2.7 Existing Organization

2.7.1 National Level

The following are organizations at the national level more or less related to the execution of sewerage system development projects.

National Organization for Potable Water and Sanitary Drainage (NOPWASD)

This organization was established in 1981 by the presidential decree No. 197 merging the former General Organization for Potable Water (GOPW) and General Organization for Sewerage and Sanitary Drainage (GOSD) to undertake following tasks.

(1) Identification and planning of water supply and sewerage and sanitary drainage works including the preparation of implementation schedules to be considered in the general national development plan.

(2) Necessary studies, research, planning, designing and overseeing project implementation of the water supply and sewerage system development projects.

(3) Establishment of the national standards, technical specifications and their control for drinking water and wastewater disposal.

(4) Development of the training program to upgrade the quality of design, construction as well as operation and maintenance of the water supply and sewerage and sanitary drainage utilities.

(5) Engineering consulting services by performing the necessary research, designing, local or international tendering as well as bid evaluation and construction supervision if required by the Governorates.

This organization was established along with the national decentralization policy proclaimed by Decree No. 43, 1979, to perform its advisory functions as listed above normally exerted by the consulting service organizations. The primary objective was to endorse the autonomy of the local governorate by transferring the administrative authority from the central government to the local governorate has not yet been fully achieved and major water supply and sewerage projects for local governorates are still dealt with through NOPWASD as the project executive organization.

NOPWASD is fully responsible for water supply and sewerage system construction projects in every governorates, dealing with planning, designing and construction supervision, including local and international tendering. After the completion of the system construction, however, such completed systems are placed under the control of the local governorates.

Ministry of Housing and Public Utilities

This Ministry is a key central agency which administers major construction works in Egypt including sewerage construction and administratively oversees NOPWASD and functions as a decision making body of public sector construction projects. The NOPWASD can not address itself to the sewerage development project unless this Ministry takes the final decision to initiate projects.

Ministry of Planning

This ministry, on the other hand, plays a key role in the selection of priority projects including sewerage development projects, in the light of national development plans in Egypt as proclaimed by the National Five-Year Plan. In other words, the final decision of Ministry of Housing and Public Utilities to implement a project is based on the priority accorded to the project by the Ministry of Planning.

Ministry of International Cooperation

This ministry is a coordinating body related to major public sector projects which require foreign technical and/or financial assistance. All foreign funding agencies or technical cooperation agencies are required to contact this ministry prior to engaging in projects.

Other Related Agencies

The Ministry of Finance provides the funds for the operation and maintenance, minor rehabilitation and extension works of public utilities systems including sewerage and sanitary drainage system of the local governorates.

The Ministry of Irrigation has an interest in sewerage development projects because irrigation canals should be protected from polluted discharges of wastewaters.

The Ministry of Health is concerned with the safeguarding the public health by setting the water quality discharge standard.

2.7.2 Local Level

The Governorate of Sharqiya is a local government agency responsible for local administration of Sharqiya region including sewerage system administration. The administrative area of Sharqiya Governorate is divided into 12 district areas called Markaz (city-center status) and one city, i.e., Marakaz of Zagaizig, Huseiniya, Kafr Saqr, Faqus, Abu Kebir, Abu Hammad, Ibrahimiya, Hihya, Diarb Nigm, Bilbeis, Minyet El Qamh, Mashtul El Soak, and Qenayat City. The office of each Markaz and the city has a sewerage control unit, as well as a water supply unit under the engineering department. In the governorate office located in Zagazig, the capital city of Sharqiya Governorate, there is a Section of Cities & Village Sewerage and Drainage which centrally controls the sewerage and drainage systems all over the administrative areas of the Governorate. This section is under the water supply & sewerage division which belongs to Housing Department. This Housing Department is directly controlled by Ministry of Housing and Public Utilities. The organization chart of the above sewerage related units is given by Figure 2.15.

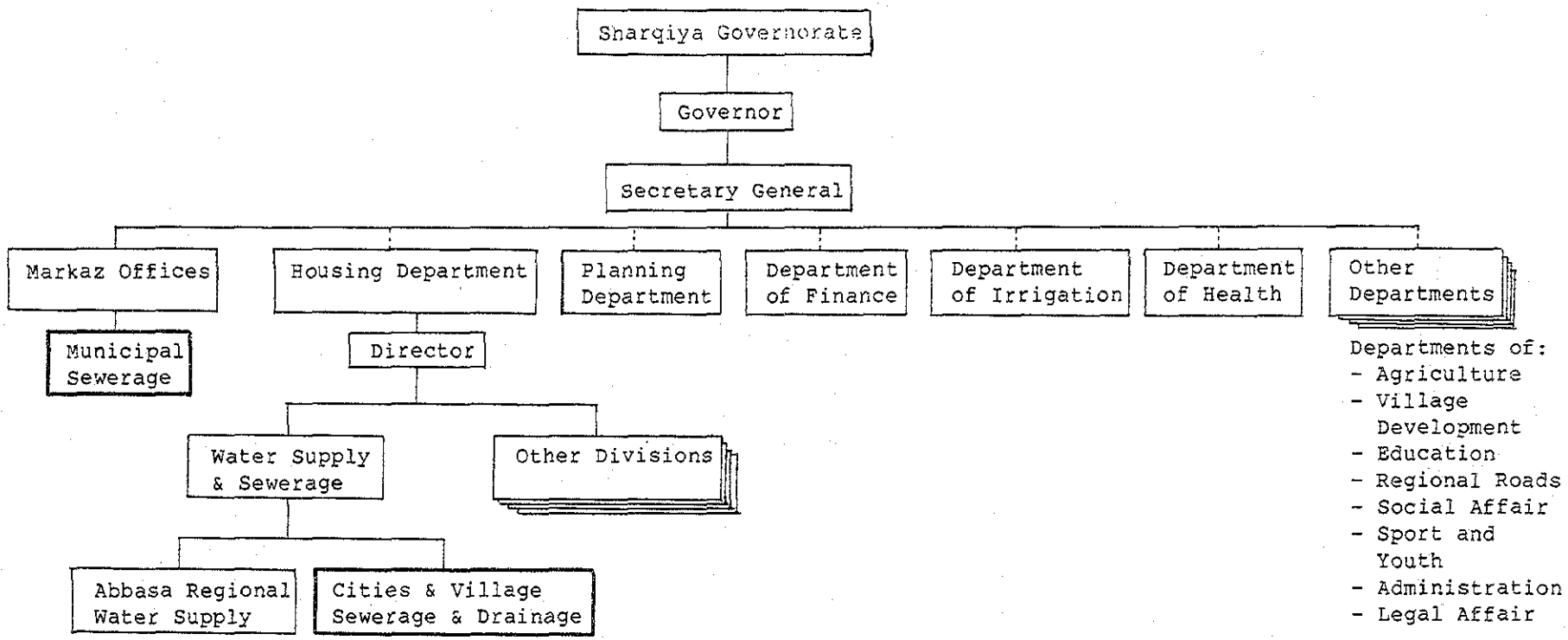
The Section of Cities & Village Sewerage & Drainage is responsible for planning, designing and construction of sewerage and sanitary drainage systems. At present, the staff of this section consists of one senior engineer (civil), two sub-engineers (civil and mechanical) and one foreman, who deal with several construction works of the sewerage utilities, including related designs.

The sewerage control units of each Markaz office is responsible mainly for the operation and maintenance including minor rehabilitation and extensions of the systems.

The staffing of the each sewerage control unit is dependent on the level of sewerage related facilities being operated and maintained, such as pump station, pipeline, and transh systems.

In general, the staffing is insufficient in terms of the number and qualification. Due to this shortage of skilled labor, preventive maintenance can not be adequately undertaken performed and as a result, these units are not able to do much more than responding to emergencies.

The organization charts of the units related to sewerage works in every Marakaz and the city are shown in Tables X-1 through X-13 in Appendix X. The organization chart of Marakaz and the present staffing is shown in Table 2.28.



Notes: (1) ▭ Sewerage Wroks Units

(2) Dashed lines show relations under direct control of respective Ministry of central government

Figure 2.15 Sewerage Works Organization in Sharqiya Governorate

Table 2.28 Existing Staff in All Sewerage Works Units

Markaz	Sewerage Unit	Engineer	Technician	Draftman	Skilled Labor	Common Labor	Clerk	Driver	Total
Zagazig	Pipeline	1	25	18	76	48	10	4	182
	Pump Station	10	29	-	-	74	-	-	113
	Treatment Plant	1	2	-	-	23	-	-	26
Huseiniya	Transh System	-	1	2	-	5	-	5	13
Kafr Saqr	Pipeline	2	-	2	-	10	-	-	14
	Pump Station	1	4	1	-	3	-	1	10
	Transh System	-	-	-	-	3	-	2	5
Faqus	Pipeline	1	1	-	1	10	-	-	13
	Pump Station		1	-	4	4	-	-	9
	Transh System	-	-	-	-	5	-	5	10
Abu Kebir	Pipeline	1	-	2	-	14	-	-	17
	Pump Station	1	-	2	-	12	-	-	15
	Transh System	-	-	-	-	4	-	4	8
Abu Hammad	Pipeline	-	1	-	-	23	-	-	24
	Pump Station	3	3	-	1	11	-	-	18
	Transh System	-	-	-	-	5	-	5	10
Ibrahimiya	Pipeline	-	1	-	-	5	-	-	6
	Pump Station	1	2	-	-	-	-	-	3
Hihiya	Pipeline	1	2	-	1	8	-	-	12
	Pump Station	3	1	-	-	15	-	-	19
	Transh System	-	-	-	-	5	-	5	10
Diarb Nigm	Pipeline	1	1	-	-	3	-	-	5
	Transh System	-	-	-	-	4	-	4	8
Bilbeis	Pipeline	1	6	-	13	25	-	-	45
	Pump Station		3	-	3	24	-	-	30
Minyet El Qamh	Pipeline	1	8	4	-	22	-	-	35
	Pump Station	5	16	-	-	21	-	-	42
	Transh System	-	-	-	-	5	1	5	11
Mashtul El Soak	Pipeline	1	1	-	-	2	-	-	4
	Transh System	-	-	---	-	3	-	3	6
Qenayat City	Pipeline	1	3	-	-	2	-	-	6
	Transh System	-	-	-	-	3	-	3	6
Governorate Office	Housing Department	3	-	1	-	-		-	4
Total		39	111	32	99	401	11	46	739

2.8 Water Supply Systems

2.8.1 General

The first modern water supply system in the Sharqiya Governorate was constructed in Zagazig City in 1909. This system took in water from the Muweis Canal and supplied settled water to the central part of the city through cast iron distribution pipelines that are still in use today. Water supply systems in Bilbeis and Minyet El Qamh were constructed in 1928, and Faqus in 1932. In addition, these of other cities were completed by 1954.

For isolated areas, where potable groundwater could be obtained, many rural water supply systems were constructed by the Housing Department of Sharqiya Govenorate from the early 1950s. At present, a total of 27,000 m^3/day of groundwater is supplied to about 802,000 people in 189 villages.

In order to supply as much potable water as possible to communities without their own water systems and/or appropriate water sources, the construction of Abbasa Regional Water Supply System (ARWSS) was completed and started operation in 1959 as one of the regional water supply systems planned by GOPW. In addition to this system, many groundwater pumping stations have been provided in the Abbasa system as supplementary facilities.

Consequently there are three categories of water supply system in the Governorate, namely city owned system, Housing Department system, and Abbasa system. An outline is given in Table 2.29.

At present, a total of 227,000 m^3/day of potable water is supplied to roughly 2.9 million people, which accounts for about 91 percent of the total population in the Governorate through these three water supply systems. These systems are operated and managed by the Sharqiya Governorate in line with the national policy of Decentralization.

Table 2.29 Outline of the Water Supply Systems in 1986

Area	System	City's Name or No. of Villages	Source	Production (m3/day)	Population(1,000) Served	Population(1,000) Total	Service Ratio(%)
Urban	City owned	Zagazig	Canal & D.W				
		Faqus	Canal				
		Abu Kebir	D.W				
		Ibrahimiya	"				
		Hihya	"				House connection 85
		Diarb Nigm	"				Standpipe 12
		Bilbeis	"				
		Mashtul El Soak	"				Unserved
		Minyet El Qamh	"				3
		Sub Total		84,976	607.0	620.7	
	ARWSS	Huseiniya	Canal & D.W				
		Kafr Saqr					
		Abu Hammad					
		Qenayat					
		Sub Total			85.0	90.8	
	Total				692.0	711.5	97
Rural	ARWSS	240 villages	Canal & D.W	114,739	1,464.0		H.C 9 S.P 80 U.S 11
	Housing Dept.	189 villages	D.W	27,211	802.0		
	Total	429 villages		141,940	2,266.0	2,542.8	89.0
Grand Total		13 cities and 429 villages		226,926	2,958.0	3,254.3	90.9

Note: Total number of villages in the Governorate is 460, and service ratio based on village number is 93%.
D.W is Deep Well in abbreviation.

2.8.2 Physical Systems

(1) City-owned Water Supply Systems

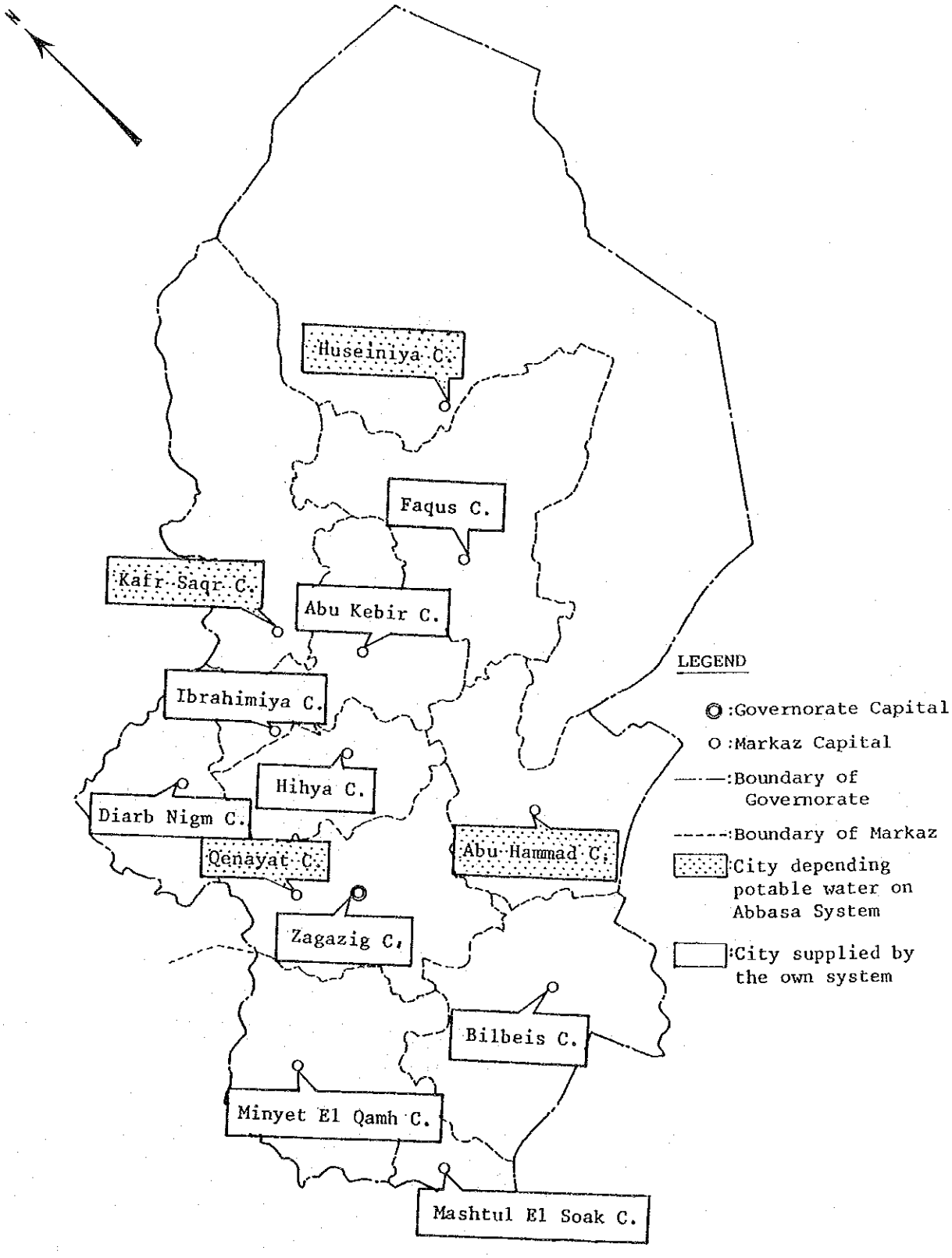
Of the thirteen cities in the Governorate, nine cities, namely Zagazig, Faqus, Abu Kebir, Ibrahimiya, Hihya, Diarb Nigm, Bilbeis, Minyet El Qamh, and Mashtul El Soak, have their own water sources and distribution pipe networks within their administrative areas.

