9. Minyet el Qamh City Water Supply System

The people of Minyet el Qamh are supplied with public water by the city-owned groundwater supply system which consists of 4 groundwater stations, one elevated tank and distribution networks.

The total population of the city is about 42,000 and about 60% of it is served by the system, that is, 42,000 x 60 % = 25,200 persons. Regarding the number of service connections, there are 9,000 individual (apartments) connections and 3,160 group connections, making a total of 12,160. Although all the connections are metered 80 % of the meters are not working.

In addition to the existing 4 groundwater stations, the city is now constructing the fifth station. The construction started in 1976 and already two wells, 10" dia and 65 m depth, and an elevated tank, 500 m^3 capacity, 38 m height and reinforced concrete construction, have been completed. However, due to the shortage of funds, the pumps and electrical equipment have not been installed yet.

Groundwater Station

1) No. 1 Groundwater Station (Main Station)

Constructed in	: 1928	
Rehabilitated in	: 1955	
Expanded in	: 1973	
Well	: 2 wells x 10" dia x 65 m depth	(1955)
	2 " x 10" " x 65 m "	(1973)
Elevated tank	: 300 m^3 capacity, 28 m neight , steel	(1928)
Electric pumps	: 3 units x 30 l/sec x 50 m head x 50 HP	(1955)
	3 " x 30 " x 50 m " x 50 "	(1973)
Power Generator	: 200 KWH for emergency use	(1977)
Output	: 30 l/sec x 12 hrs. x 2 units +	
	30 " x 24 "	
	= 5,184 m^3/day	

2) No. 2 Groundwater Station (El Sadat)

Constructed in : 1970
Well : 1 well x 10" dia x 65 m depth
Electric pump : 1 unit x 30 l/sec x 50 m head x 50 HP
Output : 30 l/sec x 12 hrs. = 1,296 m^3/day

3) No. 3 Groundwater Station (El Markes el Kadeem)

Constructed in : 1972
Well : 1 well x 10" dia x 65 m depth
Electric pump : 1 unit x 30 l/sec x 50 m head x 50 HP
Output : 30 l/sec x 12 hrs. = 1,296 m^3/day

4) No. 4 Groundwater Station (El Zerae)

Constructed in : 1972
Well : 1 well x 10" dia x 65 m depth
Electric pump : 1 unit x 50 m head x 50 HP
Output : 1,296 m^3/day

5) Total Production

Summing the outputs of No. 1 to No. 4 Stations' output, the total nominal production is :

5,184 + 1,296 + 1,296 + 1,296 = 7,776 m^3/day

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

7,776 x 60 % = 4,666 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 operated and maintained by the city's Engineering Department. The staff working for it numbers 83 and they are divided into two divisions. One division, consisting of one chief engineer, 2 assisting engineers, 7 technicians and 38 labors, is responsible for the groundwater stations, while another, of one engineer, 4 technicians and 30 labors, the pipelines and services.

The annual budget for the system, excluding the salary, is LE 25,000.

List of Distribution Pipelines
(Minyet el Qamh City)

No.	Location	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
1	El Bahr Street	10"	CIP	100	1935	
2	" "	12"	ACP	400	1979	
3	Port Said Street	10"	CIP	400	1935	
4	El Bahr Street	8"	SP	350	1932	
5	Hassan el Bana Street	8"	CIP	200	"	
6	Seidy Eisa Street	8"	SP	250	"	
7	El Bahr Street	8"	ACP	100	1975	
8	Hassan el Bana Street	6"	"	220	1981	
9	Sad Street	6"	CIP	960	1938	
10	El Nasr Street	10"	ACP	350	1980	
11	El Horia Street	10"	"	300	"	
12	El Sheikh Goda Street	6"	CIP	380	1938	
13	Awad Soliman Street	6"	"	100	"	
14	El Bahr Street	6"	"	50	"	
15	El Salkhana Street	6"	"	100	"	
16	Tarik Malames Road	6"	ACP	600	1975	
17	Tarik el Khors Road	5"	"	800	1976	
18	Lottfy Street	6"	"	440	1981	
19	El Mostafa Street	4"	"	900	1980	
20	El Gameria Street	4"	"	360	1978	
21	Ali Fahmy Street	4"	"	420	1981	
22	El Sakia Street	4"	"	230	1968	
23	Abou el Elaa	4"	"	250	1981	
24	Khaled Street	4"	CIP	160	1959	
25	Oraby Street	4"	"	160	"	
26	Ali Ebn Abou Taleb St.	4"	ACP	190	1969	
27	Awad Soliman Street	4"	"	100	"	
28	Nasr Masoud Street	4"	CIP	120	1959	
29	" " "	4"	ACP	100	1965	
30	Gergis Eliass Street	4"	CIP	120	1959	
31	Harett el Wasett St.	4"	"	260	1938	
32	El Geish Street	4"	"	120	1935	

List of Distribution Pipelines (2)

(Minyet el Qamh City)

No.	Location	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
33	El Salakhana Street	4"	CIP	100	1960	
	" " "	4"	ACP	500	1965	
34	Sied Marey Street	4"	"	1,000	1963/70	
35	El Abazia District	4"	CIP	250	1963	
36	Handaset el Ray Street	4"	ACP	250	1976	
	" " "	4"	CIP	150	1961	
37	Malames Street	4"	"	100	"	
38	El Delta Street	4"	ACP	230	1973	
39	Saad Street	4"	"	550	"	
40	Mostafa Afendy Street	4"	"	350	1978	
41	Meet Yazied Street	4"	CIP	1,200	1959	
42	Khairy Abd el Elaziz St.	4"	"	250	"	
	" " " "	4"	ACP	270	1973	
43	Abbasa Street	4"	"	450	"	
44	23rd July Street	6"	"	220	1977	
45	Seidy Mansour Street	8"	"	220	"	
	" " "	4"	"	320	1978	
46	El Esawy Street	4"	"	450	1970	
47	El Madmasa Street	8"	"	650	1982	
48	El Manshia Street	4"	CIP	150	1963	
49	El Taroty Street	4"	ACP	240	1969	
50	Abou Frahat Street	4"	"	240	"	
51	Abou Saber Street	4"	"	250	"	
52	Sad el Sherbeny Street	4"	"	250	"	
53	Terat el Sath Street	4"	CIP	200	1963	
54	El Sharkawy Street	4"	ACP	220	1979	
55	Abou Mosalem Street	4"	"	390	1975	
56	Sad Zaghlool Street	4"	"	700	1976	
57	El Mooled Street	3"	CIP	330	1963	
58	El Bably Street	3"	"	290	"	
59	El Lawahenia Street	3"	"	430	"	
60	El Fath Street	3"	"	430	1960	

List of Distribution Pipelines (3)

(Minyet el Qamh City)

No.	Location	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
61	Ahmed Ali Street	6"	ACP	150	1981	
62	El Kanisa Street	3"	CIP	220	1963	
63	El Mamoon Street	3"	"	220	1961	
64	Abd Rabo Street	3"	"	200	"	
65	El Shwader Street	3"	"	130	1963	
66	Gafer Street	4"	ACP	280	1981	
67	El Manshia District	4"	CIP	340	1963	
68	Sad Street	3"	ACP	120	1969	
69	El Trabishy Street	4"	"	90	"	
70	El Shamy Street	4"	"	240	1978	
	" "	3"	CIP	170	1960	
71	Handaset el Ray Street	12"	ACP	120	1978	
72	Fawzy Rafey District	4"	"	350	1977	
Total				23,850		

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) Voltage drop of electricity
2) No diesel power generator in case of power failure
3) Shortage of technicians and skilled labors

Future Programs of Groundwater Stations

1) Construction of a new groundwater station in the western part of the city with a sufficient number of wells.
2) Installation of electric pumps and transformers, both of appropriate capacity
3) Construction of well-equipped pump houses as the present ones are unsuited for present conditions.
4) Construction of auxiliary buildings such as administration, maintenanc and storage

Problems of Pipelines

1) Inadequate size of pipe diameter is causing excessive friction loss, which in turn causes low pressure in the network.
2) Due to the old age of pipes, troublesome incidents occur frequently.
3) Lacking the valve chambers, valves are laid bare in the ground.

Future Programs of Pipelines

1) Replacing the old cast iron pipes by new asbesto-cement pipes of larger diameter.

2) Reorganizing the network to provide a higher service pressure at the end area of pipelines.
3) Constructing valve chambers for protection of the existing ones
4) Assigning skilled labors to peration and maintenance of the pipelines

10. Mashtul el Souk City Water Supply System

Mashtul el Souk city, the capital of Mashtul el Souk Markaz, was separated and became independent from Bilbeis Markaz in 1977. The people is supplied with public water by the city-owned groundwater supply system which consists of one groundwater station, one elevated tank and distribution pipelines.

The population is about 27,000 approximately 60 % of which is served water by the system, that is, 27,000 x 60 % = 16,200 persons. The house connections are about 4,000 and other connections are 12 for fire hydrants, 18 free taps, 22 mosques' and one church's.

All connections are equipped with water meters and owing to an extensive rehabilitation work made in 1983, almost all meters are in working condition. The work's cost was covered by payment from the consumers.

Groundwater Station

The station was constructed in 1948, at first, with two wells of 8" dia and one elevated tank. The wells were replaced by new ones in 1978 and 1980 and an additional well was put into service in 1981.

The main features are:

Well	:	1 well x 10" dia x 58 - 64 m depth (1978)
		1 " x 8" " x 58 - 64 m " (1980)
		1 " x 10" " x 58 - 64 m " (1981)
Elevated tank	:	100 m^3 capacity, 30 m height, reinforced concrete made (1948)
Electric pump	:	1 unit x 25 l/sec x 60 m head x 50 HP (1981)
		2 units x 25 " x 50 m " x 40 " (1978/1980)
Diesel pump	:	1 unit x 25 " x 40 m " x 28 " (1950)
		2 units x 25 " x 40 m " x 34 " (1980)
Operation	:	electric pumps for 12 hrs. in daytime and diesel pumps for 12 hrs. in nighttime
Output	:	50 l/sec x 12 hrs. + 25 l/sec x 12 hrs. = 3,240 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 operated and maintained by the city's Engineering Department. The staff working for it numbers 26 and they are divided into two divisions. One division, consisting of one engineer, 4 technicians and 10 labors, attends the groundwater station, while another is responsible for managing the pipelines and services.

The annual budget for managing the system is about LE 15,000, excluding salaries.

List of Distribution Pipelines

(Mashtul el Souk City)

No.	Location	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
1	Water Station - Shop of Rasaad Naily	8"	ACP	1,600	1980	
2	Kobry el Shwan - Village El Tabia	4"	"	1,600	1981	
3	Village Tabia - Ezbat Hegazy	4"	"	800	"	
4	Koobry Gamall Sharaf passing by Trat el Souk	4"	"	528	1979	
5	Water Station - Kafr Yousph	4"	"	3,500	1977	
6	Water Station - Kafr el Agamy	4"	"	1,200	1968	
7	Water Station - Village Nabtiet	4"	"	4,000	1958	
8	Shop of Youseph Nassar - El Hag Saeid Habashy	8"	"	200	1981	
9	Shop of Rasaad el Manayly - Electric transformer location	4"	"	600	1950	Many damages
10	Shop Kamel Abou el Eish - Mosque el Abbaein	4"	"	300	1975	
11	Koobry el Shwamen - Markaz el Shorta	4"	"	500	1981	
12	End of el Souk - Ezbet Hessien Fahmy	4"	"	250	1983	
13	El Seka el Hadied - Ezbet el Saida	4"	"	200	"	
14	Markaz el Shabab - El Mahed el el Diny	4"	"	200	1979	
15	El Arbaein Street	4"	"	300	1981	
16	Erbed Street	4"	"	450	1955	Many damages
17	El Madeina el Monawara Street	4"	"	400	1955	" "
18	El Shwafein Street	4"	"	300	"	" "
19	Benteit Street	4"	"	300	1980	
	Total			17,228		

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) 100 m^3 capacity of the existing elevated tank is obviously too small and consequently 24 hrs' pump operation is needed.
2) More pumps and wells are wanted.
3) Between 5 p.m. and 10 p.m. the electricity voltage drops frequently.
4) The diesel generator has no standby.
5) Technicians and skilled labors are in short supply.

Request for Groundwater Station

Solving the above mentioned problems is requested generally. Specifically, one elevated tank of 500 m^3 capacity and 50 m height was wanted.

Problems of Pipelines

1) Most pipelines are coming close to the end of service life.
2) Shortage of skilled labor.
3) 3" pipelines are causing inconvenience in operation.

Request for Pipeline

1) Replacement of the old pipelines, 15,000 m length in all, by 8" pipe is urgently needed.
2) Establishing a section taking care of water meters exclusively is wanted.
3) Staffing operation and maintenance works with proper number of technicians and skilled labors.

11. Huseiniya City Water Supply System

Huseiniya was administratively prompted to the city by a national law in 1960. Until those days, the people in Huseiniya were using shallow well groundwater, although it was not necessarily good quality, but rather salty; or canal water sometimes. The shallow well groundwater has been used still presently as miscellaneous purposes by the people.

Sources

The city receives groundwater which is taken at Didamoon Groundwater Station of the Abbasa Regional Supply System in bulk and distribute it to the people through its own distribution pipelines.

Supply Services

The present population is estimated at about 18,000 and about 50 % of them are supplied by the public water. Number of house connections is 1,033 in addition to 10 standpipes, 11 fire hydrants and 11 mosques.

The city receives 600 m^3/day in average from the Abbasa system.

Pipelines

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

Management

The distribution pipelines are operated and maintained by the city's Engineering Department. The staff attending the pipelines number 9, consisting of 2 technicians and 7 labors.

In 1982, LE 60,000 was expended for new construction of wells at Diamoon Groundwater Station.

List of Distribution Pipelines
(Huseiniya City)

No.	Location	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
1	Huseiniya Booster St. - Markaz Street	7"	ACP	1,500	'60	
2	El Shabaka Street - Mamal Street	5"	"	800	'60	
3	2nd District of Huseiniya - Ezbat Bedier	6"	"	10,000	'77	
4	Khalig el Raml St. - El Manshia St.	5"	"	1,000	'60	
5	Serag Street - Ezbat el Tell	4"	"	600	'76	
6	El Mahed el Diny St.	4"	"	4,000	'80	
7	El Markaz Street - El Noman Street	4"	"	1,000	'71	
8	El Markaz Street - El Eighawa Street	4"	"	500	'77	
9	El Markaz Street - El Mahkama Street	4"	"	800	'79	
10	El Markaz Street - Port Said Street	4"	"	600	'79	
11	El Madarse Street - El Markaz Street	4"	"	400	'80	
12	El Gabana Street - Masged el Markaz	4"	"	1,000	'80	
13	El Khashab Street - Manshia Street	4"	"	800	'76	
14	Abu Rahmo Street - Abou el Maati Street	4"	"	800	'81	
15	Khalig el Street - Ezbat Farag Street	4"	"	2,000	'60	
Total				25,800		

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

1) Not enough in water quantity and service pressure. Water cannot be supplied to the 2nd floors of buildings.
2) Oftenly Huseiniya Booster Station became no operation due to electric/ mechanical troubles.
3) No serious problems in network pipelines presently.

Future Program

1) Construction of a new treatment plant with canal water in Huseiniya Markaz. Because presently Huseiniya Markaz depends on groundwater and station of which is located at remoted place in another Markaz . Huseiniya Markaz wants its own water source.
2) Construction of a maintenance center with technicians and skilled labors, and equipped with machinery and tools for maintenance of pipelines and booster stations.

12. Kafr Saqr City Water Supply System

Kafr Saqr City is located in northern part of the Governorate where groundwater is not potable due to salinity. The water supply of the city, therefore, has been fully depending on the Abbasa System through Abu Kebir Groundwater Station located in the adjacent Markaz of Abu Kebir. The supply from the groundwater station, however, has become rather difficult because the people along the transmission pipeline has needed much water. To solve the above difficulty, so-called "compact unit" to treat canal surface water was installed in 1981 by U. S. aid in Kafr Saqr. The capacity of the unit is 100 m^3/hour and it has been distributed to both the city and its surrounding rural area. In November 1983 an additional compact unit was completed beside Muweis Canal to supply to the city; and the former unit was converted to the rural area use. The units belong to the Abbasa System and they are not always operated continuously because of a shortage of electric supply capacity.

Supply Condition

The city receives 1,500 m^3/day in bulk from the Abbasa System through the groundwater station and compact units presently. Present population is about 17,000 and 50 % of it receives water through public supply system. Number of connection is about 3,000 in addition to 10 stanspipes and 15 fire hydrants.

Pipelines

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

Management

The distribution pipelines are operated and maintained by the city's Engineering Department. The staff attending the pipelines number 10, consisting of one chief technician, 2 technicians and 7 labors.

In 1983 LE 70,000 was expended mainly for construction for new compact units.

List of Distribution Pipelines

(Kafr Saqr City)

No.	Location	Diameter (Inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
1	El Glaa St.	6"	ACP	1,483	1960	
2	From elevated tank through El Glaa St.	10"/8"	ACP	1,443	1963	
3	El Tahrier St.	6"	ACP	733	1960	
4	El Giesh St.	4"	ACP	585	1960	
5	Hafez Ebrahim St.	4"	ACP	425	1960	
6	Abd Elsalam Aref St.	5"	ACP	270	1965	
7	Treot Elkhoduria St.	5"	ACP	253	1968	
		4"	ACP	160	1977	
8	Oraby St.	4"	ACP	300	1965	
9	El Moostawsaf St.	5"	ACP	360	1967	
10	El Gamhoria El Gharby St.	6"	ACP	550	1965	
		4"	ACP	270	1970	
11	El Gamhoria El Shargy St.	4"	ACP	220	1967	
		5"	ACP	490	1967	
12	Treit Elkhodahia El Gadida St.	5"	ACP	420	1976	
13	Abu Hend St.	4"	ACP	165	1976	
14	El Adwy St.	4"	ACP	208	1976	
15	El Banaien St.	3"	ACP	207	1977	
16	Abd El Ghafoor El Adawy St.	4"	ACP	391	1976	
17	Abd El Kader Saied St.	4"	ACP	142	1977	
18	Makienet Shonoda St.	6"	ACP	328	1977	
19	Omar Efendy St.	4"	ACP	100	1977	
		3"	ACP	62	1977	
20	El Shiekh Abd El Ghany St.	3"	ACP	143	1977	
21	El Ettehad El Eshtraky St.	4"	ACP	139	1977	

List of Distribution Pipelines

(Kafr Saqr City)

No.	Location	Diameter (Inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
22	El Shiekh Motwally St.	3"	ACP	152	1977	
23	Mahmood Atia St.	3"	ACP	78	1977	
24	El Gazarien St.	3"	ACP	80	1976	
25	Hesien Eliewa St.	4"	ACP	200	1980	
26	Abbas Dsoky St.	4"	ACP	220	1980	
27	Wadie Elias St.	4"	ACP	148	1980	
28	Omar Ebn Elkhatab St.	4"	ACP	148	1980	
29	Teriet Sangha St.	6"	ACP	183	1980	
30	Shoon El Malh St.	4"	ACP	72	1980	
31	El Gamiea El Saghier St.	4"	ACP	108	1980	
32	Mohamed Faried St.	4"	ACP	110	1980	
33	Mohamed Kamel St.	4"	ACP	226	1970	
34	Kafr Othman St.	3"	ACP	38	1977	
		2.5"	ACP	24	1977	
35	Masraf El Adiesia St.	3"	ACP	478	1969	
36	Zienab Khalaf Section	4"	ACP	210	1980	
37	El Gamhoria El Sharky St.	3"	ACP	78	1977	
38	Mostafa Kamel St.	6"	ACP	324	1977	
39	El Kiniesa St.	4"	ACP	464	1977	
40	El Warsha St.	4"	ACP	200	1977	
41	Abd El Aziez St.	4"	ACP	100	1980	
42	Abou Saeid St.	5"	ACP	320	1970	
43	Madrst El Nasr St.	4"	ACP	124	1977	
44	Kafl El Masaken El Shabia St.	4"	ACP	200	1983	
45	Shiniet El Harabwa St.	5"	ACP	470	1977	

List of Distribution Pipelines

(Kafr Saqr City)

No.	Location	Diameter (Inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
46	El Shiekh Gamal St.	4"	ACP	250	1976	
47	El Madrasa El Eidadia St.	3"	ACP	64	1977	
48	Kalf Madraset El Zeraa St.	4"	ACP	160	1975	
49	Abou Nafea St.	4"	ACP	60	1982	
50	Abd El Fatah Othman St.	4"	ACP	84	1978	
51	El Tahrier St.	4"	ACP	300	1982	
52	Tiret Natora St.	4"	ACP	280	1977	
53	El Saha El Shabia St.	2.5"	ACP	150	1972	
54	Madraset Eltegara St.	3"	ACP	80	1972	
55	Abd El Ghani St.	3"	ACP	70	1972	
56	Abou Behiery St.	4"	ACP	150	1981	
57	El Sied Abou Othman St	4"	ACP	70	1981	
58	Abou El Wadaa St.	4"	ACP	80	1981	
59	El Bahmasy St.	4"	ACP	120	1982	
60	Abou Shihata St.	3"	ACP	88	1973	
61	Abd El Mgied El Slamy St.	4"	ACP	152	1975	
62	El Shabrawy St.	4"	ACP	132	1975	
63	El Betrool St.	4"	ACP	160	1975	
64	Ebn Elbashbiehi St.	3"	ACP	148	1975	
65	El Eiman St.	4"	ACP	160	1975	
Total				17,360		

Views of Waterworks Staff

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

1) The main pipeline of 6" dia has been undersized due to expansion of buildings; this main requires at least 10" dia.
2) Other pipelines of 4" - 3" are also required to be replaced by 8" - 6" dia pipes.
3) There is strongly need to increase number of the compact units and to construct new wells on the bank of Sady Canal from where transmission pipeline of 10" dia and 6 km long will be installed to Kafr Saqr City.
4) Over-time charge for personnel shall be paid; as well as done in Electric Company and Drainage Plant.
5) To increase number of labors.
6) To increase water tariff. Current tariff is considered too cheap-
7) Strongly need for vehicles for observation and maintenance of stations and pipelines.

13. Abu Hammad City Water Supply System

The served population of the city is estimated at about 25,000 at present and as 1,500 m^3/day is supplied the per capita consumption is calculated as 60 lpcd.

Source

The city receives water from the Abbassa Regional Supply System at three spc and distributes it to the people through its own distribution pipelines. A standby and emergency source belonging to the city, one well of 8" dia anc 55 m depth with 30 l/sec, 40 m head and 40 HP pumpsets, was prepared in 196

Pipelines

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

Management

The distribution pipelines are operated and maintained by the city's Engineering Department. The staff attending the pipelines numbers 20, consistir of one chief engineer, 3 technicians, 5 skilled labors and 11 labors.

In 1982, LE 5,000 was expended for the system, including a new extension work of the distribution pipeline. For operation and maintenance the budget is limited to approximately LE 600 annually, excluding salaries.

List of Distribution Pipelines

(Abu Hammad City)

No.	Location	Diameter (inches)	Pipe Material	Length (m)	Year of Instal-lation	Remarks
(A)	Abu Hammad el Balad from Waddy Canal to Road Bilbels end					
1	Sad Zaghlool Street - El Wehda el Zraeia	4"	CIP	1,200	1962	No problem
2	Big and small streets in above district	4"	ACP	7,800	1965/82	"
(B)	Central area of Abu Hammad					
1	El Geish Road: Station Square - Road end	4"	ACP	590	1960	"
2	El Galaa Road	5"	"	550	1960	"
3	Ali Ebn Abu Taleb Road	4"	CIP	600	1962	"
4	All small road in the above district	4"	ACP	4,650	1965/82	"
(C)	El Manshia District					
1	El Tahreer Road	6"	ACP	1,450	1980	"
2	El Shiegh Mohamedaboo Road	4"	CIP	775	1962	"
3	All small road in the above district	4"	ACP	4,625	1962/82	"
	Total			22,240		

Views of Waterworks Staff

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

The city's problems as regards water supply are centered on its dependency on the Abbassa Regional System. This problem is observable because:

1) When the Abbassa water stops, the shortage is felt acutely.
2) The connecting part of pipeline of Abbassa supply line and the city's distribution system is bottlenecking the supply.
3) Accordingly the service pressure is low, only about 10 m head.

Solutions

1) Construction of new groundwater stations of its own to self-support the demand.

Other Problems

The groundwater level is rather high in the city area, about 80 cm below the ground level. A sanitary drainage system is strongly wanted therefore.

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

WORKING REPORT NO.5

POPULATION AND WATER DEMAND FORECAST

JAPAN INTERNATIONAL COOPERATION AGENCY

WORKING PAPER NO.5

Population and Water Demand Forecast

CONTENTS

Chapter 1 Introduction

This paper is to present the results of demographic analysis and consequent water demand forecast up to the year 2005, for studying the feasibility of Sharqiya Water Supply Project.

