5. Financial Feasibility

5.1 Funding arrangements

The capital investment required for the first priority phase program has been estimated as LE 126,015,000 in total with foreign currency cost of US$ 66,230,000 equivalent to LE 54,287,000 and local currency costs of LE 71,728,000 including price contingency.

The funding requirements for such capital investments are normally considered to be met from various alternative sources of foreign loan or grant, local loan or government subsidy or equity and internally generated fund and direct contribution from the consumers depending on the specific financial capacity of the project executive agency.

The foreign or local loan will require the obligation of the interest and principals payments which will have major impacts or financial burden on future financial program including revenue earning program and tariff schedule.

The present less affordable financing situation with heavy dependence on subsidy inhibits the funding which will give rise to heavy financial burden and consequent tariff increases to an unacceptable level.
The foreign currency portion is recommended to be met by foreign loan preferably at lenient loan condition with low interest rate and extended repayment period and the remaining local currency portion should be provided by the government equity or subsidy.

5.2 Water tariff

As indicated in previous section for the existing financial performance, the present water tariff have been unchanged at the lowest level which have been a main obstacle for the water operation to be financially sound. In addition, the present free charge system for the standpipe water is worsening the financial climate in water sector.

The water tariff is basically set to meet the financial objective which commonly requires the water revenues to cover the operation and maintenance costs, debt service or depreciation costs and in some cases, the costs of system expansion costs especially when the water supply executive agency is required to be financially independent.

The consumers' ability to pay sometimes may not be sufficient for the required tariff set by above financially independent base.
The social background and national pricing policy sometimes inhibit the drastic upheaval of the existing subsidized water prices. In such case the government is required to provide subsidies to cover the required costs not fully covered by the water tariff revenue, providing, however, that the proposed executive organization(Sharqiya PWC) would be able to achieve a sound financial position after a possible shortest time span.

Inorder to assume the average water tariff per cubic meter of water supplied by the new water supply organization including the proposed project's water supply, the financial projections have been explored based on the financial objective to achieve financial autonomy which requires water revenues sufficient to project the required net profits.

The annual water revenues required to raise a required level of surplus over the operation and maintenance costs and depreciation costs after the year of system completion of the project are indicated as below.

	1990	1991	1992	1993	1994	1995	1996
Water Sale (1,000 m^3/year)	74,484	76,887	79,289	81,692	82,293	84,095	84,095
Required Annual Revenue (LE1,000)	7,759	10,356	13,285	14,521	16,009	17,762	19,444
Average Water Tariff (Pts/m^3)	10	13	17	18	19	21	23

Another projection is also attempted to assume average water tariff to raise a minimum level of the revenues sufficient to maintain the future water supply operation not based on the rigid financial requirements but depending on more government subvention.

	1990	1991	1992	1993	1994	1995	1996
Water Sale (1,000 m3/year)	74,484	76,887	79,289	81,692	82,293	84,095	84,095
Required Annual Revenue (LE 1,000)	6,269	7,401	8,604	9,588	9,799	10,087	10,087
Average Water Tariff (Pts/m3)	8	10	11	12	12	12	12

Ability to pay of the consumers have been assessed based on the consumers' income survey. The average monthly income of the average family (consited of 6 persons) is estimated as LE 70 as of the year 1984. The low level income per month is about LE 40 and high income level is about LE 120 monthly.

The affordability of the water consumers are normally estimated by the percentage of water charge to income ranging 2 % at minimum and 5 % at maximum. The affordable amount of the water tariff and corresponding water tariff per cubic meter are estimated per year from 1990 to 1996 based on the average monthly income of LE 70 and conservative ability ratio of 2 % of average water consumption as below. The monthly income is escalated by 5 % per annum.

	1990	1991	1992	1993	1994	1995	1996
Monthly Income (LE)	94	99	104	109	114	120	126
Ability Ratio (%)	2	2	2	2	2	2	2
Affordable Water Tariff (LE)	1.88	1.98	2.08	2.18	2.28	2.40	2.52
Average Water Consumption per Capita (lcd)	96	96	97	97	98	98	98
Average Family Water Consumption per month (m3)	17	17	17	17	18	18	18
Average Water Tariff (Pts/m3)	11	12	12	13	13	13	14

As far as the ability of the consumers to pay as estimated as above is concerned, the future water tariff will be within the range of Pts 8 - 12 as scheduled in previous paragraph in order to raise the water revenues sufficient to maintain at least water supply operation on cash base.

Based on above basic concept of the required tariff schedule for the overall water supply operation, the further detailed analysis has been made for the actual implementation of the tariff systems broken down by two categories of water consumers of standpipe and house connection incorporating the ability of the different consumers to pay the proposed water tariff and block rate water charging system.

The present standpipe water is recommended to be charged at the adequate price in order to make consumers aware that the water is valuable and discourage the waste of water. The consumers of the standpipe water belong to the lower income group and therefore their monthly or yearly water charge should be lower than that of the higher income group of house connected water consumers mostly resident in the urban areas.