The remaining four cities with smaller population than other cities are supplied with water by the Abbasa Regional Water Supply System. Three cities (Huseiniya, Kafr Saqr and Abu Hammad) have their own distribution pipelines and maintain them by their own staff, but the distribution network in Qenayat is maintained by the ARWSS.

Of the total population of 711,500 in the above thirteen cities, about 607,000 people reside in the nine cities with their own water systems, and 85,000 in the remaining four cities supplied by ARWSS. Zagazig and Faqus have water treatment plants taking raw water from the nearby canals diverted from the Nile River. The rest of the cities rely on deep wells, 50 to 70 m in depth. An outline of the systems are shown in Figure 2.16.

(2) Housing Department Water Supply System

The Housing Department presently owns and operates a total of 82 groundwater stations in seven Marakaz in the southern part of the Governorate. The total supply capacity of the stations is 27,211 m^3/day, covering 189 villages with the population of about 802,000. Groundwater is delivered through elevated resevoirs without chlorination. These systems were planned and constructed in the 1950's by the Housing Department financed by the national budget, before the ARWSS was constructed. Locations of ground water stations are illustrated in Figure 2.17.



Scale 1:500,000

Figure 2.16 Outline of Water Supply Systems

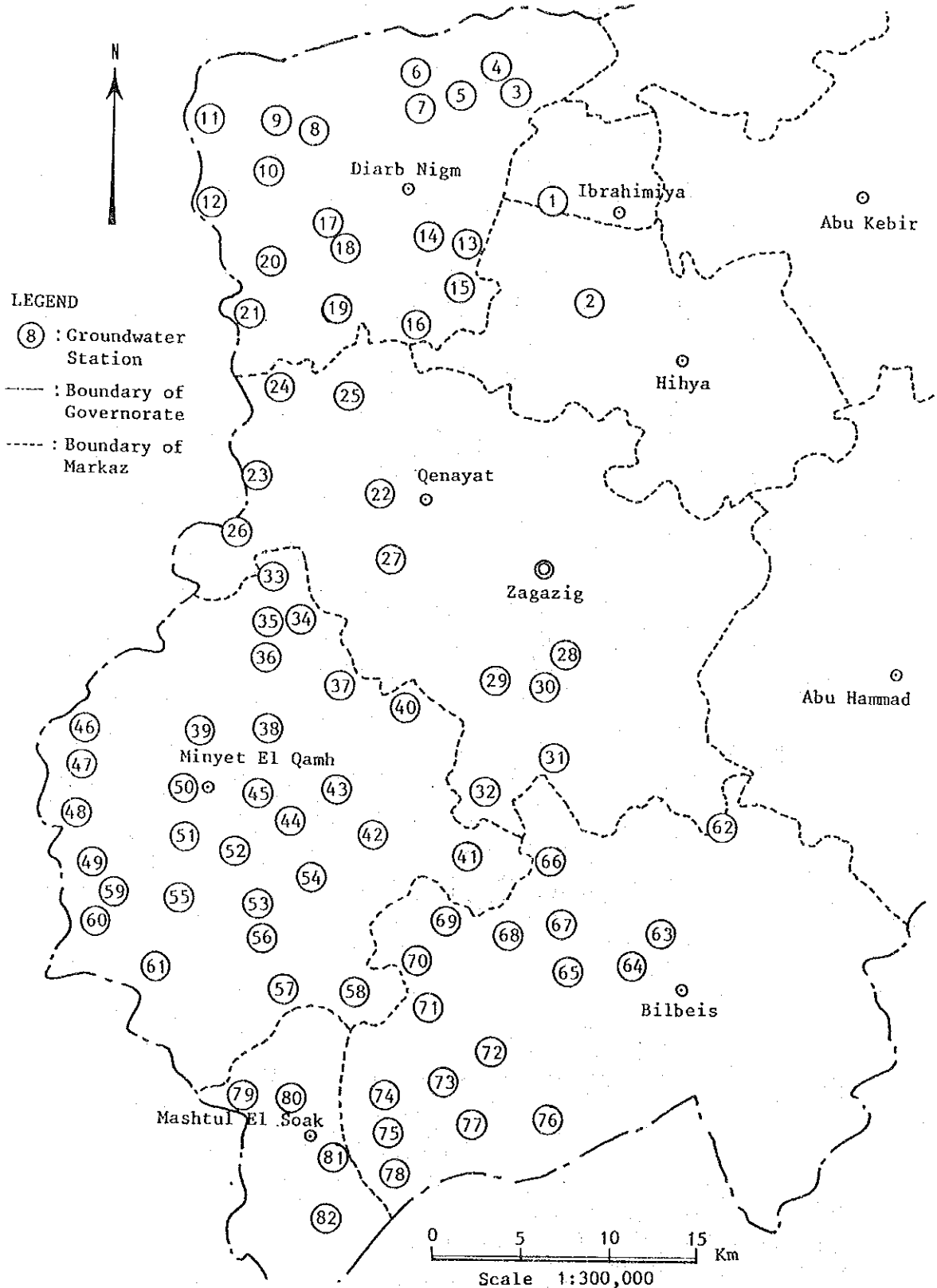


Figure 2.17 Locations of Groundwater Station

(3) Abbasa Regional Water Supply System

Abbasa Regional Water Supply System (ARWSS) started its services in 1959 as one of the GOPW's major regional water supply systems in Egypt aiming to supply potable water to municipalities without public water supply system, particularly in the northern part of the Governorate, where groundwater is not potable due to high salinity.

ARWSS comprises Abbasa water treatment plant, five booster stations, eighteen elevated reservoirs, and distribution mains. The raw water is taken from the Ismailiya Canal. The treatment process is the rapid sand filtration.

Water demand in the area has been increasing gradually and exceeded the original supply capacity, and as such, the system stopped to supply water to remote areas. Almost all the elevated tanks were not fully filled up due to the shortage of supplied water and low water pressure prevailing. The booster pumping stations have been out of operation.

The system is illustrated in Figure 2.18.

(4) Compact Units

To supply potable water to areas which are isolated from the Abbasa Plant, and where groundwater is not fit for everday use due to its salinity, several "Compact Units" have been operated in Huseiniya and Kafr Saqr Marakaz as supplementary facilities of the system. Their total capacity is about 4,800 m^3/day.

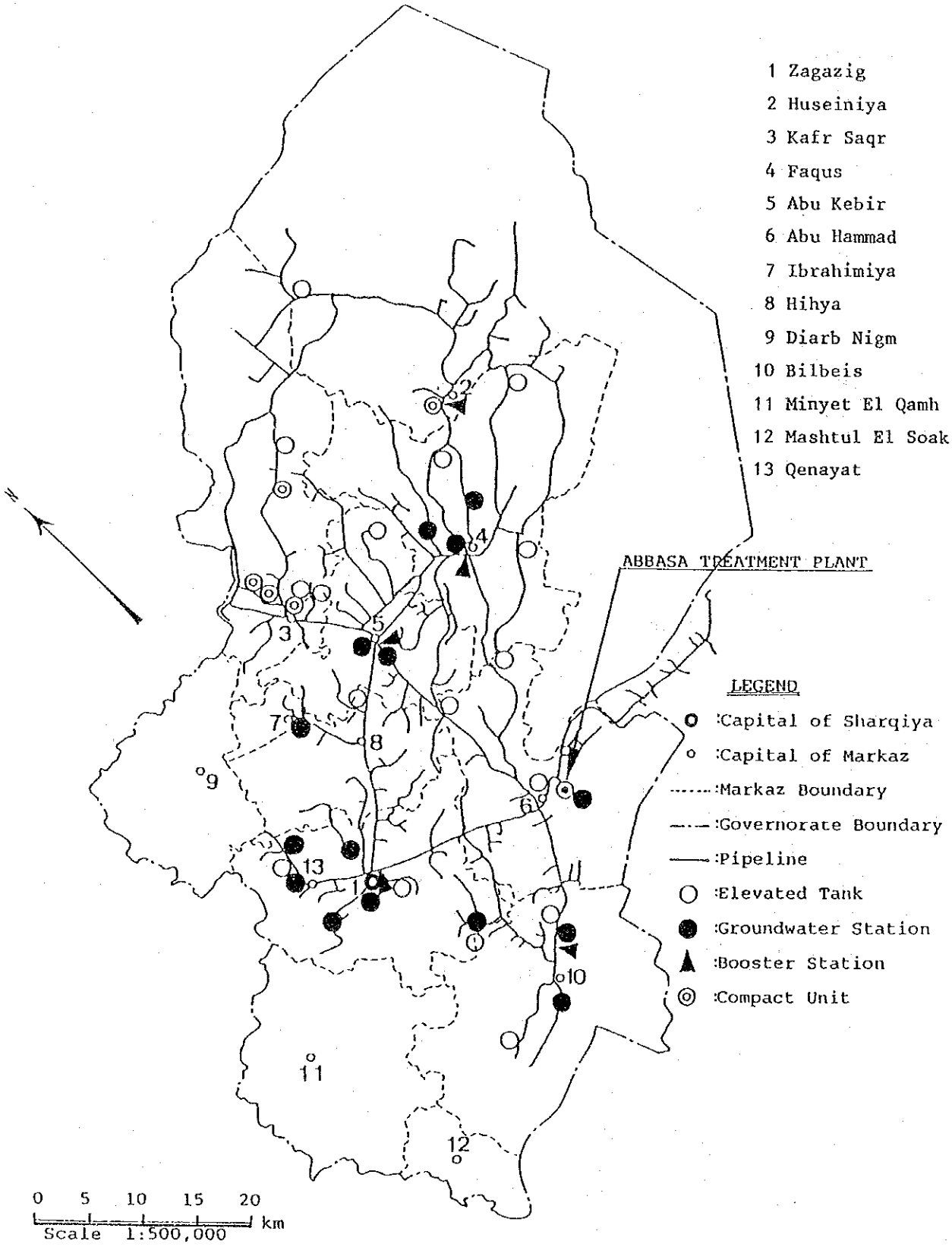


Figure 2.18 Abbasa Regional Water Supply System

2.8.3 Service Levels

(1) Service Ratio and Accessibility to Systems

Roughly 0.71 million or 23 percent of the Sharqiya's population live in the urban areas and the rest of 2,543 million in the rural areas, as of 1986. Water is supplied to users either through house connections or standpipes. In addition, indirect water supply is practiced through private water vendors who deliver water to isolated communities in Huseiniya and Kafr Saqr Marakaz.

In the urban areas, roughly 85 percent of population obtain water through privately installed house connections and 12 percent through standpipes, whereas 80 percent of residents rely on standpipes and 9 percent on house connections in rural areas in 1986.

Dwellers who are not supplied with piped water have been compelled to use qualitatively questionable water of shallow wells. This is considered to be the main reason for a number of waterborne disease incidents.

(2) Supply Quantity and Quality

The per capita water consumptions in the urban areas are larger than in the rural areas. Since the shortage of water supply is perennial, consumers who need more water are compelled to use shallow wells and/or canal water for washing clothes or kitchenware.

The water quality of public systems are acceptable, conforming to the drinking water quality standards of GOGCWS. Though residual chlorine is detected at the distribution mains just after the treatment plant, there is no residual chlorine at almost all taps. However, all fecal coli tests conducted during the water supply study showed negative results, while general bacterial tests indicated positive (lower than 10/ml).

(3) Pressures and Continuity of Supply

At present, the shortage of water supply has been very severe throughout the Governorate, due to insufficient capacities of supply systems, limited operating time of groundwater stations, especially in the Housing Department systems, and wastage in water use. Most water supply systems do not maintain continuous supply with appropriate pressure.

(4) Private Water Supplies

There are, at present, no private water supply systems to supply water to the public in the Governorate. Some non-domestic consumers, particularly in industrial processing and manufacturing fields, have their private water systems. For domestic use, roughly 730,000 people rely for their drinking water reqiurements on shallow wells, in many cases equipped with hand pumps.

2.8.4 Organization and Management

(1) City-owned Water Supply Systems

The municipalities which have their own water supply systems maintain engineering sections to manage the systems. Those supplied with the bulk water from the Abbasa system maintain only a section for the pipe network.

(2) Housing Department Water Supply Systems

The Housing Department was responsible in the 1950's for the extensive groundwater supply systems to improve the conditions in the rural areas. Presently, the control of this groundwater system is delegated to the mechanical and electrical division, but the system is conveniently called as "the Housing Department Water Supply System." This organization is in charge of groundwater supply and its development mostly in southern part of the Governorate where groundwater is still in good condition with low salinity.

(3) Abbasa Regional Water Supply System

The organization of the system comprises three functional units, namely administration and accounting, maintenance, and technical. The major works of the maintenance of all the distribution pipelines are undertaken by the technical division which controls eleven maintenance groups stationed in some Marakaz.

2.8.5 Long-Term Plan for Water Supply Development

(1) Target Year and Service Area

The target year for the long-term plan of the water supply system is set at 2005. The system is planned, when completed, to cover the administrative area of the Sharqiya Governorate, but excludes the area of Tenth of Ramadan.

(2) Planned Service Population

The future populations to be served by the system are projected as shown in Table 2.30. A total of 4,885,000 people, which is equal to the entire population, will be supplied with piped water by the year 2005.

Table 2.30 Served Population Estimated

(1,000 persons)

Area	1983	1985	1990	1995	2000	2005
Urban	602	651	776	946	1,122	1,320
Rural	1,720	1,835	2,151	2,509	3,081	3,565
Total	2,322	2,486	2,927	3,455	4,203	4,885

(3) Water Demands

The water consumptions are estimated for the following five classified categories: urban domestic, rural domestic, commercial, industrial, and institutional.

The water demands were projected on the assumptions that the present water losses of 30 to 40 percent will gradually decrease to 18 to 25 percent by 2005. The estimated maximum daily water demand is shown in Table 2.31.