The study area is the entire Governorate of Sharqiya which is located in the Nile Delta to the northeast of Cairo, the capital of Egypt. The Governorate measures 100 km from northeast to southwest, and 50 km from northwest to southeast. The Governorate's economy is generally based on agriculture.

As of September 1983, Sharqiya Governorate is administratively divided into twelve Markazes and one Town. Each Markaz comprises one capital city and Local Units ranging from two to nine in numbers. A Local Unit is composed of several villages. Thus, the number of villages in the Governorate totals to 460. Zagazig is the Capital of the Governorate.

According to the last census conducted in 1976, the Governorate held a 2,617,938 population in the habitable area of 4,179.5 km^2, making the population density 626 persons per km^2. The Governorate's population is estimated at approximately 3,048,000 in 1983.

Resulting from reorganization of Markazes, one Town and two Markazes were established after the 1976 Census. El Qenayat was separated from Zagazig Markaz to form a Town. Mashtul el Soak, separated from Bilbeis Markaz, was established as a Markaz. El Ibrahimiya, then belonging to Hihya Markaz, was separated and together with three villages of Abu Kebir Markaz and one village of Kafr Sakr Markaz, formed a Markaz, too. The reform is summarized in Table 1.1 REFORM OF MARKAZ.

After the 1976 National Census of Egypt, the following separation of markaz was undertaken:

Table 1.1 REFORM OF MARKAZ

NO.	BEFORE SEPARATION	AFTER SEPARATION	YEAR UNDERTAKEN
1.	Zagazig Markaz	Zagazig Markaz and El Qenayat Town	1980
2.	Bilbeis Markaz	Bilbeis Markaz and Mashtul el Soak Markaz	1977
3.	Hihya Markaz	Hihya Markaz and El Ibrahimiya Markaz (including 3 villages separated from Abu Kebir Markaz and 1 village separated from Kafr Saqr Markaz)	1979

Source: Planning Department, Sharqiya Governorate.

Chapter 2 Demographic Analysis

2.1 Records of National Census

The national censuses were conducted in the country in 1882, 1897, 1907, 1917, 1927, 1937, 1947, 1960, 1966 and 1976. CAPMAS is the organization that conducts the census, analyses data and publishes the results. It is also responsible for the studies such as estimating the future population of the country and analyzing the internal migration.

The records of 1960, 1966 and 1976 Censuses, containing populations down to the village level, are available in Arabic at CAPMAS.

The census records of Sharqiya Governorate, from 1882 to 1976, are presented in Table 2.1. Further detailed populations by Markaz from 1960 to 1976 is shown in Table 2.2.

Sharqiya Governorate's population has been about 7% of the all Egypt's for the last two decades. Since 1960, the male population has been larger than the female's.

The administrative changes were frequently undertaken: two Markazes and one Town were established as described in the previous chapter; merger, separation, and renaming are often among villages. In addition to such administrative changes, lack of the census maps makes the demographic analysis impractical at the village level.

Therefore 1976 populations only are adjusted according to the present Markaz boundaries. The adjusted urban and rural populations of each Markaz in 1976 make the basis of future population forecast.

Table 2.1 SHARQIYA GOVERNORATE CENSUS RECORDS

YEAR	MALE	FEMALE	TOTAL	EGYPT ('000)	RATIO (%)
1882	227,768	229,663	457,431	6,712	(6.82)
1897	367,615	367,270	734,885	9,669	(7.60)
1907	435,076	437,397	872,473	11,190	(7.80)
1917	462,884	475,108	937,992	12,718	(7.38)
1927	521,377	550,752	1,072,129	14,178	(7.56)
1937	575,412	597,046	1,173,458	15,921	(7.37)
1947	668,072	693,591	1,361,663	18,967	(7.18)
1960	913,878	905,920	1,819,798	26,085	(6.98)
1966	1,058,803	1,049,168	2,107,971	30,076	(7.01)
1976	1,334,860	1,283,078	2,617,938	36,626	(7.15)

Source: CAPMAS

Note : Governorate boundary not confirmed.

Ratio : Sharqiya to all Egypt

Table-2.2 RECORDS OF NATIONAL CENSUSES

Markaz		1960	1966	1976	Remarks
1. EL ZAGAZIG	U	124,417	151,186	202,575	
	R	224,104	255,859	312,336	
	T	348,521	407,045	514,911	
2. EL HUSEINIYA	U	7,696	10,024	14,385	
	R	109,465	126,728	185,100	
	T	117,161	136,752	199,485	
3. KAFR SAQR	U	7,790	9,856	13,726	
	R	137,211	159,389	191,632	
	T	145,001	169,245	205,358	
4. FAQUS	U	13,180	40,561	39,090	
	R	197,210	203,918	251,747	
	T	210,390	244,479	290,837	
5. ABU KEBIR	U	36,800	41,789	54,858	
	R	100,405	112,915	115,661	
	T	137,205	154,704	170,519	
6. ABU HAMMAD	U	11,509	13,591	17,595	
	R	131,405	148,191	180,739	
	T	142,914	161,782	198,334	
7. EL IBRAHIMIYA	U	(14,915)	(16,476)	18,522	
	R	–	–	52,674	
	T	–	–	71,196	
8. HIHYA	U	15,519	17,696	22,774	
	R	106,907	121,164	86,594	
	T	122,426	138,860	109,368	
9. DIARB NIGM	U	12,456	14,372	21,535	
	R	118,601	135,568	162,374	
	T	131,057	149,940	183,909	
10. BILBEIS	U	37,941	55,070	69,312	
	R	206,275	233,994	208,550	
	T	244,216	289,064	277,662	
11. MINYET EL QAMH	U	18,464	31,533	33,609	
	R	202,443	224,567	266,145	
	T	220,907	256,100	299,754	
12. MASHTUL EL SOAK	U	(18,244)	(20,301)	22,270	
	R	–	–	51,658	
	T	–	–	73,928	
13. EL QENAYAT	U	(15,949)	(18,396)	22,677	
		(15,949)	(18,396)	22,677	
TOTAL	U	285,772	385,676	552,728	
	R	1,534,026	1,722,293	2,065,210	
	T	1,819,798	2,107,971	2,617,938	

NOTES 1. 1976 populations adjusted according to current Markaz boundaries.
2. El Qenayat Town included in El Zagazig 1960 and 1966 rural population.

The 1976 Census found that the outgoing population is about two times of the incoming one in the Governorate.

The intercensal growth rates of both the Governorate and the country is shown below:

Table INTERCENSAL GROWTH RATE (% per annum)

	Sharqiya Governorate			Egypt		
Period	Urban	Rural	All	Urban	Rural	All
1947 - 1960	3.03	2.18	2.31	3.43	1.91	2.45
1960 - 1966	4.71	2.03	2.49	3.52	1.67	2.39
1966 - 1976	3.14	1.96	2.19	2.82	1.47	2.04
1947 - 1976	3.42	2.07	2.31	3.24	1.70	2.29
1960 - 1976	3.73	1.99	2.30	3.08	1.54	2.17

"Urban" refers to the Governorate capital and Markaz capitals, while "Rural" to the villages.

The Health Department of each Governorate deals with the death and birth registration and reports the vital statistics to CAPMAS in March every year. CAPMAS estimates the short-term future population based on the natural growth rate over the last three years. The estimates are adjusted every year according to the latest, annual vital statistics. It should be noted that the statistics include neither international nor rural-to-urban migration and disregard of migration accounts for an overestimate of the population growth rate for Sharqiya, where the net migration is substantially negative. The short-term estimates by CAPMAS are not used for the present study, therefore.

2.2 Future Population Forecast

The future population is estimated from the 1976 populations in the following process:

1) To estimate the future populations of the Governorate on several population growth models up to 2005 and to identify the most probable model;

2) To forecast the rural and urban populations within the estimated governorate populations; and

3) To estimate the future population of each city in relation to the other cities within the estimated urban populations.

2.2.1 Governorate Population

The following three models, i.e. high, medium, and low series of population growth are assumed:

High series:
The population forecast is based on the combination of growth rates presented by the Planning Department of the Governorate and recorded in the past censuses.

Medium series:
The population is assumed to increase at the rates combining trends of the last intercensal period and future socio-economic conditions.

Low series:
The forecast is based on the extrapolation of the linear growth model applied to the last census records.

High Series

The following growth rates are the basis of the estimate:

Period	Annual Growth Rate (%)
1976 - 1985	2.78
1985 - 1995	2.48
1995 - 2005	2.30

2.78% for 1976 to 1985 was presented by the Planning Department of Sharqiya Governorate. Two figures of 2.48 and 2.30% were assumed since the growth will be slowed with the improvement of socioeconomic conditions.

Medium Series

Period	Annual Growth Rate (%)
1976 - 1990	2.20
1990 - 2005	2.15

The population increase is assumed at 2.2% for the period from 1976 through 1990. The rate is derived from the intercensal growth rate of 2.19% per annum from 1966 to 1976. Then the increase is assumed to be somewhat decelerated to 2.15% due to the effect of the ongoing family planning.

Low Series

The forecast is an application of the linear growth model to 1960, 1966, and 1976 census records by the least square method. The census records indicate a stable increase of about 50,000 persons a year.

Conclusion

The results of the above three series are summerized in Table 2.3 and shown on Fig.2.1 with reference to the forecast made by CAPMAS and the IBRD study (the Master Plan study) for the period 1990 to 2000.

For the purpose of the present study, the Medium Series is employed. As a ground of this decision, the recent vital statistics are discussed. The Health Department of the Governorate registered 82,000 to 86,000 persons per year as a natural increase of population (births less deaths) from 1980 to 1982. On the other hand, 1976 Census recorded the population decrease due to internal migration as about 21,000 in average for 10 years. If the outflow of population still continues at a similar rate, the net population increase of the Governorate is about 61,000 to 65,000. Since the 2.2% per annum increase for 10 to 15 years period corresponds to 61,000 to 65,000 persons per annum increase over the same period, the rate of 2.2% is considered reasonable.

Table 2.3 FUTURE POPULATION FORECAST

('000)

YEAR	JICA	CAPMAS	IBRD*
1983	3,048	—	—
1985	3,184	—	—
1990	3,550	3,592	3,475
1995	3,948	—	—
2000	4,391	4,478	4,276
2005	4,885	—	—

* Master plan for Provincial Water Supplies Project.

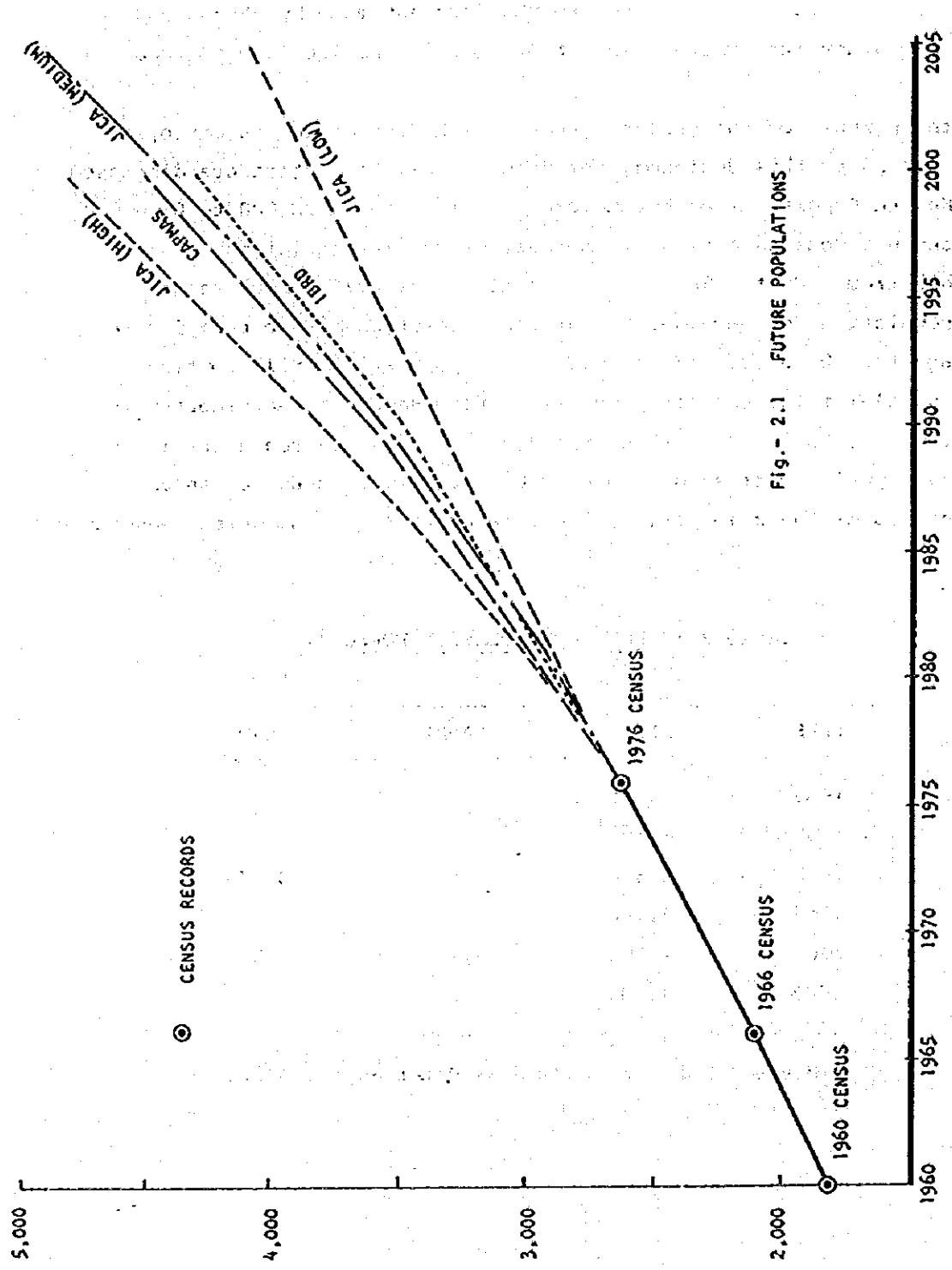


Fig.- 2.1 FUTURE POPULATIONS

Fig.- 2.1 FUTURE POPULATIONS

Markaz Populations

The population of each Markaz is estimated in the following manner:

1) The population estimates, in all aspects, start from the 1976 Census data quoted in Table 2.2,

2) The total population in the Governorate will grow at 2.2% per annum up to 1990 and at 2.15% per annum up to 2005,

3) The rural population, regardless of the Markaz condition, is assumed to grow at 1.9% per annum through the study period, and

4) The urban population's growth rate, however, will differ on the cities and towns, though an overall rate of about 3% is deduced from the 2) and 3) assumptions.

For estimating the urban population, twelve cities and one town are classified into three levels of growth. See Table 2.4.

Table 2.4 FUTURE POPULATION GROWTH RATES (Urban)

(% per annum)

Level	City/Town	Period		
		1976-90	1990-95	1995-2005
High	Zagazig	3.4	3.2	3.1
Medium	El Huseiniya Kafr Saqr Faqus Hihya Diarb Nigm Bilbeis Minyet el Qamh	3.2	3.0	2.9
Low	Abu Kebir Abu Hammad El Ibrahimiya Mashtul el Soak El Qenayat	2.8	2.6	2.5

To the high level belongs Zagazig, the Governorate Capital. The high rate is justified by the function the city fulfills as the administrative center of the Governorate in addition to the educational, commercial, and industrial activities in the city.

To the medium level belong the following seven cities: i.e., El Huseiniya, Kafr Sakr, Faqus, Hihya, Diarb Nigm, Bilbeis and Minyet el Qamh. All of them are Markaz capital and populated with sizable number of people already. The trend of urbanization will continue for the foreseeable future and concentration of the population.

To the low level belong the four cities: i.e., Abu Kebir, Abu Hammad, El Ibrahimiya, Mashtul el Soak and a town of El Qenayat. The urbanization is considered less rapid in these areas.

The future populations, thus estimated for each Markaz up to 2005, is listed in Table 2.5.

The total population of the Governorate is estimated at 3,948,000 in 1995 and at 4,884,000 in 2005. The population forecasts made by CAPMAS and IBRD study (the Master Plan for Provincial Water Supplies Project) respectively are shown in Fig. 2.1 for reference. The medium series of the present study falls between the two forecasts. The medium series estimate is higher than the IBRD study, though the difference is considered insignificant. Thus the medium series estimate is adopted for the present study.

The ratio of the urban population to the rural's was 1:3.7 in 1976, and will be reduced to 1:2.7 by 2005. This trend of urbanization is relatively moderate in Sharqiya, while CAPMAS forecasts the urban population of all Egypt will exceed the rural population by 2000 mainly due to the rapid increase of populations in such major cities as Cairo and Alexandria.

It is recommended that the population estimate be subjected to a careful review and adjustment after the National Census scheduled in 1986.

Table-2.5 PROJECTED POPULATIONS

('000)

		1976 CENSUS*	1983	1985	1990	1995	2000	2005
1. EL ZAGAZIG	U	202,575	257	276	325	379	442	514
	R	312,336	356	371	407	447	491	539
	T	514,911	613	647	732	826	933	1,053
2. EL HUSEINIYA	U	14,385	18	19	23	27	31	36
	R	185,100	211	219	241	265	291	319
	T	199,485	229	238	264	292	322	355
3. KAFR SAQR	U	13,726	17	18	21	24	28	32
	R	191,632	219	227	249	274	301	331
	T	205,358	236	245	270	298	329	363
4. FAQUS	U	39,090	49	52	61	70	81	93
	R	251,747	287	298	328	360	395	435
	T	290,837	336	350	389	430	476	528
5. ABU KEBIR	U	54,858	67	71	81	92	103	117
	R	115,661	132	137	151	165	182	200
	T	170,519	199	208	232	257	285	317
6. ABU HAMMAD	U	17,595	22	23	26	29	33	37
	R	180,739	206	214	235	258	283	312
	T	198,334	228	237	261	287	316	349
7. EL IBRAHIMIYA	U	18,522	23	24	27	31	35	39
	R	52,674	60	62	69	75	83	91
	T	71,196	82	86	96	106	118	130
8. HIHYA	U	22,774	28	30	36	42	48	56
	R	86,594	99	103	113	124	136	149
	T	109,368	127	133	149	166	184	205
9. DIARB NEGM	U	21,535	27	29	34	39	45	52
	R	162,374	185	192	211	232	255	281
	T	183,909	213	221	245	271	300	333
10. BILBEIS	U	69,112	87	94	108	125	145	167
	R	208,550	238	247	271	298	328	360
	T	277,662	325	341	379	423	473	527
11. MINET EL QAMH	U	33,609	42	45	53	61	70	81
	R	266,145	304	315	346	381	418	459
	T	299,754	346	360	399	442	488	540
12. MASHTUL EL SOAK	U	22,270	27	28	33	37	42	47
	R	51,658	59	61	67	74	81	89
	T	73,928	86	89	100	111	123	136
13. EL QENAYAT	U	22,677	28	29	34	39	44	49
		—	—	—	—	—	—	—
TOTAL	U	552,728	692	738	862	995	1,147	1,320
	R	2,065,210	2,356	2,446	2,688	2,953	3,244	3,565
	T	2,617,938	3,048	3,184	3,550	3,948	4,391	4,885

* Adjusted according to the present boundaries, presented in persons.

2.3 Served Population

After discussions with the Governorate and Markazes' officials and examining the IBRD study, the present service ratio is estimated as 87% for the urban areas and 73% for the Rural. (See Table 2.6)

The future served population is projected taking into consideration the expansion of the service area, socio-economic conditions, availability of alternative sources, and the target of the Master Plan by the IBRD study. The Master Plan sets the target that the 100% population shall have an access to the piped water supply by 2000. Though, considering the delay of the commencement of the present project, the present study envisages that the 100% supply will be achieved by 2005 and an considerable amount of capital investment will be undertaken to improve the present conditions of water supply to accomplish the target. (Refer to Table 2.6)

The urban service ratio will be gradually increase to reach 100% by 2005. Most urban consumers have house-connections. The use of urban standpipes has been discouraged by the Markaz office and by 1990 the urban standpipe users are expected to be facilitated with house-connections.

The rural service ratio will be also increases to 100% by 2005. In rural areas however, the change for house-connection will go far slow, so that 95% of the rural consumers will be depending on the standpipe supply up to 1995, then the ratio will decrease to 90% by 2005.

The above trends are tabulated in Table 2.8.

Table 2.6 PERCENTAGE OF CONSUMERS

(%)

Area	Category	1976 Census (CAPMAS)	1976 Water Resources Study *	1983 JICA Estimate
Urban	House-connections within dwelling	59.3	59	85
	House-connections outside dwelling	5.3	5	
	Standpipes	35.4	18	2
	No piped supply		18	13
Rural	House-connections within dwelling	2.0	2	7.3
	House-connections outside dwelling	0.7	0.7	
	Standpipes	97.3	63.3	65.7
	No piped supply		34	27

* The study conducted by UNDP/IBRD in 1981.

Table 2.7 ESTIMATED SERVICE RATIO AND CONSUMER CLASSIFICATION

(%)

	1976*	1980	1983	1985	1990	1995	2000	2005
Urban								
Service Ratio	82	85	87	88	90	95	98	100
Classification								
Individual Connections	78	90	98	100	100	100	100	100
Standpipes	22	10	2	0	0	0	0	0
Rural								
Service Ratio	67	70	73	75	80	85	95	100
Classification								
Individual Connections	4	5	10	13	15	20	23	25
Standpipes	96	95	90	87	85	80	77	75

* Based on 1976 census and UNDP/IBRD Study (1981)

Table-2.8 SERVED POPULATIONS ESTIMATED ('000)

		1983	1985	1990	1995	2000	2005
1. EL ZAGAZIG	U	224	243	292	360	433	514
	R	260	278	326	380	466	539
	T	484	521	618	740	899	1,053
2. EL HUSEINIYA	U	16	17	21	26	30	36
	R	154	164	193	225	276	319
	T	170	181	214	251	306	355
3. KAFR SAQR	U	15	16	19	23	27	32
	R	160	170	199	233	286	331
	T	175	186	218	256	313	363
4. FAQUS	U	43	46	55	67	79	93
	R	210	224	262	306	375	435
	T	253	270	317	373	454	528
5. ABU KEBIR	U	58	62	73	87	101	117
	R	96	103	121	140	173	200
	T	154	165	194	227	274	317
6. ABU HAMMAD	U	19	20	23	28	32	37
	R	150	161	188	219	269	312
	T	169	181	211	247	301	349
7. EL IBRAHIMIYA	U	20	21	24	29	34	39
	R	44	47	55	64	79	91
	T	64	68	79	93	113	130
8. HIHYA	U	24	26	32	40	47	56
	R	72	77	90	105	129	149
	T	96	103	122	145	176	205
9. DIARB NIGM	U	23	26	31	37	44	52
	R	135	144	169	197	242	281
	T	158	170	200	234	286	333
10. BILBEIS	U	76	83	97	119	142	167
	R	174	185	217	253	312	360
	T	250	268	314	372	454	527
11. MINYET EL QAMH	U	37	40	48	58	69	81
	R	222	236	277	324	397	459
	T	259	276	325	382	466	540
12. MASHTUL EL SOAK	U	23	25	30	35	41	47
	R	43	46	54	63	77	89
	T	66	71	84	98	118	136
13. EL QENAYAT	U	24	26	31	37	43	49
TOTAL	U	602	651	776	946	1,122	1,320
	R	1,720	1,835	2,151	2,509	3,081	3,565
	T	2,322	2,486	2,927	3,455	4,203	4,885

3. Water Consumptions and Water Demands

The water consumption is defined in the study as the quantity of water to be needed by consumers, while the demand refers to the necessary amount of water to be supplied by the water supply system.

The unit water consumptions for Sharqiya are developed from the criteria of the Master Plan and the actual conditions investigated during the field survey. The future water demands are estimated on the basis of the unit water consumption and the served populations.

The demand is obtained from the water consumption and the losses of the system.

The above water demand and consumption are discussed on the average daily basis unless otherwise indicated.

3.1 Consumer Categories and Unit Consumptions

The intermediate analysis of the ongoing field survey of consumers indicates that the unit consumption criteria of the Master Plant is applicable to the present study, so that the unit water consumption are discussed on the basis of the consumer categories established in the Master Plan as follows:

- Urban domestic,
- Rural domestic,
- Non-domestic
  - Commercial,
  - Industrial,
  - Institutional.

Non-domestic demands are applied to the urban areas only.

Urban Domestic

"Urban" refers to the Governorate Capital, the Markaz Capitals, and El Qenayat Town. Urban settlements totals to 13 in the Governorate.

Most of the urban residents rely on the piped water supply through individual house connections or neighbors' taps, while those who live in the outskirts or the suburbs of the urban area hardly have an access to the piped water and use handpump wells (water-table wells) instead. Since the number of urban standpipes (free taps) is very limited and their use is discouraged by the Markaz office, urban standpipes are currently diminishing and will be terminated in the near future. Therefore the present and future urban standpipe consumers are included in the low class house-connection users in the study.

