Sharqiya Governorate, has population of 257,000 and they are supplied by city-owned public water supply system. The city keeps one treatment plant and 18 groundwater stations as water sources. The system originally commenced in 1909 with the treatment plant taking water from Muweis Canal. The Zagazig water supply system is one of the oldest ones in Egypt. Presently the people is supplied with 40,900 m /day through 40,000 individual connections.

Treatment Plant

Zagazig Treatment Plant is owned and managed by the city.

In 1909, the old treatment system in the plant was commissioned after being constructed with German technology. The source was Muweis Canal's surface water and the treatment process was plain sedimentation, not followed by sand filtration. In 1950, it was put out of operation coming to the end of service life.

The present treatment system was constructed in 1950, at a site adjacent to the old system's, with British technology. Taking water from the same canal at a rate of 200 l/sec, it has treated the raw water by a series of coagulation, sedimentation, filtration and chlorination.

The raw water passes, by gravity, through an intake screen and gate, and flows into a receiving well by way of a 20" cast iron pipeline. Pre-chlorination dosage is fed at a junction well in the pipeline and then alum at the receiving well. It is lifted into a clarifier by three low-lift pumps, including one standby, of 20 m head, 100 l/sec discharge and 50 HP rating.

The clarifier, circular shaped and two hours detention capacity, functions as a coagulation/sedimentation basin through leading the flow upwards. The settled water, supernatant overflowing the clarifier, is led to two sand filters of 88 m^2 to be filtered.

The filterated water falls to a reservoir of 400 m^3 capacity constructed beneath the filters, for storage and post-chlorination. Four pump sets including one standby, of 60 m head, 100 l/sec discharge and 140 HP rating, lift and distribute the finished water to consumers. An elevated tank, 47 m high and of 1,000 m^3 capacity, regulates the inflow by pumps and outflow for distribution.

To supplement the plant's output, four wells constructed in the plant compound collect groundwater which is lifted by three pump sets, including one standby, of 25 l/sec capacity for distribution. The water is not chlorinated, but mixed with the treated and finished water of the canal.

The plant output is 200 l/sec finished sufrace water and 50 l/sec groundwater, totalling 250 l/sec.

In addition to the said systems, an emergency groundwater system is made ready for operation, as the canal water level is lowered in winter periodically for maintenance work of the canal and it results in a drastic reduction of the intake flow.

The major problems are the shortage of production capacity and obsolescence of almost all equipments. Large-scaled repair and replacement works are needed badly. Now, a difficulty in operating filters is presenting a serious problem. Filters are forced to be backwashed at about four hours interval and as a sizable portion of the filtered water is consumed by the operation, the actual plant output is affected adversely. The cause is supposedly clogging of the surface of sand beds.

The layout of plant is shown on the following page.

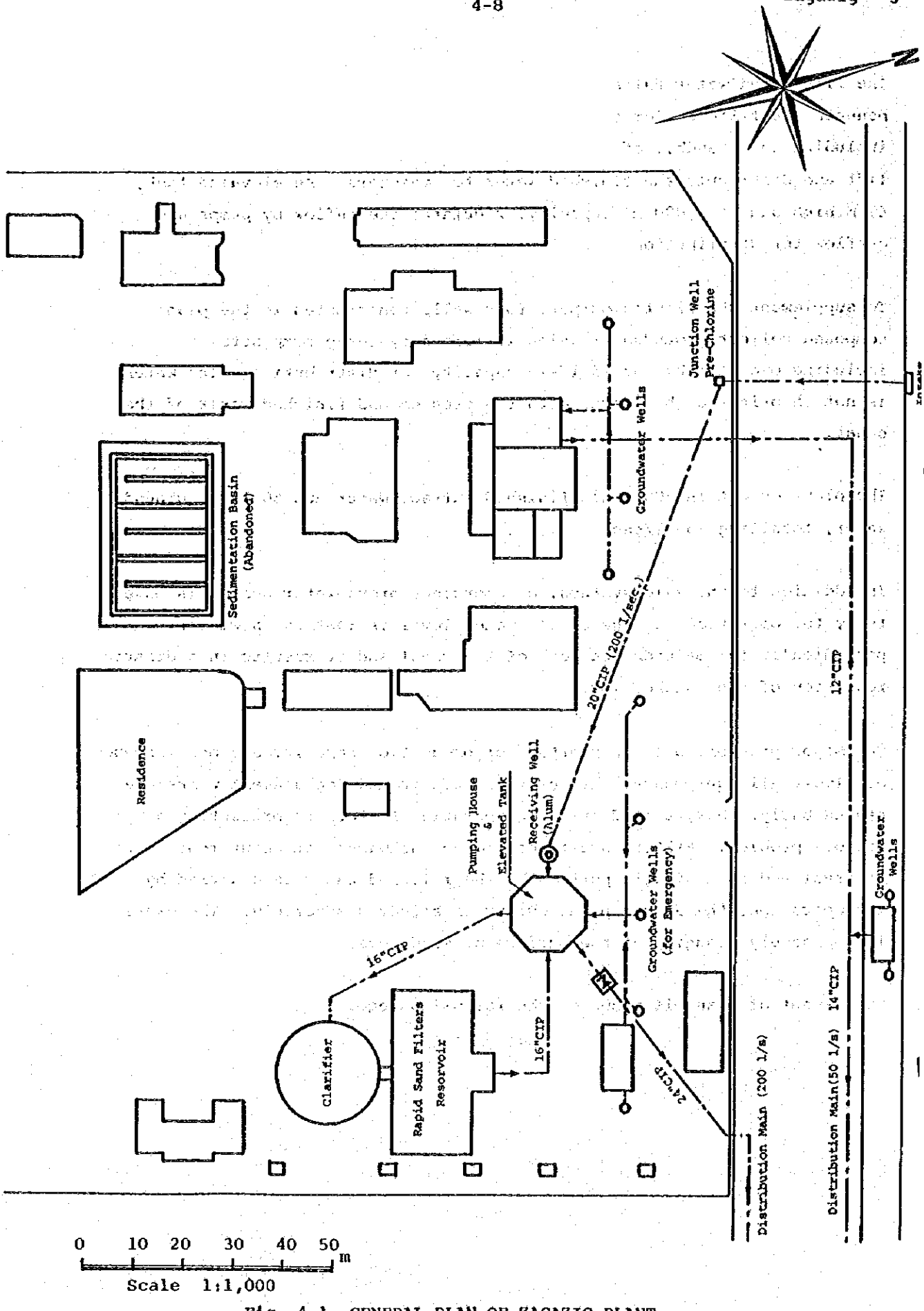

Fig. 4-1 GENERAL PLAN OF ZAGAZIG PLANT

Groundwater Stations

Muweis Canal flows passing through the central area of Zagazig City and a substantial amount of the canal water seems to be infiltrating to the underground aquifer around the city. Owing to the favourable conditions, many wells have been built in the city area and the groundwater stations drawing water from the wells, as listed below, are supplying water to the people, to meet the demand which cannot be covered by the before mentioned treatment plant.

Table 4-3 List of Groundwater Stations

Location	No. of station	No. of well	Dia inch	No. of pump	Pump c'city l/sec.	Constructed year	Remarks
Bahr	1	2	10	2	30	1968	
Mohaphza	1	2	10	2	30	1967	
Mabarra	1	2	10	2	30	"	
El Shamss	1	2	10	2	30 & 25	1975	
Abu Aamer	1	2	10	2	30	1974	
Hassan-Saleh	1	2	10	2	30	1975	
Sook El Gomla	1	2	10	2	30	1975	
El Tagnied	1	1	10	2	30 & 25	1975	electric & diesel
Agricultire Fuculty	3			3	30	1969	incl. one standby
Same as above	3	2	10	2	30	1979	

The pumps used in the above stations are horizontal, centrifugal type.