Table 2.31 Maximum Daily Demand

(1,000 m^3/day)

Area	1983	1985	1990	1995	2000	2005
Urban	168	184	225	244	303	344
Rural	163	183	241	251	311	343
Total	331	367	466	495	614	687

(4) Supply Capacity Requirements

The future water supply capacity requirements, which were calculated by reduction of present capacity from the maximum daily demand, are 268,000 m^3/day by 1995 and 460,000 m^3/day by 2005, as shown in Table 2.32.

Table 2.32 Water Requirement to be Developed

(1,000 m^3/day)

Area	Existing Capacity (1983)	Future Demand (Daily Max.) (1995)	(2005)	Requirement to be Developed (by 1995)	(by 2005)
Urban	90	244	344	154	254
Rural	137	251	343	114	206
Total	227	495	687	268	460

(5) Long-term Development Plan

The water demand in 429 villages in 12 Marakaz is not high. The demand will be met by the groundwater except in the northern areas where the groundwater source is scarce. Figure 2.19 illustrates the water supply development plan in rural areas. Cities currently supplied by their own systems will be continuously supplied by the existing facilities, but cities with large demands and cities located in northern areas will be supplied by new treatment plants.

The future water supply development requires construction of new water treatment plants. The areas to be covered by the new treatment plants will be municipalities of the categories of D, M and N, as shown in Figures 2.19 and 2.21. Some municipalities belonging to category M will have their own sources and the future water demands in the case of city-owned water source will be supplemented by the new plant.

The existing groundwater stations will be used continuously in the future. In addition, new groundwater stations will be developed to meet increased demands for the coming years. The groundwater to be developed by 2005 is estimated at 151,200 m^3/day and 120 new groundwater stations will be constructed.

The water supply development schedule is shown in Figure 2.22 the construction costs estimated thereof are shown in Table 2.33.

Table 2.33 Construction Costs

	Item	Construction Cost
1)	Emergency Works	LE 11.8 Million
2)	New Kafr Saqr Treatment Plant	LE 13.7 Million
3)	New Northeast Treatment Plant	LE 18.2 Million
4)	New Zagazig Treatment Plant	LE 35.5 Million
5)	New Bilbeis Treatment Plant	LE 13.2 Million
6)	New booster pumping stations	LE 2.3 Million
7)	Transmission pipelines	LE 17.5 Million
8)	Extension of distribution pipelines	LE 43.4 Million
9)	New groundwater stations equipped with iron/manganese removal facility, 77 stations	LE 70.8 Million
10)	- ditto - without above facility, 35 stations	LE 20.4 Million
11)	Rehabilitation/replacement of existing groundwater stations, 140 stations	LE 60.9 Million
12)	Rehabilitation/replacement of existing pipelines	LE 22.3 Million
	Total Costs	LE 430.0 Million

Note: Cost are estimated at 1984 price.