The urban domestic consumers are classified as follows:

Class A:
High living standard, 3 or more taps, 2 or more WCs, occasionally with a bath tub, and connection provided to the sewerage system.

Class B:
Medium standard of living, 2 or 3 taps, 1 WC or a pour-flush squatting-type toilet, connected to the sewerage system.

Class C1:
Low standard of living, 1 tap a household, pour-flush squatting-type toilet, occasionally connected to the sewerage system.

The future unit water demands by category and class are presented in Table 3.1.

Rural Domestic

"Rural" refers to the villages of the Markaz.

According to the 1976 Census, 97% households in the rural area have no house-connection and 3% households own individual house-connections or can use neighbors' taps. The present field survey disclosed that those consumers who have no access to house-connections rely drinking water on standpipes or handpump wells and take water for laundry and animal uses from handpump wells or at canals. Even some of the rural house-connection users still keep handpump wells to cope with discontinuous supply and low service pressure of the piped water. Since the connection fee can not be off ordered by most of rural residents, considerable part of served population increase in rural shall be covered by the standpipe supply.

The rural domestic consumers are classified as follows:

Class C1:
Same as the urban consumer class C1.

Class C2:
Lowest class of house-connection users, generally in rural areas only, 1 tap, sewage disposed of in field or canal.

Class D:
Standpipe users, majority of rural served populations.

Refer to Table 3.1 for future unit demands.

Non-domestic

The non-domestic consumers refer to such consumers as offices, schools, shops, and hospitals in urban area. The rural non-domestic consumption is assumed to be included in the rural domestic since the former is insignificantly small.

Commercial

The commercial are such trades as shops, hotels, and restaurants. According to the Master Plan, the unit water consumption for the category is assumed as 10 lcd on the total served population. This assumption will result in the ratio of commercial consumption to total urban consumption of 7 to 9% in 1983 and 6 to 8% in 2005.

Industrial

This category refers to all factories and manufacturers.
For example, Zagazig City holds the following major factories:

- soft drinks,
- ice,
- cotton oil processing and soap,
- textile (wool and cotton), and
- cattle feeds processing.

The large cotton oil processing factory mentioned above operates own wells which are used for processing and domestic purpose within the premises and no public water supply was undertaken to the factory. Some of the other major factories also have supplemental supply by own wells. If an industrial development project is implemented, supplemental wells will be installed for new factories. The above fact and the current practice in the area are the basis of the assumptions of the study that the industrial consumptions are 10% of the sum of the domestic and commercial consumptions in the cities where populations exceed 75,000 and gradual increase of the industrial water demand is envisaged up to the year 2005. Thus the industrial water consumptions are estimated for the following cities only:

- Zagazig and Bilbeis: through the year 2005,
- Abu Kebir : from 1990 through 2005,
- Faqus : from 2000 through 2005, and
- Minyet el Qamh : 2005.

Institutional

This includes such establishments as governorate offices, educational institutions, railway stations, mosques, churches, and hospitals. The military installations are excluded from the present study since no major military facilities are located in the Governorate.

The unit consumption for the institutional use is assumed as 15% of the sum of domestic and commercial consumption for Zagazig and 10% for the other towns.

3.2 Water Consumption

As described in the previous section, the water consumption is derived from the unit consumption and served population forecast. The served population is categorized and classified according to the methodology of the Master Plan. (See Table 3.2 for the classification.)

The summary of water consumptions by Markaz is shown on Table 3.3

Table 3.1 ESTIMATED PER CAPITA CONSUMPTIONS

(lcd)

CATEGORY			1980	1983	1985	1990	1995	2000	2005
DOMESTIC (lcd)	House-Connection	A	180	183	185	190	195	200	205
		B	115	118	120	125	130	140	150
		C1	90	90	90	90	90	90	90
		C2	65	65	65	65	65	65	65
	Standpipe	D	40	45	48	55	55	55	55
NON DOMESTIC	URBAN								
	Industrial		10% of domestic and commercial demands in the following towns:						
	Zagazig & Bilbeis								
	Abu Kebir								
	Faqus								
	Minyet El Qamh								
	Commercial		10 lcd on served population						
	Institutional		15% of domestic and commercial demands for Zagazig 10% for others						
	RURAL		Included in domestic demands						

Table 3.2 URBAN DOMESTIC CONSUMER POPULATIONS BY CLASSIFICATION AND PER CAPITA DEMANDS

YEAR	CLASS	PER CAPITA CON-SUMPTION (lcd)	ZAGAZIG (%)	Fagus, Bilbeis, Abu Kebir & Minyet el Qamh (%)	Other Cities and El Qenayat (%)
1980	A	180	14	7	-
	B	115	26	25	15
	C1	90	60	68	85
1983	A	183	15	7.5	-
	B	118	27	26.0	16
	C1	90	58	66.5	8
	Average		(112 lcd)	(104 lcd)	(94 lcd)
1985	A	185	16	8.0	-
	B	120	28	26.5	16.5
	C1	90	56	65.5	83.5
	Average		(114 lcd)	(106 lcd)	(95 lcd)
1990	A	190	17	8.5	-
	B	125	30.5	27.5	17.5
	C1	90	52.5	64.0	82.5
	Average		(118 lcd)	(108 lcd)	(96 lcd)
1995	A	195	19	9.5	-
	B	130	33	28.5	19
	C1	90	48	62.0	81
	Average		(123 lcd)	(111 lcd)	(98 lcd)
2000	A	200	20	10	-
	B	140	35	30	20
	C1	90	45	60	80
	Average		(130 lcd)	(116 lcd)	(100 lcd)
2005	A	205	20	10	-
	B	150	35	30	20
	C1	90	45	60	80
	Average		(134 lcd)	(120 lcd)	(102 lcd)

Table-3.3 WATER CONSUMPTIONS

Markaz		Average Daily Basis (m^3/day)					
		1983	1985	1990	1995	2000	2005
1. EL ZAGAZIG	U	34,023	37,544	46,410	59,917	75,505	92,520
	R	12,415	14,229	18,786	22,230	27,506	32,003
	T	46,438	51,773	65,196	82,147	103,011	124,523
2. EL HUSEINIYA	U	1,832	1,962	2,252	3,078	3,630	4,435
	R	7,354	8,394	11,122	13,163	16,291	18,941
	T	9,177	10,356	13,374	16,241	19,921	23,376
3. KAFR SAQR	U	1,709	1,847	2,218	2,723	3,267	3,942
	R	7,640	8,701	11,467	13,631	16,881	19,653
	T	9,349	10,548	13,685	16,354	20,148	23,595
4. FAQUS	U	5,404	5,845	7,147	8,945	11,944	14,452
	R	10,028	11,465	15,098	17,904	22,134	25,828
	T	15,432	17,310	22,245	26,846	34,078	40,280
5. ABU KEBIR	U	7,290	7,880	10,347	12,672	15,272	18,182
	R	4,584	5,272	6,973	8,190	10,211	11,875
	T	11,874	13,152	17,320	20,862	25,483	30,057
6. ABU HAMMAD	U	2,165	2,309	2,685	3,314	3,872	4,558
	R	7,163	8,241	10,834	12,812	15,878	18,525
	T	9,328	10,550	13,519	16,126	19,750	23,083
7. EL IBRAHIMIYA	U	2,279	2,424	2,802	3,432	4,114	4,805
	R	2,101	2,406	3,169	3,744	4,663	5,403
	T	4,380	4,830	5,971	7,176	8,777	10,208
8. HIHYA	U	2,735	3,002	3,736	4,734	5,687	6,899
	R	3,438	3,941	5,186	6,143	7,614	8,847
	T	6,173	6,943	8,922	10,877	13,301	15,746
9. DIARB NIGM	U	2,620	3,002	3,399	4,379	5,324	6,406
	R	6,446	7,371	9,739	11,525	14,284	16,684
	T	9,066	10,373	13,138	15,904	19,608	23,090
10. BILBEIS	U	10,419	11,509	13,750	17,332	21,470	25,953
	R	8,309	9,469	12,505	14,801	18,416	21,375
	T	18,728	20,978	26,255	32,133	39,886	47,328
11. MINYET EL QAMH	U	4,650	5,084	6,237	7,744	9,563	12,588
	R	10,601	12,080	15,962	18,954	23,443	27,253
	T	15,251	17,164	22,199	26,698	33,006	3,841
12. MASHTUL EL SOAK	U	2,620	2,886	3,502	4,143	4,961	5,790
	R	2,053	2,355	3,112	3,686	4,545	5,284
	T	4,673	5,241	6,614	7,829	9,506	11,074
13. EL QENAYAT	U	2,735	3,002	3,399	4,379	5,203	6,037
TOTAL	U	80,472	88,296	107,884	136,792	169,812	206,567
	R	82,132	93,924	123,953	146,780	181,866	211,671
	T	162,604	182,220	231,837	283,572	351,678	418,238

3.3 Water Demand

The water Demand is the quantity of water to be supplied by the system: they consist of the water consumptions and the losses of the system.

The amount of the system losses, i.e. leakage and other unaccounted-for water can not be exactly determined due to insufficient information on operation and lack of measuring equipment.

However the field survey including interviews to the system operators suggests that the losses is fairly high. For the study, the following assumptions are made on the losses of the water supply systems in the Governorate:

Table 3.4 SYSTEM LOSSES

(% of demand)

WATER SUPPLY BODY	CURRENT	TARGET		
		By 1985	By 1995	By 2005
Housing Dept.	30	25	20	18
Abbasa System/ City-owned Systems	40	40	30	25

Thus the demand is obtained by combining the water consumptions and the system losses, and it is shown in Table 3.5. Water demands by each Markaz are summerized in Table 3.6.

Maximum Daily Water Demand

The preceeding discussions are based on the average daily demands, though the maximum daily demands are needed to determine the capacity of a water treatment plant, transmission mains and intake facilities. In estimating the maximum daily demands, the peaking factor is assumed as 1.25 for both the urban and rural demands. Refer to Table 3.7 for the maximum daily demands.

Table 3.5 WATER DEMANDS

(m^3/day)

	1983	1985	1990	1995	2000	2005
Urban *						
Consumption	80,472	88,296	107,884	136,792	169,812	206,567
Losses	53,647	58,862	71,924	58,627	72,775	68,855
Demand	134,119	147,158	179,808	195,419	242,587	275,422
Max. Daily Demand	167,652	183,950	218,934	244,276	303,235	344,277
Rural						
Consumption	82,132	93,924	123,953	146,780	181,866	211,671
Losses	48,229	52,191	68,863	54,163	67,105	62,521
Demand	130,361	146,115	192,816	200,907	249,071	274,192
Max. Daily Demand	162,954	182,645	241,022	251,178	311,216	342,741
Total						
Consumption	162,604	182,220	231,837	283,572	351,678	418,238
Losses	101,876	111,053	140,787	112,790	139,880	131,376
(%) **	(39)	(38)	(38)	(28)	(28)	(24)
Demand	264,480	293,273	372,624	396,326	491,658	549,614
Max. Daily Demand	330,606	366,595	465,782	495,454	614,451	687,018

* Inclding non-domestic demands.

** Percentage of losses to demands.

Table 3.6 WATER DEMANDS BY MARKAZ

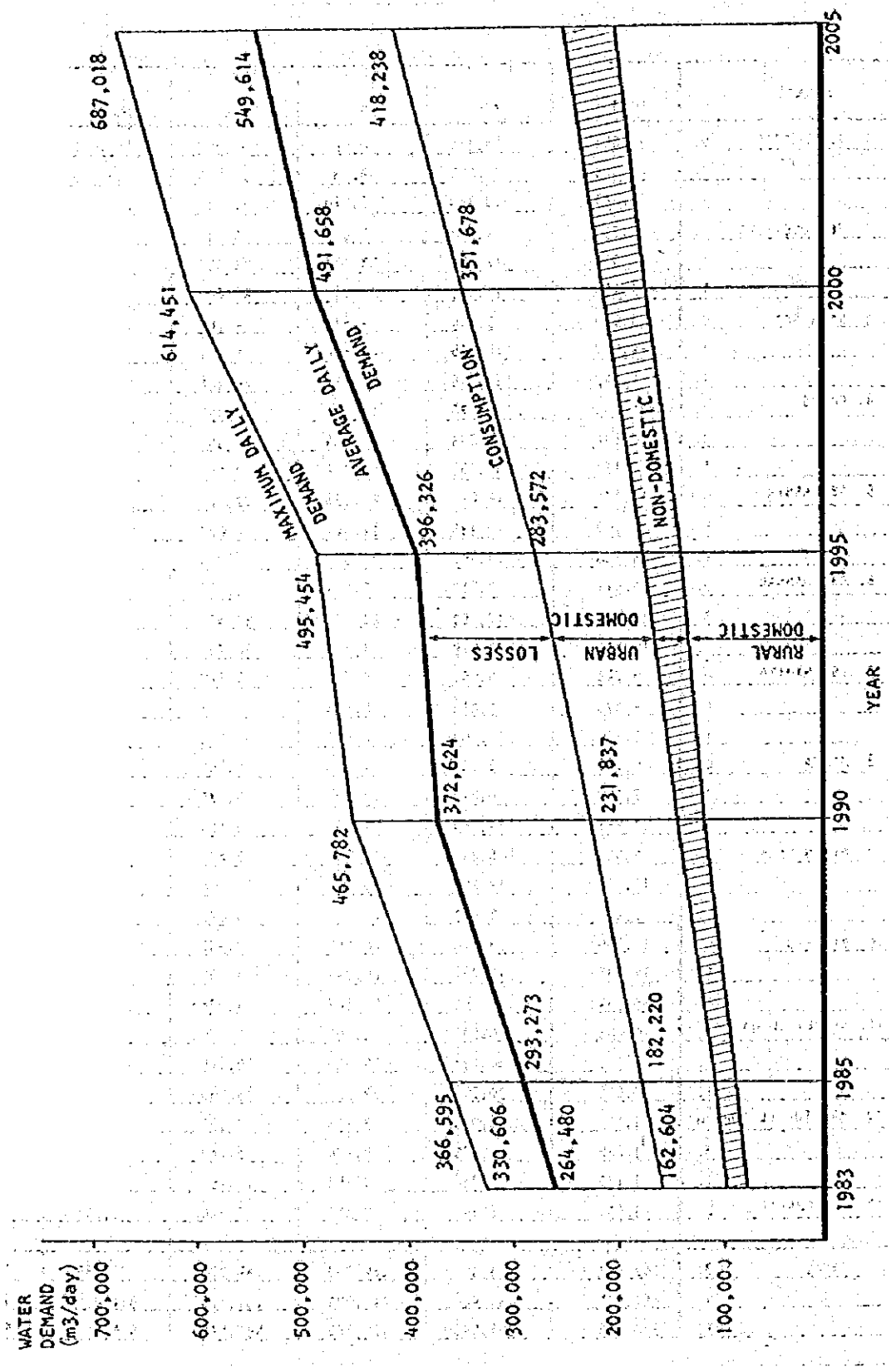
(Average Daily m^3/d)

MARKAZ		1983	1985	1990	1995	2000	2005
1. EL ZAGAZIG	U.	56,705	62,573	77,350	85,596	107,864	123,360
	R.	20,692	23,715	31,310	31,757	39,294	42,671
	T.	77,397	86,288	108,660	117,357	147,158	166,031
2. EL HUSEINIYA	U.	3,038	3,270	3,753	4,397	5,186	5,913
	R.	12,257	13,990	18,537	18,804	23,273	25,255
	T.	15,295	17,260	22,290	23,201	28,459	31,168
3. KAFR SAQR	U.	2,848	3,078	3,697	3,890	4,667	5,256
	R.	12,733	14,502	19,112	19,437	24,116	26,204
	T.	15,581	17,580	22,809	23,363	28,783	31,460
4. FAQUS	U.	9,007	9,742	11,912	12,779	17,063	19,269
	R.	16,713	19,108	25,163	25,573	31,620	34,473
	T.	25,720	28,850	37,075	38,352	48,683	53,706
5. ABU KEBIR	U.	12,150	13,133	17,245	18,103	21,817	24,243
	R.	7,640	8,787	11,622	11,700	14,587	15,833
	T.	19,790	21,920	28,867	29,803	36,404	40,076
6. ABU HAMMAD	U.	3,608	3,848	4,475	4,734	5,531	6,077
	R.	11,938	13,735	18,057	18,303	22,683	24,700
	T.	15,546	17,583	22,532	23,037	28,214	30,777
7. IBRAHIMIYA	U.	3,798	4,040	4,670	4,903	5,877	6,407
	R.	3,502	4,010	5,282	5,349	6,661	7,204
	T.	7,300	8,050	9,952	10,252	12,538	13,611
8. HIHYA	U.	4,558	5,003	6,227	6,763	8,124	9,199
	R.	5,730	6,568	8,643	8,776	10,877	11,796
	T.	10,288	11,571	14,870	15,539	19,001	20,995
9. DIARB NIGM	U.	4,367	5,003	5,655	6,256	7,606	8,541
	R.	9,202	9,828	12,985	14,484	17,855	20,346
	T.	13,576	14,831	18,650	20,662	25,561	28,887
10. BILBEIS	U.	17,365	19,182	22,917	24,760	30,671	34,604
	R.	11,870	12,625	16,673	18,501	23,020	26,067
	T.	29,235	31,807	39,590	43,261	53,691	60,671
11. MINYET EL QAMH	U.	7,750	8,473	10,395	11,063	13,661	16,784
	R.	15,144	16,107	21,283	23,693	29,304	33,235
	T.	22,894	24,580	31,678	34,756	42,965	50,019
12. MASHTUL EL SOAK	U.	4,367	4,810	5,837	5,919	7,087	7,720
	R.	2,933	3,140	4,149	4,608	5,681	6,444
	T.	7,300	7,950	9,986	10,527	12,768	14,164
13. EL QENAYAT	U.	4,558	5,003	5,665	6,256	7,433	8,049
TOTAL	U.	134,119	147,158	179,808	195,419	242,587	275,422
	R.	130,361	146,115	192,816	200,907	249,071	274,192
	T.	264,480	293,273	372,624	396,326	491,658	549,614

Table 3.7 MAX DAILY DEMANDS

(m^3/day)

MARKAZ		1983	1985	1990	1995	2000	2005
1. EL ZAGAZIG	U.	70,681	78,216	96,688	106,995	134,830	154,200
	R.	25,865	29,644	39,138	39,696	49,118	53,338
	T.	96,746	107,860	135,826	146,691	183,948	207,538
2. EL HUSEINIYA	U.	3,796	4,088	4,691	5,496	6,483	7,391
	R.	15,321	17,487	23,171	23,505	29,091	31,568
	T.	19,119	21,575	27,862	29,001	35,574	38,959
3. KAFR SAQR	U.	3,560	3,848	4,621	4,863	5,834	6,570
	R.	15,917	18,128	23,890	24,341	30,145	32,755
	T.	19,477	21,976	28,511	29,204	35,979	39,325
4. FAQUS	U.	11,259	12,178	14,890	15,974	21,329	24,086
	R.	20,892	23,855	31,454	31,966	39,525	43,047
	T.	32,151	36,063	46,344	47,940	60,854	67,133
5. ABU KEBIR	U.	15,188	16,416	21,556	22,629	27,271	30,304
	R.	9,550	10,984	14,527	14,625	18,234	19,792
	T.	24,738	27,400	36,083	37,254	45,505	50,096
6. ABU HAMMAD	U.	4,511	4,810	5,594	5,918	6,914	7,596
	R.	14,923	17,169	22,571	22,879	28,354	30,875
	T.	19,434	21,979	28,165	28,797	35,268	38,471
7. IBRAHIMIYA	U.	4,748	5,050	5,838	6,129	7,346	8,009
	R.	4,378	5,013	6,603	6,686	8,327	9,005
	T.	9,126	10,063	12,441	12,815	15,673	17,014
8. HIHYA	U.	5,698	6,254	7,784	8,454	10,155	11,499
	R.	7,163	8,210	10,804	10,970	13,596	14,745
	T.	12,861	14,464	18,588	19,424	23,751	26,244
9. DIARB NIGM	U.	5,459	6,254	7,081	7,820	9,508	10,676
	R.	11,511	12,285	16,232	18,008	22,319	25,433
	T.	16,970	18,539	23,313	25,828	31,827	36,109
10. BILBEIS	U.	21,706	23,978	28,646	30,950	38,339	43,255
	R.	14,838	15,782	20,842	23,126	28,775	32,584
	T.	36,544	39,760	49,488	54,076	67,114	75,839
11. MINYET EL QAMH	U.	9,688	10,591	12,994	13,829	17,076	20,980
	R.	18,930	20,133	26,604	29,616	36,630	41,544
	T.	28,618	30,724	39,598	43,445	53,706	62,524
12. MASHTUL EL SOAK	U.	5,459	6,013	7,296	7,399	8,859	9,650
	R.	3,666	3,925	5,186	5,760	7,102	8,055
	T.	9,125	9,938	12,482	13,159	15,961	17,705
13. EL QENAYAT	U.	5,698	6,254	7,081	7,820	9,291	10,061
TOTAL	U.	167,652	183,950	224,760	244,276	303,235	344,277
	R.	162,954	182,645	241,022	251,178	311,216	342,741
	T.	330,606	366,595	465,782	495,454	614,451	687,018


WATER DEMAND (m3/day)
700,000
600,000
500,000
400,000
300,000
200,000
100,000
1983
1985
1990
1995
2000
2005
YEAR
687,018
614,451
549,614
495,454
491,658
465,782
418,238
396,326
372,624
366,595
351,678
330,606
293,273
283,572
264,480
231,837
182,220
162,604
MAXIMUM DAILY DEMAND
AVERAGE DAILY DEMAND
CONSUMPTION
LOSSES
URBAN DOMESTIC
RURAL DOMESTIC
NON-DOMESTIC

4. Conclusion

The study is concluded as follows:

The population of the study area is estimated to increase from 3,048,000 in 1983 to 3,948,000 by 1995 and to 4,885,000 by 2005.

The served population in rural will increase to 2,509,000 (85%) by 1995 and to 3,565,000 (100%) by 2005. The urban served population will increase to 946,000 (100%) by 1995 and to 1,320,000 (100%) by 2005.

The water demand is estimated at about 264,000 m^3/day on an average daily demand basis in 1983 and increase to about 396,000 m^3/day by 1995 and to about 550,000 m^3/day by 2005. The estimated water demand insignificantly differs from the future requirement by the Master Plan. A comparison is made between the two estimates as follows:

	1985	1990	1995	2000	2005 ('000 m^3/day)
JICA Study	293.3	372.6	396.3	491.7	549.6
Master Plan	272.3	322.8	370.7	425.5	-

This difference is due to increase of rural house-connection users.

REFERENCES

1) The General Population and Housing Census 1976: Sharqiya Governorate. CAPMAS, September 1978.

2) The General Population and Housing Census 1976: The Preliminary Results. CAPMAS, March 1977.

3) A Statement on the Population of the Arab Republic of Egypt. CAPMAS, October 1982.

4) Arab Republic of Egypt, Provincial Water Supplies Project, Final Report. Vol. 1 Report Summary, Vol. 2 Existing Situtation, and Vol. 3 Future Development. Binnie/Taylor, February 1980.

5) Arab Republic of Egypt, Statistical Yearbook. CAPMAS, JULY 1979.

6) Arab Republic of Egypt, Statistical Yearbook. CAPMAS, July 1981.

7) Arab Republic of Egypt, Statistical Yearbook. CAPMAS, August 1982.

8) Egypt, Statistical Indicators (1952 - 1979), CAPMAS, July 1980.

9) Arab Republic of Egypt, Master Plan for Water Resources Development and Use, Water Demands. Ministry of Irrigation, UNDP, & IBRD, March 1981.

10) Arab Republic of Egypt, Master Plan for Water Resources Development and Use, Water and Wastewater Studies, Municipal and Industrial Sectors. Ministry of Irrigation, UNDP & IBRD, March 1981.

12) Villages of Sharqiya Governorate 1983. Planning Department, Sharqiya Governorate, 1983.

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

WORKING REPORT NO.6

CANALS AND GROUNDWATER

AS

WATER SOURCES

JAPAN INTERNATIONAL COOPERATION AGENCY

CONTENTS

I. GENERAL

In the Sharqiya Governorate there are two water sources of water supply systems, that is, canals and groundwater. Existing water sources have been managed 1) by the Governorate as Abbasa System, 2) by the Housing Department which mainly cover the southern rural area of the Governorate, and 3) by the cities (Markaz capitals) having intake and distribution facilities.

Broadly classifying existing canals in the Governorate, they consist of 1) canals originating from El Raiyah El Taufiqi Canal like Abu Alhdar Canal, Muweis Canal, El Hanut Canal and so forth, and 2) canals diverting from El Ismailia Canal like El Wadi Canal, Faqus Canal, El Saidah and the like. Almost existing canals flow from the southwest area to the northeast area of the Governorate, and eventually the canals flow into the Manzala Lake located at the northern area of the Governorate, although only El Ismailia Canal flows to Ismailia city.