List of Groundwater Stations (continued)

Location	No. of station	No. of well	Dia	No. of pump	Pump c'city	Construc-ted year	Remarks
			inch		l/ sec		
Abu Khalil Square	1	2	10		25		
Galaa St.	1	4	10		25		
Kafr Abd El Aaziz	1	1	10		25		
Zagazig-North	1	1	10		25		
Sia Dien District	1	1	10		25		
Hosania District	1	1	10		25		

The pumps in the above stations are submersible type.

List of Distribution Pipelines
(Zagazig City)

No.	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Road Name	Location
1	24" 1/	CIP	600	1960	Saad Basha	Treatment Plant - Secondary School
	18"	"	1,500	1960	"	Secondary School - Markaz Building
	12" 2/	"	300	1909	"	Markaz Building - Elevated tank in Montazah Square
2	14" 1/	"	600	1909	"	Treatment Plant - Secondary School
	12"	"	1,000	1909	"	Secondary School - Araby Square
	12"	ACP	400	1974	"	Araby Square - 23 Street
3	16" 2/	"	1,000	1980	"	Treatment Plant - Ghalaia Building
4	16"	"	2,000	1970	Sadaat	Agriculture faculty - Lakooz Building
5	10"	"	800	1970	"	Geish Street - Mosslemien Street
6	8"	"	800	1970	"	Mosslemien Street - Old Hospital Street
7	12"	"	100	1960	Gamal Abd El Naser	Main double steel crossing 12" pipeline - Commercial Faculty
8	10"	"	1,000	1970	"	Commercial Faculty - Islamic Faculty
9	12"	"	2,000	1970	"	Mohaphza crossing - Naseria School
10	10"	"	1,500	1972	"	Mohaphza Building - Kanater El Tesaa
11	8"	"	500	1974	"	Kanater El Tesaa - Saiaden District
12	8"	"	1,000	1976	"	Gamal Abd El Naser Road - Eqwa drainage for Engineering District

List of Distribution Pipelines (2)
(Zagazig City)

No.	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Road Name	Location
13	10"	ACP	500	1974	Moahda	16" pipeline at Agri-culture Faculty - Faraq Street
14	8"	"	500	1974	"	Faraq Street - Wood manufacture building
15	8"	CIP	2,000	1960	Nokrashy	16" pipeline at Abou Amee Ra - Railway cross-ing at Horrania District
16	8"	ACP	500	1979	"	Railway crossing at Horrania District - Chest Hospital
17	8"	CIP	2,000	1960	Secondary Islamic School	24" Abd El Aziz Street - Railway crossing at Horrania District
18	8"	ACP	500	1983	"	Above railway crossing - End of Abd El Aziz Abaza Street from Maallimien School side
19	8"	ACP	500	1980	"	Makarun Manufacturer at underground crossing - Kafr Abou Hessien Canal
20	8"	CIP	500	1960	El Hariry	12" ACP in front of Omar El Fandi through Geish Street to Kobry El Mamer
21	8"	ACP	800	1979	Malga El Aitam	Noqrashy Street - Farouk Street
22	8"	ACP	1,000	1979	El Madafn	Noqrashy Street - Farouk Street
23	10"	ACP	800	1970	Moror	El Kobry El Gadied - Secondary Girl School
24	8"	"	350	1980	"	Secondary Girl School - Secondary Technical School

List of Distribution Pipelines (3)

(Zagazig City)

No.	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Road Name	Location
25	8"	CIP	500	1960	Hamam	Keisaria - Moror Street
26	8"	ACP	300	1975	El Siad Farag	El Eskandrany Street - El Mathen, Special from Abou Amer Station
Total			25,850			

Note 1/ : Connected each other in front of Abd El Aziz Ababa (Kobry El Thanawia).

2/ : Connected each other in front of Ghalaia Building to the elevated tank.

Problems

1) Water treatment plant in Zagazig City has been deteriorated and almost has reached to the end of service life; it, therefore, shall be reconstructed.

2) All of cast iron pipes and steel pipes for distribution have been deteroirated and they shall be replaced with new pipes with larger diameters.

3) Water pressure in distribution pipelines is not enough, and the water seldom reach upper floors of buildings.

4) Water production is less enough than actual water demand.

5) Newly-developed areas has very poor supply condition.

6) As to groundwater, quantity is available but its quality is not always acceptable.

7) Administration and operation and maintenance have not always been made well.

3. Faqus City Water Supply System

Faqus City is one of the two cities which have city-owned water treatment plants in the Sharqiya Governorate. The system started in 1932 with the treatment plant of 40 l/sec capacity; thereafter groundwater stations were added to the system, and presently the city supplies 9,500 m^3/day to the city with 49,000 population.

Faqus Treatment Plant

Faqus treatment plant was constructed in 1932 with the assistance of British engineering, taking water from Faqus canal which flows through Faqus city. The treatment method is sedimentation, rapid sand filtration and chlorination.

The original production capacity was 40 l/sec in 1932, and in 1940 groundwater was added to it by 40 l/sec, and in 1974 an extention work of canal water treatment was made. The present production capacity, therefore, is 100 l/sec including groundwater.

Raw water is taken from Faqus canal, passes through the intake screen/chamber/gate and flows into a receiving well by gravity, by way of an intake pipeline of 600 mm steel pipe. Pre-chlorine is dosed in the receiving sell. Then the raw water is lifted to a mixing well by intake pumps (80 l/sec x 15 m x 2 units, including one standby).

Aluminum sulphate is added to the water in the mixing well at 25 ppm, and the water flows to a coagulation basin for flocculation. The mixing well equipped with a flush mixer and coagulation basin with a vertical shaft flocculater were installed in 1974, when the plant was extended. The coagulated and flocculated water flows into two sedimentation basins of 60 l/sec capacity each. The sedimentation basins are horizontal/spiral flow type.

The settled water is filtered by three rapid sand filters with 20 l/sec capacity each (two constructed in 1932 and one added in 1974). The filtrated water is stored in the reservoir constructed beneath the filters and there post-chlorine is fed at 2 ppm.

The finished water is supplied to the consumers by the distribution pumps (40 l/sec x 50 m x 3 units, including one standby, two installed in 1932 and the third in 1972), and the balanced quantity between pumped inflow and supplied outflow is regulated by the elevated tank (350 m^3, H=40 m) erected in the plant site.

The plant's layout is shown on Fig. 4-2.

In addition, groundwater wells were constructed in 1940 in the plant site, to supplement the surface water's output. The nominal capacity of 40 l/sec of the groundwater is fed into the distribution main, 400 mm steel pipe, without chlorination.

As to the measurement of flows in the plant, no equipment has been in working order since the original ones went out of service many years ago.

The current problems of Faqus plant are:

- Laboratory is lacking,
- Protection device/equipment for handling chlorine gas is lacking,
- Flow measurements have not been made,
- Maintenance works of the plant are in a poor condition,
- Most of the pipes in the plant are at the end of service life,
- Filters' nozzles are deteriorated, and
- Raw water quality is undesirable, since it is mixed by the drainage water upstream of Faqus canal.