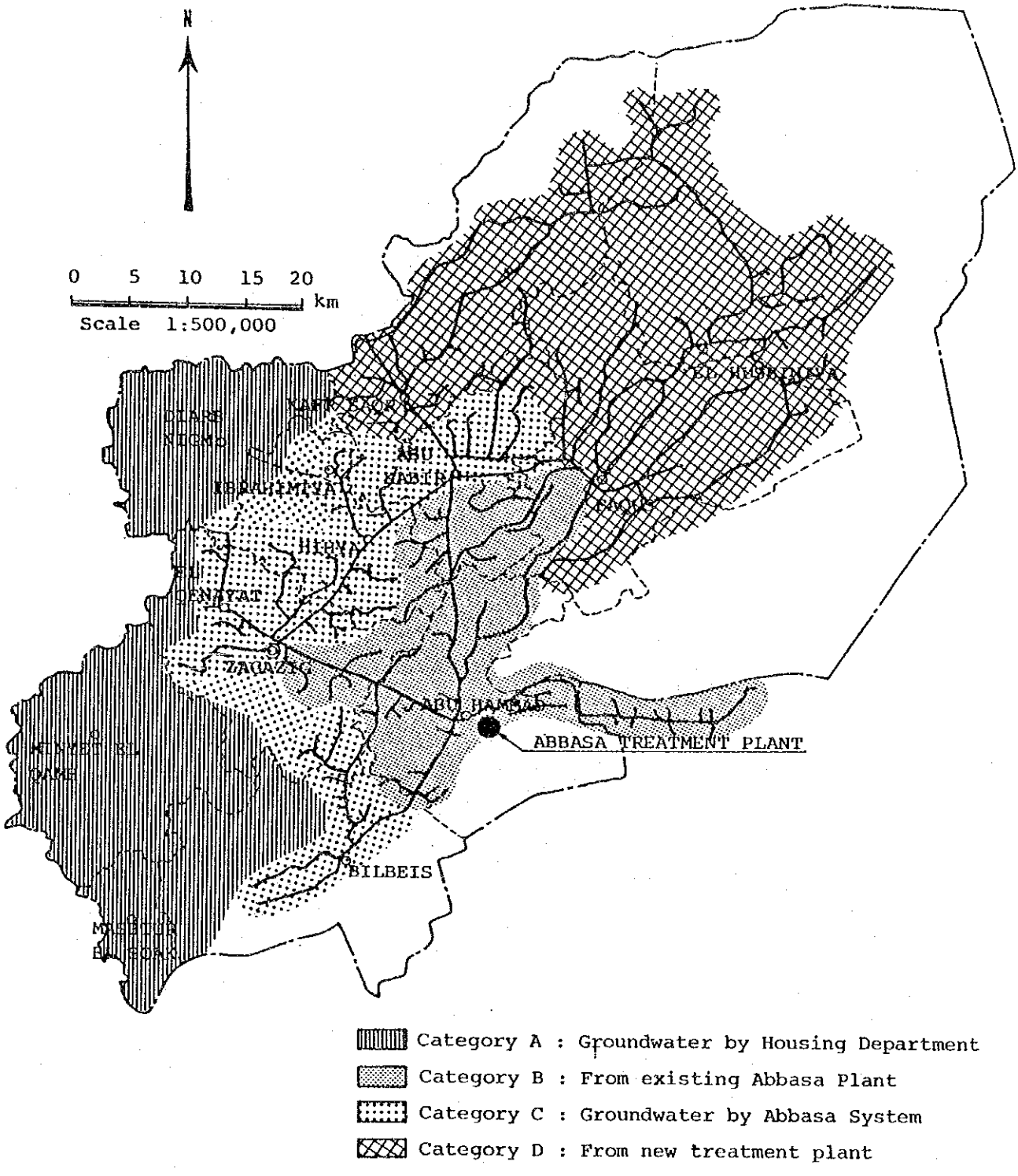


Figure 2.19 Future Water Supply Development Plan in Rural Area

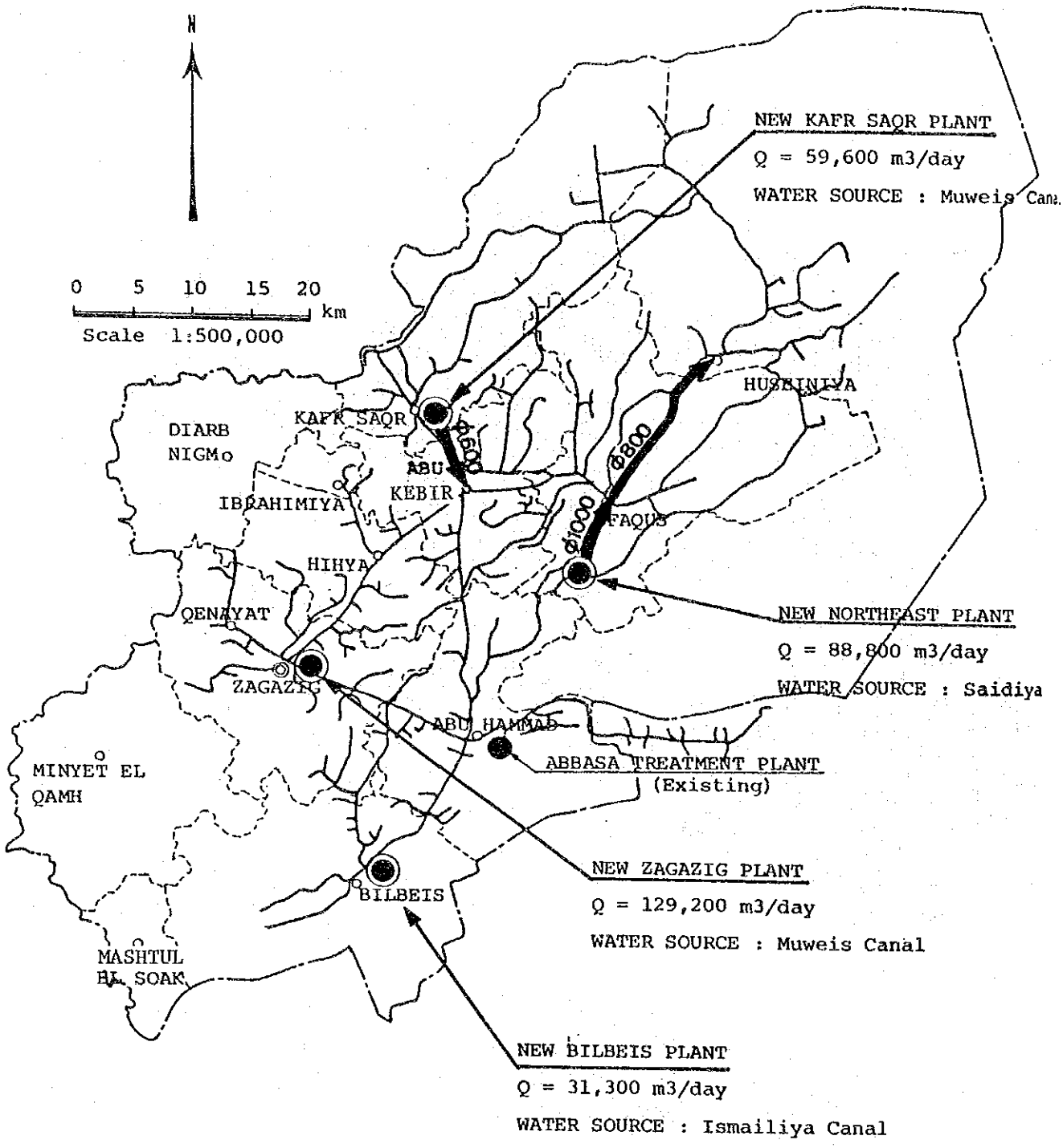


Figure 2.20 Plan of New Treatment Plant

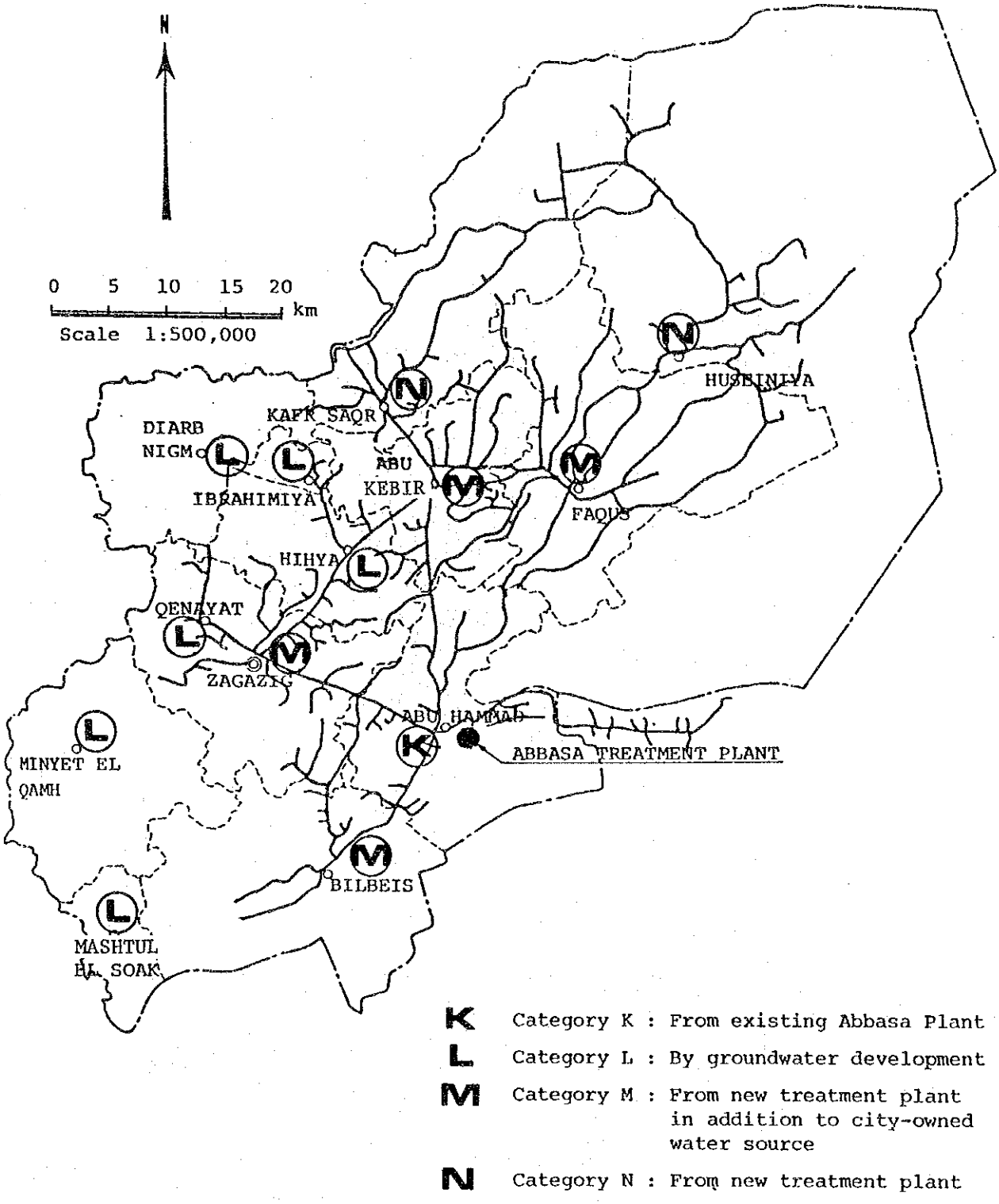


Figure 2.21 Future Water Supply Development Plan in Urban Municipalities

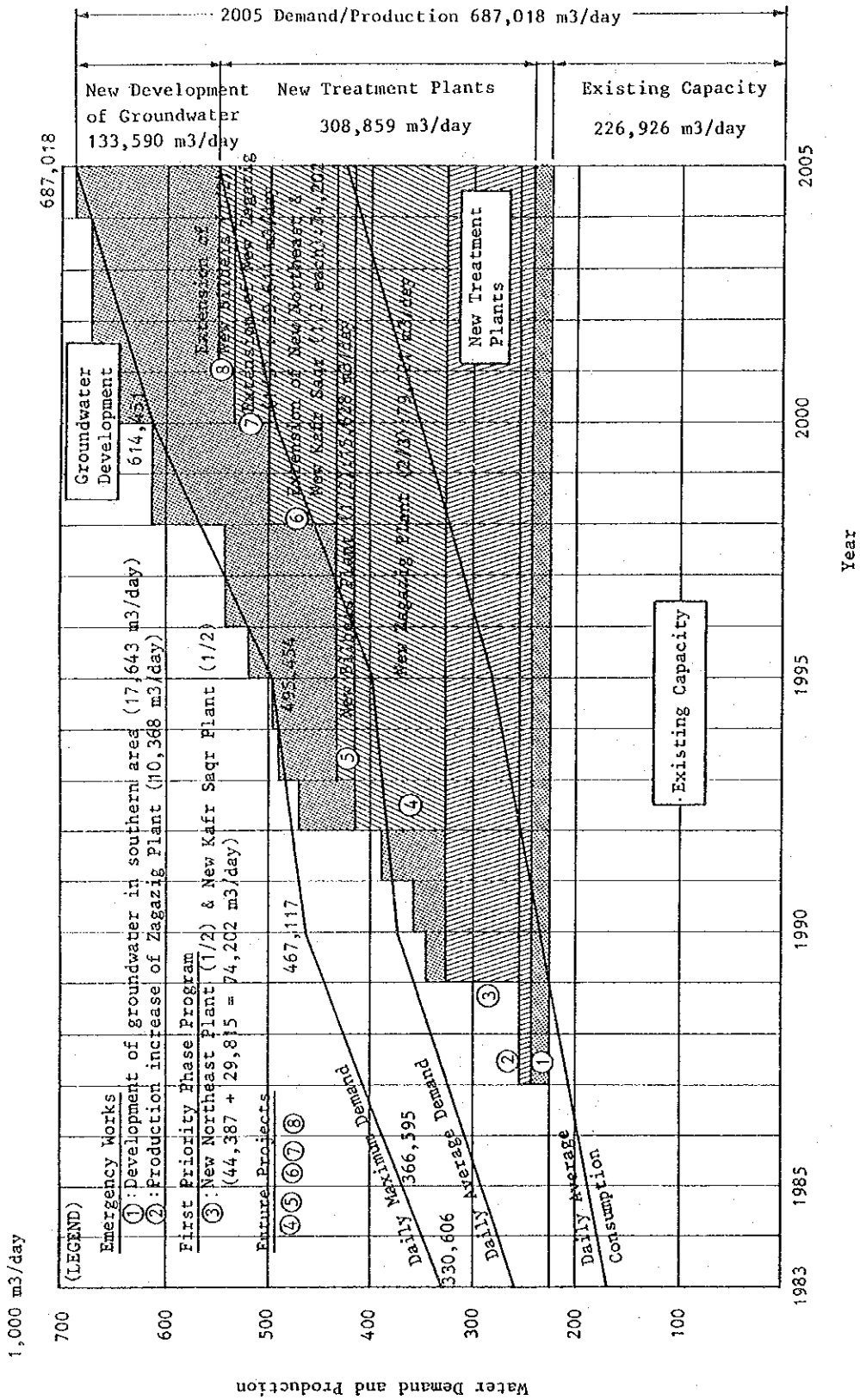


Figure 2.22 Water Supply Development Schedule

2.9 Wastewater Quantities and Qualities

2.9.1 Wastewater Quantities

Wastewater collected is the consumed water supply, though somewhat less than water consumption due to the losses for sprinkling, swiming pools, etc. As discussed in the Section 3.4, Chapter 3, these losses are reasonably assumed to be 10 percent of the consumption. Under the water supply feasibility study, the water consumption patterns were identified in three categories, namely i) urban domestic, ii) rural domestic, and iii) non-domestic including industrial, commercial and institutional waters. The domestic water consumption, both urban and rural, were further classified into several classes according to the levels of service and living standards. Per capita water consumption was estimated based on the classification. Per capita water consumption and per capita wastewater production rates calculated from the former are shown in the following table.

Table 2.34 Per Capita Domestic Water Consumption and Wastewater Production

Classification	Per Capita Water Consumption (lcd)*	Per Capita Wastewater Production (lcd)
Urban		
Class A	185	166.5
Class B	120	108.0
Class C1	90	81.0
Rural		
Class C1	90	81.0
Class C2	65	58.5
Class D	48	43.2

Note: * Per capita domestic water consumption was estimated by water supply feasibility study

Non-domestic water consumption was estimated, according to the aforementioned categories, and added to the domestic water consumption. Proportion of the non-domestic water to domestic water varies, according to the characteristics of each city (Ref. to Appendix-V Wastewater Quantities and Qualities). The present wastewater quantity in the Governorate was calculated by using domestic and non-domestic wastewater production and present population in each classification, to be 219,674 m^3/day on daily average basis.

This includes wastewater produced by the people who are not supplied their drinking water by the public water supply systems. An assumption was made that their per capita wastewater production rates are the same as Class D of the previous table. Wastewater quantities in each Markaz specified by urban and rural categories are shown in Table 2.35. The water supply feasibility study estimated the total water consumption and production capacity in 1985 to be 182,645 m^3/day and 227,000 m^3/day. Wastewater quantity of 219,674 m^3/day is considered close enough to these figures, taking into consideration the losses and the present unserved population which accounts for about 20 percent of the whole population.

Table 2.35 Wastewater Quantities in 1986

Markaz	Wastewater Quantities (m^3/ day) Urban	Rural
Zagazig	34,370	21,338
Huseiniya	2,011	12,923
Kafr Saqr	2,181	6,712
Faqus	6,026	16,968
Abu Kebir	8,618	7,487
Abu Hammad	2,746	9,721
Ibrahimiya	2,769	3,402
Hihya	3,311	5,681
Diarb Nigm	3,639	10,639
Bilbeis	12,063	13,943
Minyet El Qamh	5,692	17,396
Mashtul El Soak	3,243	3,473
Qenayat	3,322	-
Total	89,991	129,683

Of the total wastewater produced in the Governorate, 89,991 m^3 /day or 41 persent originates in urban areas, and 129,674 m^3 /day or 59 percent in rural areas.

2.9.2 Wastewater Quality

Water quality surveys were conducted during the course of the first and the second on-site survey periods for the long term and the first phase programs. Results of the water quality analysis of raw sewage and treated effluent characteristics are summarized as shown in Table 2.36. Five raw sewage grab samples from five major cities, namely Zagazig, Bilbeis, Minyet El Qamh, Abu Kebir and Faqus, were analysed during the first on-site survey. Ten samples each covering 24 hours were taken at two pumping stations, one in Bilbeis and another in Faqus, during the second on-site survey (see Appendices IV and V).

Biochemical oxygen demand (BOD) concentrations range from 350 to 900 mg/l, with a mean value of 501 mg/l. These are considered normal figures of raw sewage which is predominantly domestic in origin. Suspended solids (SS) concentrations range from 166 to 2,622 mg/l, with a mean value of 426 mg/l. These figures are very high, although SS concentrations in raw sewage in Egypt is, in general, higher than those in other countries. SS concentration of 2,622 mg/l recorded in Abu Kebir City is extraordinarily high, taking into consideration the results of the other water quality parameters. Therefore, this high figure is disregarded in calculating the average. For the development of the design basis, it is considered appropriate to use the results of the analyses, putting emphasis on the second survey.

A sample was taken in the effluent from the Zagazig sewage treatment plant. Comparing the figures in raw sewage and in effluent, some reductions are recognized in such items as SS, NH_4-N, BOD and COD. However, effluent quality neither meets the legal requirements nor satisfies the standards which are normally expected for secondary treatment.

Table 2.36 Wastewater Quality

Item	First Analysis							Second Analysis**		
	Zagazig		Bilbeis	Minyet El Qamh	Abu Kebir	Faqus	Average Raw Sewege	Bilbeis	Faqus	Average 1st and 2nd Analyses
	effl.*	raw								
pH	7.4	6.9	6.9	7.4	6.9	7.1	7.0	7.0	7.5	7.2
Temperature (°C)	26	26	25	26	26	26	26	17.4	17.8	
Dissolved Solids	1,140	1,189	1,016	694	1,788	1,428	1,223	n.a.	n.a.	
Suspended Solids	122	342	364	166	2,622	1,014	902 (472)	509	297	426
NH_4-N	15	25	30	20	40	30	29	30	32	30
NO_2-N	-	-	-	-	-	-	-	-	-	-
NO_3-N	-	-	-	-	-	-	-	-	-	-
BOD	350	500	610	440	900	680	626	500	376	501
COD-Mn	82	170	220	110	420	210	226	183	88	166
Cl^-	240	264	168	164	460	336	278	n.a.	n.a.	
Total Alkalinity	576	580	704	564	760	728	667	n.a.	n.a.	
Total-P	10	12	18	9	22	10	14	n.a.	n.a.	

Note: Units are mg/l unless otherwise indicated.

( ) in Suspended Solids indicates average of 5 samples except for 2,622 mg/l.

* is effluent from sewage treatement plant.

** Figures are average of ten samples taken during 24 hours.

n.a. means not analysed.

2.10 Existing Sewerage Systems

2.10.1 General

Presently, all the thirteen cities except Huseiniya City in the Governorate have sewerage systems, but only Zagazig has a sewage treatment plant (See Appendix-VI, Volume Three). As shown in the following table, approximately 409,300 or about 57.5 percent of the urban population of 711,500 are served by the sewerage system.

Table 2.37 Population Served by Sewerage Systems

Markaz	Population Total	Population Urban	Served Population	Service Ratio(%)
Zagazig*	663,900	245,500	201,300	82
Bilbeis**	369,900	96,500	60,000	62
Abu Kebir	216,300	69,500	52,100	75
Faqus	381,300	48,600	12,100	25
Minyet El Qamh	387,000	45,900	36,700	80
Total(5 cities)	2,018,400	506,000	362,200	71.6
Hihya	140,700	29,300	5,900	20
Qenayat	29,400	29,400	600	2
Mashtul El Soak	96,800	28,700	7,200	25
Ibrahimiya	91,200	24,500	6,100	25
Diarb Nigm	240,800	32,200	9,700	30
Abu Hammad	214,900	24,300	6,000	25
Huseiniya	271,200	17,800	0	0
Kafr Saqr	150,900	19,300	11,600	60
Total 8(cities)	1,235,900	205,500	47,100	22.9
Grand Total	3,254,300	711,500	409,300	57.5

Note: * Average quantity of sewage 46,600 m^3/day

** Average quantity of sewage 10,368 m^3/day

Service ratios are calculated by served population/urban population

2.10.2 General Characteristics of the Existing Systems

As can be seen from the previous table, the sewerage service ratios in the five cities are generally high, more than 70% on average, and those in small cities reach around 20%. This tendency reflects a fact that the medium size cities have a longer history of sewerage systems. For instance, the sewerage system in Zagazig City was constructed some 50 years ago, and that of most of the small cities commenced construction only a few years ago. Interviews with engineers in charge of sewerage in each city revealed a noteworthy fact that there are no major problems in operation and maintenance of the system. Since one existing sewage treatment plant in Zagazig is obsolete and no treatment facilities are provided in the other cities, the need for a treatment plant is strongly recognized by them.

There are no distinctive features in topography in the region, and terrain is generally flat. A number of pumping stations are provided in sewer networks. These pumping stations discharge sewage waters to the nearby agricultural drains without any treatment causing water pollution problems. In some cases, when canal water is inadequate, drain water is pumped up to the canal. This once caused severe pollution in the canal water in Faqus City used for potable water, and water supply was stopped for two years. In the north-eastern part of the Governorate where canal water is inadequate, groundwater contains high salinity, and high groundwater level prevents usage of transh system, construction of the sewerage system in parallel with provision of piped water supply system is most desirable.

In unsewered areas, both in the cities and in the villages, transh systems are commonly used. Sewage penetrates into soils from transhes causing pollution in the underlying groundwater. Sludges removed by vacuum cars from the transhes are also dumped into the drains. This causes not only water pollution problems in the drains, but also results in high operation and maintenance cost for the frequent removals required particularly where the groundwater level is high.

A need to keep canal water clean is well understood by everybody. No wastewater is discharged into the canals. On the other hand, drains receiving urban and rural wastes are badly contaminated. Law 48/82 stipulates water quality standards for discharge to the drain. However, these standards have never been met. Dumping of sludges and sewages from transhes, and discharging of wastewaters collected by pipe networks without any treatment are common practice all over the Governorate. This is in violation of the legal requirements. Provision of the treatment facilities for both public sewerage system and individual transh system is of urgent necessity.

Clay pipes are commonly used for sewer. Minimum covering depth is about 40 cm with special protection by concrete encasement. PVC pipes have also come into use recently.

Circular type pump pits are commonly used by many pumping stations. Diesel engine driven pumps are widely used for on-duty and standby purposes together with electric motor driven pumps. A diesel engine generator was equipped in one pumping station in Zagazig City for emergency use.

2.10.3 Sewerage System in Five Medium Cities

(1) Zagazig

The sewerage system in use in Zagazig City includes conventional gravity sewers, pumping stations and sewage treatment works. Historically, the construction of the original sewerage system started in the late 1930's. The original system comprised a sewer network, pumping stations and a sewage treatment plant, with the scale smaller than the present system. As the urban areas of the City gradually expanded, the sewers have also been extended to meet the requirements.

1) Sewers

As shown in Figure 2.23, the existing gravity sewer pipes cover most of the built-up urban areas of the City and serve about 80 percent of the total population. The sewage from houses is first led to an inspection chamber provided in front of each house, and then flows down to the nearby sewerage manholes through house connection. The branches, laterals and main sewers range from 7 to 36 in. in diameter with a total length of roughly 40,000 m. The pipe materials are clay, asbestos cement and cast iron and in general, concrete pipes are not used. The sizes, pipe lengths, materials and construction years of the sewers are tabulated in the following table.

Table 2.38 Existing Sewers, Zagazig City

Diameter		Material	Length (m)	Construction Year
Inch	mm			
36	900	Cast Iron	150	1938
30	750	Cast Iron	900	1938
24	600	Clay	100	1938
22	550	Cast Iron	600	1940
18	450	Clay	1,500	1945
15	375	Cast Iron	300	1945
12	300	Clay	2,500	1955 - 60
12	300	A. C. P.	1,000	1979
9	225	Clay	12,000	1955 - 60
9 - 7*	225 - 175	Clay	20,000	1938 - 80
36 - 7	900 - 175		39,050	1938 - 80

(Note) Data Source: Sanitary Drainage Dept. of Zagazig city.
* : All branches from main to housing.

2) Pumping Stations

Because of the flat terrain in the area, pumping stations are installed to lift the sewage to continue onward gravity flows to the sewage treatment plant. At present, a total of twelve pumping stations are in operation, of which nine are public and three are private, and three other pumping stations are under construction. Of the existing pumping stations, four major stations are discharging the collected sewage either directly to drains or to the sewage treatment plant. As indicated in Figure 2.23, two major stations are used in series to convey the sewage to the treatment plant, while two other stations, by-pass the plant and discharge directly to the drains without providing any treatment.

As the old Abu Khalil pumping station became obsolete and overloaded, a new pumping station was constructed by NOPWASD in 1980 to cater to the increased sewage flow, and since then, the old station has been out of operation but kept reserve for emergency use. The new station, located at the central part of the city close to the railway station, receives most of the sewage from the city through a main gravity sewer 36" in diameter and discharges through a 24" diameter pressure pipe to the sewage treatment plant about 2 km to the southeast.

The new station has now 5 sewage pumps, of which 2 pumps are being operated for 24 hours. The pumps, with a capacity of 120 l/sec each, are equiped with an electric motor of 160 kVA. In case of electric failure or other emergencies, a diesel generator with a capacity of 650 kVA is to be installed as a standing to avoid any interruption of the pump operation.

The sewage flows into the grit chamber and then screened by a coarse screen prior to being pumped up. The grit chamber and screen are supposedly cleaned once every two days.

3) Sewage Treatment Works

The Main Sewage Treatment Plant, constructed in 1938, provides secondary treatment based on the oxidation ditch process and trickling filters before discharging the sewage into the nearby drain.