In and adjacent to the Governorate, Salam Canal and Sulheiya Canal are under construction for the completion in 1985. The former diverts from Damietta Branch of the Nile River near Fariskur city located between Damietta and Shirbin city, for irrigation of the northern coastal area and Sinai. The latter branches from Ismailia Canal to irrigate and cultivate sulheiya desert which project has already started by one of the national companies under the instructions of President Sadatt.

From the viewpoint of utilizing canals' water, the following features are characterized :

1) Two kinds of canals are operated at present; one is irrigation canals and another drain canals for wastewater,

2) To use water more effectively, the drain canal water is added to the irrigation canals, as far as the water quality is acceptable for irrigative use, and

3) Canal flow is periodically stopped for about a month a year during December to January for the maintenance of canals, except for Ismailia Canal.

As studied in the separate report on the Water Resources, the groundwater is widely utilized in the Governorate. Even the treatment plants which treat canal water keep their own groundwater sources as their standby for when the canal water flow is stopped, these standby sources have to be operated not as the standby but permanent facility to meet the present shortage of water.

Nowadays, to strengthen the capacity of Abbasa System which was originally planned to supply water to the areas that had not their own facilities, many groundwater stations are operated for supplying water into the pipelines. More than 80 groundwater pump stations managed by the Housing Department operate 160 wells scattered mainly over the southern rural area of the governorate where the Department is responsible for potable water supply. In addition, almost all cities also have their groundwater stations to cover their own territories wholly.

The characteristics of the groundwater in the Governorate are as follows :

1) As a comparatively abundant aquifer, a gravel layer is located under about 30 m depth from the surface,

2) At almost all sites, the groundwater contains iron and manganese, although the water quality is fit for drinking purposes, and

3) The groundwater in the northern area of the Governorate is not fit for drinking due to salinity.

II. CANALS

1. Existing Canals

The major canals which flow in and adjacent to the Governorate are divided into two groups according to their sources, one taking water from El Raiyah El Taufiqi Canal and another from Ismailiya Canal. Muweis Canal belongs to the former group while El Wadi and El Saidiya to the latter. Faqus Canal, though originating in El Raiyah El Taufiqi Canal, receives water of El Wadi Canal, a branch of Ismailiya Canal.

The water quality upstreams of Hanut shown in the attached drawing is kept well as it does not receive any wastewater discharge, but at hanut, it receives a substantial amount of both domestic and agricultural wastewater, resulting in deterioration of water quality. Examination of the conductivity and chlorine concentration shows that they change from 600 µS/cm, 83 - 110 mg/l between El Zagazig and Kafr Saqu to 1,500 µS/cm 246 mg/l at Hanut and 1,600 µS/cm, 260 mg/l at Dafau, indicating an obvious increase of the values or notable decrease of the water quality.

Ismailiya Canal is branched from the Nile River at Cairo, flows to the northeast and runs about 50 km distance through Sharqiya Governorate, approximately one third of the 130 km total length from Cairo to Ismailiya. It turns to the east after crossing the Governorate boundary near Abbasa and reaches Ismailiya.

El Wadi Canal is branched from Ismailiya Canal at Abbasa, flows through the city of Abu Hammad and discharges into Faqus Canal at Abu El Akhder. A pump station located on the way pumps wastewater to the canal. Another station is planned to be installed in the future. Deterioration of the water quality will be almost inevitable.

El Saidia Canal is also branched from Ismailiya Canal, at a point close to that of El Wadi Canal and then flows to the northwest, passing by the east of Faqus City. The canal does not receive wastewater. Faqus Canal is the downstream part of Bahr Abu El Akhder Canal, a branch of Muweis Canal, the name being changed on the way, and reaches Faqus City. It merges with El Wadi Canal which has received wastewater and further downwards it will receive more wastewater from a planned pumping station. Degradation of the quality will be forecast with certainty.

El Samana Canal, branched from Faqus Canal at Faqus City area, flows to the north to El Huseinia City. Beside the major canals as described heretofore, a number of minor canals branched from them run across the area like trees' branches and boughs. Also the drain canal systems which collect wastewater from habitation and drainage from farmland run in a sililar way as the canal systems supplying water.

The existing canals are shown in Fig-1, and discharges at verious points are tabulated in Table-1, respectively.

2. Canals under Construction

Two canals, which are planned by the Ministry of Irrigation and are under construction, pass through the Sharqiya Governorate as shown on Fig-1. The canals are named Salam Canal and Sulheiya Canal, and the former runs in the coastal area of the delta and the latter, branched from Ismailiya Canal, runs through the area between Cairo and Ismailiya cities.

Salam Canal is planned to irrigate about 263,000 ha (650,000 acres) consisting of 81,000 ha in the northern coastal area of the delta and 182,000 ha in Sinai area. The construction of the canal was commenced in 1981 and it will be completed in 1985, as the first stage construction, reaching Suez Canal. The second stage will be executed with the construction of the invert siphon to cross over Suez Canal to supply water to Sinai area. The headwork of the river-mouth of Damietta Branch, a branch of the Nile River has been constructed together with the barrage to prevent the sea water intrusion.

The diverted water of 9.5 million m3/day (110 m3/sec) flows into the canal through the headwork by gravity. At a point about 12.5 km distant from the headwork, Sroui Drain Canal water of 1.5 m3/day is to be added into the canal flow, and Hadaus Drain Canal water of 8.0 million m3/day also will be pumped into the canal. The system is shown schecatically on the attached drawing.

Sulheiya Canal branched at the downstream of the left-bank of Ismailiya near Abbasa Treatment Plant has been constructed since 1980 for irrigation and cultivation of the so-called Sulheiya desert, located close to the northern oblique line of the Nile Delta.

The water conveyed through the canal of 83.3 m3/sec will be served to 77,000 ha (190,000 acres) located along 32.0 km canal length. The construction of the canal is expected to be completed in 1985. Sulheiya Canal is not supplied wastewater by any drain canals.

The amount of water listed in Table-2 is already counted in the flow of Ismailiya and Sulheiya Canals.

Table-2 Amount Counted in Canals for Industrial and Potable Water Projects

No.	Area	Source	Amount (m3/day)
1	The Greater Cairo	Ismailiya Canal	2,000,000
2	10th of Ramadan	do	300,000
3	Abbasa Plant	do	400,000
4	Sharqiya Governorate	do	200,000
5	Ismailiya City	do	600,000
6	Suez City	do	750,000
7	Port Said City	do	750,000
	Total		5,000,000 m3/day (57.9 m3/sec)

3. Quality of Canal Water

As the quality of the canal water is studied in the separate Working Paper No.2, it is not described in this section.

III. GROUNDWATER

1. Utilization of Groundwater

The wells for water supply are overwhelmingly concentrated in the western and southern part of Sharqiya Governorate. The groundwater station at Didamoon in Faqus Markaz is the northernmost one in the Governorate.

The number of well systems supplying water is 8 for cities, 14 for the Abbasa System and 82 for towns and villages. The towns and villages' 82 systems are placed under the management of the governorate's Housing Department. Each station consists of a pump station and a few wells which are used in turn. For almost all pumps, a pumpset unit is in 20 - 25 l/sec capacity range.

2. Well and Aquifer

Wells in the above mentioned stations are mostly of 200 - 300 mm diameter and the depth is about 50 - 60 m, more or less similar for all wells in the area. A strainer covers a length of about 20 m long part at the bottom.

Available literature report that k values (permeability coefficient) are 60 - 100 m/day, but they will differ substantially depending on the area's geology.

3. Distribution of Groundwater

The groundwater will be divided roughly into 3 levels of quality concerning the conductivity, namely above 3,000 µS/cm, between 3,000 µS/cm and 2,000 µS/cm as shown in the attached drawing.

As for the chloride (ion) concentration, the division line is 200 mg/l and the whole area is divided into the 300 - 200 part and below 200 part, the former approximately coincideing with below 2,000 μS/cm conductivity area.

Below 200 mg/l value is detected at the western part, close to the branch of El Raiya El Taufiqi from the Nile, and at the eastern part where the Ismailiya Canal runs. It will be deduced that the groundwater in those area is affected greatly by seepage of the Nile and the canals' water.

4. Quality of Groundwater

As the quality of the groundwater is studied in the separate Working Paper No.2, it is kot described in this section.

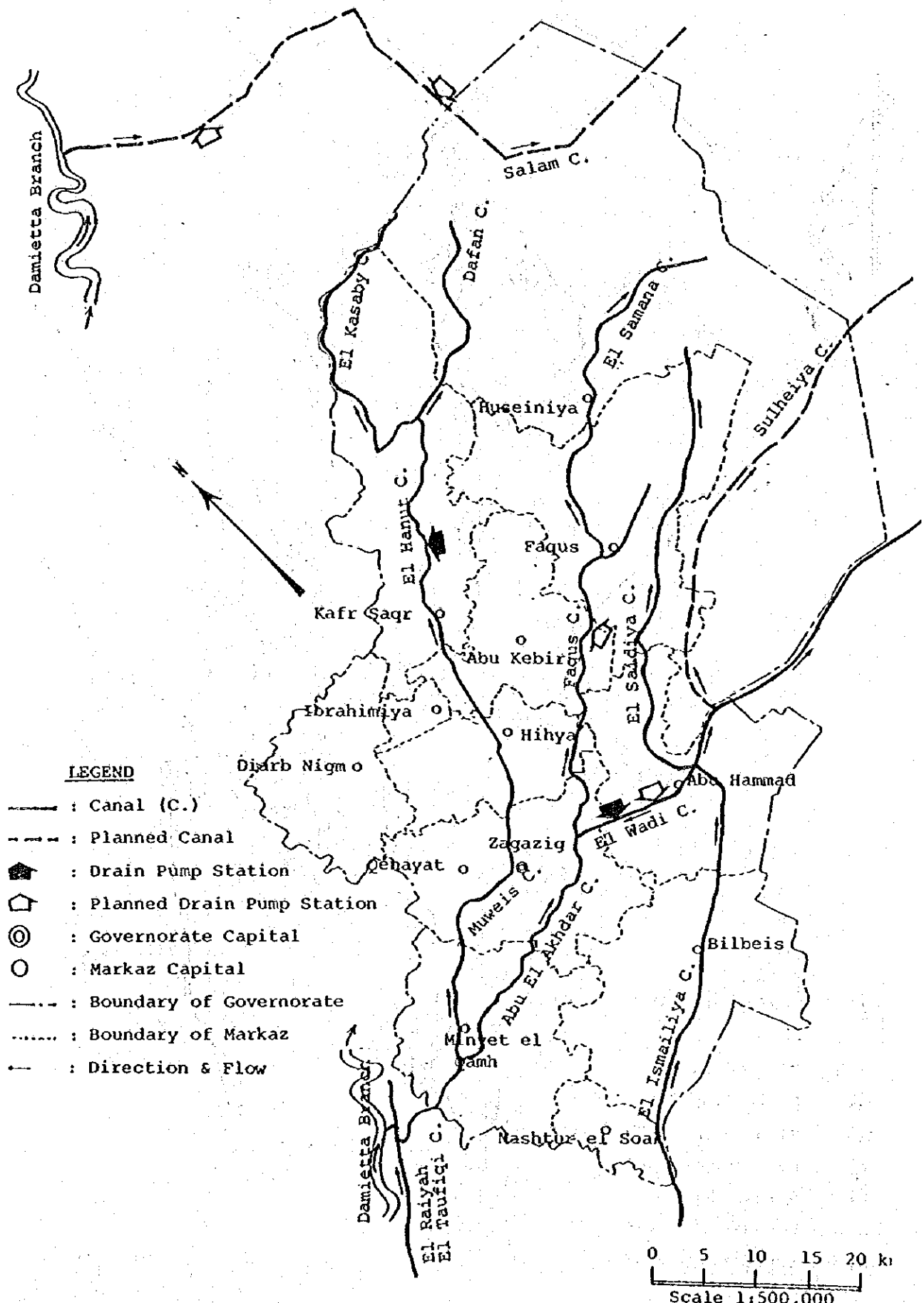


Fig-1 CANAL AND DRAIN PUMP STATION

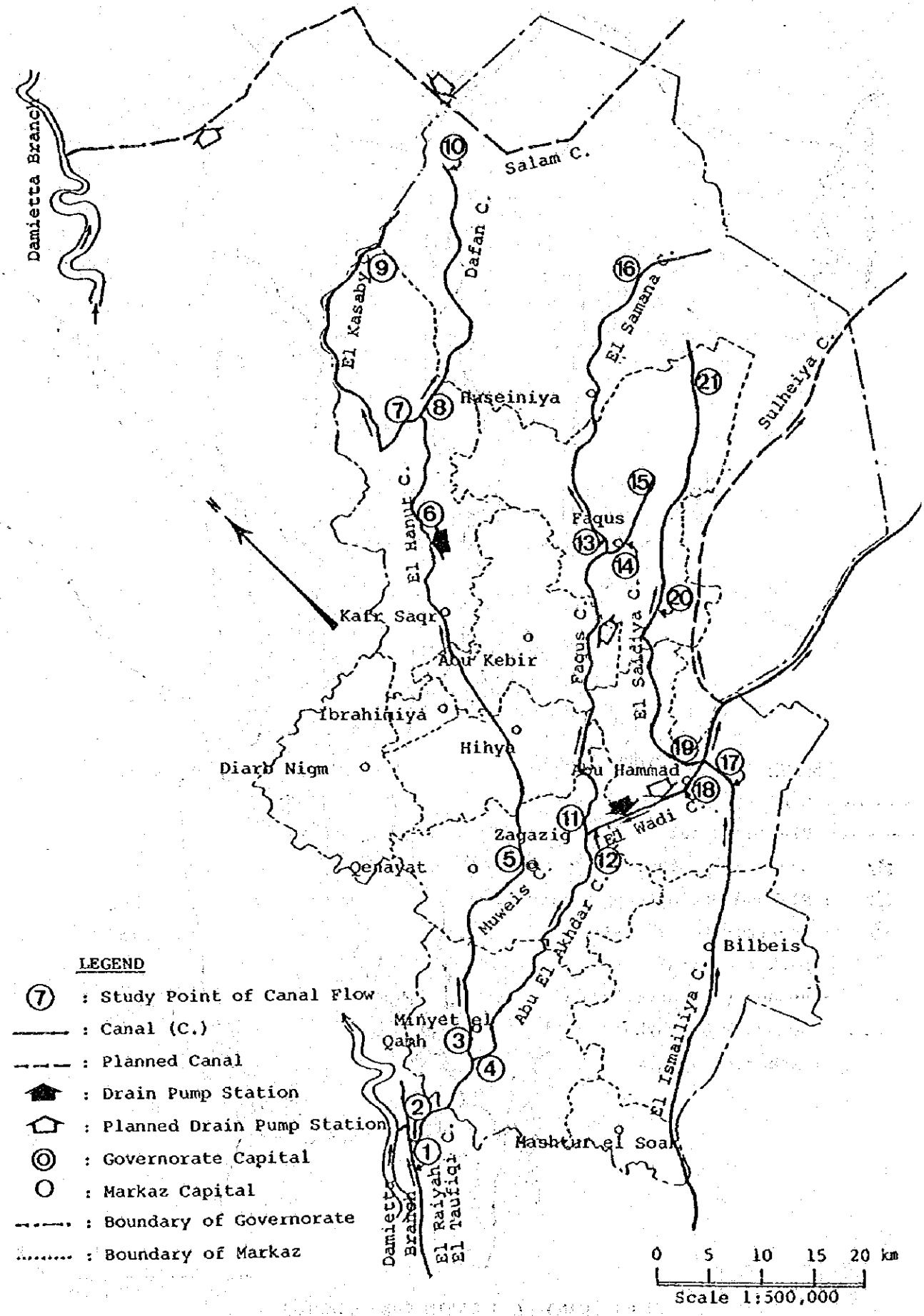


Fig-2 STUDY POINT OF CANAL FLOW

Table-1 WATER LEVEL, DISCHARGE AND SECTION OF CANALS (a)

No.	Name of Canal and Location	Water Level High (m)	Water Level Low (m)	Discharge Max. (m3/sec)	Discharge Min. (m3/sec)	Cross Section Width of Canal Bed (m)	Cross Section Elevation of Canal Bed (m)	Cross Section Side Slope	Note
1	El Raiyah El Taufiqi (Before Muweis branch)	+12.47	+12.00			40	+7.50	1:2	1/
2	Muweis Canal (After branch)	+12.40	+10.50	144.7	34.7	46	+8.60	1:2	1/
3	Muweis Canal (Before Abu El Akhdar branch)	+11.30	+9.75	137.1	31.8	46	+7.75	1:2	1/
4	Abu El Akhadar Canal (After branch)	+10.60	+8.80	46.3	13.8	20	+7.50	1:2	2/
5	Muweis Canal (In Zagazig City)	+ 9.40	+8.75	111.1	23.1	26	+5.15	1:2	1/
6	Muweis Canal (After Kawasienr)	+ 4.00	+2.70	21.8	6.5	13	+1.43	2:3	2/ 3/
7	El Kasaby Canal (After branch)	+ 2.40	+1.80	14.2	4.3	8	+0.15	2:3	2/ 3/
8	Dafan Canal (After branch)	+ 2.40	+1.80	13.9	4.2	9	+0.15	1:2	2/ 3/
9	End of Kasaby Canal	+ 0.70	+0.45	zero	zero	5	-0.20	2:3	2/ 3/
10	End of Dafan Canal	+ 0.20	-0.65	zero	zero	1	-1.46	1:2	2/ 3/
11	Faqus Canal (After branch)	+ 7.60	+6.60	64.35	19.3	25	+4.40	2:3	1/ 4/
12	East Wadi Canal (supplying to Faqus Canal)	+ 8.00	+7.00	24	7.2	13	+5.05	2:3	1/ 4/
13	El Samana Canal (After branch)	+ 5.40	+4.50	32.1	4.6	15	+2.40	2:3	2/ 4/

Table -1 WATER LEVEL, DISCHARGE AND SECTION OF CANAL (b)

No.	Name of Canal and Location	Water Level High (m)	Water Level Low (m)	Discharge Max. (m3/sec)	Discharge Min. (m3/sec)	Cross Section Width of Canal Bed (m)	Cross Section Elevator of Canal Bed (m)	Cross Section Side Slope	Note
14	Faqus Canal (After Samana Canal branch)	+5.42	+5.10	5.13	1.5	14	+2.65	2:3	2/ 4/
15	End of Faqus Canal	+5.35	+4.50	10.3	7.4	8	+3.05	2:3	2/
16	End of El Samana Canal	+2.40	+2.10	nil	nil	8	+1.13	2:3	2/ 4/
17	Ismailia Canal (Before East Wadi branch)	+9.45	+8.90	332		54	+5.46	1:2	
18	East Wadi Canal (After branch)	+8.70	+7.90	19.8	6	15	+5.80	2:3	1/
19	El Saidiya Canal (After Canal)	+8.20	+7.75	42	12.6	19	+5.10	1:2	2/
20	El Saidiya Canal	+6.30	+5.50	35	10.5	16	+3.31	1:2	2/
21	El Saidiya Canal (After branch of Brttigh)	+4.20	+3.50	21.4	6.4	14	+1.90	1:2	2/

Note : 1/ No water flow during period end of December to around 20th January.

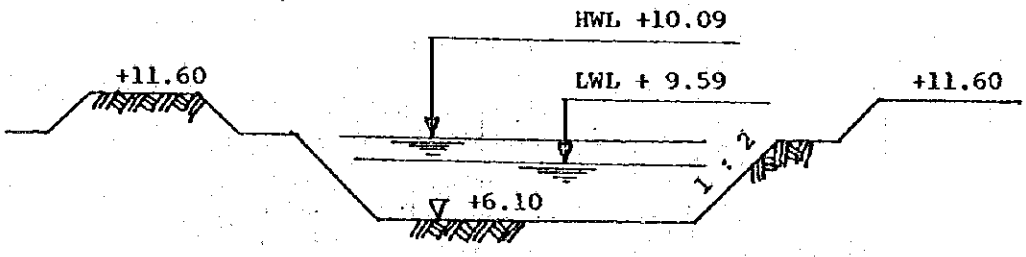
2/ In addition to above condition, water level is not constant throughout the year.

3/ Hanut Drain water is mixed.

4/ Kaliadria Drain water is mixed.

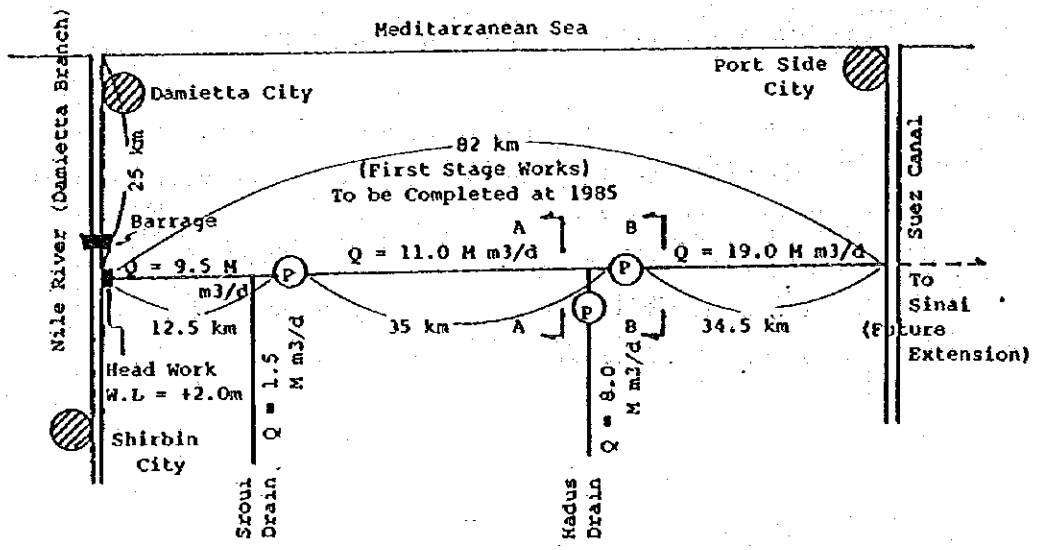
Dimension of Ismailiya Canal at Abbasa

High Water Level	(HWL)	= +10.09 m above sea level
Low Water Level	(LWL)	= + 9.59 m above sea level
Elevation of Bank		= +11.60 m - do -
Elevation of Canal Bed		= + 6.10 m - do -
Width of Canal Bed		= 54.00 m
Gradient of Canal Edge		= 1:2

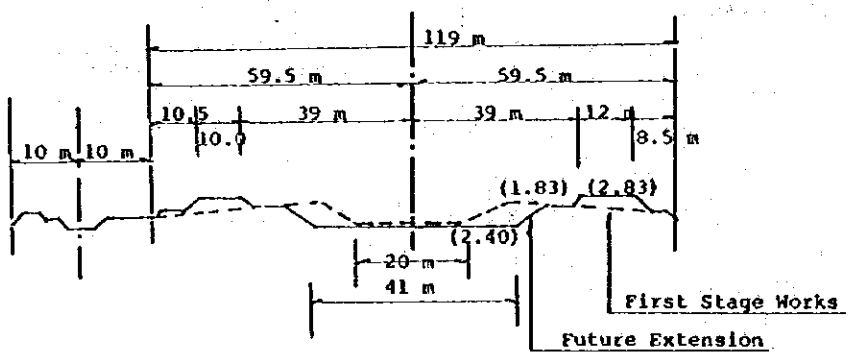


(Note) The section denotes the final plan at Abbasa Plant.