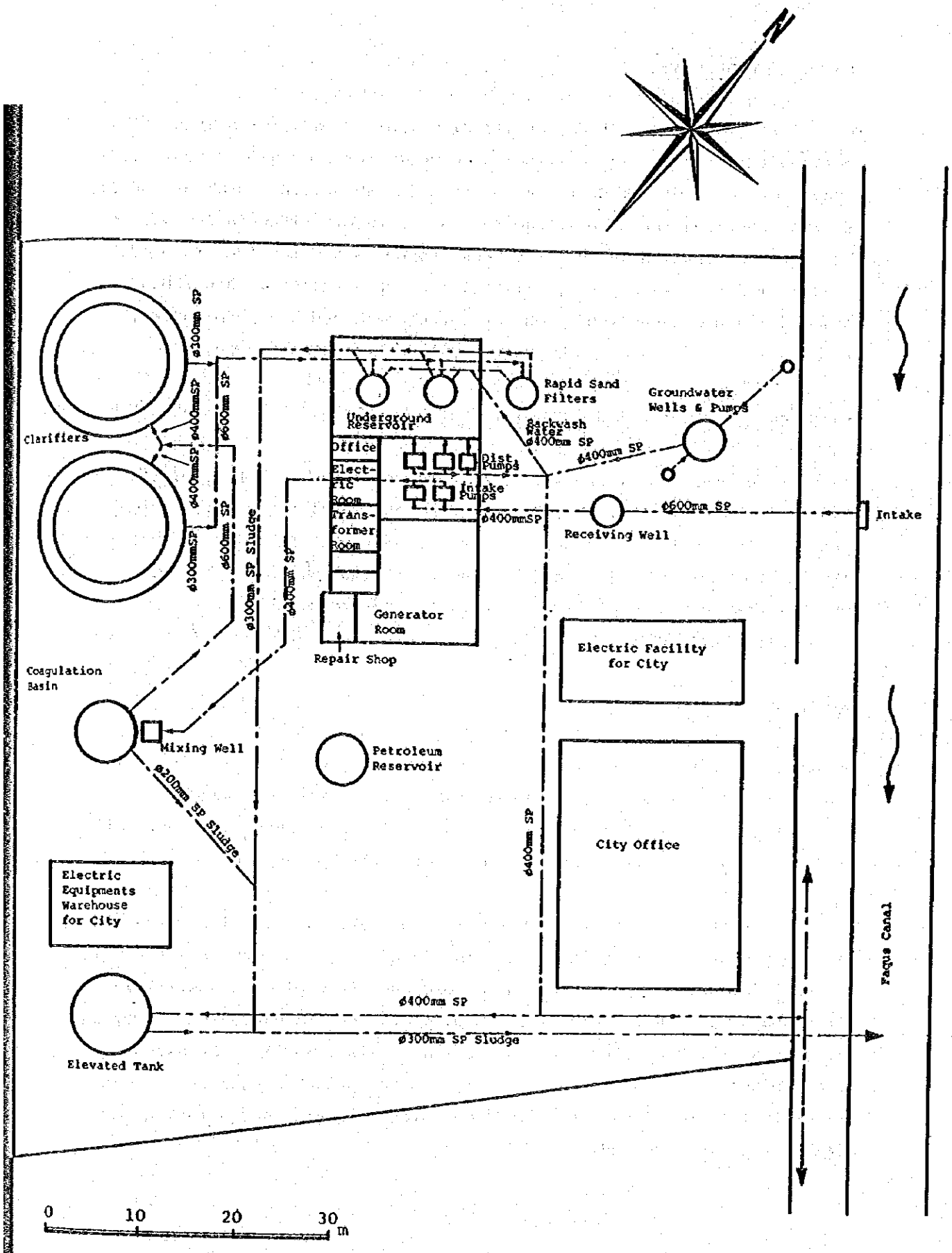

Fig. 4-2 GENERAL PLAN OF FAQUS PLANT

Groundwater Station

The before-mentioned station, called Principal Groundwater Station, was constructed in 1940. The station's two wells were rehabilitated in 1972, because of the capacity decrease due to a faulty screen. Bank Groundwater Station comprises three wells and two pump houses. Although one well of the three constructed in 1945 has been stopped since the summer in 1982, because of decreased capacity, it will be reconstructed within 1983. Said Hessien Groundwater Station has three wells and two pump houses, of which two wells and one pump house will start operation in the near future.

Management of Plant and Groundwater Stations

Engineering Division of Faqus city, placed under the authority of the Head Master and his Deputy, Secretary General, manages the water supply system. Plant Maintenance Section, belonging to the division and staffed with one Chief Engineer, 10 assistants and 60 labors, is responsible for the maintenance of the treatment plant and groundwater stations. For supplying water continuously, the operators work three shifts a day.

Pipelines

Maintenance of the city's pipelines is handled by Pipeline Section which belongs to the Engineering Division, too. It consists of one Chief Technician, 4 technicians and 20 labors. The maintenance work covers the service pipes to water meters, besides the distribution pipes.

When the treatment plant was constructed in 1932, the pipelines were also laid to convey the produced water. In those days, cast iron was the main material for water pipes. Though the old cast iron pipes are still in service as mains in the distribution pipework, due to decreased conveying capacity and leakage, they are not working satisfactorily. As asbestos cement pipes are produced domestically and the price is cheaper, almost all newly laid pipelines are using the material, even though leakage of sizable rate is supposedly caused.

Stop valves installed in the valve chambers are located less than 1,000 m of interval along the pipelines and at key points in the pipeworks. Drain valves, called wash valves here, are installed at proper locations for convenience of maintenance work. No air valves are installed although the ground levels differ from place to place within the city area. Water taps at the end of house connections function in releasing air from the pipelines, in place of the air valves.

In spite of present poor supply conditions, no measure has been taken in controlling the increase of connection. Whoever applies for a house connection will be granted and facilitated. To supply water to high buildings and to get more water from the system, many consumers are installing, at their own expenses, and using pumps. As the trend is spreading widely, the supply condition will be worsened and such a practice may result in cross-connection which is dangerous sanitarily.

95 % of the served population is supplied with the house connections while the rest is depending on the standpipes which are free of charge. Although all house connections are equipped with water meters, almost 90 % of them are said to be faulty.

Lists of the distribution pipelines are attached herewith.

List of Distribution Pipelines

(Faqus City)

No.	Location	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
1	Main GW Station - Start of Faqus City	12"	SP	1,000	1933	Many damages due to life end
2	Start of Samana Canal - Khedawia Street	12"/6"	"	1,000	"	" "
3	Markas-Reaiet el Tefel - Square	6"	CIP	300	"	" "
4	Square Samana - 2nd Section	6"	"	1,000	"	" "
5	Bank Misr - Salah el Tarotee	6"	"	1,000	"	" "
6	Building of electric distribution - Ezbet el Manhia	6"	CIP/SP	1,000	"	" "
7	Railway - Ezbet Omyosef	4"	CIP	1,000	1948	" "
8	El Mazlkan - Al Wehdael Zraeia	6"	"	700	"	" "
9	El Andaloss - End of Shoona	6"	ACP	1,000	1983	No problems
10	El Midan - El Andaloos	6"	CIP	250	1933	Many damages due to life end
11	Handaset el Ray - Kafr el Hoot	6"	ACP	1,000	1982	No problems
12	Mawkef el Otobies - Secondary Nasr School	6"	"	1,000	1981	" "
13	Markas - Madraset el Moa Llimate	4"	"	700	1983	" "
14	El Mashroe - El Moahda	4"	CIP	700	1948	Many damages due to life end
15	El Mashroe - Mabna el Salkhana	4"	"	400	"	" "
16	Start of Samana Canal - Kabrie el Sahabie	4"	CIP	1,000	1948	" "
17	El Gahhoria - Samana Canal	4"	"	400	"	" "
18	Abo Zied - Atalla	4"	"	300	"	" "
19	Samana - El Gamhoria 2nd Section	4"	"	500	1933	" "