The original plant consists of i) inlet facilities, ii) primary sedimentation tanks, iii) oxidation ditches, iv) trickling filters, v) final sedimentation tanks, and vi) sludge drying beds, together with auxiliary facilities.

Detailed information with regard to the design basis for the plant are not available to review the function of the plant, however, because of the obsolete nature of the facilities and operation and maintenance problems, the plant capacity does not seem to be fully utilized. The old facilities have been out of use except those for sedimentation, and desludging has not been practiced in a proper manner. Trickling filters are completely inoperational and so too are the oxidation ditches. Presently, more than half of the collected sewage by-passes to the open channels near the plant and is directly discharged to a drain.

Flow meters to measure the actual sewage discharge rates from the plant are not provided in the plant: however, based on the pump operating capacities of Abu Khalil and other stations which directly convey sewage to the treatment plant, it is roughly estimated that an average of 46,600 m3/day sewage effluent is being discharged to the drain. The water quality survey conducted under the present study revealed that the average quality of the plant effluent was 350 mg/l in terms of BOD, while SS was 122 mg/l. Since the dry weather flow rate from the plant is estimated to be 46,600 m3/day, the organic loads discharged to the drain would be almost 16,310 kg/day in terms of BOD.

In order to improve the deteriorating conditions of the existing treatment plant, and due to its obsolescense, NOPWASD planned to construct a new sewage treatment plant close to the old plant. The new plant, which is to employ the conventional activated sludge process, consists of :

- headworks
- 4 circular primary sedimentation tanks
- 4 aeration tanks with surface aerators
- 6 circular final sedimentation tanks
- 20 sludge drying sand beds
- sludge thickening and other facilities
- chlorinators
- other auxiliary facilities

The plant layout and hydraulic profile are shown in Figures 2.24 and 2.25 and in Appendix-VI, Volume Three.

Following the plan and design of the new treatment plant, the construction of civil works is now in progress, and if the work proceeds as scheduled, about two thirds of the entire system is expected to be completed within a few years from now. The plant, when completed, will have a total average treatment capacity of 195,750 m^3/day.

The excess sludge will not be treated but directly dosed on the sludge drying beds. More details of both old and new treatment plant facilities are shown in Apendix-VI, Volume Three.

4) Operation and Maintenance

The sewerage facilities have been maintained by the Utilities Division of the Engineering Department of Zagazig City, under the Chief Engineer's control. The Chief Engineer is assisted by a sub-chief Engineer for actual execution of the work. The Utilities Division is divided into two Sections, viz., the Sewerage Section and the Water Supply Section. The Sewerage Section is divided into three units on the basis of the type of work, viz., pipeworks, pumping station and treatment plant work units. Currently, a total of about 160 personnel are attached to the Pipeworks Unit, comprising 26 engineers and technicians, 14 administrative staff for store-keeping, gardening, automobiles, etc. for daytime duty, and about 120 labors for maintenance work. Laborers are primarily involved in pipe maintenance and pipe construction as may be required, though the primary duty is the cleaning of the existing sewer pipes in its entirety once every three months, working mainly at night for the period of a week at a time.

Approximately 110 personnel are currently working in the pump station unit, comprising 49 engineers and technicians with 15 laborers working under them, exclusively on daytime duty, and about 60 persons on a three-shift working schedule. Three engineers and technicians, with about 20 laborers are stationed at the sewage treatment plant working on the day-to-day operation and maintenance of the plant.

(2) Bilbeis

Figure 2.26 shows the main features of the sanitary sewerage system in Bilbeis City, which covers roughly 60 percent of the total population of the City. The sewage from residences, commercial areas and other sources are collected through house connections, branches, laterals, mains and through three sewage pumping stations, to be eventually disposed of to drains. The present sewerage service area is divided into three sewerage districts, based on the topography, road network and other physical and development conditions. The sewage flowing into terminal stations are discharged to the drains after being subjected to degritting and screening only.

The sewer reticulation, comprising of pipes of 6" to 13" in dia. have been laid in the 1930s for the purpose of lowering the high groundwater elevations in the area. The sewage from the pumping stations is sent to the drain through pressure pipelines of 8" dia.

Of the three existing sewage pumping stations, No. 1 station, or Council Office station, located at the site of the Municipal Office, receives sewage flows mainly from the northeastern portion of the City and sends it through an 8" dia. pressure pipeline to the drain about 1.5 km away. The No. 1 station has two vertical motor-driven sewage pumps, each having a discharge capacity of 20 l/sec, or 1.2 m^3/hr. Both pumps are reported to have been operating for over 8 hours a day. The substructure of the station is a circular reinforced concrete well, which is being separated into dry and wet wells. The operational conditions of the station are said to be satisfactory in general, according to the City.

No. 2 pumping station or, Secondary Pumping Station, is situated in the central part of the City. Presently, two 6" dia. sewage pumps of 45 l/sec capacity have been in operation alternately over 18 hours a day, on an average. The inlet gravity sewer is an 8" clay pipe. It is planned that an additional 45 l/sec capacity pump will be provided in the future when the sewage inflows increase. The station effluent, after receiving degritting and screening only, is sent to the drain through an 8" asbestos cement pressure pipeline.

No. 3 pumping station, located in the southwestern part of the City, has two 6" dia. sewage pumps with a capacity of 45 l/sec, each being operated for 18 hours a day. The sewage collected through the gravity sewers flows into the pumping station through a 12" dia. inlet clay pipe and is sent to the drain through a 6" dia. asbestos cement pressure pipe after degritting and screening.

The Sewerage Section of the City is responsible for the construction, operation and maintenance of the sewerage system. At present, a total of 75 personnel are on duty for the sewerage system management, including engineers, technicians and laborers. At each pumping station, about 10 operational staff members, including technicians, are available. About 45 staff members are attached to the operation and maintenance of the some network.

The existing sewerage system being managed by the City may become inadequate to serve the growing population in the near future. A comprehensive sewerage planning is now under consideration aimed at providing a modern sewerage system to cover the entire urbanized area of the City. At present, all domestic and commercial wastes are discharged directly to drains. The pollutant loads discharged to the drain are eventually transported to the Bahr El Bakar Drain. A pollution survey conducted under the present study confirmed that the pollutant loads imposed on the drain by the wastewater is approximately 6,322 kg BOD/day, having an average BOD concentration of 610 mg/l, and this is one of the major causes of the water pollution in the drain.

(3) Abu Kebir

The City of Abu Kebir with a population of about 69,500 is located approximately 30 km northeast of Zagazig City. The original sewerage system was constructed in the 1970s for the purpose of lowering the groundwater levels in the area, but this was later converted to a sanitary sewerage after the groundwater elevations of the area were considerably lowered. As of 1987, the existing sewer networks cover roughly 75 percent of the City's urban population.

As shown in Figure 2.27, the present sewerage system comprises of gravity sewer networks and three sewage pumping stations with pressure outfall pipelines. From the pumping stations, collected sewage is conveyed through the outfall pipelines to the branch of the Bahr El Bakar Drain. Some pertinent data of the pumping stations are shown in the following table.

Table 2.39 Pumping Stations in Abu Kebir

Name	No.of Pump	Average Capacity	Design Capacity	Drain
Said Zagloal	2	60 l/s	140 l/s	Berk
Abu Awad	2	60 l/s	140 l/s	El-Madyna
Manshyat Salh	2	60 l/s	140 l/s	

Source: Sharqiya Governorate

The sewage flows into the influent chamber and receives degritting and screening prior to pumping up to the pressure outfall pipeline. The Abu Awad Station was constructed in 1979, whereas Said Zagloal Station constructed in 1980. Manshyat Salh started operations in 1981. The construction of the fourth pumping station started in 1986 and the work is in progress as of mid-1987. The pressure outfall asbestos cement pipelines from the pumping stations range from 8" to 12" in diameter.

The sewerage system is managed by the Sewerage Section, with the assistance of the Housing Department of the Governorate. The Section now has a total of about 40 personnel, one engineer and two draftmen for pumping stations, one engineer and two draftmen for pipe works and 26 laborers for sewer and pumping station operation and maintenance work.

According to the City officials, the operation and maintenance of the sewer pipes are less problematic than the pumping stations. In view of the present conditions of the system, 2 or 3 more pumping stations are needed to meet the ever-increasing demand for safe discharge of the sewage.

(4) Faqus

The City started the construction of the original drainage system for the purpose of lowering the groundwater table in the 1970s and since then, a sewer network and a sewage pumping station have come in operation, serving about 25 percent of the City population.

The sewer pipes, mostly made of clay and ranging from 6" to 10" in dia., convey the sewage to the pumping station. The sewage is then further sent to the outfall through a pressure pipeline located near the slaughter house.

The sewage pumping station has been in operation since its construction in 1973. The station has two sewage pumping units, but they are used, alternately. The 6" dia. electric motor driven sewage pump has a capacity of 30 l/sec. The average period of operation is 12 hours a day. The sewage, after receiving degritting and screening, flows down to the Bahr El-Bakar Drain.

The pressure outfall pipe of 6" dia. asbestos cement pipe was first laid in 1973, and in 1982, an additional 12" dia. clay pipe was laid along the initial pipeline, to cater to the increased discharge of sewage from the tributary.

The layout of the sewerage system is shown in Figure 2.28.

The operation and maintenance of the existing sewerage sytem is the responsibility of the Sewerage Section.

(5) Minyet El Qamh

Historically, the City's existing sanitary sewerage facilities were constructed in the 1950s for the purpose of lowering the high groundwater table in the area. This system was to collect groundwater through manholes constructed with perforated walls that allow the infiltration of water.

The water was then led through the pipelines that were corrected and sealed by ordinary watertight joints to the terminal pumping stations for final discharge to the drains. At the time, most of the wastewater from houses and shops were directly discharged to underground or nearby drains, causing the groundwater table to rise.

After the system was completed and put into operation, however, the groundwater levels gradually subsided and the wastewater from houses were connected to the system to convert the system to a sanitary sewerage system. The perforated manhole walls were then plastered by mortar and made water tight to prevent further groundwater infiltration. Presently, the groundwater elevations of the area are, in general, low as had been intended.

The existing sewerage system has been gradually extended from the initial facilities. As shown in Figure 2.29, the sewer networks cover approximately 80 perctnt of the City's population. The sewers, which are mostly clay pipes ranging between 7 and 10" in dia., collect the sewage from through house connection, and convey it to the three pumping stations. Each house or apartment complex has an inspection chamber through which the sewage is led to the nearby manhole through the house connection pipe.

No. 1 and No. 2 sewage pumping stations receive sewage mainly from the central part of the city, while No. 3 receives sewage from the areas west of the railway line. No. 1 station or Old Hussan El Banua pumping station, is provided with 3 electric motor driven pumps and one diesel engine driven pump with the capacity of 40 l/sec. Any one pump is in use for over 20 hours a day. No. 2 station, or Gerges El Yas station, has 3 electric motor driven pump units and one diesel engine driven pump, each having a capacity of 40 l/sec. Motor/engine output is 37 kW or 50 HP. This station was constructed in 1976. No. 3 station was constructed in 1982 and provided with one electric motor driven pump and one diesel engine driven pump with the capacity of 25 l/sec. The pumps are put in operation alternately for over 20 hours a day.

The operation and maintenance of the sewerage system have been the responsibility of the Sewerage Section. Currently, one engineer, 22 laborers and 8 technicians are attached to the pipeworks, and 5 engineers, 16 technicians and 21 laborers are assigned to the pump station operation and maintenance works.