Fig-2.2.3 SECTION OF ISMAILIYA CANAL



A - A SECTION



B - B SECTION

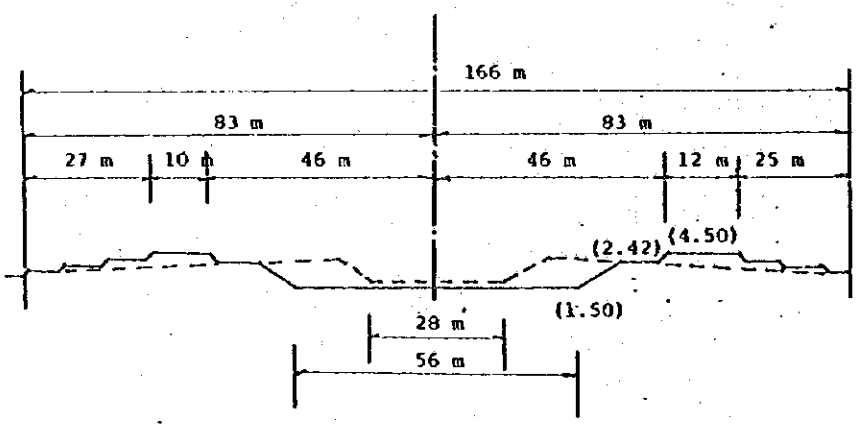
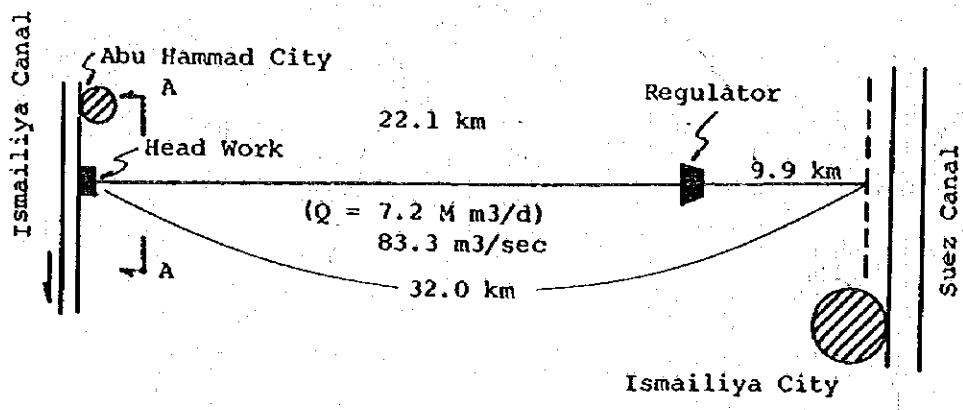
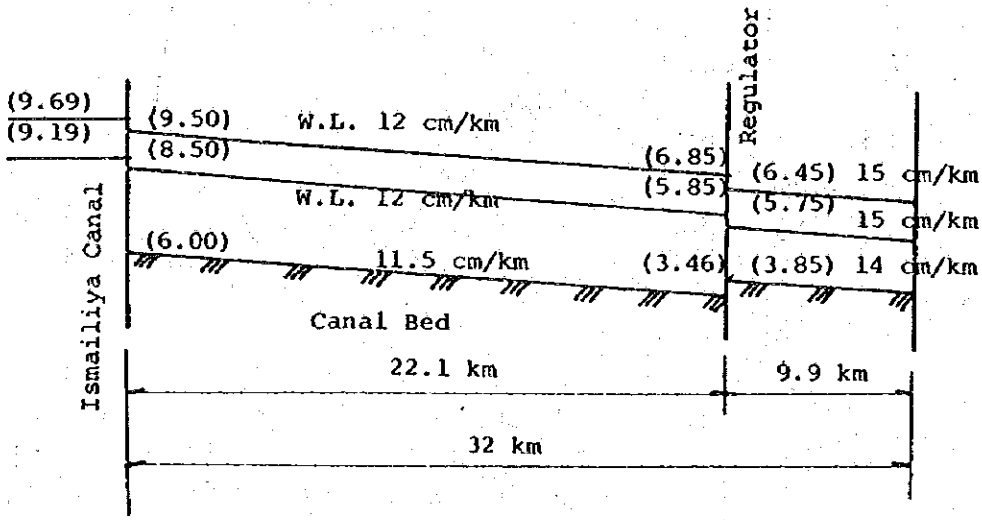


Fig-3 SCHEMATIC PLAN OF SALAM CANAL

(Non-Scale)



LONGITUDINAL SECTION



A - A SECTION

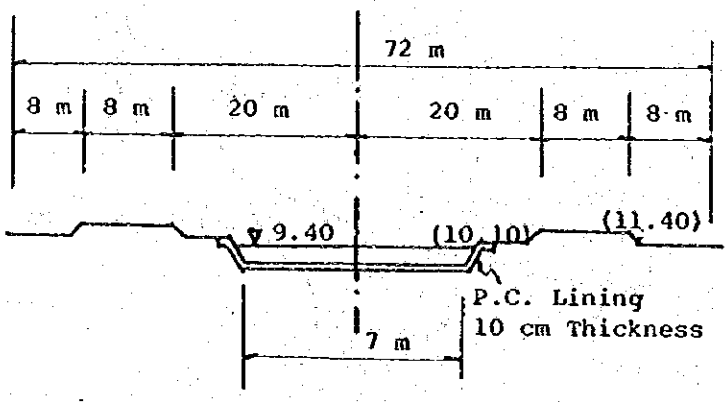


Fig-4 SCHMATIC PLAN OF SULHEIYA CANAL

(Non-Scale)

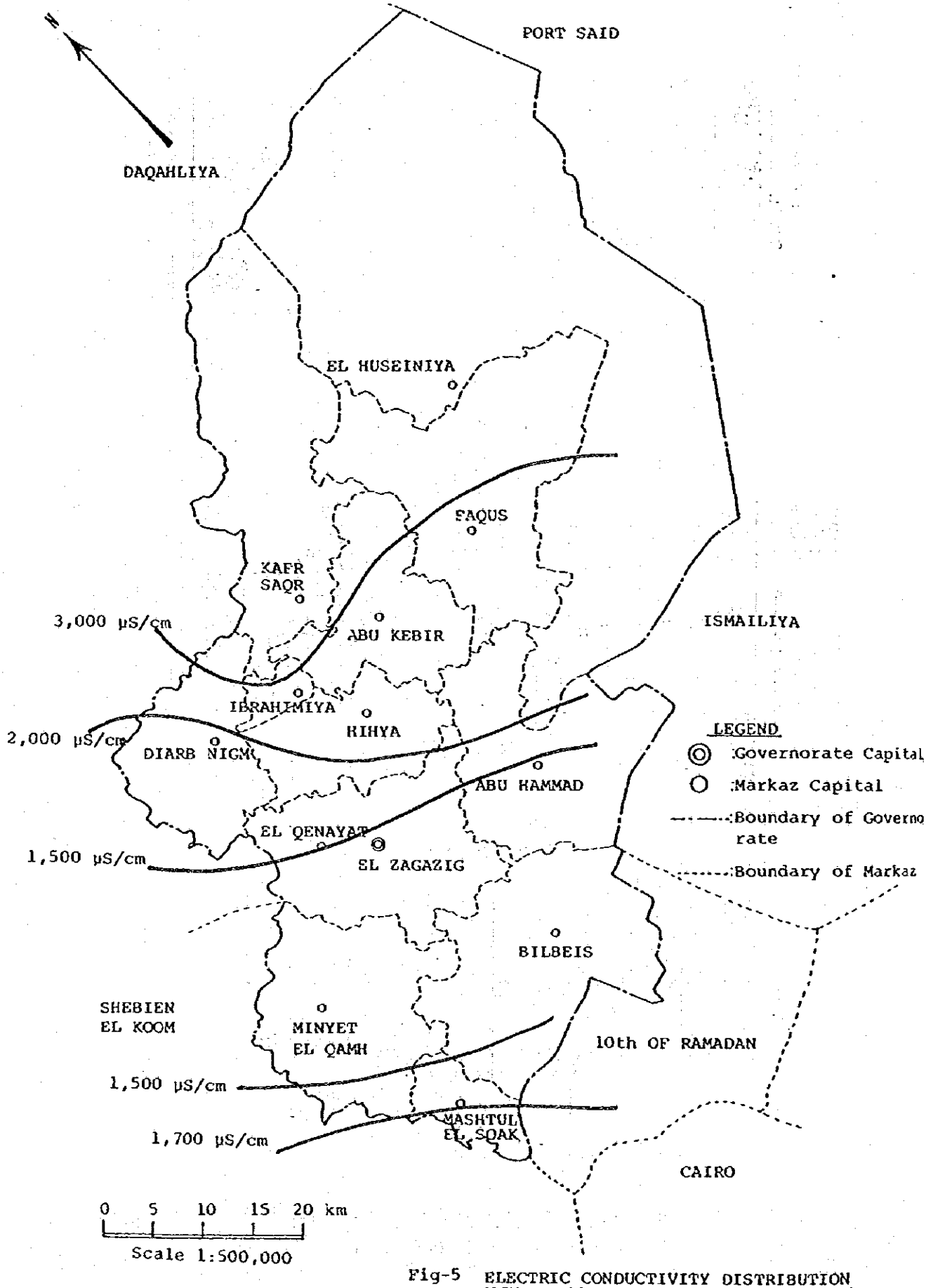


Fig-5 ELECTRIC CONDUCTIVITY DISTRIBUTION

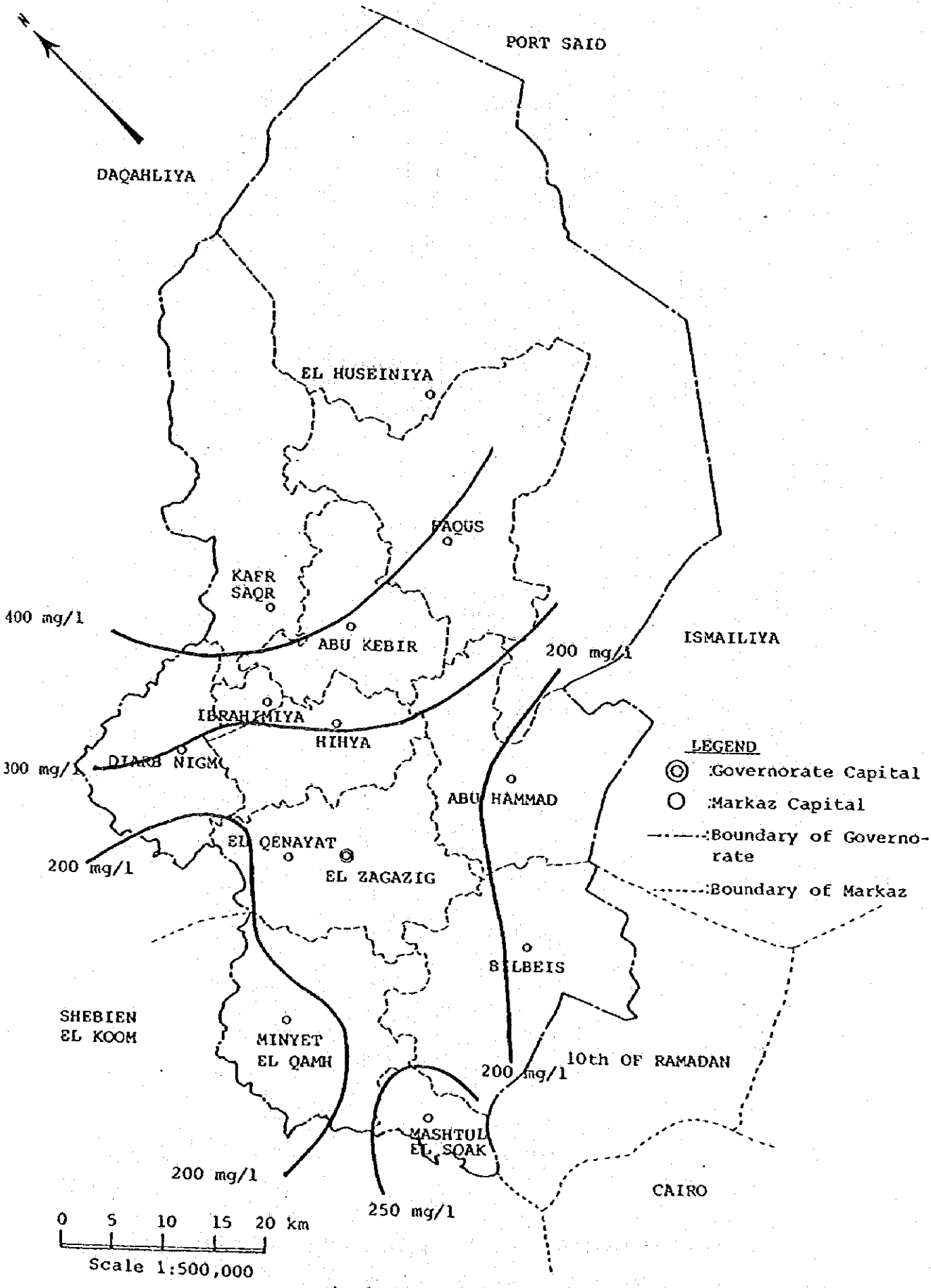


Fig-6 CHLORIDE ION CONCENTRATION DISTRIBUTION

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

WORKING REPORT NO.7

PRELIMINARY HYDRAULIC ANALYSIS

OF

ABBASA SYSTEM

JAPAN INTERNATIONAL COOPERATION AGENCY

INTRODUCTION

There are three water supply systems which are called Abbasa system, Housing Department system and City-Owned system in Sharqiya Governorate. Abbasa system supplying mainly to rural area is the biggest system in the governorate.

The purpose of this working paper is to make present supply conditions of Abbasa system clear by way of hydraulic analysis.

METHOD OF ANALYSIS

The Abbasa system consists of Abbasa treatment plant, 14 groundwater stations, and 5 compact units as water sources.

Firstly basing on the imformations from the governorate during the field survey period, the served area of Abbasa system was identified.

Avoiding complicated analysis, the area which is supplied by Abbasa system was divided into 7 areas by difference of water source. These areas are shown in Fig-1; and water source, population, and per capita consumption in each area in Table-1. Per capita consumption was calculated by dividing total water production by total served population in each area.

For the hydraulic calculation Hazen-Williams' Formula was employed and following assumptions were made:

i) C-value of the Hazen-Williams' Formula is C=110
ii) Elevation of the ground surface is same at all discharge points,
iii) Population data employed is as of 1983,
iv) No consideration for leakage is made, and
v) No circulation of water between dfferent areas is made, except Abbasa area, (See Fig-2)

FINDINGS

The analysis revealed followings:

1. In Bilbeis area, Zagazig area, and Abu Hammad area, sufficient service pressure is obtained in almost of all villages.
2. In northern part of Sharqiya Governorate, Faqus area, Kafr Saqr area, and Huseiniya area, not only per capita consumption but supply pressure is very low comparing with other areas.
3. In Abu Kebir area, Hihya area, and Ibrahimiya area, although water quantity by calculation is enough, survice pressure is very low. Because of undersized pipe diameter, villages being remote from water source hardly obtain water.

It is really apparent that water supply condition is going to be very severe with population growth in the near future, unless proper counter-measure is executed.

Table and Figures

Table-1 POPULATION, WATER SOURCE, DISCHARGE AND PER CAPITA CONSUMPTION

Area	Population	Water Source	Discharge (m3/day)	Per Capita Consumption (lcd)
Bilbeis	129,534	Burdien G.W.S. Saadat B.P.S. Ghita G.W.S. from Abbasa Area	2,851 1,469 1,469 2,160	
		Total	7,949	61.4
Zagazig	219,755	Bichet Kayed G.W.S. Bahnabai G.W.S. Qenayat G.W.S. Zanklon G.W.S. Zagazig B.P.S. from Abbasa Area	1,469 1,469 1,469 1,469 4,320 3,456	
		Total	13,652	62.1
Abbasa	377,526	Abbasa Treatment Plant	41,268	
		Total	41,268	116.1
Abu Kebir	232,088	Mdlemien G.W.S. Abu Kebir B.P.S. Ibrahimiya G.W.S. from Abbasa Area	1,469 10,109 2,851 6,048	
		Total	20,477	88.2
Faqus	240,936	Faqus B.P.S.	8,640	
		Total	8,640	35.9
Kafr Saqr	222,450	Abu Kebir G.W.S. Compact Unit (No.1 - 4)	3,586 4,836	
		Total	8,422	37.9
Huseiniya	129,415	Didamoon G.W.S.	5,789	
		Total	5,789	44.7
Total	1,551,704		106,197	68.4