List of Distribution Pipelines (2)

(Faqus City)

No.	Location	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
20	Start of Alilea - Nasr Allah	4"	CIP	700	1933	Many damages due to life end
21	Start of Alilea - Tell el Beghall	4"	"	500	"	" "
22	Tell el Beghall - Abdo el Kady	4"	"	300	"	" "
23	Shamaa - El Harby el Sagheer	4"	"	200	"	" "
24	Gamhoria - Wekalet Abd el Monem	4"	"	200	1948	" "
25	Samana - El Gamhoria 1st Section	4"	"	300	"	" "
26	Mostafa Basha - El Madafen	4"	"	500	1949	" "
27	Railway - El Madafen	6"	ACP	400	1980	No problems
28	Nograshy - Abd el Kader	4"	CIP	500	1963	" "
29	Nograshy - Masged el Mamoor	4"	"	500	1948	Many damages due to life end
30	El Gamhoria - El Masaken	4"	CIP	500	"	" "
31	Mostafa Basha - Masged el Nasr	4"	"	500	"	" "
32	El Gamhoria - End of the road	4"	"	200	1953	No problems
33	El Gamhoria - Kafr Abo Nigm	4"	"	300	1948	Many damages due to life end
34	Madghel el Dakatra - Masged Shamaa	4"	"	300	"	" "
35	Masged el Emam - El Agzaghana el Gadiedn	4"	"	200	"	" "
36	Masged el Badarna - Faqus el Balad	3"	ACP	700	1953	" "
	Total			21,050		

Views of Waterworks Staff

The following issues about present problems and concept of the development plan were presented by the staff of the city.

Problems in Faqus Treatment Plant

1) Raw water is mixed with wastewater drained into the canal.
2) Many equipment, pipes, valves, filters, etc., are coming close to the end of service life.
3) Mechanical Department which is necessary for maintenance works is lacking.
4) No measuring instrument is equipped for dosing chemicals.
5) No oxygen aspirator is prepared for protecting the operators from chlorine gas danger.
6) No systems installed for measuring the water flow and pressure.

Request by Treatment Plant Staff

1) Increasing the number of standby units of pumps and motors.
2) Increasing the number of wells to raise the production capacity to meet the demand.
3) Constructing a new surface water treatment plant of reasonable capacity, to cope with the present and future demand.

Problems with Pipelines

1) Bursting of pipes due to the age occurs almost everyday.
2) The existing pipelines are too small in size.

The above leads to requests for replacement by newer and larger pipes.

Request for Pipeline Extention

Urgently needed is the extention of pipelines, as listed below:

Location	Diameter (inch)	Length (meter)
1) Ezbet Yooseph	10	2,000
2) El Sahaby, 2nd section	"	1,000
3) Ezbet El Serw	"	2,000
4) Manshiet El Masoon	"	1,000
5) Kafr El Hoot	"	1,500
6) El Saaha	"	2,000
7) Ezbet El Gran	"	1,000
8) Meniet El Mokarem	"	1,500
9) El Haddana	"	2,500
10) Kalf El Shoona	"	1,000

4. Abu Kebir City Water Supply System

The people of Abu Kebir city are supplied with public water by the city-owned groundwater system. It has four groundwater stations as its water source.

The served population is estimated at 59,000 about 87% of the total 68,000. The service connections number approximately 7,000.

Groundwater Station

1) No. 1 Groundwater Station.(Main Station)

Constructed in	:	1945
Well	:	2 wells x 6" dia x 75 m depth (1945)
		2 wells x 10" dia x 75 m depth (1972)
Electric pump	:	4 units x 25 l/sec x 50 m head x 40 HP
Diesel pump	:	2 " x 25 " x 50 m "
Elevated tank	:	100 m^3 capacity, 28 m height steel made
Delivery pipe	:	8" steel pipe
Output	:	50 l/sec x 24 hrs. = 4,320 m^3/day

2) No. 2 Groundwater Station (Damysa)

Constructed in	:	1972
Well	:	1 well x 6" dia x 65 m depth
		1 well x 10" dia x 65 m depth
Electric pump	:	1 unit x 25 l/sec x 50 m x 40 HP
Diesel pump	:	2 units
Output	:	25 l/sec x 11 hrs. = 990 m^3/day

3) No. 3 Groundwater Station (Kafr Abd Kebir)

Constructed in	:	1972
Well	:	1 well x 8" dia x 85 m depth
Electric pump	:	2 units x 25 l/sec x 55 m head x 40 HP
Output	:	25 l/sec x 8 hrs. = 720 m^3/day

4) No. 4 Groundwater Station (Kafr Swarass)

Constructed in	:	1978
Well	:	1 well x 10" dia x 75 m depth
Electric pump	:	2 units x 25 l/sec. x 50 m head x 40 HP
Output	:	25 l/sec x 14 hrs. = 1,260 m^3/day

5) Total Production

Summing the outputs of No. 1 to No. 4, the total nominal production is:
4,320 + 990 + 720 + 1,260 = 7,290 m^3/day

Pipelines

The details of pipelines such as diameter, pipe material, length, year of installation, etc. are listed on the following page.

Management

The system is operated and maintained by the city's Engineering Department. The staff numbers 65 and they are divided into two divisions. One, responsible for the groundwater stations, consists of one chief engineer, 4 technicians, 8 skilled labors and 27 labors, while another division attends the pipelines and services with a force of one sub-engineer, 3 technicians, 3 skilled labors, 7 semi-skilled labors and 11 labors.

List of Distribution Pipelines

(Abu Kebir City)

No.	Location	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
1	El Tahreer Street - End of the Street	4"	CIP	600	1950	Life end and decrease of inner diameter
2	Hamzast - End	3"	"	500	"	" "
3	Street Motium and Abou Bakr el Saddik	4"	"	250	"	" "
4	El Swalim - End	3"	"	500	"	" "
5	Saad Street - End	3"	"	500	"	" "
6	Asker Street - End	4"	"	500	"	" "
7	Abou Gabal Street - End	2"	SP	250	1955	" "
8	El Hadidy Street - Abou Ghalil	2"	"	400	"	" "
Total				3,500		

Views of Waterworks Staff

The following issues about present problems and concept of the development plan were presented by the staff of the city.

Problems of Groundwater Station

1) Two wells of 6" dia constructed in 1945 are falling in their production level.
2) As the voltage drop in frequent, a stabilizer with sufficient capacity is needed.
3) Shortage of No. 1 Station's pumps are to be coped with.
4) No. 1 Station's delivery pipeline is too small.
5) No. 4 Station's delivery pipeline is also too small.

Request of Groundwater Station

Corresponding to the above problems, the following meqsures are to be taken:

1) Construction of two 10" dia wells.
2) Installation of large capacity transformers.
3) Replacement of the existing 4 units electric pump of 25 l/sec discharge by 4 pumps of 50 l/sec discharge.
4) Replacement of the existing 8" pipeline by 12" one.
5) Replacement of the existing 6" pipeline by 10" one.
6) Installation of a power generator for emergency use.

Problems of Pipelines

1) Shortage of storage of the elevated tank.
2) Insufficient flow capacity of the distribution pipelines.
3) Urgency of extending the network to densely populated areas.