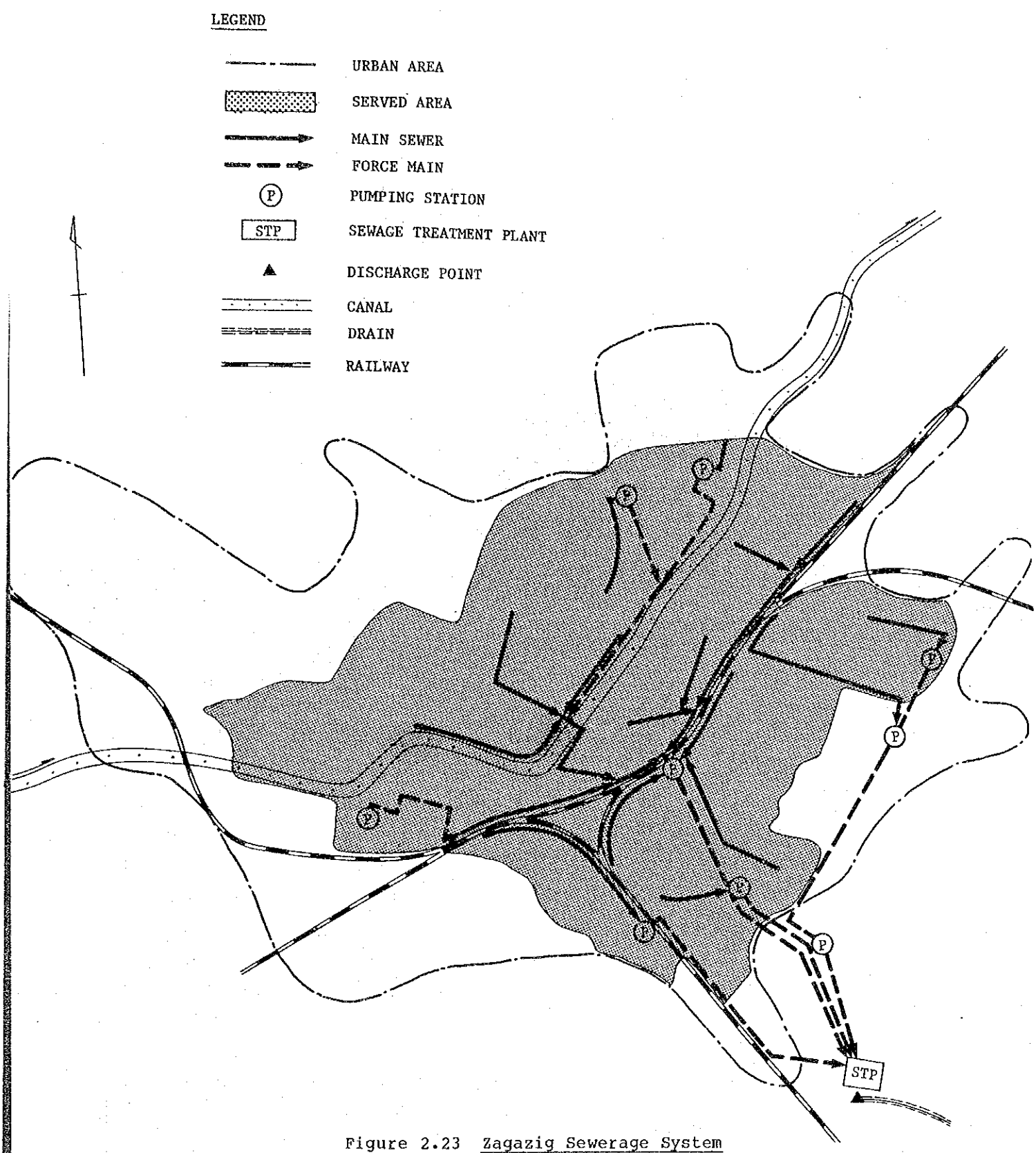


Figure 2.23 Zagazig Sewerage System

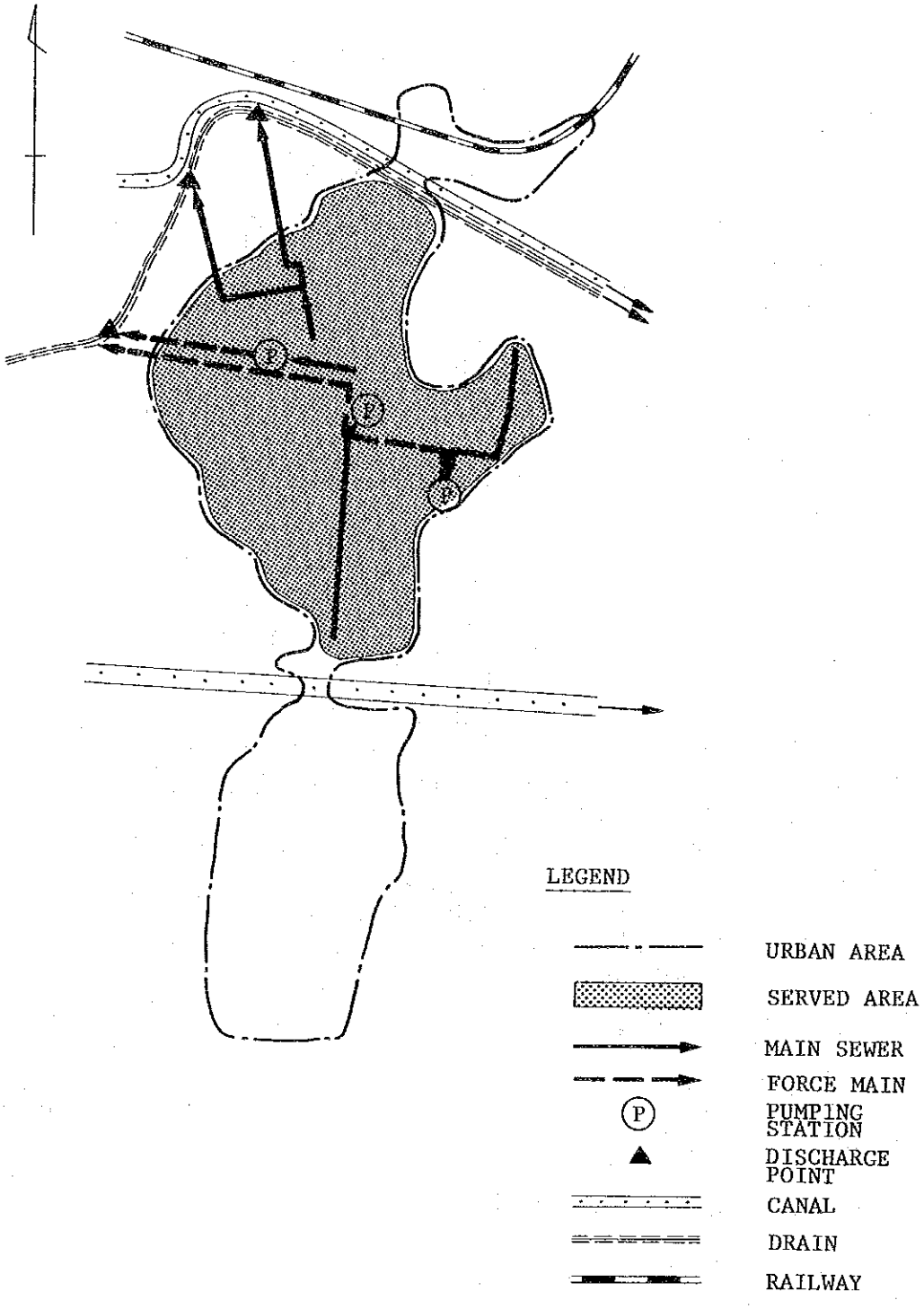


Figure 2.26 Bilbeis Sewerage System

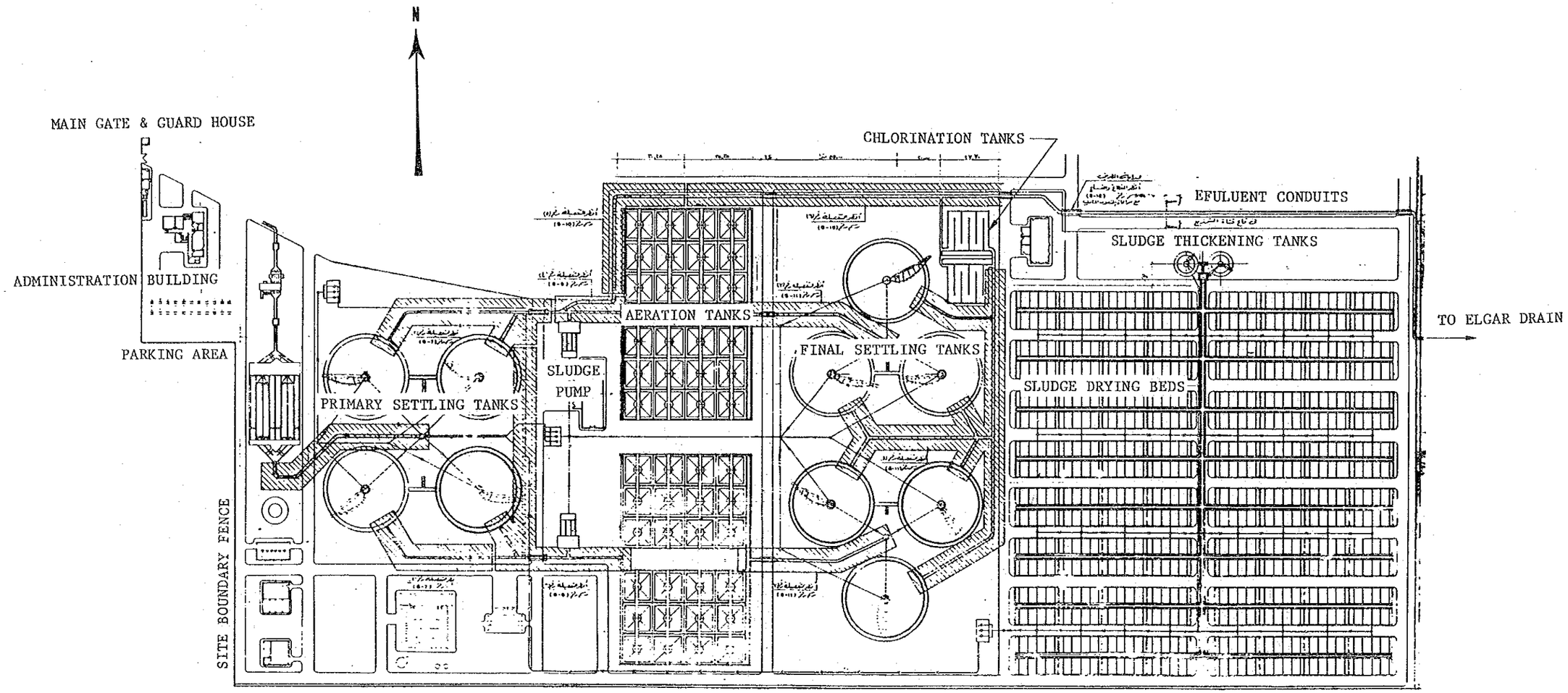


Figure 2.24 General Plan of Zagazig New STP

FEASIBILITY STUDY ON SHARQIYA SEWERAGE SYSTEM	DATE SEP. 1986	JICA
ZAGAZIG NEW STP GENERAL LAYOUT PLAN	SCALE 1 1,000	DRAWING NO.

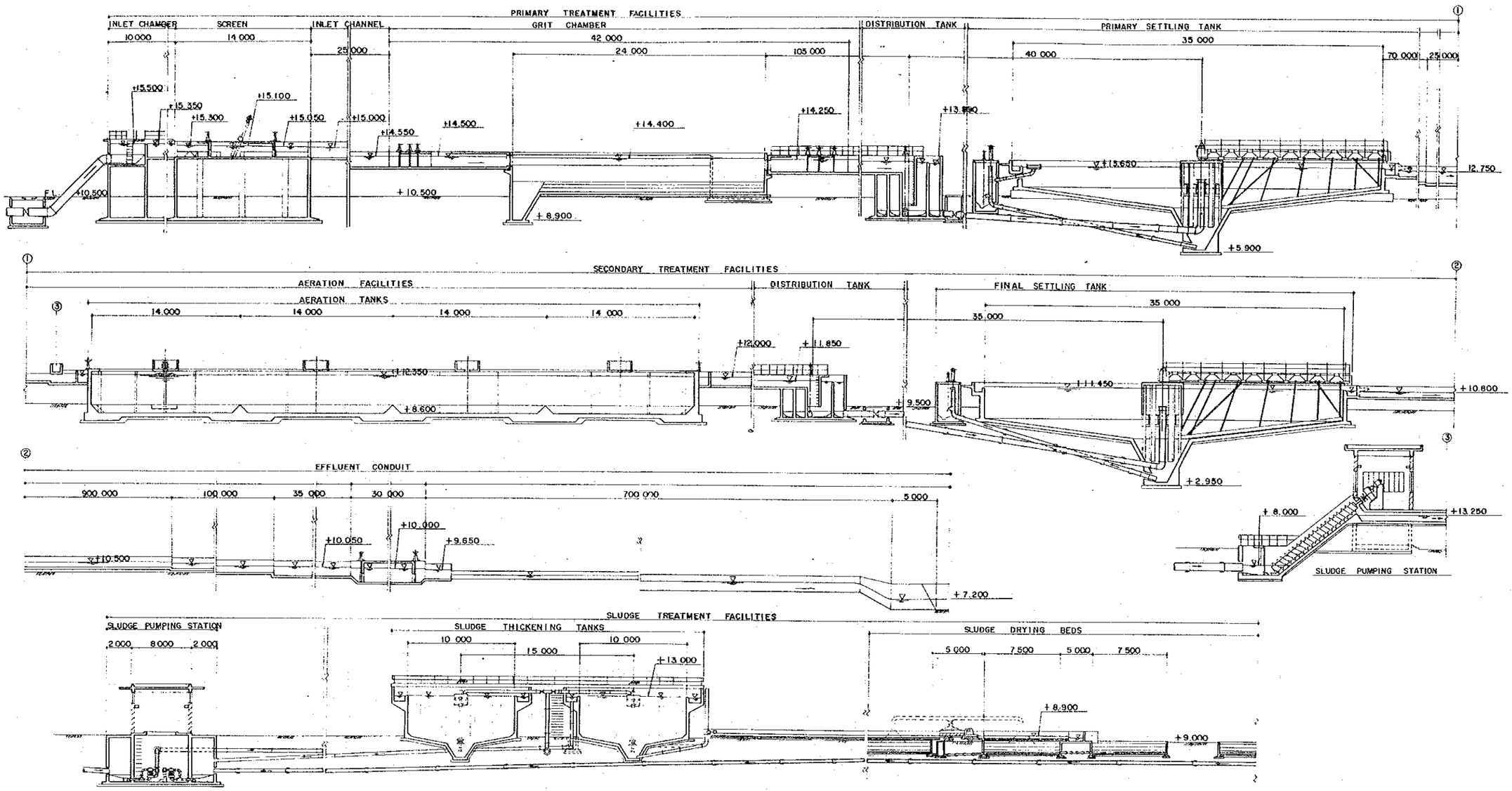


Figure 2.25 Hydraulic Profile of Zagazig New STP

FEASIBILITY STUDY ON SHARQIYA SEWERAGE SYSTEM	DATE: SEP. 1988	JICA
ZAGAZIG NEW STP HYDRAULIC PROFILE	SCALE: 1 : 200	DRAWING NO.: II - 21