G.W.S. : Groundwater Station
B.P.S. : Booster Pumping Station

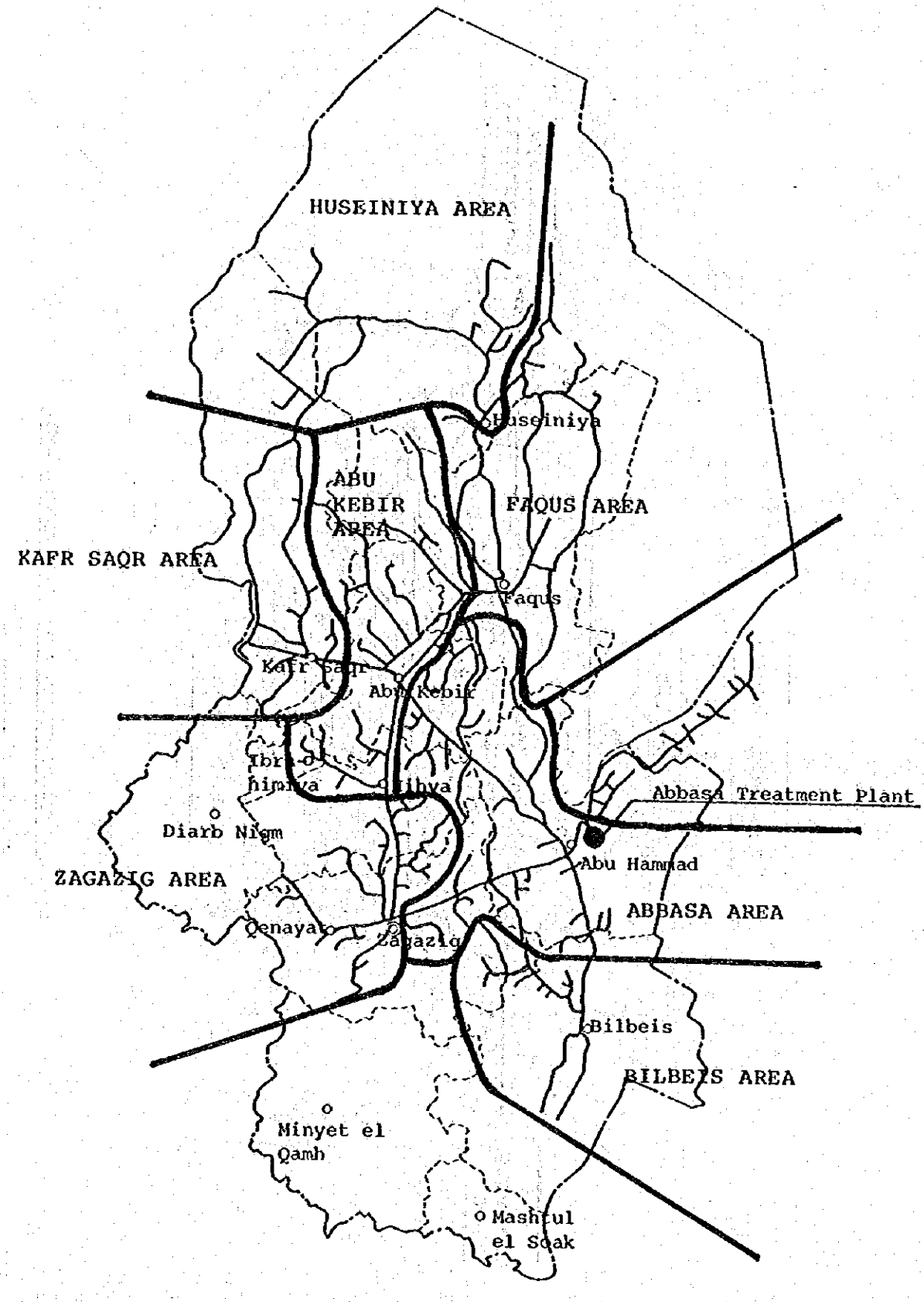


Fig-1 DISTRIBUTION AREAS

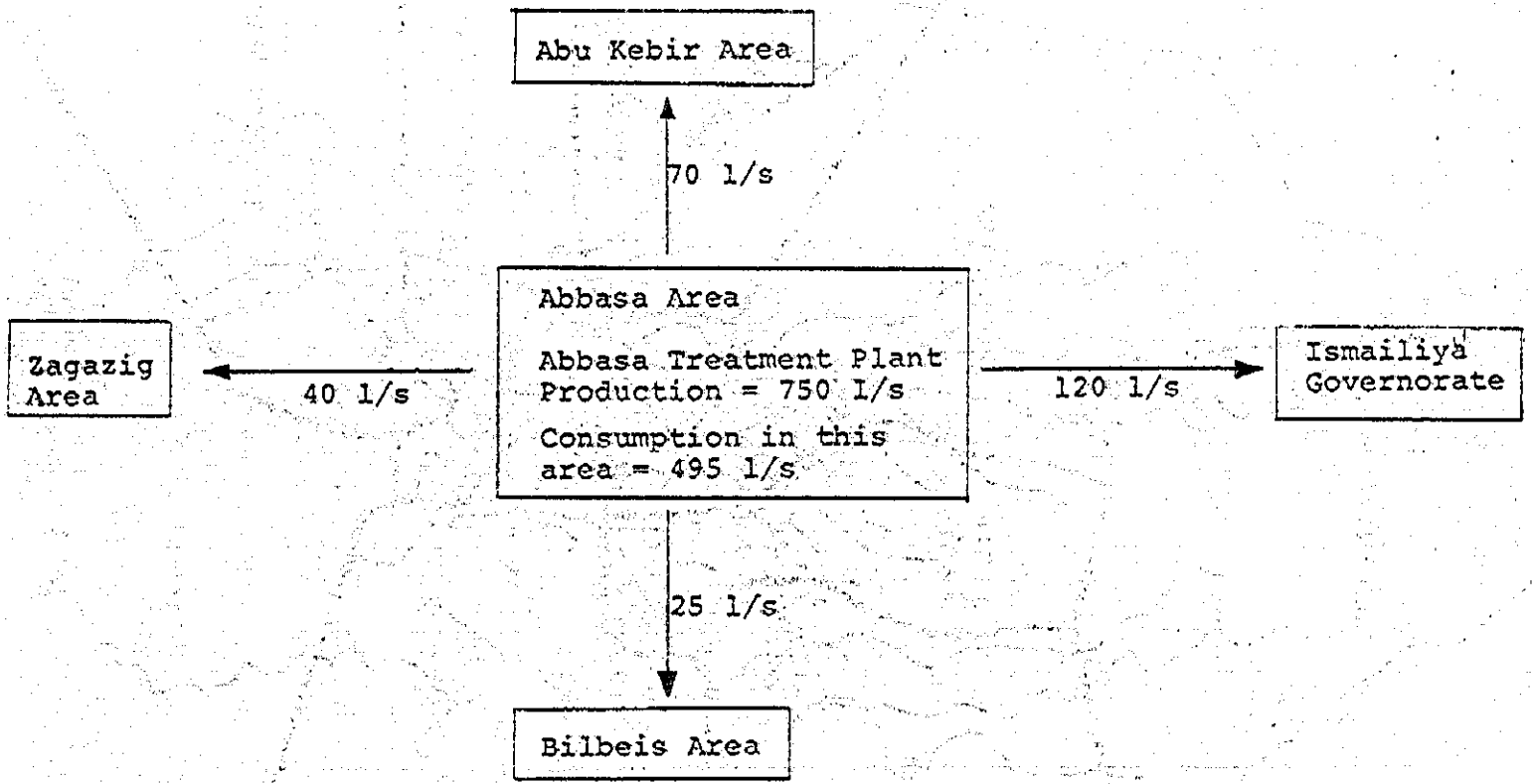


Fig-2 WATER CIRCULATION BETWEEN ABBASA AREA AND NEIGHBORING AREAS

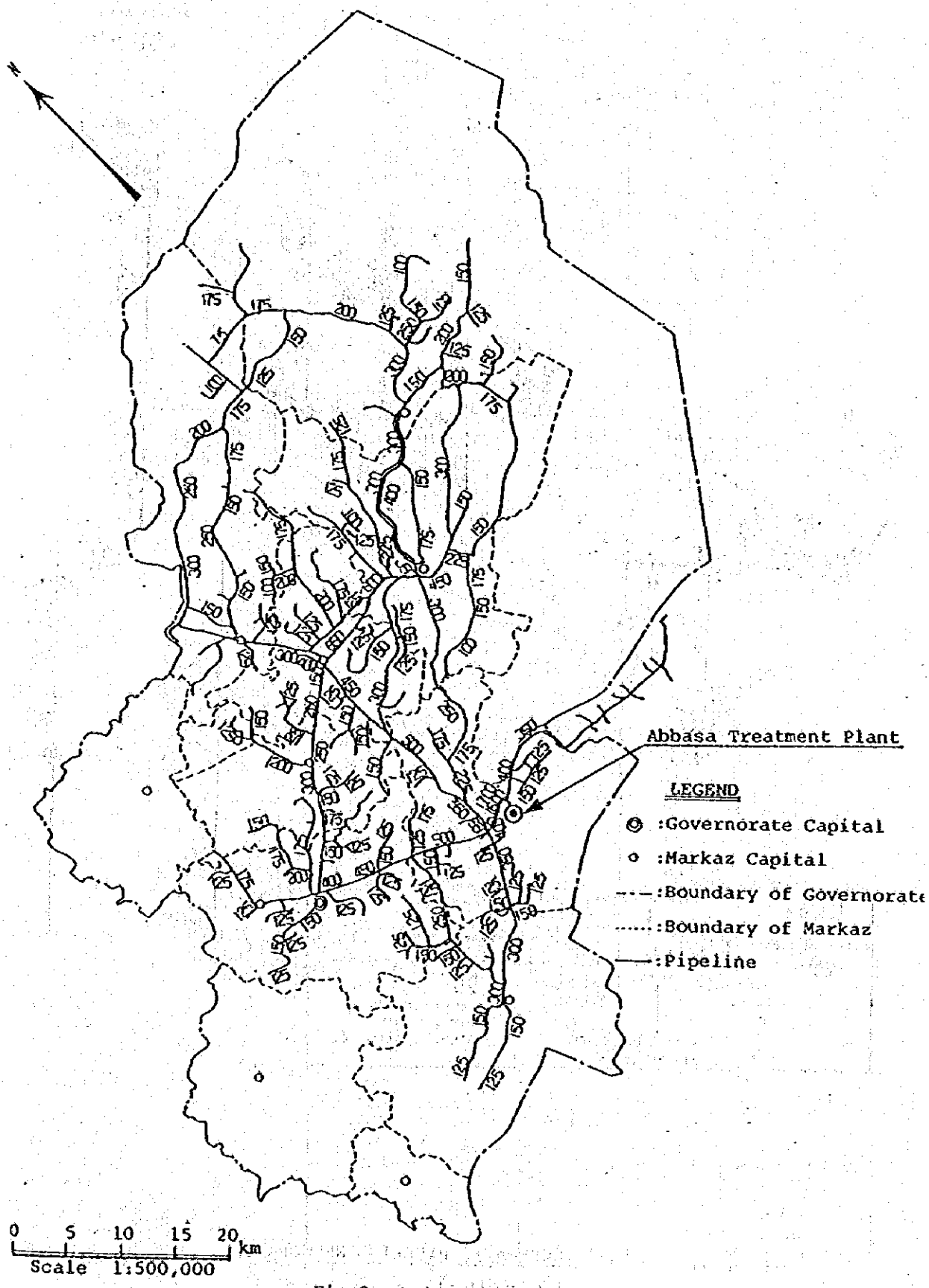


Fig-3 PIPELINE NETWORK

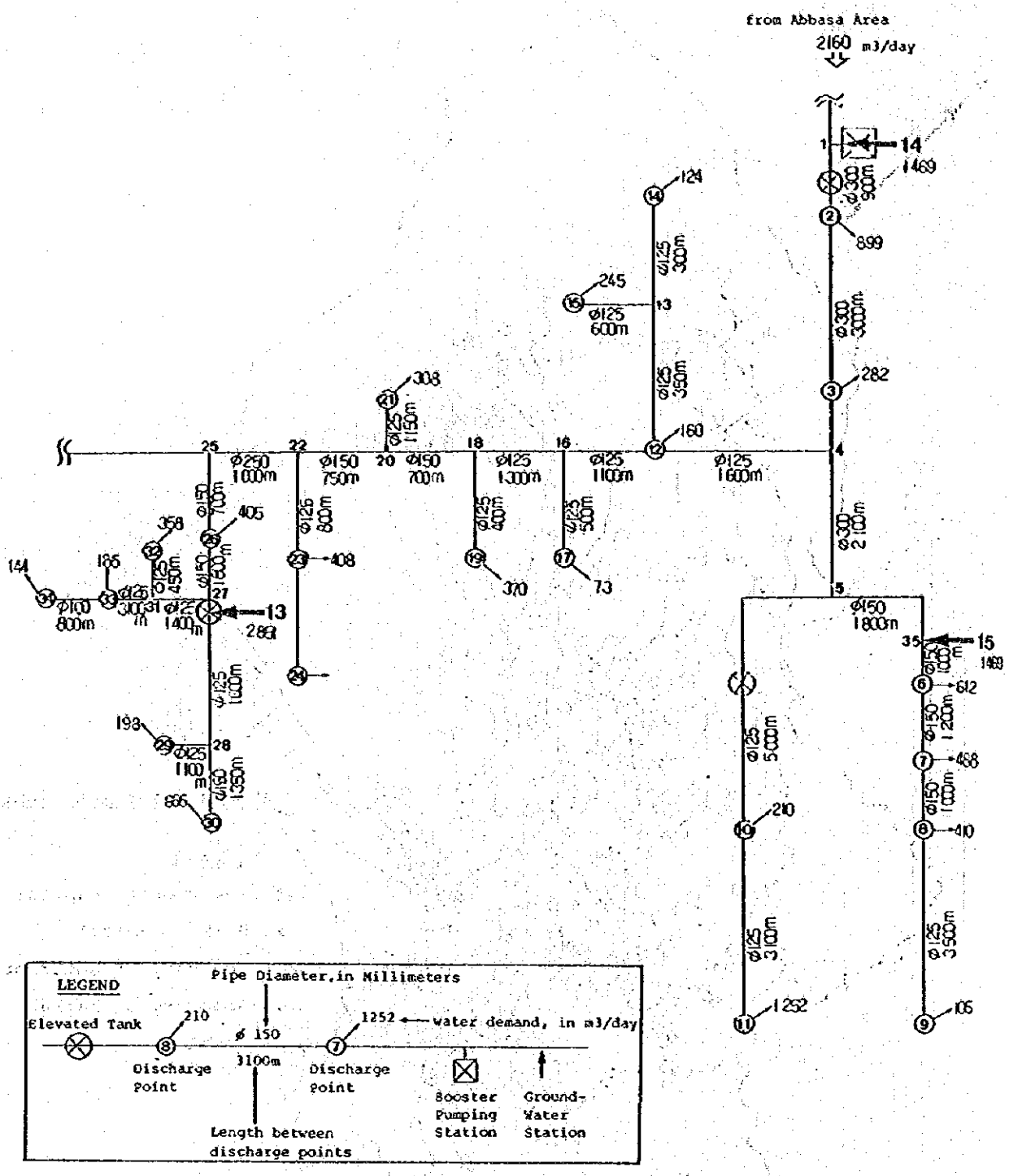


Fig-4 SCHEMATIC PIPELINE NETWORK (1)

Bilbeis Area

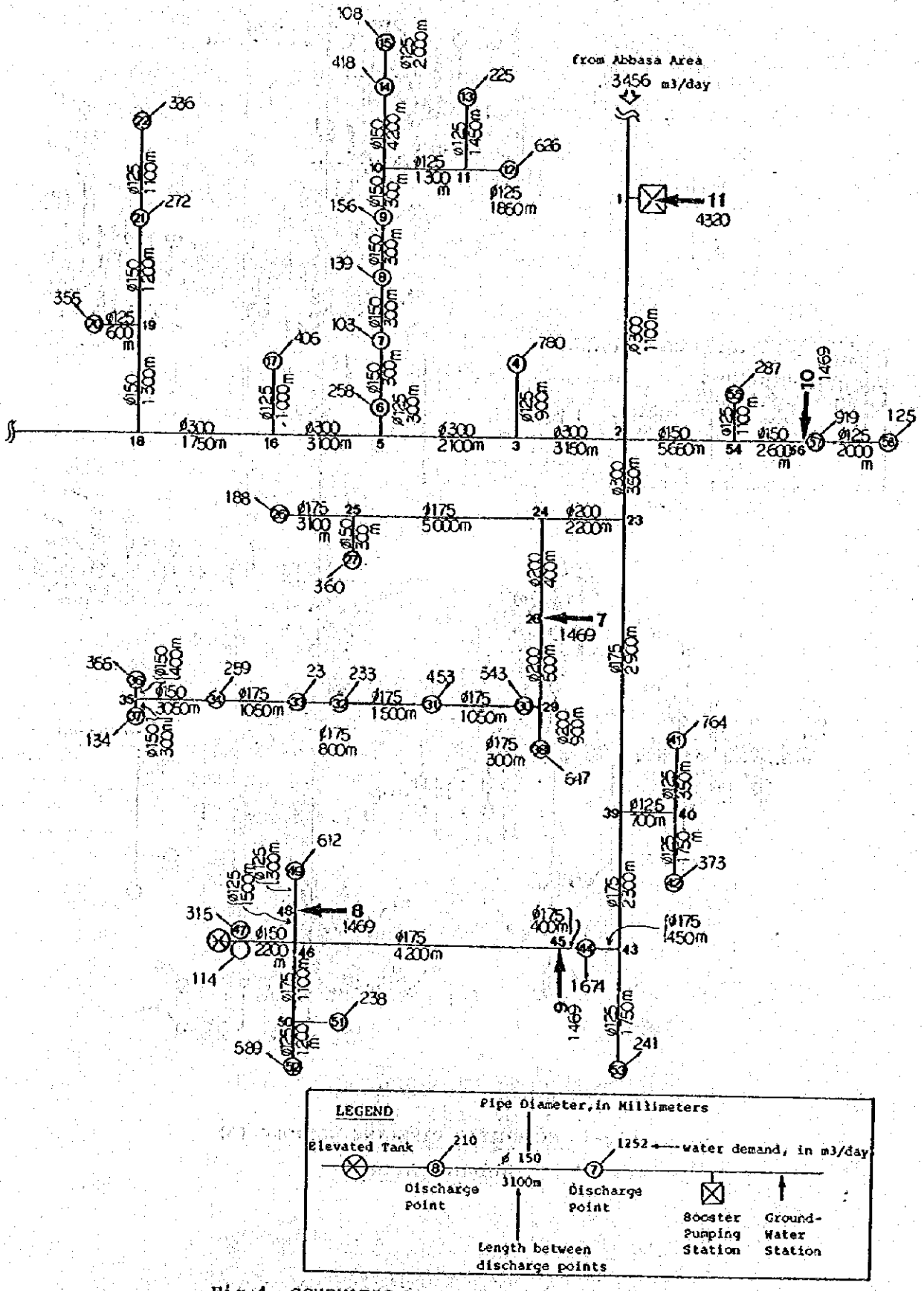


Fig-4 SCHEMATIC PIPELINE NETWORK (2)

Zagazig Area

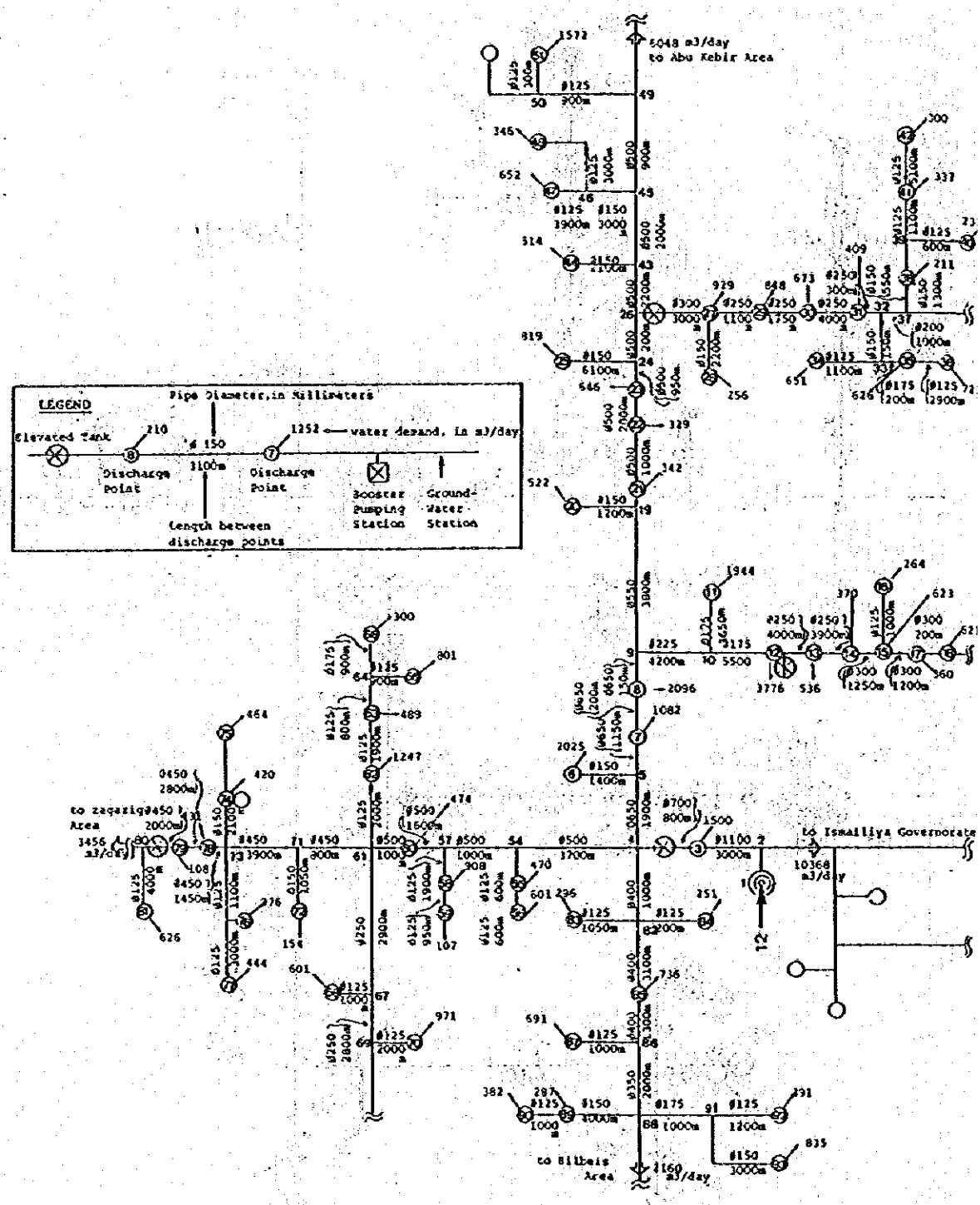


Fig-4 SCHEMATIC PIPELINE NETWORK (3)

Abbasa Area

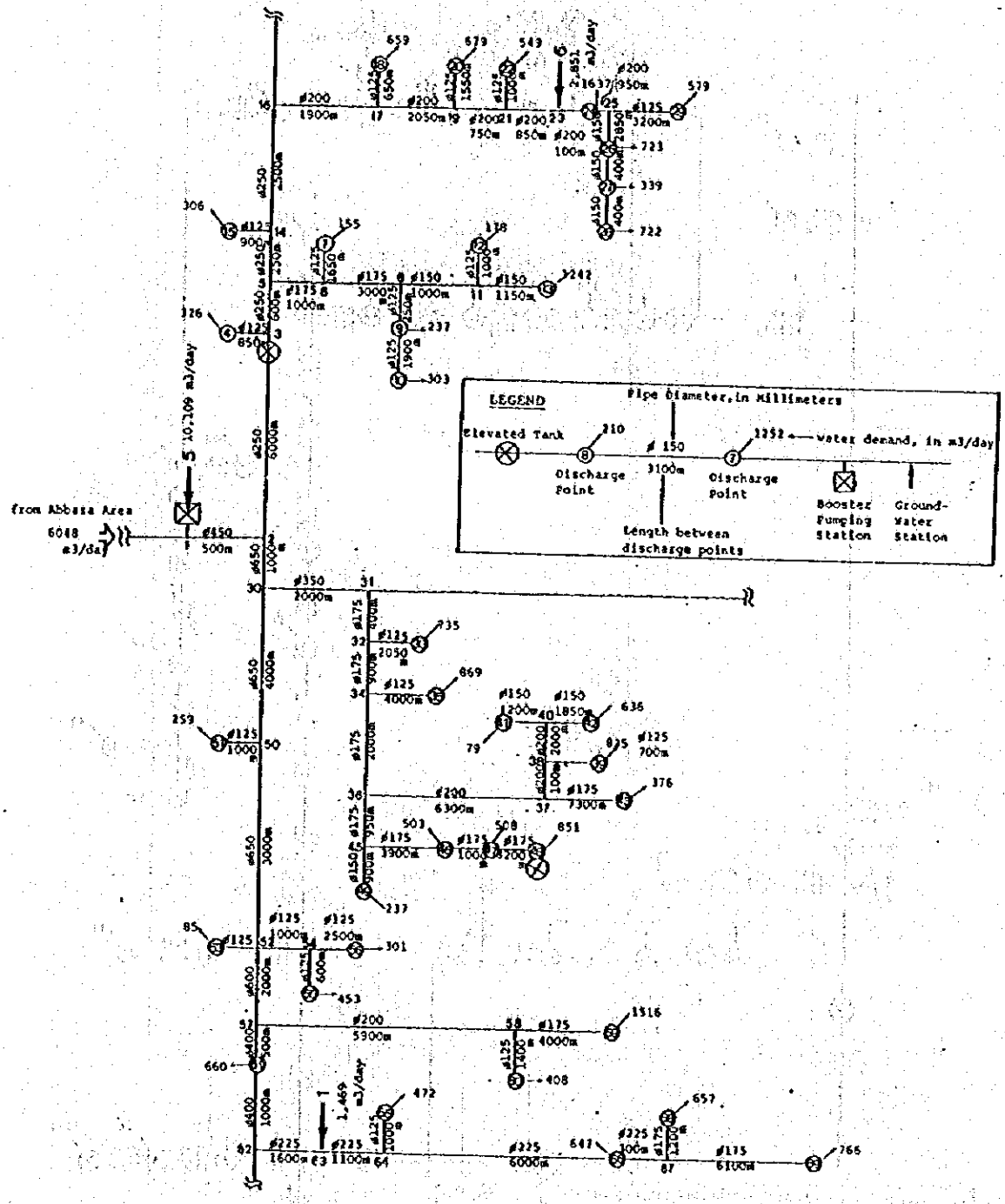


Fig-4 SCHEMATIC PIPELINE NETWORK (4)

Abu Kebir Area

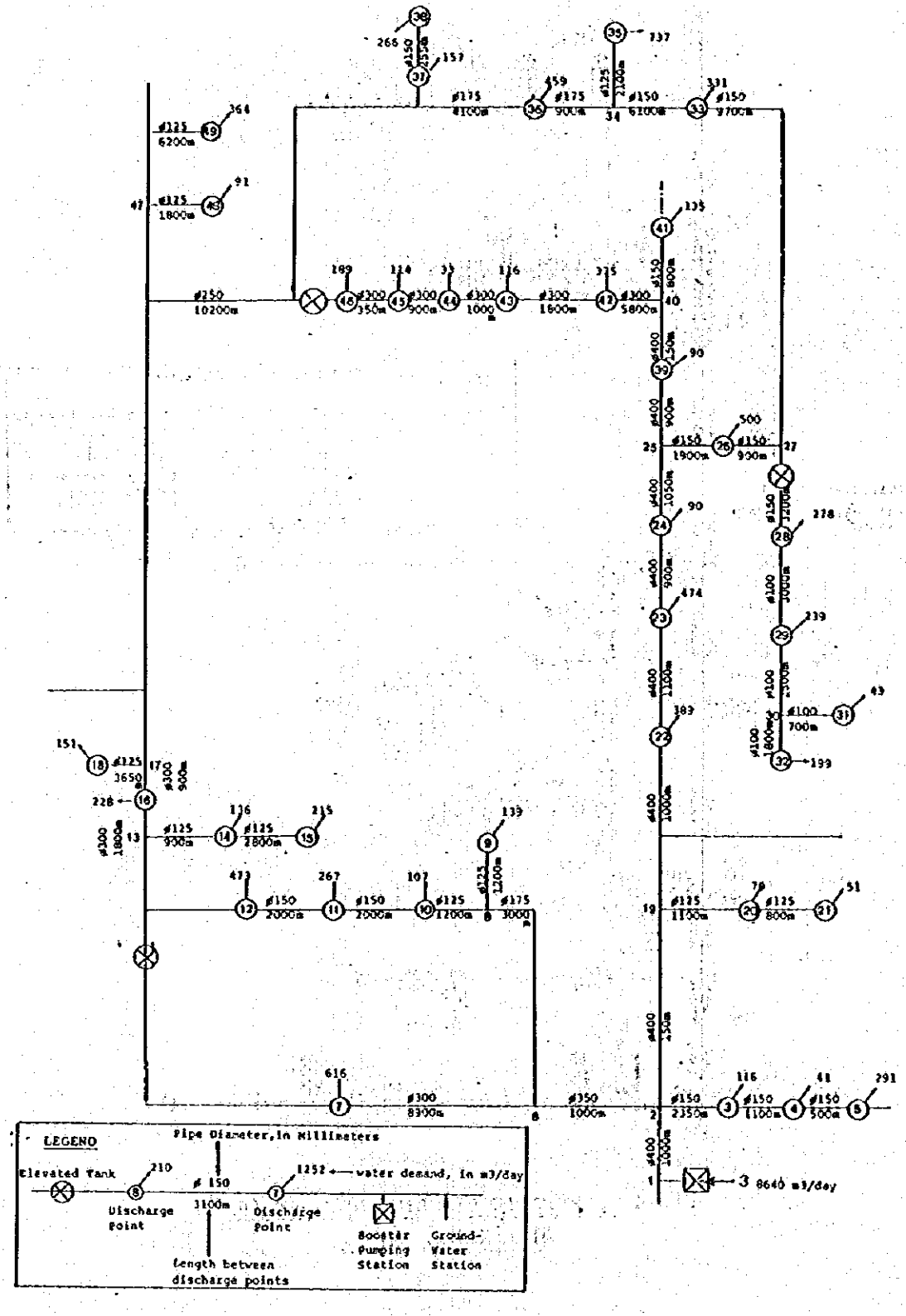


Fig-4 SCHEMATIC PIPELINE NETWORK (5)

Fagus Area

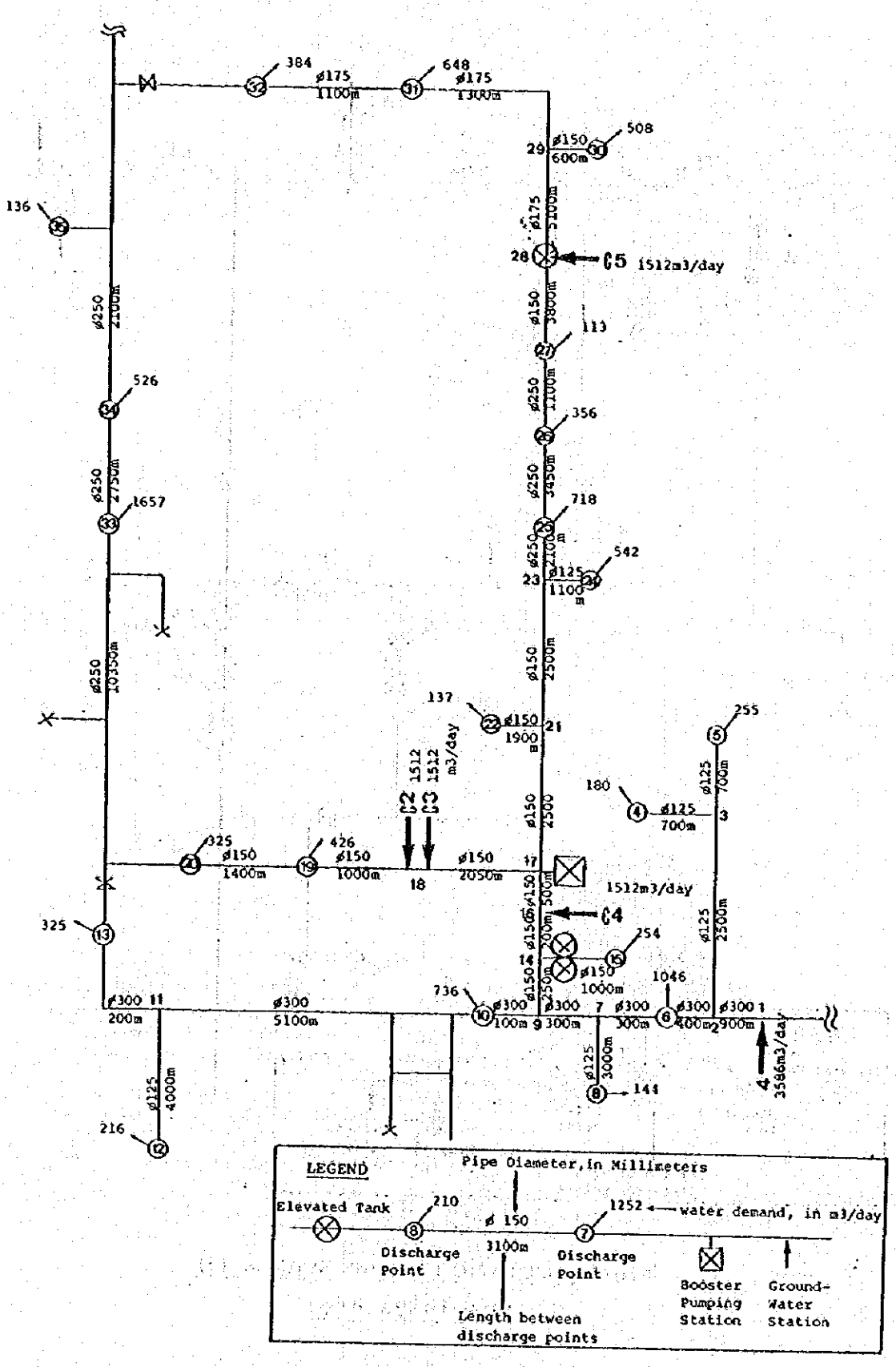


Fig-4 SCHEMATIC PIPELINE NETWORK (6)
Kafr Saqr Area

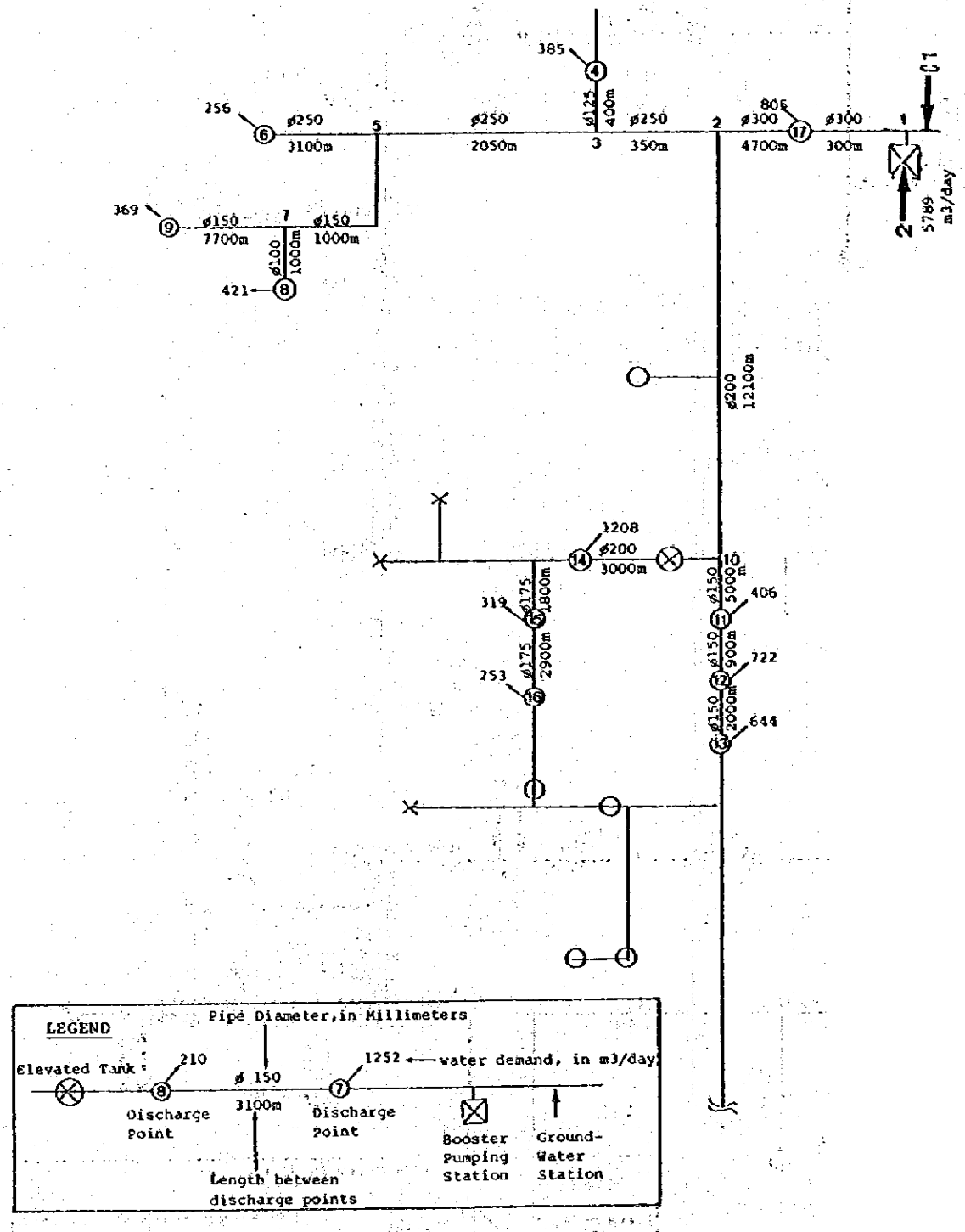


Fig-4 SCHEMATIC PIPELINE NETWORK (7)