Request of Pipelines

1) A 750 m^3 capacity and 45 m height elevated tank is wanted.
2) Smaller size pipes should be replaced by new pipes of no less than 4" diameter.
3) 6" dia asbestos-cement pipelines are to be laid to supply Menshat, Street Sabery Shereef and Horia Street areas.

5. Ibrahimiya City Water Supply System

Ibrahimiya, a village in Hihya Markaz, was prompted to Town status in 1975. In 1979, when the reorganization of the markaz took place and Ibrahimiya Markaz was formed, it was again raised to the status of capital of the newly formed Markaz, becoming independent of Hihya Markaz.

The people of Ibrahimiya are supplied with public water by the city-owned groundwater system which consists of three groundwater stations, one elevated tank and distribution networks.

In 1948 the first groundwater station with two wells was built (8" dia. x 84 m depth). The wells were abandoned in 1983, however, due to the salinity of the water. As a substitute for them, No. 2 Groundwater Station wells which were a component of Abbassa Regional System, have been changed for use by Ibrahimiya city.

Population of the city is about 23,000 and approximately 65 % of it is supplied with the public water, that is 23,000 x 65 % = 15,000 persons. As to the service connections, the city keeps 1,664 individual connections, 15 fire hydrants, 15 free taps, 10 mosques' connections. All of the individual connections are equipped with meters, but only 30 % of them are said to be in working order.

Groundwater Stations

1) No. 1 (Main) Groundwater Station

Constructed in	: 1948	
Well	: 2 wells x 8" dia x 84 m depth	(1948)
Diesel pump	: 2 units x 25 l/sec x 50 m head x 40 HP	(")
Elevated tank	: 100 m , 47 m high, reinforced concrete,	(")
Electric pump	: 2 units x 20 l/sec x 50 m head x 25 HP	(1965)

Except the elevated tank, the station was taken out of operation in 1983, due to the salinity of the water.

2) No. 2 Groundwater Station (the same site as No. 1)
Constructed in :
Well : 2 wells x 10" dia x 50 m depth
Electric pump : 2 units x 25 l/sec x 50 m head x 40 HP
Production : 50 l/sec x 9 hrs. + 25 l/sec x 15 hrs. =
2,970 m^3/day

This station was originally constructed as a component of the Abbassa Regional System and since the change mentioned above, it has been supplying Ibrahimiya city and the villages belonging to the Abbassa System.

3) No. 3 Groundwater Station (El Gadidaa)
Constructed in : 1981
Well : 1 well x 8" x 50 m depth
Electric pump : 2 units x 25 l/sec x 50 m head x 40 HP
Production : 25 l/sec x 18 hrs. = 1,620 m^3/day

Though this station was constructed for the use of Ibrahimiya city, it is supplying the villages belonging to the Abbasa System exclusively and not to the city.

4) Estimated Delivery and Per Capital Consumption

No. 2 station is the only source for the city supply. Assuming the percentage of actual production to the nominal capacity as 70 % and the city uses' portion to the total as 80 %, the delivery is:

2,970 x 80 % x 70 % = 1,663 m^3/day

With the before mentioned served population, the per capital consumption is:

1,663 m^3/day ÷ 15,000 persons = 111 lpcd (liter per capita per day)

Pipelines

The details of pipelines such as diameter, pipe material, length, year of installation etc. are listed on the following pages.

Management

The city's Engineering Department manages the system. The staff working for it numbers 22 persons and they are divided into two divisions: one is for groundwater station operation, forming a team of two technicians and nine labors and another for pipeline maintenance and service, with three technicians and eight labors team.

The annual budget covering operation and maintenance of the system is, excluding salaries, LE 15,000.

List of Distribution Pipelines
(Ibrahimiya City)

No.	Location	Diameter (mm)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
1	Main Groundwater Station (No.1) - Ahmed Oraby Street	200	CIP	950	'48	Main pipeline
2	Mazlakan passing by El Gamhoria Street - End of Ahmed Oraby Street	150	"	1,000	"	"
3	Social Department - Groundwater Sta. No.3	150	"	270	"	"
4	Ahmad Oraby Street - El Tambool Street	150	ACP	240	'80	"
5	Main Groundwater Sta. (No.1) - El Masaken el Shabia	100	"	400	'70	Branch pipeline
6	Horia Street passing by Abd el Aziz Ali St.	100	CIP	360	'55	"
7	Abd el Aziz Ali Street - Seket el Alhal Awat Street	100	ACP	150	'76	"
8	Abd el Aziz Ali Street - El Salakhan el Gadieda	100	"	300	'80	"
9	Horia St. - El Zafran St.	100	CIP	300	'55	"
10	Ahmed Oraby Street - Abd el Aziz Ali Street	100	ACP	500	'81	"
11	Abu Dekn Street - Makienet el Tampoly St.	100	"	250	'72	"
12	El Gamhoria Street - El Bosta Street	100	CIP	350	'50	"
13	Ahmed Oraby Street - Soliman Gad Street	100	ACP	250	'80	"
14	Horia Street - Ezbat Abu Aiad	100	"	150	'83	"
15	Abd el Aziz Ali Street - Foad Sediek Street	100	"	200	'83	"
16	El Tamboly Street - Bikeer Street	100	"	200	'80	"
17	El Gamhoria Street - Soliman Gad Street	100	CIP	450	'50	"
18	Groundwater Sta. No.3 - Hospital	100	"	400	'50	"

List of Distribution Pipelines (2)
(Ibrahimiya City)

No.	Location	Diameter (mm)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
19	Hafiez Street - Fire hydrant of El Anas	100	CIP	255	'52	Branch pipeline
20	Port Said Street - Ezbat el Kasr	100	ACP	270	'80	"
21	El Anas Street - Mosque of El Hag Ibrahim	75	"	250	'78	"
22	Hafiz St. - Soliman St.	75	CIP	350	'50	"
23	Abd el Aziz Ali St. - El Seka el Hadid St.	75	"	300	'50	"
24	Ahmed Oraby Street - Abo Amer Street	75	ACP	100	'65	"
25	Soliman Gado Street - Abo Taha Street	75	"	100	'67	"
26	Ibrahimiya Hospital - Ezbat el Kashmiery	50	SP	285	'58	"
27	El Shawader Street - Passing by Nabka	50	"	500	'58	"
28	El Montazah - Hafiz St.	50	"	200	'59	"
29	Old el Bosta Street - Shafie Mosa Street	50	"	100	'57	"
30	Old el Bosta Street - El Saiegh Street	75	"	300	'54	"
31	Abo Dekn St. - El Baz St.	50	"	150	'58	"
32	Ahmed Oraby Street - El Tokhy Street	50	"	190	'58	"
33	Ahmed Oraby Street - El Gazarien Street	100	ACP	100	'62	"
34	Ahmed Oraby Street - El Magless el Kadiem	50	SP	150	'58	"
35	Port Said Street - Soliman el Dory St.	50	"	300	'59	"
36	Ahmed Oraby Street - Khalil Street	50	"	200	'58	"
37	Soliman Gad Street - El Sied Gamal Street	50	"	300	'56	"
38	Mosque of Helmy - Afiz Street	75	CIP	350	'56	"

List of Distribution Pipelines (3)
(Ibrahimiya City)

No.	Location	Diameter (mm)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
39	El Shawaden Street - Abo Seda Street	50	SP	150	'60	Branch Pipeline
40	El Seka el Hadid - Kafr Mizo	75	ACP	350	'65	"
Total				11,970		

Views of Waterworks Staff

The following issues about present problems and concept of the development plan were presented by the staff of the city.