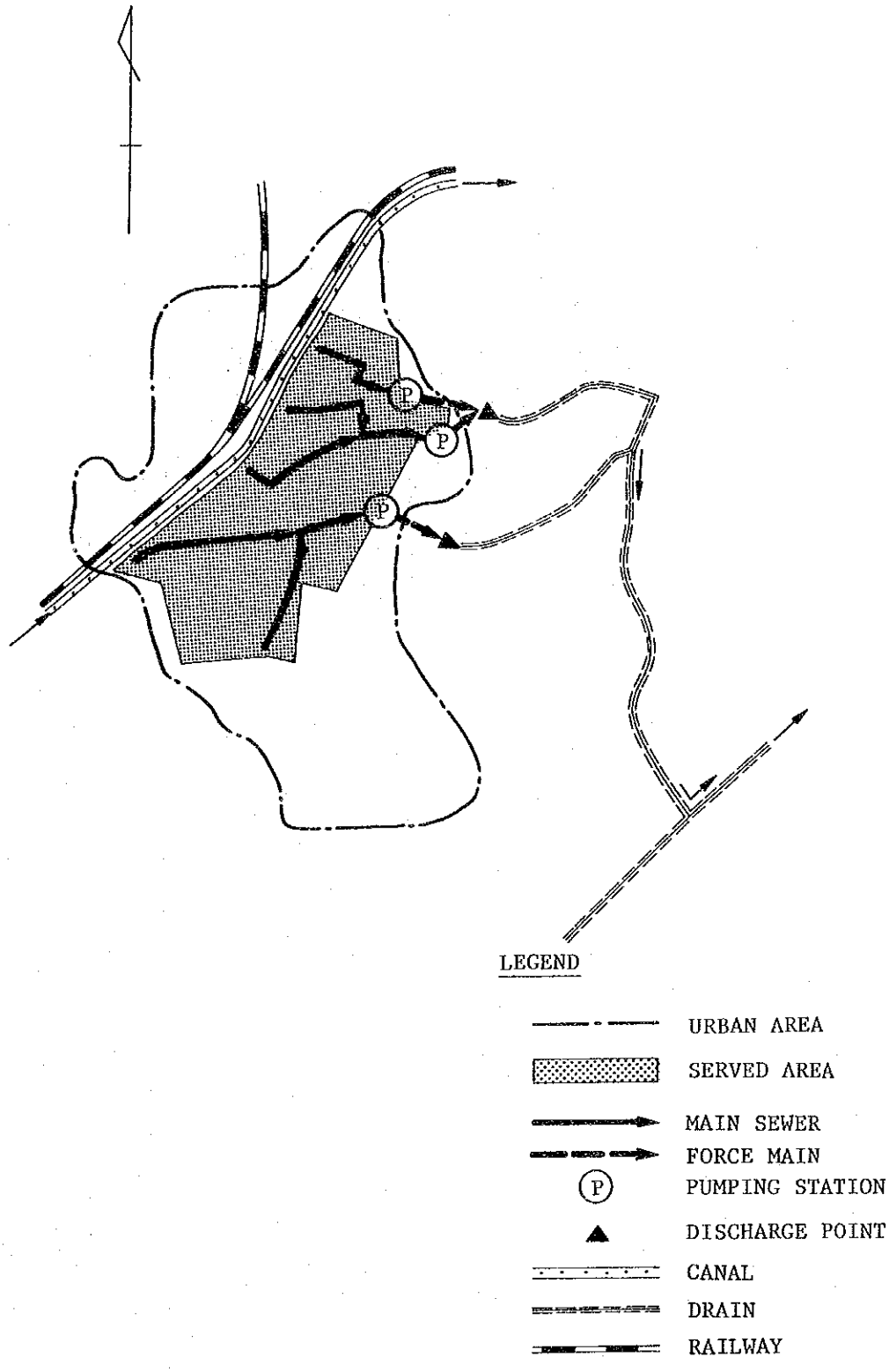


Figure 2.27 Abu Kebir Sewerage System

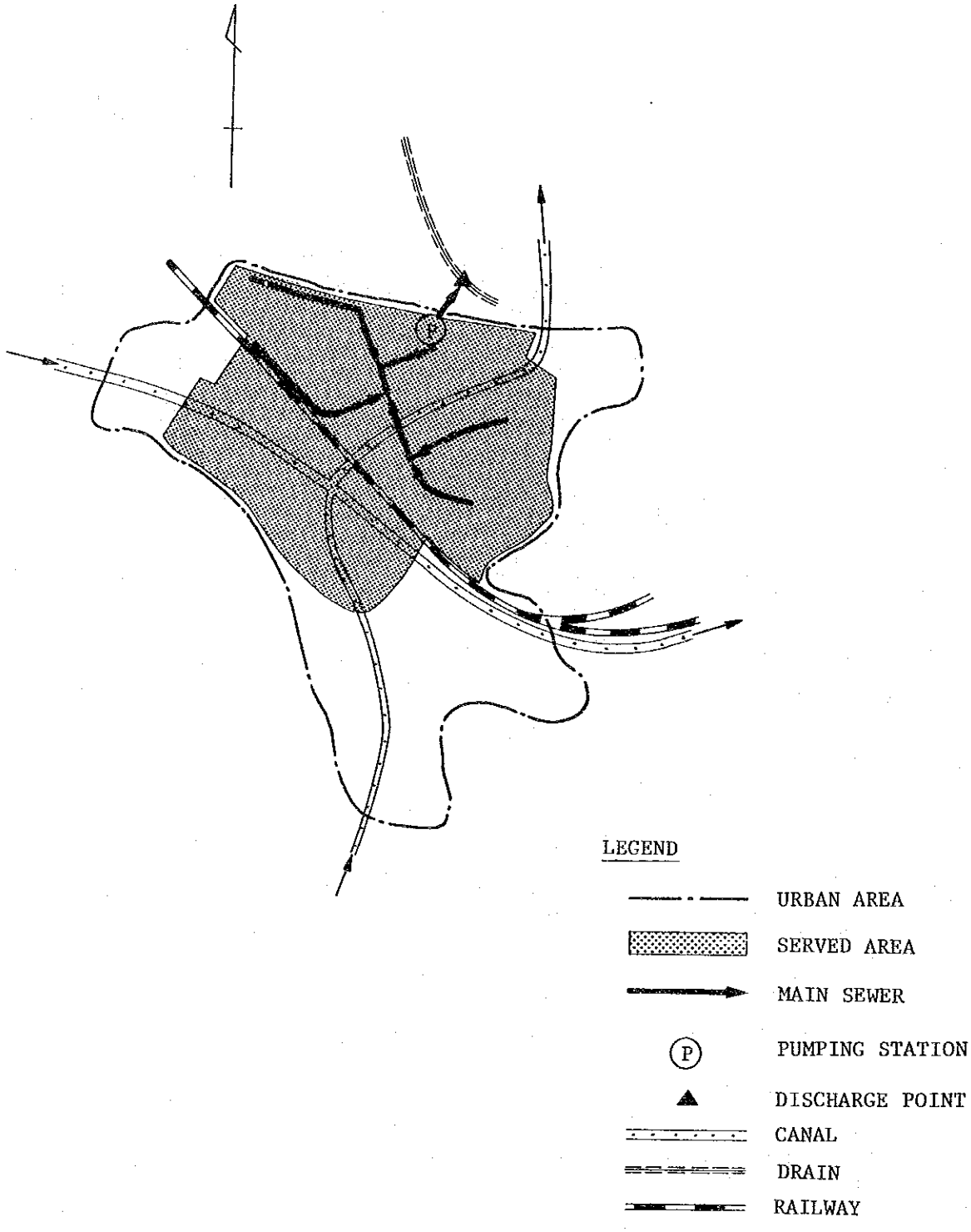


Figure 2.28 Faqus Sewerage System

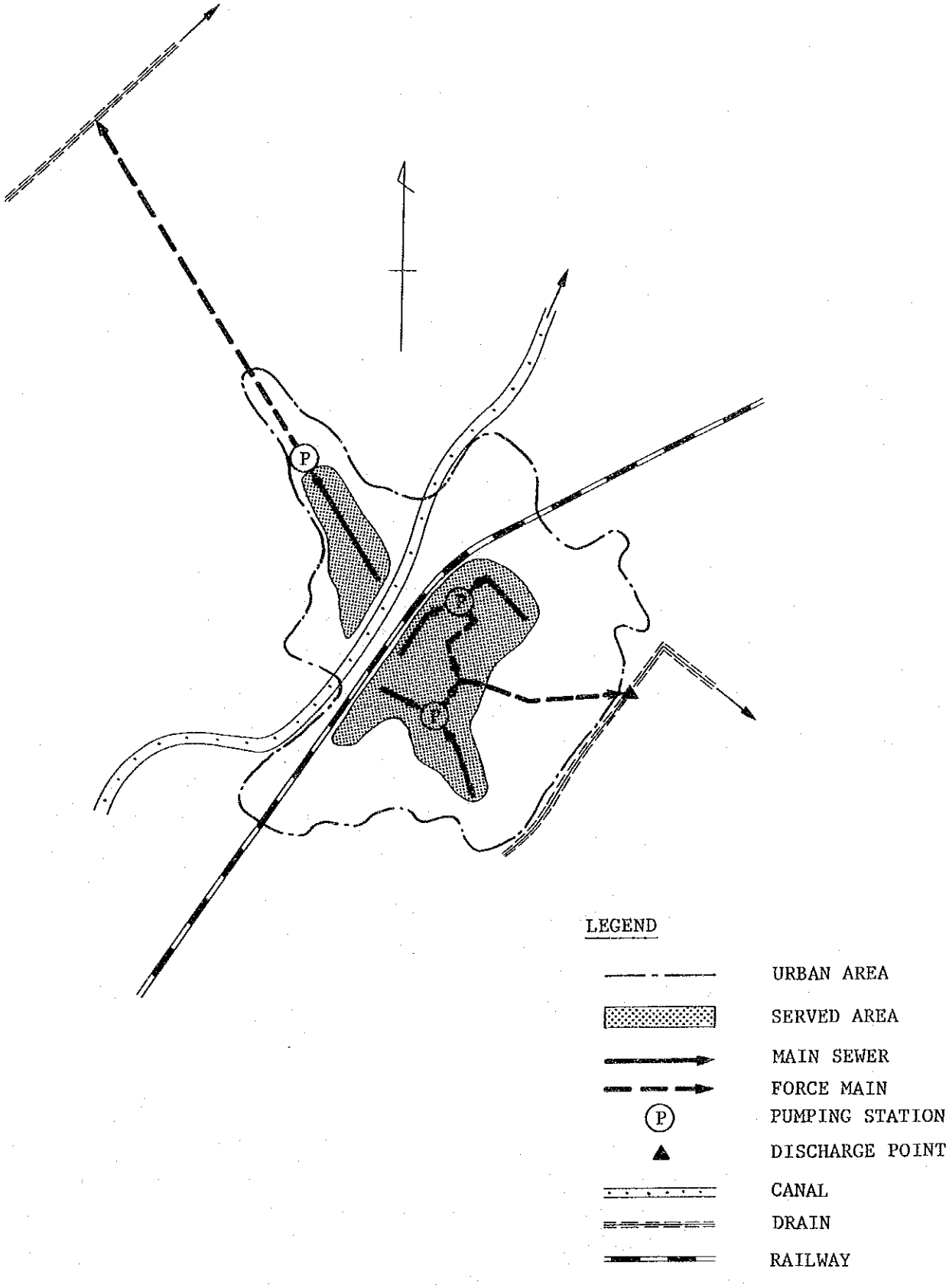


Figure 2.29 Minyet El Qamh Sewerage System

2.10.4 Sewerage Systems in the Eight Small Cities

The eight small cities are (1) Qenayat, (2) Hihya, (3) Diarb Nigm, (4) Ibrahimiya, (5) Kafr Saqr, (6) Huseiniya, (7) Abu Hammad, and (8) Mashtul El Soak. Seven of them are presently provided with sewerage systems. The only one city which does not have sewer a network is Huseiniya City. Sewerage systems in the seven cities have been constructed quite recently, about three or four years ago. There is no sewage treatment facility of any kind and raw sewage is discharged directly to the nearby agricultural drain, either by gravity or by pumping stations.

The population of the eight cities, ranging 20,000 to 30,000, is small compared to those of the five medium size cities. However, physical characteristics of the urban area, mostly consisting of four to five story housing and commercial units and a few institutional buildings, are very similar to each other and to those of the five medium size cities, except those in Zagazig, the capital of the Sharqiya Governorate. Urban areas are surrounded by fertile agricultural areas. Although urban areas are encroaching onto agricultural areas, this tendency seems to be somewhat tempered by the relatively high population density in the encroached areas. This is probably a reflection of the national policy of agricultural land conservation. There are several large factories, however, they are located away from residential areas. The need for the construction of a sewerage system is parallel to the piped water supply system appears to be widely felt in the Governorate.

A brief description of each city is given hereafter.

(1) Qenayat

Administratively, Qenayat has recently become a city; however it has not been accorded city-center status and still belongs to the Zagazig Markaz. In the near future, Qenayat is expected to become a city-center with an independent Markaz area. The city had an urban population of 29,400 in 1986. There are two sewer pipelines, 300 m and 500 m in length, in the City. These pipes are 12 inch in diameter and made of clay. Construction started in 1983, and about 240 housing units (100 old + 140 new) are connected to them at present. One pumping station is now under construction by the Sharqiya Governorate. This pumping station will discharge to the Ekwa Drain.

(2) Hihya

The city has 29,300 residents in the urban area at present. About 20% of the urban population is served by a sewer system. The remaining 80% is served by the transh systems. There are five sewer pipe lines in the city totaling 3 km in length. Diameter of the pipes range between 9 in. and 18 in., all made of clay. Three pumping stations are currently in operation. Details of each pumping station are as follows:

Table 2.40 Pumping Stations in Hihya

Pumping station	No. 1	No. 2	No. 3
Initial Year of operation	1984	1973	1975
Number of pumps	1	1	1
Capacity	60 l/s	40 l/s	40 l/s
Pump drive	diesel	diesel	diesel
Diameter	10 in.	6 in.	12 in.
Pumping main (dia.)	10 in.	8 in.	12 in.
Operating hours per day	10 hrs.	5 hrs.	4 hrs.
Discharging drain	Omshook	Sheaded	Omshook

(3) Diarb Nigm

About 32,200 persons are now living in the city, of which 30 percent or 9,700 persons are served by the sewerage system. In the city area, there are pipe networks, which have a total length of about 10 km. Pipe lines are generally short, and sewage is conveyed by gravity to seven discharging points in the Saft Zireak Drain. Pipe diameters are 6, 7, 8, 10 and 16 inch. Most of the pipes are of clay except for a short section of 500 m asbestos cement pipe. These pipe networks have a total of 1,140 house connections. Sedimentation tanks are installed at every discharge point.

(4) Ibrahimiya

24,500 persons inhabit the urban area. A sewer pipe network totaling 1,800 m in length serves 25% of the city population. Sewer pipes are 12 and 15 inch in diameter and made of clay. There is one pumping station which was constructed in 1985. This pumping station, however, is not in operation. Sewage is discharged directly to the Hosny Drain by gravity, by-passing the pumping station and sedimentation tank attached to the station for treatment. Three pumps, two motor driven and one with diesel engine are available in the station.

(5) Kafr Saqr

Total population of the city is about 19,300. Sewer pipe networks serve about 60% of the city population. It has 1,334 connections for 5,620 households. Construction of the system began in 1968 and is still continuing. Currently, the length of the pipeline totals about 15 km. Pipe diameters are 7, 8, 9, 12, and 15 inch. All pipes are made of clay. There are two pumping stations in operation. Details of these pumping stations are as follows:

Table 2.41 Pumping Stations in Kafr Saqr

Pumping station	No. 1	No. 2
Name of station	Hayel Nasr	Hayel Salam
Initial Year of operation	1968	1970
Number of pumps	2	2
Capacity	100 l/s each	100 l/s each
Pump drive	1 motor/ 1 diesel	1 motor/ 1 diesel
Pumping main (dia.)	none	10 in.
Discharging drain	El Adasya	El Awaf

(6) Huseiniya

The population of the city is about 17,800. There is no sewerage system in the city. They are served by the transh systems. The city has four vacuum cars, each having 4 m^3 capacity. In the city area, groundwater level is generally high, about 0.5 m below the ground. This causes intrusion of the groundwater into the transhes, which have to be emptied every one or two days. The drain which receives wastewater from the city is Tahawy Drain, a branch of the Bahr El Bakar Drain.

(7) Abu Hammad

The population in the city is 24,300 persons in 1986. About 25% of the city population is served by a sewerage system which is composed of a 6 km pipe network and two pumping stations. Pipes are 8, 10 and 12 inch in diameter and made of clay. Details of two pumping stations are shown in the following table.

Table 2.42 Pumping Stations in Abu Hammad

Pumping station	No. 1	No. 2
Name of station	El Mogaz	Abu Hammad El Balad
Initial Year of operation	1984	1984
Number of pumps	3	2
Capacity	40 m^3/hr	100 m^3/hr
Pump drive	2 motor/ 1 diesel	2 diesel
Diameter	3 in.	8 in.
Pumping main	none	none
Operating hours per day	20 to 24	15
Discharging drain	El Katawia	El Eraky

In addition to the two pumping stations, one sewer line discharges sewage to the El Katawia drain by gravity. A new pipe line, about 1.5 km in length, is currently under construction, financed by the beneficiaries. This line empties into the Masla Dimo drain.

(8) Mashtul El Soak

The total population of the city is about 28,700, of which 25% is served by the sewerage system. Sewer pipelines totaling about 3 km in length on PVC pipes of 10 and 12 inch in diameter and 12 and 15 inch clay pipes have been installed. Construction of pipe system commenced in 1983. There is no pumping station in the system. Sewages are now discharged by gravity to the Sandar Hoor drain devoid of any treatment.

2.10.5 Sewerage Systems in Rural Area

Some villages in the rural area of the Governorate have sewer pipe systems, although they are a minority and the served population size is generally small. Construction of these systems were financed by residents or by USAID. In the case of self effort construction, consultation with the engineers in local authority is usually held regarding engineering matters, but the local authority is not responsible for either construction or maintenance of the system. On the other hand, all construction costs are borne by the Governorate for the systems provided under the USAID program, and operation and maintenance of the system is the responsiblity of the local council.

There are no sewage treatment facilities of any kind in the rural sewerage systems. Sewage collected from the houses are directly discharged to the nearby agricultural drains.

2.10.6 Critiques of the Existing Systems

Major problem areas in the existing sewerage and sanitation systems may be stated as follows:

(1) operation and maintenance of the existing Zagazig sewage treatment plant,

(2) disposal of urban wastewater to drains

(3) inadequate operation and maintenance of the systems.

(1) Zagazig Sewage Treatment Plant

The sewage treatment plant has not been functioning as planned. Most of the sewage flow, currently estimated to be roughly 46,600 m^3/day, either by-passes treatment or, is discharged to the nearby drains after sedimentation of some part of the flow. The effluent is of poor quality as the plant has long been out of use. Effluent containing at least 16,310 kg of BOD per day is discharged into the drain, and this is the major source of pollutants to the drain. New sewage treatment plant now under construction may not be put in operation in the immediate future due to financial constraints.