Huseiniya Area

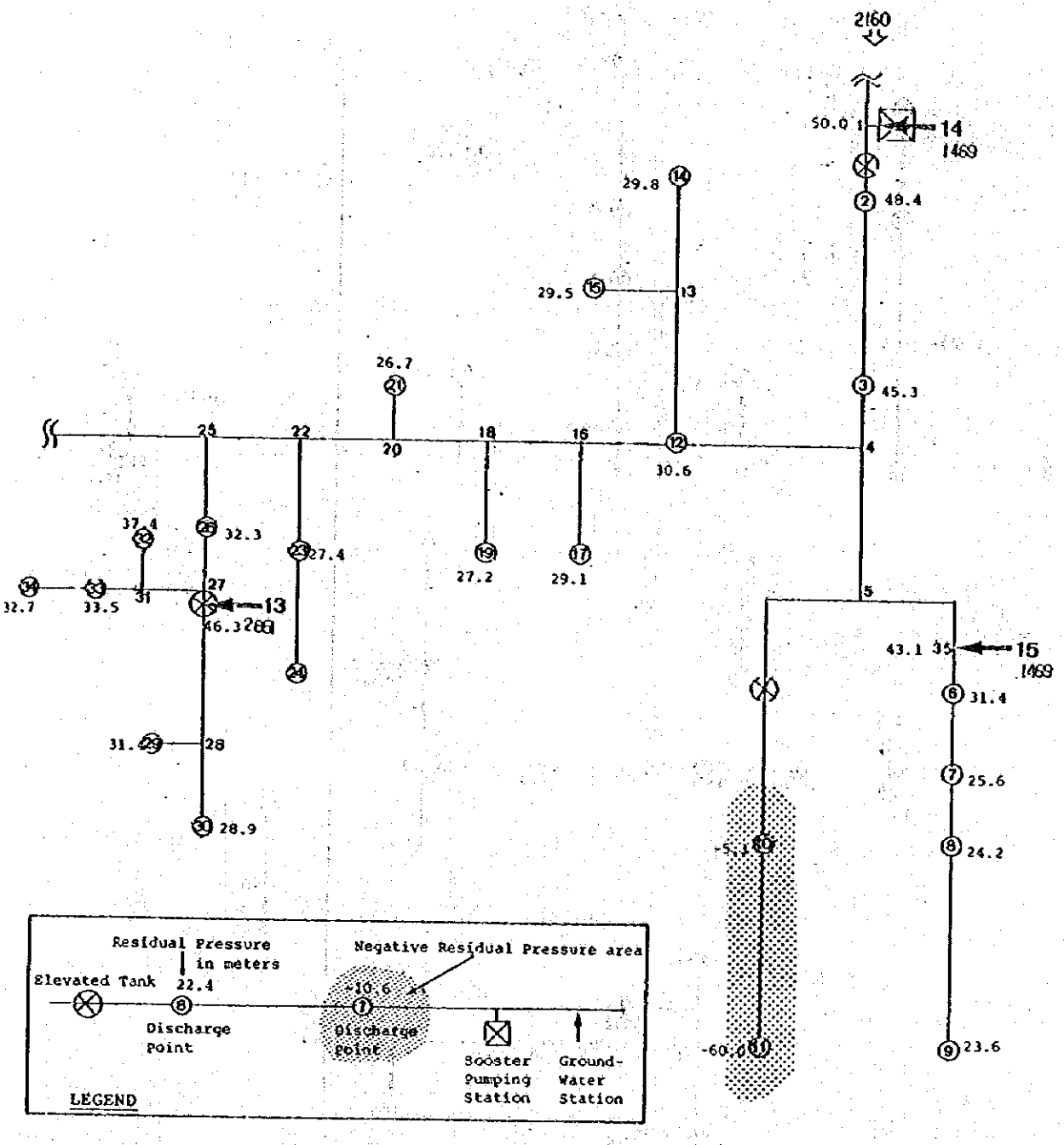


Fig-5 SERVICE PRESSURE (1)

Bilbeis Area

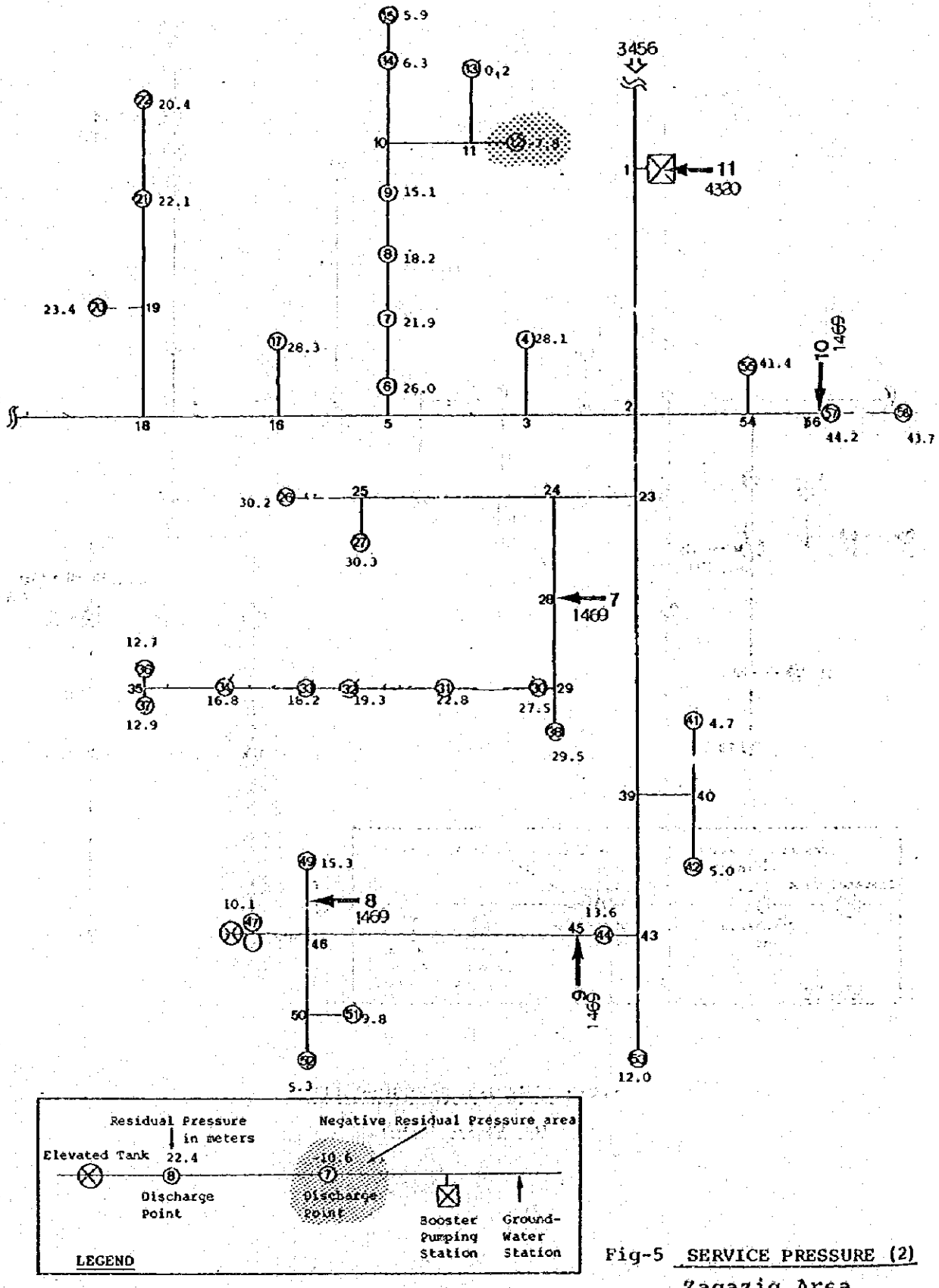


Fig-5 SERVICE PRESSURE (2)
Zagazig Area

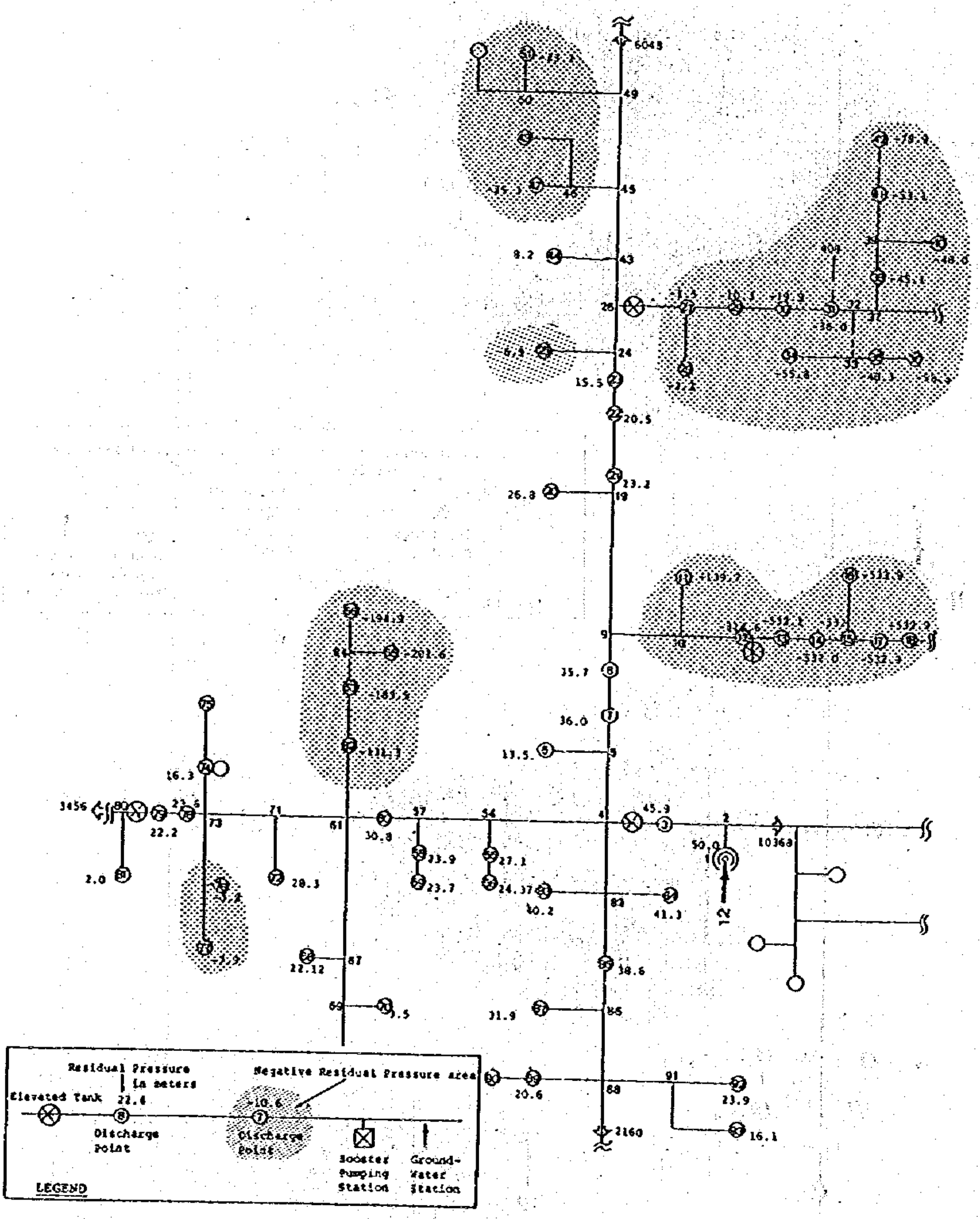


Fig-5 SERVICE PRESSURE (3)

Abbasa Area

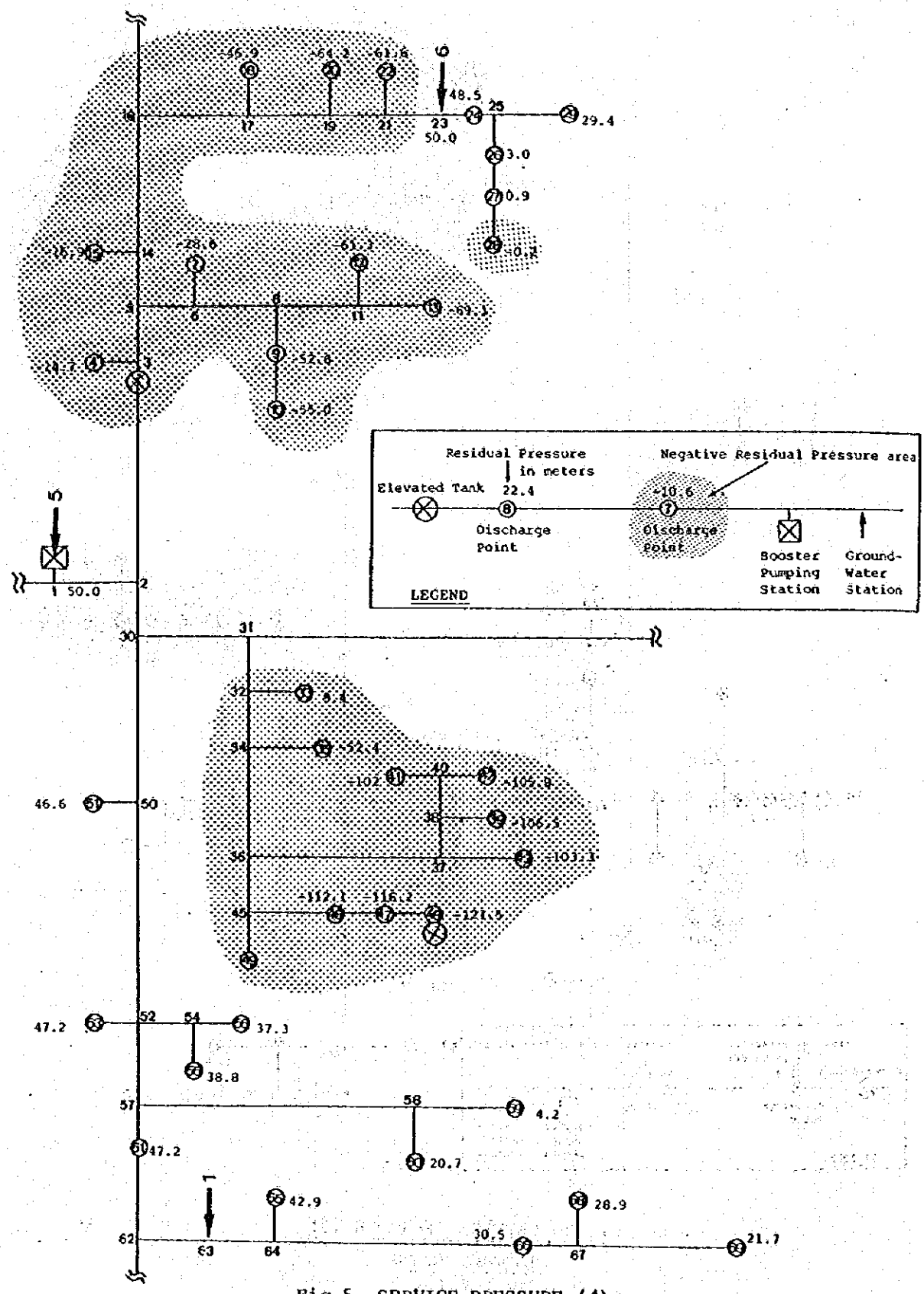


Fig-5 SERVICE PRESSURE (4)

Abu Kebir Area

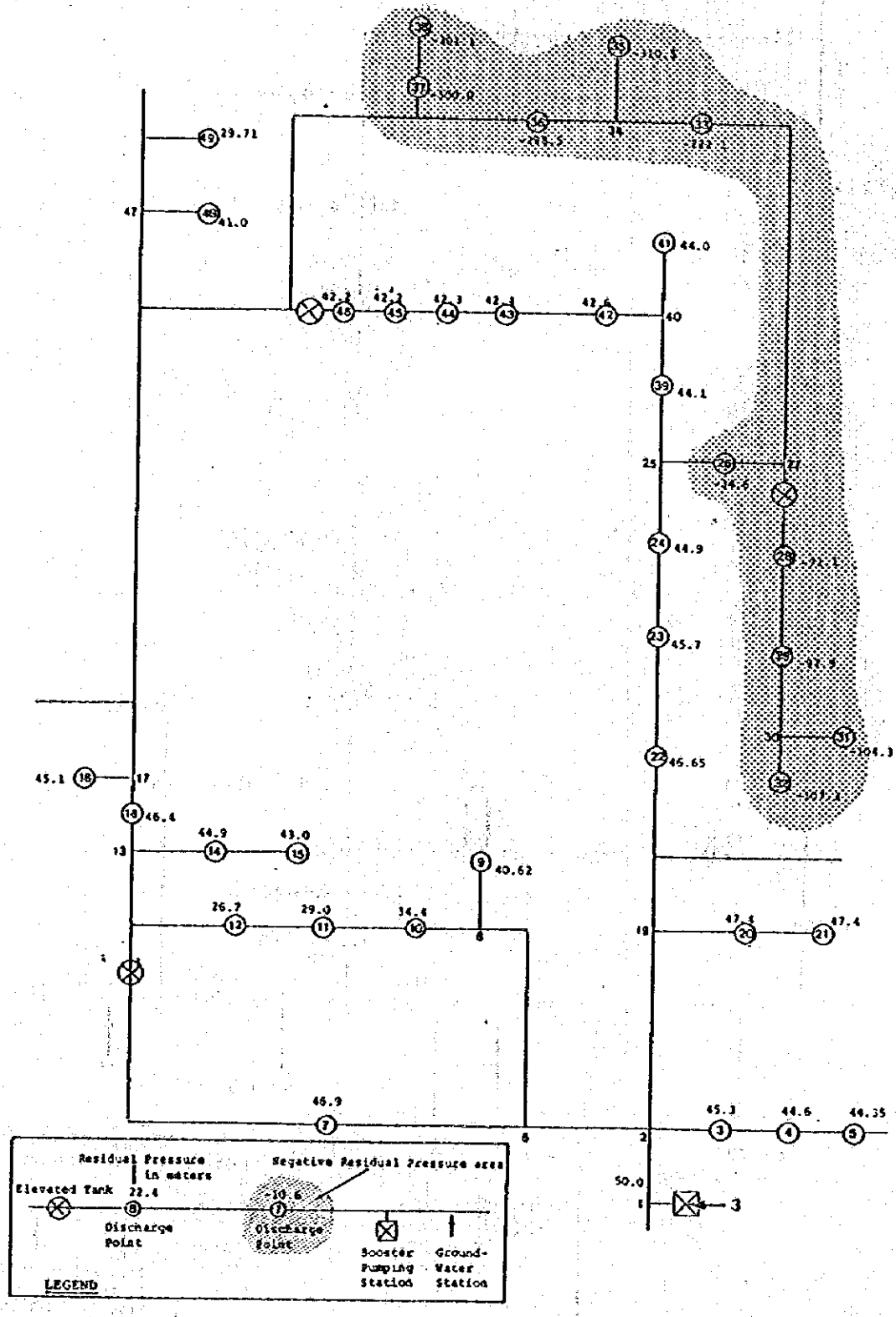


Fig-5 SERVICE PRESSURE (5)

Faqus Area

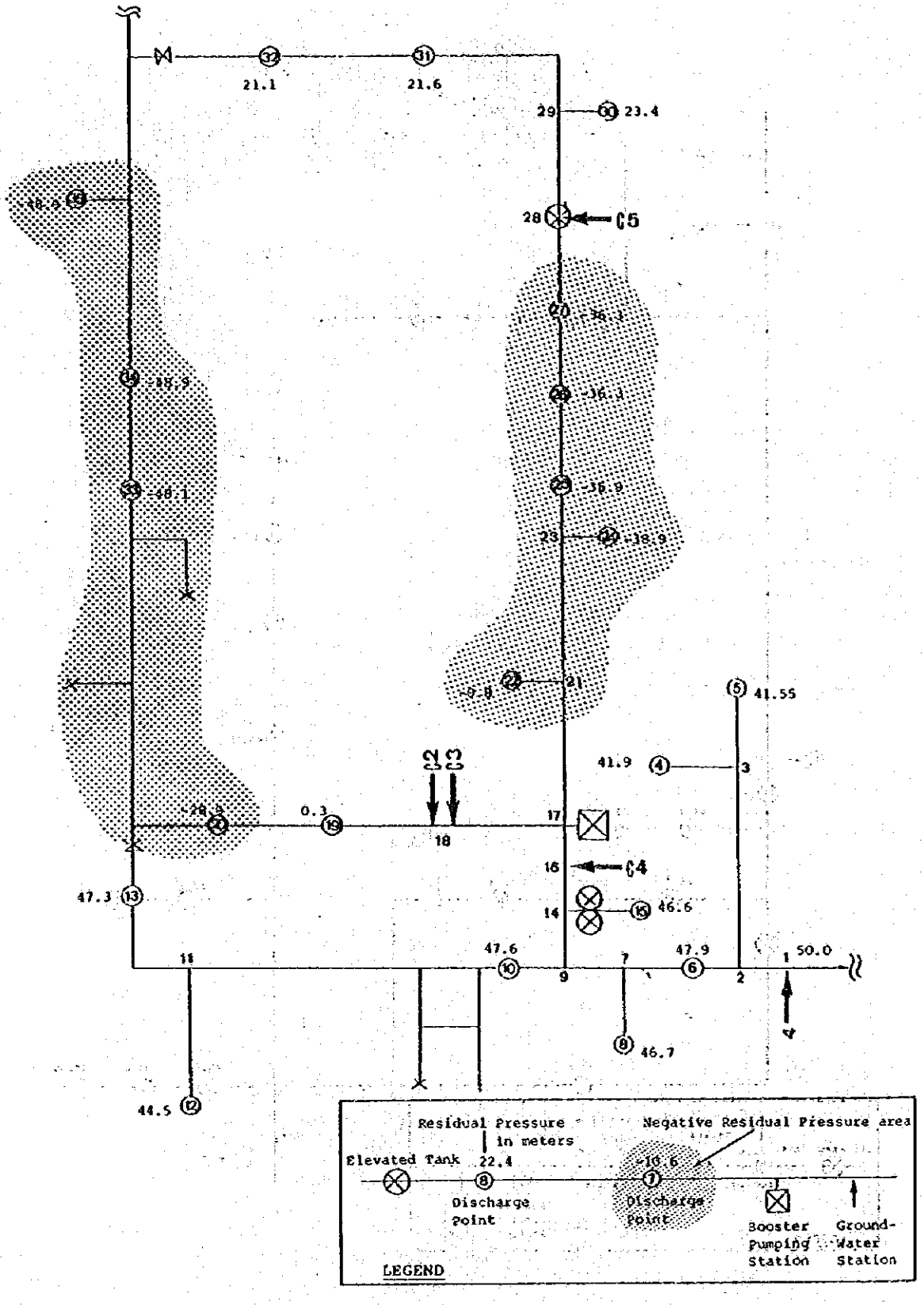


Fig-5 SERVICE PRESSURE (6)