Problems and Future Program of Groundwater Station

Presently water production does not face to serious problem, but there are some important matters to be taken into consideration to avoid a shortage of water production in the near future. They are:

1) To construct 2 new wells of 10" diameter and 50 m depth at No. 1 Groundwater Station.
2) To install 2 new electric pumps with 40 HP.
3) To complete proper maintenance system for existing diesel machines to be ready to operate when electricity is cut off.
4) To reconstruct the existing pump house.
5) To construct a new well of 10" diameter in the No. 3 Groundwater Station.
6) To make maintenance of diesel machines easy for their starting.
7) To construct the boundary wall made of brick around the area of the No. 3 Groundwater Station to prevent troubles.
8) To increase the number of skilled labors and technicians for particular activities.

Problems and Future Program of Pipelines

1) Since most of the pipelines made of cast iron or steel (CIP or SP) have reached their lifetime limit, they can not be used with high pressure, and supplied water cannot reach the second floors of buildings.
2) Great shortage of skilled labors to operate and maintain, especially during the night shift. Additional 25 labors/technicians for the pipelines are needed.

3) To obtain modern machines to be used for pipeline maintenance.

4) To construct valve chambers. (Presently there are no valve chambers.)

5) About 1/3 of pipelines are of 2" or 3" diameters which are considered undersized.

6) Some streets are paved over the pipelines so that new pipelines may be constructed on both sides of the roads.

6. Hihya City Water Supply System

The people of Hihya city are supplied with public water by the city owned groundwater system. A part of the population living in the westernmost area and including about 5 percent of the whole population, however, is covered by the Abbasa Regional System.

Groundwater Stations

1) Main Groundwater Station (El Mahatta el Raeisin)

Located in the western part of the city, it was constructed with one well and one elevated tank in 1948 and one more well was added as part of an expansion scheme.

Main features are:

Well	:	2 wells x 10" dia x 55 m depth
Electric pump	:	2 units x 25 l/sec x 50 m head x 30 HP
Diesel pump	:	2 units x 25 l/sec x 50 m head x 40 HP
Output	:	50 l/sec x 18 hrs. = 3,240 m^3/day

2) No. 2 Groundwater Station

Located 400m apart from the above mentioned station, it was constructed in 1963 to reinforce the output.

Main features are:

Well	:	1 well x 10" dia x 60 m depth
Diesel pump	:	1 unit x 25 l/sec x 40 m head x 28 HP
Output	:	25 l/sec x 7 hrs. = 630 m^3/day

3) No. 3 Groundwater Station

Located in the eastern part of the city, it was constructed in 1977 to supply the newly developed area.

Main features are:

Well	:	1 well x 10" dia x 45 m depth
Electric pump	:	1 unit x 25 l/sec x 55 m head x 50 HP
Diesel pump	:	1 unit x 25 l/sec x 40 m head x 28 HP
Output	:	25 l/sec x 18 hrs. = 1,620 m^3/day

4) Total Production

Summing the three stations' output, the total production is:

3,240 + 630 + 1,620 = 5,490 m^3/day

Pipelines

The details of pipelines such as diameter, pipe material, length, year of installation etc. are listed on the following pages.

Management

The city's Engineering Department manages the system. 40 staff are divided into two divisions: one is for the groundwater stations, consisting of 2 engineers, 5 technicians, 2 skilled labors and 10 operators, numbering 19 in total and another is for the pipeline maintenance and service, consisting of 1 high-level technician, 6 technicians, 4 skilled labors and 10 labors, 21 in all.

In 1982, the allocated annual budget covering operation and maintenance of the system was LE 25,000, but the actual expenditure, excluding salaries, was LE 35,000.

List of Distribution Pipelines
(Hihya City)

No.	Location	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
1	Mohatet el Sahaa passing by Ahmed Oraby St. - Hihya Hospital	6"/8"	CIP	2,000		
2	Ahmed Oraby Street - Railway	8"	ACP	1,000		
3	Muweis Canal - Omar Ebn el Khattab Street	8"	"	800		
4	Gamhoria Street - Omar Ebn el Khattab Street	6"	CIP	700		
5	Bahr Muweis Street - New Bridge	6"/8"	"	900		
6	Mostafa Kamel Street - Gamhoria Street	8"	"	1,000		
7	Omar Ebn el Khatab St. - El Madrasa el Azharia	12"/6"	ACP/CIP	850		
8	Khaled Ebn el Walied St. - Sad Zaghlool St.	4"	ACP	400		
9	Abou Ziena Street - Dawar el Omdaa	4"	"	200		
10	Ezbet Fahmy Street - Emarat Bank el Eskan	6"/4"	ACP	164/292		
11	Ezbet Abou Akoora St.	4"	"	200		
12	El Souk el Gadied St. - El Emarat el Sakania	4"	"	400		
13	Ahmed Oraby Street - Kalawoon Street	4"	"	300		
14	Ahmed Oraby Street - El Souk el Kadima	6"	"	700		
15	El Geish Street	4"	"	200		
16	Othman Ebn Afan Street	4"	"	400		
17	El Gehad Street	4"	"	500		
18	El Markaz Street	4"	CIP	200		
19	El Gamea el Kabeir St.	4"	"	300		
20	El Kamoon Street	4"	CIP/ACP	100/100		
21	Brins Street	4"	ACP	200		
22	El Mahdia Street	4"	ACP	200		

List of Distribution Pipelines (2)
(Hihya City)

No.	Location	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
23	Gheida Ganaien Street	4"	ACP	150		
24	Abd el Hameid Rashed	4"	"	200		
25	Fathy el Ariny	4"	"	100		
26	Kalf Mamooriet el Draieb	4"	"	150		
27	Kobaniet Shell Street	4"	"	300		
Total				13,006		

Views of Waterworks Staff

The following issues about present problems and concept of the development plan were presented by the staff of the city.

Problems of Operation

1) The number of standby units of pump and motor is obviously short.
2) In nighttime, the dropped power voltage causes troubles.
3) No electricity generator is prepared for emergency use.
4) Shortage of spare parts for the Raston diesel machine is serious.
5) The capacity for conveying water of the pipelines has fallen substantially.
6) Machines for maintaining the cast iron pipes are needed badly.

Request on Managerial Matters

1) Changing the present orgainzation for the water company status
2) Preparation of an appropriate budget for staff training program
3) More pay for overtime works.

Request of Groundwater Stations

1) Construction of a new treatment plant, using Muweis Canal water
2) Construction of an elevated tank, larger sized than the existing one
3) Replacement of the existing diesel-driven pumps by electricity-driven ones

Request about Pipelines

1) Construction of new transmission pipelines, with diameter larger than 12"
2) Replacement of the cast iron pipes, 6 km long and 4 to 8 inch. in diameter, part of the distribution pipelines
3) Extension of a 3 km long pipeline

7. Diarb Nigm City Water Supply System

The people of Diarb Nigm city are supplied with public water by the city-owned groundwater system which consists of three groundwater stations, two elevated tanks and distribution pipelines.

The population is about 27,000 of which 1/4 and 3/4 live in the west and east part of the city respectively. The served population is estimated at about two-thirds of the total, that is, 27,000 x 2/3 = 18,000 persons.

The number of service connections in 1983 is 3,500 for individual houses, 145 public buildings, 6 free taps, 2 public toilets and 22 fire hydrants.