(2) Disposal of Urban Wastewaters to Drains

Currently no sewage treatment plants are in operation in the major cities of the Governorate except Zagazig. All the collected wastewater through sewer networks in the cities are discharged directly to drains without receiving adequate treatment, causing serious water pollution problems in the drain waters. In addition, the effluent is generally high in BOD and SS concentration, thus giving serious negative impacts on the environment.

(3) Operation and Maintenance of Existing Systems

Many parts of the existing sewer systems require rehabilitation, as well as proper operation and maintenance. Some of the existing pumps have to be repaired or replaced by new ones to maintain continuous operation.

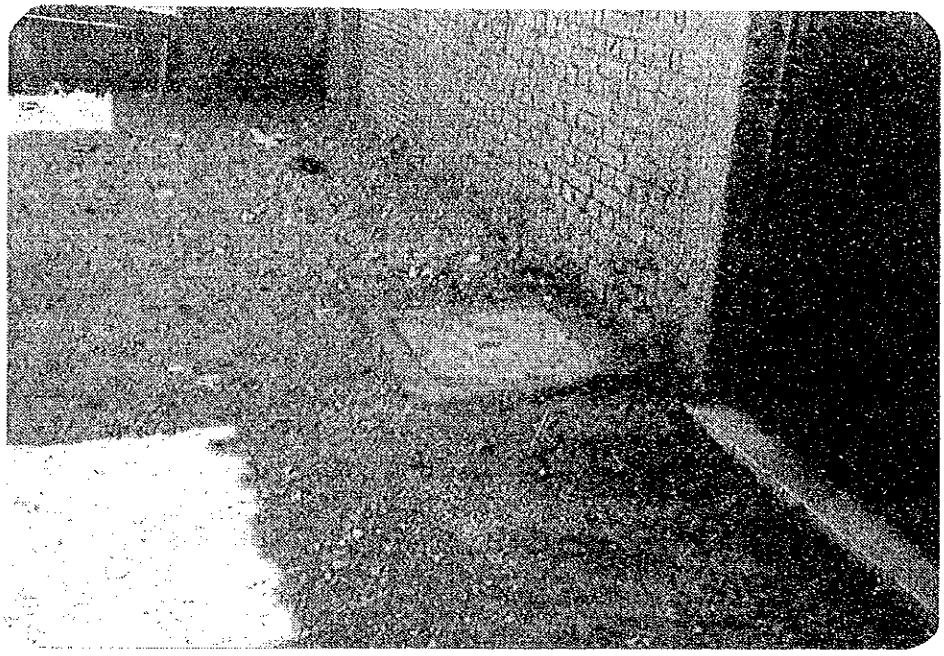


Photo 2.1 Inspection Chamber Provided for Individual House

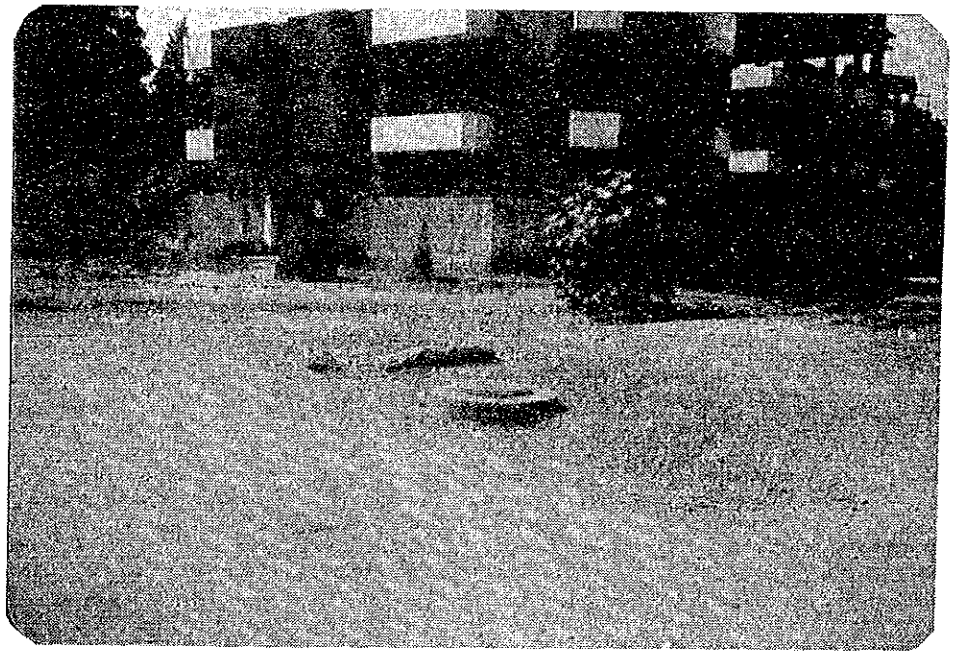


Photo 2.2 Manhole (Zagazig)

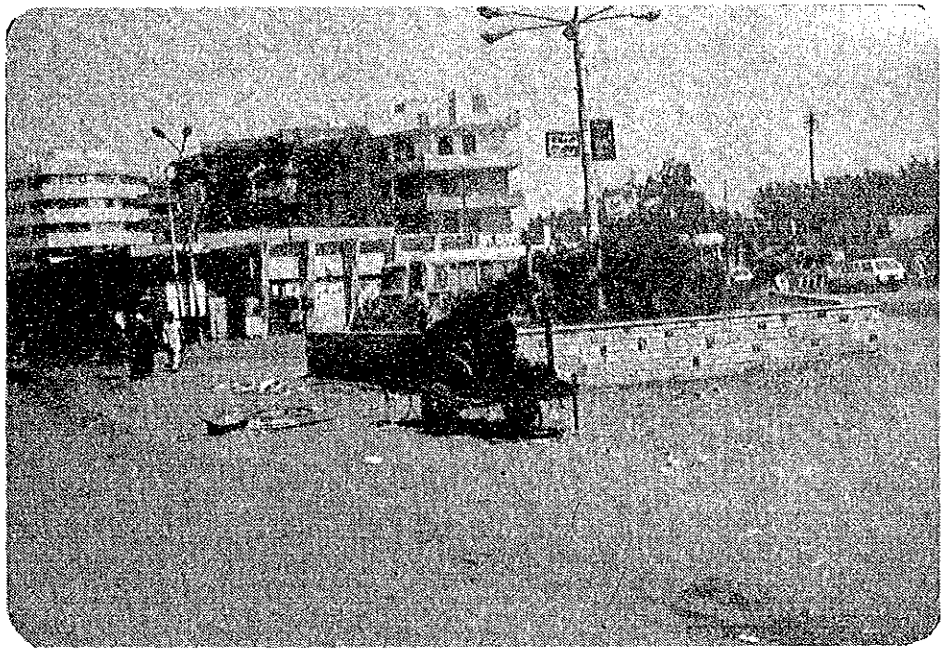


Photo 2.3 Sewer Cleaning Machine on Work (Zagazig)

Photo 2.4 Sewer Cleaning Machine on Work (Zagazig)

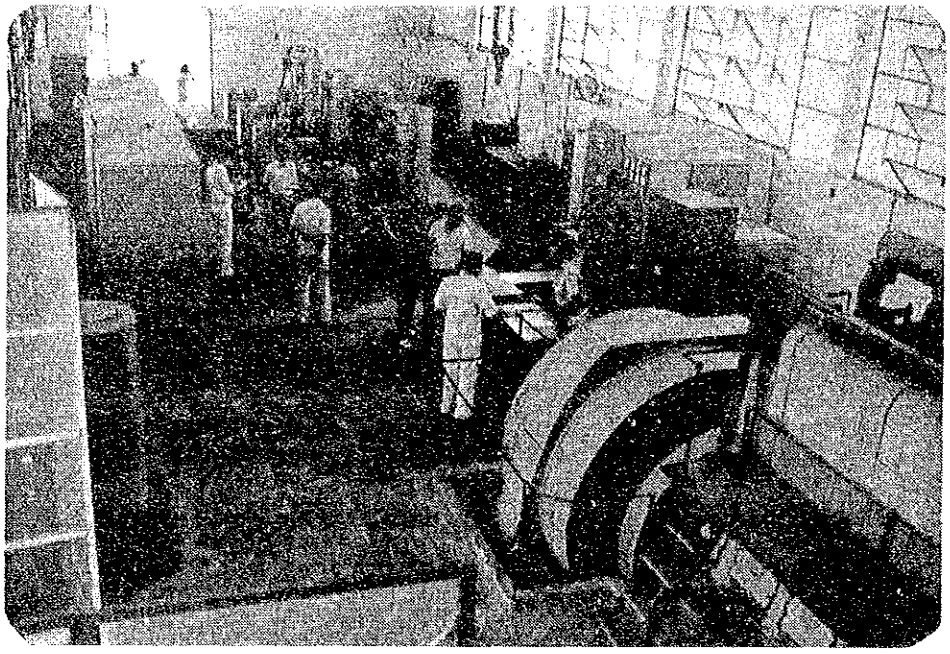


Photo 2.5 Main Pumping Station (Zagazig)

Photo 2.6 Sanawiya Pumping Station (Bilbeis)

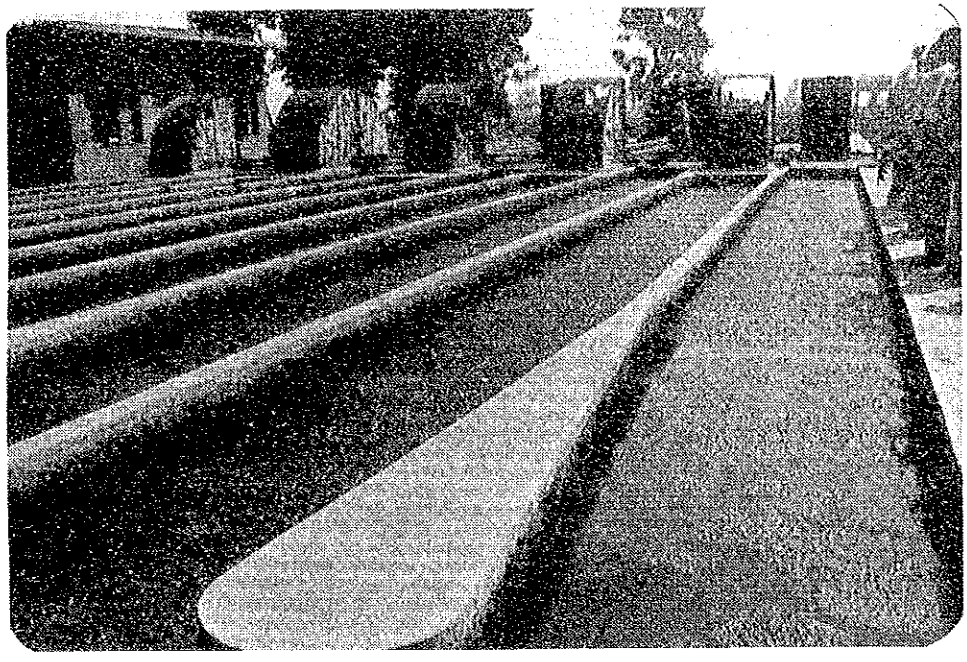


Photo 2.7 Old STP, Oxidation Ditch (Zagazig)

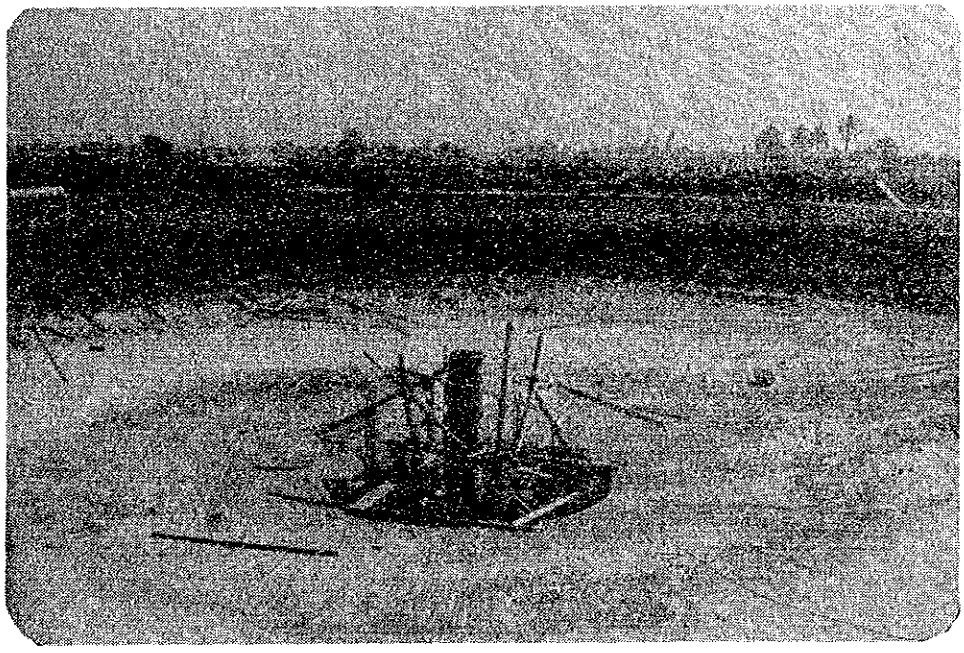


Photo 2.8 New STP Under Construction (Zagazig)

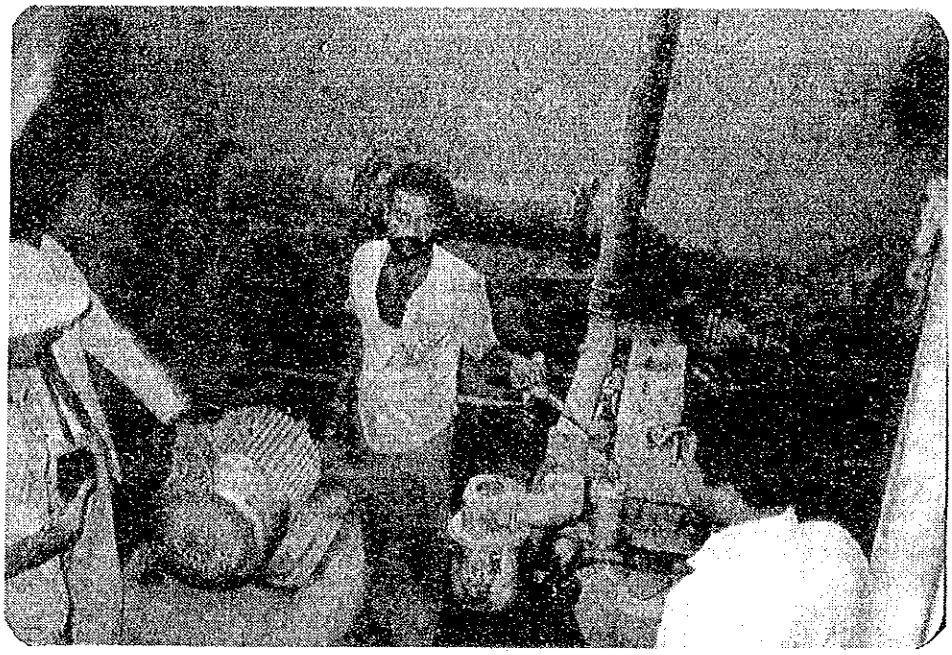


Photo 2.9 Existing Pumping Station (Bilbeis)

Photo 2.10 A Drain Receiving Wastewater (Faqus)