Kafr Saqr Area

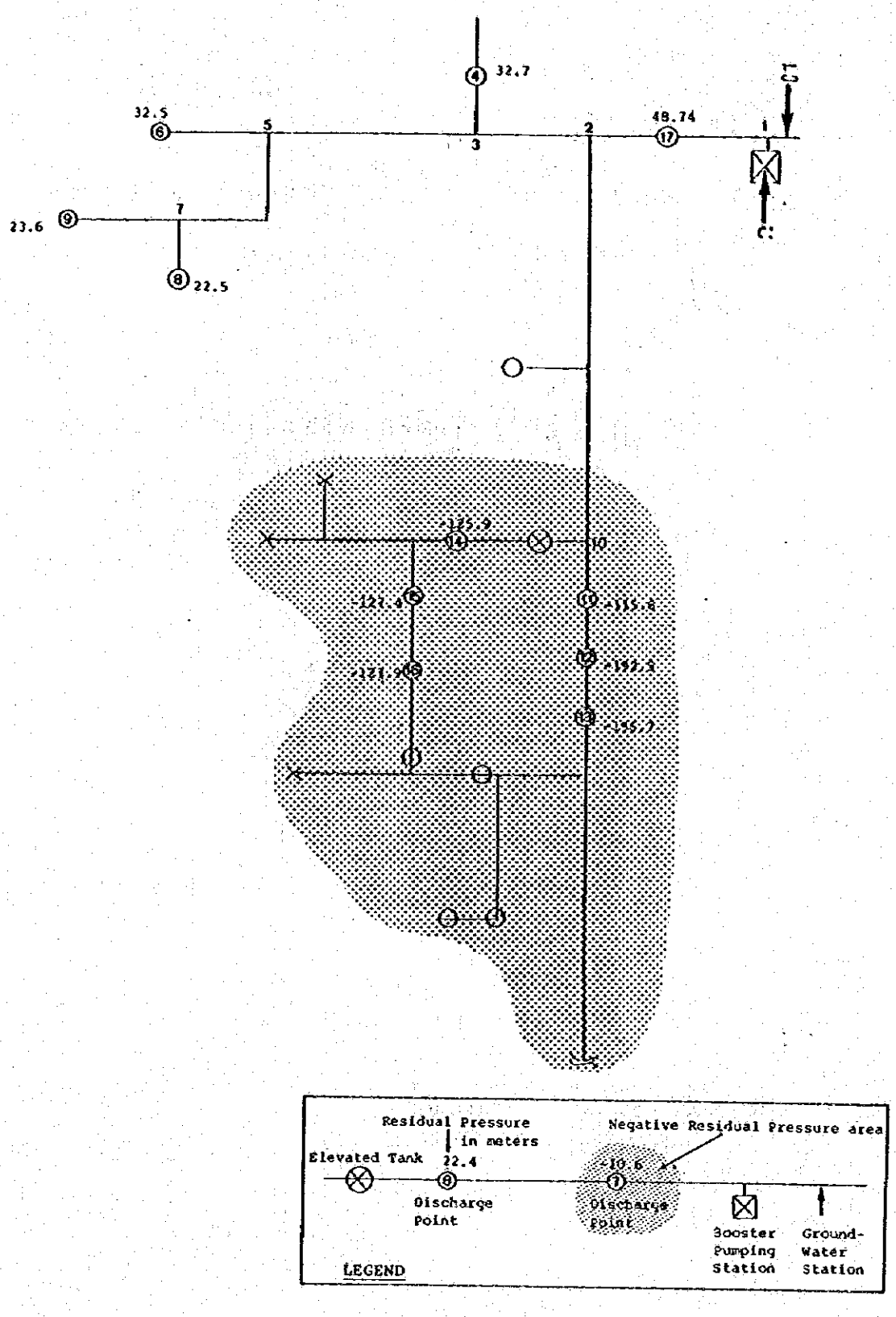


Fig-5 SERVICE PRESSURE (7)
Huseiniya Area

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

WORKING REPORT NO.8

LEAKAGE SURVEY
ON
WATER SUPPLY SYSTEMS

JAPAN INTERNATIONAL COOPERATION AGENCY

LEAKAGE SURVEY ON WATER SUPPLY SYSTEMS OF SHARQIYA GOVERNORATE

CONTENTS

I. GENERAL

The study for Sharqiya Water Supply System has been carried out for two years, 1983 to 1984 by JICA study team. During the first year 1983 the Long Term Program was studied, and successively for the second year 1984 the First Priority-Phase Program which was selected from the Long Term Program as a project to be implemented most urgently was studied.

As the leakage survey was to be studied within the First Priority-Phase Program according to the scope of works, leakage ratio obtained in the Beheira and Kafr el Sheik Governorates was used for the Long Term Program study due to lacking reliable data.

At the end of the first year's schedule, preparatory works and execution plans were discussed, as in details as possible between JICA team members and Egyptian counterparts. From the detailed discussion, Egyptian authorities concerned have made workable preparations for the survey works and substantial contribution throughout the survey period.

The local preparations and contribution consisted of the following matters in accordance with the agreement concluded from the discussion stated above :

a) Manpower composed of one engineer, four technicians and twenty workers,
b) Pipe materials such as valves, pipes, fittings and accessories,
c) Transportation consisting of two 4-ton-trucks, and
d) Budgetary arrangement for miscellaneous expenses.

JICA study team arranged the undermentioned matters on the basis of the agreement :

a) Engineers and leakage survey expert, and
b) Water meter and incidentally necessary equipments for the surveys.

The leakage survey was carried out in close cooperation with Egyptian authorities staffs concerned and all members who engaged in the survey. Especially the fruitful results were obtained with every effort and coordination of counterparts described below :

Eng. Abdel Hady Abdel Razik Hassan
Director of Abbasa Water Treatment Plant

Eng. Ahmad Kamel Mohamed Atia Mowafy
Chief of Mechanical & Electrical Section of Housing Department of Sharqiya Governorate

Eng. Fahmy Amin Schetany
Chief of Utility Section of Zagazig City

II. FIELD SURVEY

2-1 Outline

Generally, system losses consist of a) losses from facilities like leakage from pipelines and structures, and b) administratively deducted consumption for water charge such as losses originating from damaged service pipes or taps which are asked to be repaired but not repaired yet.

Such administrative losses are not described in the present report, although the said losses are still one of important factors for considering accounted-for/unaccounted-for water. In addition, leakage from facilities such as treatment plants and reservoirs is not stated because of being negligibly little comparing leakage from pipelines in any cases.

The leakage survey of pipelines were carried out in 9 sites selected from urban and rural areas from May to August 1984, although one site of urban area, that is, Midan Montaza of Zagazig city was unable to be surveyed due to difficulty of dewatering and submergence of the sensors.

The Ramadan, in other words, the fast season of Moslem was conformed to among the people from 1st to 29th June this year. As the survey was commenced from the end of May, therefore, some patterns of water consuming during the Ramadan were obtained as 24 hour living mode.

Before the water flow observations, it was said that the peak of water demand would supposedly occur not in the morning but in the evening during the Ramadan because of their living type of Moslem. Contrary to an expectation which had locally been considered for a long while, such patterns were not obtained from the survey. It was observed that water was obviously consumed in the early morning, say 2 a.m. to 3 a.m. during the Ramadan.

The survey results are stated below in order of Zagazig city, Housing Department systems and Abbasa, system, although the executed field surveys did not always follow this order.

2-2 Survey Equipment and Method

Pipelines of the water supply system in Sharqiya Governorate are mostly, 95 % of the total length, of asbestos cement. Steel pipes are used only for limited locations like crossing the canals and roads, and cast iron pipes used as the trunk mains are the ones which were laid when water supply systems were initially founded many years ago.

The equipment and methods for leakage survey were selected, as detailed in the following subsections, considering mainly the primary purpose, the available time period and the personnel's experience and capability.

2-2-1 Survey Equipments

As the survey equipments were to be arranged by the survey team itself according to the agreement, basically their kind and number were selected in consideration of a) survey term (May to August 1984), and b) number of engineers engaging in the survey and c) the survey sites mostly remote from urbanized area.

The direct purpose of the survey was to estimate the ratio of leakage to supply quantity for pipelines. Every selection of equipments necessary was carried out from the conditions stated above. They are listed as follows :

Table-1 EQUIPMENTS TRANSPORTED FROM JAPAN

Name	Type	Market	Qty.
Water Meter	Portable Supersonic	Fuji Electric Co., Ltd.	1 set
Flow Gauge	Slit and Notch	Fuji Leakage Equipment Co., Ltd.	1 set
Pressure Gauge	Bouldon Tube	- do -	10 sets
Leak Detector	WL-200 & 91	- do -	2 sets
- do -	Stethoscope	- do -	5 sets
Box Locator	F-50	- do -	2 sets

2-2-2 Survey Method

Initially Planned Method

In order to make distinction of the leakage sources between the mains, secondary mains and service pipes, the following steps were tested at the beginning of survey.

Referring Fig-1, the method will be explained. Leakage from the pipes was scheduled to be measured by the following three steps.

a) when all valves of the secondary mains branched from the main are closed, the flow indicates the leakage of the main,
b) when all valves/cocks of the service pipes are closed and all valves of the secondary mains are opened, the flow indicates the leakage of the main and the secondary mains,
c) when all service taps are closed, and all valves of the secondary mains and all valves/cocks at the service pipes are opened, the flow indicates the leakage of the main, secondary mains and service pipes.

However, shortly after commencing preparation of the maps of survey areas, the following matters as to the housing in urban areas were found from the field surveys:

a) Most of the housing are apartment houses of several stories high,
b) a service pipe for an apartment house building is branched into a number of connections with stop valves and water meters, and
c) these pipeworks are installed in the so-called "wellhole" of the building.

Service pipes, tapped from the main and laid underground for a distance of a few meters, rise aboveground and are led to the wellhole. Each of the branched connection is fixed on the walls of building, exposed in the air to lead to the respective apartment house.

With such a system, leakage in the service pipes in easily detected and immediately corrected to revent damage. Except for leaking taps leakage on the part of the service pipes can be taken out of consideration.

Noticeable features of pipelines are:

a) Secondary mains valves are shown in Fig-2 are not installed, and

b) Valves/cocks of service pipes are not set except cocks of branch saddles, and no saddle boxes are installed upon the saddle.

From these findings, the planned survey method stated above was found to be less impracticable than anticipated. Therefore steps taken for every case were as follows:

a) Preparatory works.
A pipeline map for the survey area was made and checked of conformity with the existing conditions including the pipe size, location of branching and tapping, number of connections, etc. Also some points of branching and tapping were test-dug randomly for visual inspection.

b) Preliminary survey.
Using the stethoscopes and leak detectors, every point of branch/tapping was detected of sound of possible leakage. To avoid the interference of traffic and other noises, the work was carried out mostly around and after midnight.

c) Flow and Pressure Measurement.
The flow meter recorded the flow rate, in terms of liter per second, every 10 minutes automatically. The pressure was measured hourly at a tap located near the end of main. A set of survey was made on 24 hours continuous basis during which, around noon, all the service valves/cocks were closed completely by the local workers. The operation took one to two hours usually.

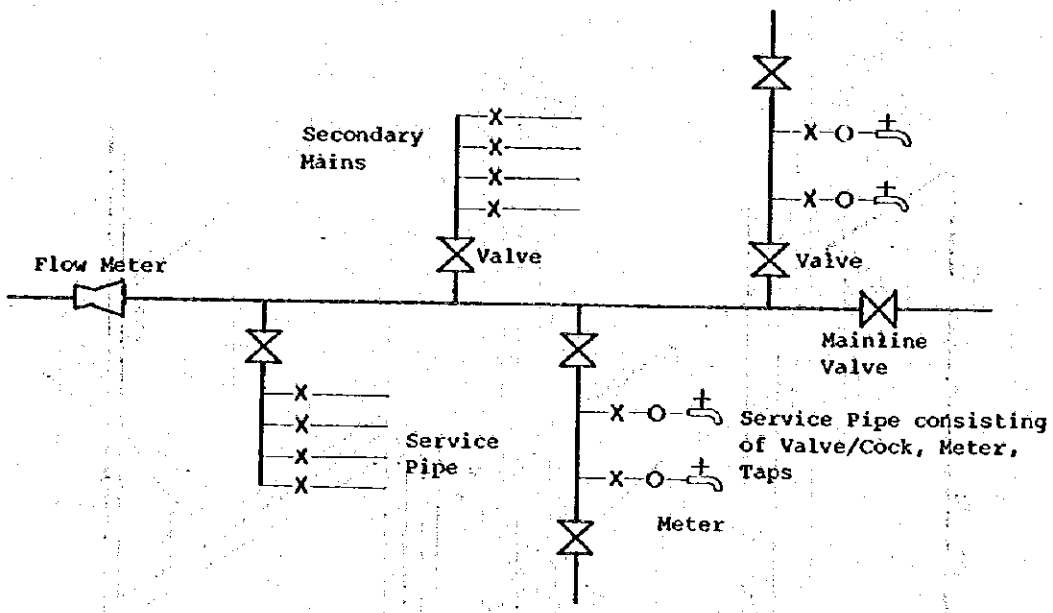


Fig-1 EXPECTED PIPE SYSTEM

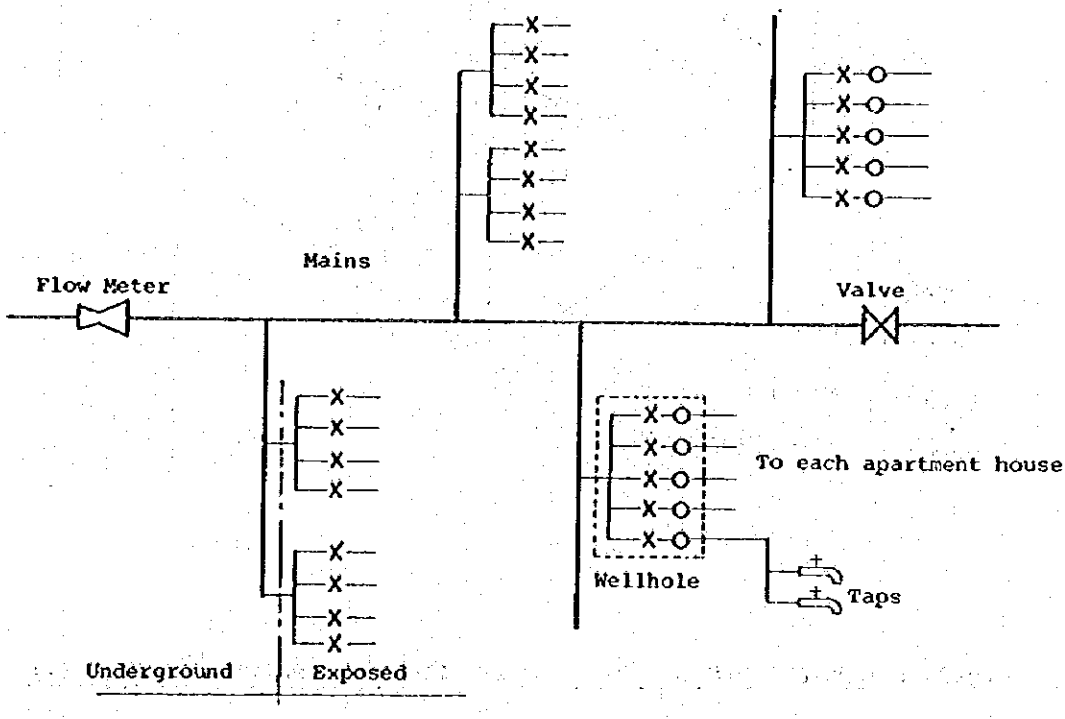


Fig-2 ACTUAL PIPE SYSTEM

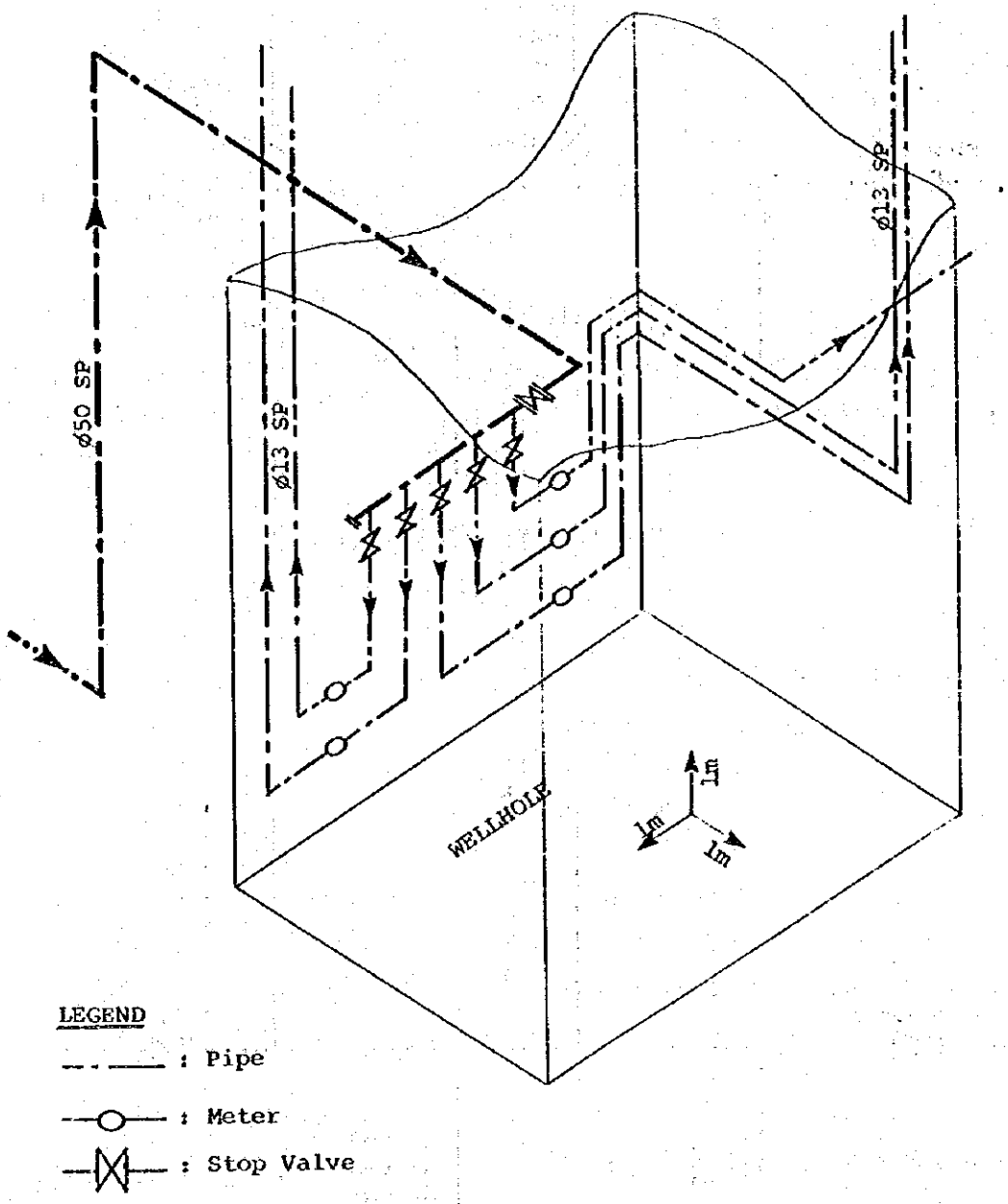


Fig-3 SCHEMATIC RISER SAMPLE IN WELLHOLE OF APATRMENT HOUSE (1)

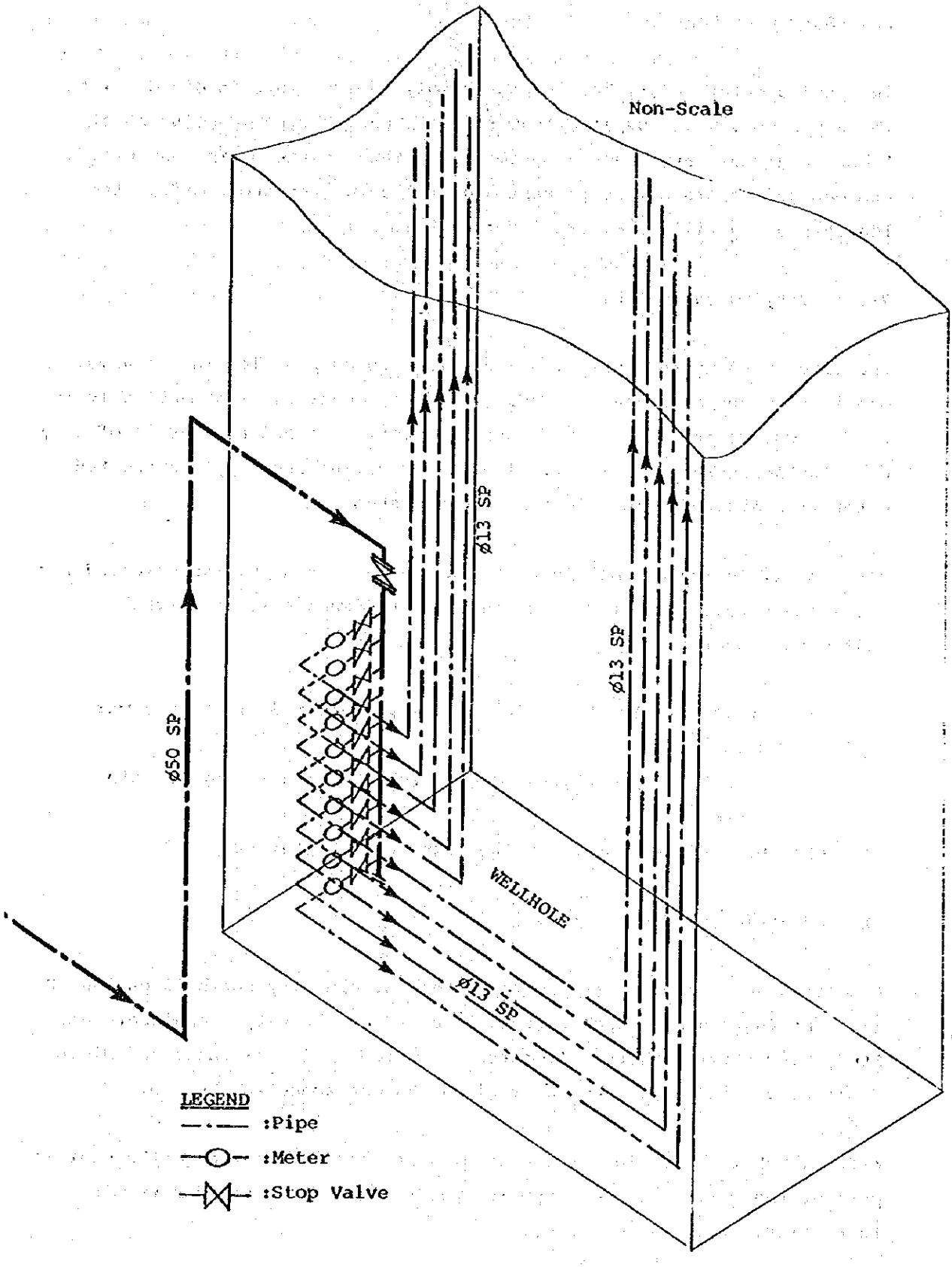


Fig-4 SCHEMATIC RISER SAMPLE IN WELLHOLE OF APARTMENT HOUSE (2)