Groundwater Stations

1) No. 1 Groundwater Station (Diarb Nigm el Balad)

The station was originally constructed in 1954 to supply water to the old city, with one 6" well, one diesel pump and one elevated tank. The 6" well was replaced by a new 8" well in 1978 and additional pumps, one electric in 1976 and one diesel in 1980, were installed.

Main features are:

Well	:	1 well x 8" dia x 65 m depth
Electric pump	:	1 unit x 30 l/sec x 40 HP
Diesel pump	:	one each of 11 HP and 45 HP
Elevated tank	:	40 m^3 capacity, 20 m height, reinforced concrete
Output	:	30 l/sec x 20 hrs. = 2,160 m^3/day

2) No. 2 Groundwater Station (Diarb Nigm el Mahatta)

The station was constructed in 1962 to supply water to the eastern part of the city.

Main features are:

Well	:	2 wells x 6" dia x 65 m depth
Electric pump	:	2 units x 35 l/sec x 40 m head x 45 HP (1964)
		1 unit x 35 " x 75 " (1975)
Diesel pump	:	1 unit x 45 HP (1962)
		1 " x 75 " (1970)
Elevated tank	:	200 m^3 capacity, 35 m height, reinforced concrete
Output	:	five pumps are operated on different time schedule and duration and produce 2,808 m^3/day in total.

3) No. 3 Groundwater Station (El Souk el Gadid)

The station was recently constructed in 1983 in the eastern part of the city.

Main features are:

Well	:	1 well x 6" dia x 60 m depth
Diesel pump	:	1 unit x 20 l/sec x 40 m head x 30 HP
Output	:	20 l/sec x 4 hrs. = 288 m^3/day

4) Total Production

Assuming the ratio of actual production to the nominal as 70 %, after summing the three station's outputs, the production is:

(2,160 + 2,808 + 288) x 70 % = 3,679 m^3/day

Pipelines

The details of pipelines such as diameter, pipe material, length, year of installation etc. are listed on the following pages.

Management

The system is managed by the city's Engineering Department. The personnel working for it numbers 58 which is divided into two divisions : one division, staffed with one engineer, 12 technicians and 12 labors, is responsible for the groundwater stations, while another maintains the distribution and service pipes with a team of one engineer, 6 technicians and 26 labors.

The annual budget for the system's operation and maintenance is about LE 25,000 excluding salary.

List of Distribution Pipelines
(Diarb Nigm City)

No.	Location	Diameter (mm)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
1	Delivery (transmission) pipeline	150	SP	20	1962	
2	Starting point of net-work - Old traffic police office	200	ACP	600	"	
3	Old traffic police office - El Sahaa el Shabia	150	"	800	"	
4	Starting point of net-work - New electric station	100	"	450	"	
5	Shop of El Siedewies - Police office of Diarb Nigm	150	"	400	"	
6	Bread Shop of Sabry Abd el Rihen - behind police office	100	"	300	"	
7	Telephone Building - Abd el Fadiel House	100	"	500	1978	
8	Police office - Secondary Agriculture School	100	"	1,400	1976	
9	Fire hydrant Homtaze - Misr Bank	100	"	400	1968	
10	Shop of El Saied Eweis - Chicken House of Diarb Nigm	100	"	350	1964	
11	Chicken House of Diarb Nigm - House of Ahmed Welny	100	"	250	1981	
12	Chicken House of Diarb Nigm - End of Ezbet Omran	100	"	350	1980	
13	Behind of Telephone Building - End of Salakhana	100	"	500	1964	
14	Bread Shop of Khaliel Riad - New Salakhana Street	100	"	800	1970	

List of Distribution Pipelines (2)

(Diarb Nigm City)

No.	Location	Diameter (mm)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
15	Shop of petroleum gas - House of Ahmed Fareg	100	ACP	200	1980	
16	Ahmed Abdo Farag House - El Souck el Gadied	150	"	400	1983	
17	Ali el Hagrasy House - Abdo Dahmash House	100	"	450	"	
18	El Hag Saied Abd el Baky House - El Masaken el Gadida	100	"	300	1982	
19	Ashour el Ghanam - El Masaken el Gadida	100	"	600	1981	
20	Pharmacy Shalaby - Shoona Street	100	"	100	1965	
21	Shop of Badwy - Shoona Street	75	"	100	"	
22	Shop of Tayea - Shoona Street	100	"	100	"	
23	Shop of Abd Allah Khairy - Shoona Street	100	"	100	"	
24	Kahwet Abou el Mal - Shoona Street	75	"	200	"	
25	El Gameia el Kadeima - Bread shop of Zeidan	100	"	200	1978	
26	Shop of Badawy - El Mahed el Diny	100	"	450	1968	
27	Shop of Abd Allah Abd el Maksood - House of Abou Ashraf	100	"	800	"	
28	House of Kereiey - House of Mahamed Yasien	100	"	300	1981	
29	Electric Station - El Mostawsaff	75/100	"	200	1964/83	
30	School of Carpenters - El Masaken	100	"	300	1973	
31	Behind of Markaz el Tadreeb el Mehany - El Maahed el Diney	100	"	450	1982	

List of Distribution Pipelines (3)

(Diarb Nigm City)

No.	Location	Diameter (mm)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
32	Nady el Moallemien - House of Abd el Megied el Askary	100	ACP	300	1978	
33	Nady el Moallemien - End of Old Post Office Street	75	"	150	1965	
34	El Masaken el Kadeima - House of Abd el Wadood	75	"	250	"	
35	Markaz Office - Ahmed Oraby Street	100	"	150	1982	
36	Pharmacy Abed - House of Ebrahim Badawy	100	"	250	"	
37	House of Mohamed el Iwa - End of Street	100	"	250	"	
38	House of Mohamed Selim - End of Street	100	"	200	"	
39	House Gooda - End of Henawy Street	100	"	250	1981	
40	House of Abd el Fadiel - House of El Gharory	100	"	200	1983	
41	House of Fathy el Kolaly - Masged Ahmed el Baka	100	"	200	"	
42	House of Fathy el Kolaly - House of Othman	100	"	200	1981	
43	Agriculture Secondary School - End of Ezbat Rizk	100	"	200	"	
	Total			14,970		

Views of Waterworks Staff

The following issues about present problems and concept of the development plan were presented by the staff of the city.

Problems of Groundwater Station

1) Power failure and voltage drop occur frequently.
2) For operation and maintenance of electrical equipments, technicians and skilled labors are extremely understaffed.
3) For cases of urgency in operation and maintenance, immediate-preparation of money is very difficult.
4) Due to the poor design of the wells' arrangement, simultaneous operation of more than two wells is practically impossible.
5) There is no way of rewarding the workers who are willing to work overtime and/or on holidays.
6) Lack of transportation facilities make tours of inspection over all stations by key personnel impossible. It also delays immediate action in cases of emergency.
7) The capacity of the elevated tank is insufficient for control.

Requests for correcting the above conditions were presented accordingly.

Problems of Pipelines

1) Shortalge of transportation facilities are felt in operation and maintenance of the pipeline networks.
2) Tools and machines for maintenance are in short supply.
3) No incentive system for good workers exists.
4) Same as the Groundwater Station Problem 3)
5) Shortage of skilled labors
6) No training program for labors

Request on Pipelines

In addition to the request for correcting the incentive problems, the following are requested also.

1) Constructing a new source and a transmission line of above 12" diameter from the source to the city.
2) The pipelines laid before 1962 shall be replaced by larger pipes.
3) The water tariff will have to be raised from the extremely unrealistic low level. Educational programs for the consumers to prepare for the change will be needed.

8. Bilbeis City Water Supply System

The people of Bilbeis city are supplied with public water by the city-owned groundwater supply system which consists of four groundwater stations, one elevated tank and distribution pipelines.

The served population is estimated at 63,000 in 1983, while the total population is 87,000. The number of service connections is about 10,500.

Historically, the first water supply facility was constructed in 1928. Its water source was Ismailia Canal surface water and the water was supplied without treatment through the distribution pipelines of 8" diameter cast iron pipe of 8 km length. The source was disused in 1944 when the groundwater was developed as a new source.

Groundwater Stations

1) No. 1 Groundwater Station (Mohada)

Constructed in	:	1975
Well	:	4 wells x 10" dia x 80 m depth
Pump	:	6 units x 60 l/sec x 50 m head x 75 HP
	:	2 " x 80 " x 50 m " x 100 HP
Output	:	60 l/sec x 2 units x 24 hrs. = 10,368 m^3/day

2) No. 2 Groundwater Station (El Saha el Shabia)

Constructed in	:	1967
Well	:	2 wells x 10" dia x 80 m depth
Pump	:	2 units x 60 l/sec x 75 HP
Output	:	60 l/sec x 24 hrs. = 5,184 m^3/day

3) No. 3 Groundwater Station (Waborat)

Constructed in	:	1948
Well	:	1 well x 10" dia x 80 m depth
Pump	:	2 units x 35 l/sec x 50 m head x 50 HP
Elevated tank	:	300 m^3 capacity, 36 m height
Output	:	35 l/sec x 24 hrs. = 3,024 m^3/day

4) No. 4 Groundwater Station (Eastern part of city)

Constructed in	:	1976
Well	:	2 wells x 10" dia x 80 m depth
Pump	:	4 units x 30 l/sec x 50 m head x 50 HP
Output	:	30 l/sec x 2 x 24 hrs. = 5,184 m^3/day

5) Total Production and Per Capita Consumption

Summing the outputs of No. to No. 4 Stations' output, the total nominal production is:

10,368 + 5,184 + 3,024 + 5,184 = 23,760 m^3/day

Assuming the ratio of actual production to total as 60 %, the actual production is :

23,760 x 60 % = 14,356 m^3/day

The per capita consumption is calculated as:

14,256 m^3/day ÷ 63,000 persons = 226 lpcd

Pipelines

The details of pipeline such as diameter, pipe material, length, year of installation etc. are listed on the following pages.

Management

The system is managed by the city's Engineering Department. The staff working for the system numbers 101 and they are divided into two divisions. One is responsible for the groundwater stations, engaging 13 technicians and 38 labors. Another does the maintenance and operation of pipelines, with one chief engineer, 3 technicians, 10 skilled labors and 36 labors, totalling 50.

The annual budget is about LE 30,000. It does not include the salary or any expansion project cost.

List of Distribution Pipelines

(Bilbeis City)

No.	Location	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
1	Midan el Moahda - Massah St. until Steel Elevated Tank	12"	ACP	2,500	1980-83	No problems
2	Shop of Abd el Latifa-bdien - Fire Protect Department until Shop of Abou Arfah	8"	"	1,500	1980	" "
3	Building of Awkaf - Shop of Abou Arfah	8"	CIP	2,500	1958	Much damaged
4	Shop of Abou Mehseeb - Port Said Street until Shop of Hasabou	8"	ACP	250	1982	No problems
5	El Saha el Shabia - Mosque Abou Eisa until Shop of Ebrahim Salem	8"	"	600	1974	" "
6	Shop of Bazzan - Fakhr Street until Hay el Nady	8"	"	650	1983	" "
7	Kahwet Abou Eisa - Shop of Abou Tarboush	8"	"	300	1982	" "
8	El Agrab Shop passing by 6th October Street	8"	"	892	"	" "
9	El Saha el Shabia passing by Abd el Monem Street	8"	"	250	1980	" "
10	Abou Ragab passing by El Zahed Street until El Sied Kandiel House	8"	"	350	"	" "
11	Manufacture District passing by Shanawanie Street - Abd el Aziem Fathalla House	8"	"	500	"	" "
12	Ahwanie passing by El Shiekh Saleh Street until Port Said Road	8"	CIP	600	1954	Much damaged due to life end
13	Anwagieh Goher passing by Port Said Street	8"	"	100	1960	" "
	Note: Aboves are in No.1 Area in the City					

List of Distribution Pipelines (2)
(Bilbeis City)

No.	Location	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
	No.3 Area					
1	Koshk el Moahda - Wagieh Gooher	6"	CIP	550	1962	Much damaged
2	Fournel Emary passing by Port Said Street - Zaghlool Street	6"	"	200	"	" "
3	Behind Markaz Office Building passing by Port Said Street until Shop of Hasabou	6"	"	300	"	" "
4	Shop of Hasabou - El Shibieny Brigde	6"	ACP	400	1962/82	No problems
5	6th October Street - Houring of Station	6"	"		1982	" "
6	Mahatet el Saha passing by Gamal Abd el Naser Street - El Boosta	6"	"	300	1970	" "
7	Ali Hany passing by Sad Zaghlool Street - El Nady	6"	"	412	1983	" "
8	Abou Shawally - El Matager	6"	"	400	1983	" "
	No.4 Area					
1	El Ashrem and El Zahed Street - Port Said St.	4"	CIP	300	1960	Much damaged
2	Abou el Waan Street - Mansy Street	4"	"	300	"	" "
3	Fakhr Street - Nady District	4"	"	400	"	" "
4	Ratreik Street - Nady District	4"	ACP	350	1970	" "
5	Abou Saleh Shop passing by Port Said Street and Omar el Emry - Daier el Bander	4"	CIP	700	1960	" "

List of Distribution Pipelines (3)

(Bilbeis City)

No.	Location	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
6	Abou Sabek Street - Abou Tarboosh Shop	4"	CIP	150	1960	Much damaged
7	Abou Esaa passing by Abou Bakr Street - Abou Tarboosh Shop	4"	"	250	"	" "
8	Abou Tarboosh Shop - Transformer Station	4"	ACP	400	1970	" "
9	Hassabou Shop passing by Ebeid Street - Siana Street	4"	"	700	1970/78	No problems
10	Mahkama Street passing Hadadein Street	4"	CIP	350	1960	Much damaged
11	Aziz Safwatt District	4"	ACP	2,000	1970	No problems
12	El Asaly Street - High Bridge	4"	"	1,500	1970/83	" "
Total				20,954		

Views of Waterworks Staff

The following issues about present problems and concept of the development plan were presented by the staff of the city.

Problems of Groundwater Station

1) Well production has been too low to satisfy demand, as verified for instance by the lowered water level during operation and slow recovery after stopping draw-off. (No. 1, 2, 4)
2) Failure of stable electricity supply occurs too often. (No. 2)
3) The pumps do not fit the structural design of housing. (No. 1)

Request of Groundwater Station

1) Construction of new wells, 10" dia and 80 m depth (No. 1, 2, 4)
2) Reparing the pumphouse (No. 2)
3) Changing the pumps' design (No. 1)
4) Replacing the pumps by ones with higher efficiency (No. 1)
5) Installing standby-diesel pumps (No. 4), -electric pumps(No. 2)
6) Laying a new 12" pipeline to improve the network (No. 4)

Problems of Pipeline

1) All of the cast iron pipes are unsuitable, due to aging during more than 40 years' service.