The block rate system providing lower price for the basic consumption will be effective to differentiate the charges between the standpipe water and house connected water because the average household water consumption from standpipe is less than that from house connection and if the base block consumption is set by maximum household consumption of standpipe water, most of the standpipe users can enjoy the lower unit price of base allowance.

The consumers of house connected water will be required to pay more higher unit charges since their consumptions will exceed the base allowance resulting in cross-subsidisation from the higher income group to lower income group.

The base block consumption for the standpipe water has been recommended to be 10 m3/household/month with unit price of 7 Pts/m3 and unit price for the consumption exceeding 10 m3 is set at 15 Pts/m3. For the house connected water the basic allowance is recommended to be 10 m3/household/month and 20 Pts/m3 for the consumption exceeding the base allowance.

Such block rate system is recommended, however, to be introduced after the project construction is completed and the system is fully operated with well developed administrative and managerial system of the new organization of Sharqiya PWC around the years 1990 - 1991. For the preparatory period prior to the introduction of the new block rate tariff system, the gradual increase of the unit price of the existing water tariff system is recommended.

The adequacy of the tariff system proposed as above has been examined by measuring the actual payment of the water charge compared with the assumed income pattern for both of the standpipe and houseconnection's water consumers as follows.

Standpipe

Years	A	B	C	D	E	F	G	H	I
1991	48	9	10	7	15	0.6	63	1	7
1992	50	9	10	7	15	0.6	64	1	7
1993	52	9	10	7	15	0.6	66	1	7
1994	53	10	10	7	15	0.7	67	1	7
1995	55	10	10	7	15	0.7	68	1	7
1996	55	10	10	7	15	0.7	70	1	7

House Connection

Years	A	B	C	D	E	F	G	H	I
1991	110	20	10	10	20	3	109	2.8	15
1992	110	20	10	10	20	3	111	2.7	15
1993	112	20	10	10	20	3	114	2.6	15
1994	112	20	10	10	20	3	116	2.6	15
1995	112	20	10	10	20	3	118	2.5	15
1996	112	20	10	10	20	3	120	2.5	15

A: Average water consumption per capita(lcd)
B: Monthly water consumption per household consisted of 6 persons(m3)
C: Base block water consumption per month(m3)
D: Unit water charge for base block consumption(Pts/m3)
E: Unit water charge for consumption exceeding base allowance(Pts/m3)
F: Monthly payment of water charge per household(LE)
G: Average monthly income per household escalated by 2 % yearly(LE)
H: Percentage of water charge to income computed by F/G(%)
I: Average unified water charge per cubic meter computed by F/B(Pts/m3)

As indicated above all standpipe users can enjoy the lower tariff afforded by the base allowance and required monthly water charges are only one percent of their monthly income satisfying sufficiently their affordability for the payment of the proposed water charge.

The percentage computed for the house connected water consumers ranges 2.5 - 2.8 % which are well within the allowable limit of the ability to pay of such higher income group.

The billing and collection of the water tariff for the standpipe water consumers will require a specific measure since each household provides no means to measure the consumption.

Each standpipe should therefore be equipped with the water meter and the water consumption should be metered monthly or quarterly or even yearly and total water charge per standpipe should be calculated taking account of the base allowance to be obtained by multiplying 10 m3 by the number of households using each standpipe. The total water charge should be divided by the number of households and equal water charge should be billed to each individual household.

5.3 Financial Projection

Based on the capital investment, funding requirements, foreign loan and government subsidy, and adequate water tariff schedule as studied in the previous section, two sets of the income statements, the cash flow statements, and the balance sheets have been prepared for two alternatives dependent on the different revenue schedule. The following assumptions have been made for the above financial statements.

The Alternative = 1 is based on the lower level of water tariff estimated basically on present practicability of tariff revision and consumers' ability to pay the water charge.

The Alternative - 2 is prepared based on the higher level of water tariff schedule to raise the water revenue sufficient to meet the financial requirements in conformance with the objective to achieve financial autonomy.

The common assumptions made for both Alternatives' financial statements are as follows:

1. The foreign currency portion (about 50 %) of total project costs is funded by loan from the foreign lending agency at the interest rate of 6 % per annum and 26 years repayment period including 6 years grace period and the local currency portion is funded by the government subsidy. The interests of the foreign loan during the grace period is capitalized and therefore included in the loan amount.

2. The foreign and local capital costs are assumed to be escalated by 7 % and 12 % per year respectively.

3. The existing assets have been evaluated as LE 48,925,000 and net value of LE 27,767,000 after reduction of the depreciation costs.
   Such values are estimated by assumed replacement costs at 1984 prices and net financial assets are assumed to be taken over to the new water company and capitalized as initial equity in the financial statements.

4. Accumulated depreciation is calculated by the composite depreciation rate of 2.5 % of the assets in service.

5. Account payable is estimated as equal to operating and maintenance expenses for one month.

6. Account receivable is estimated equal to water revenues for 6 months during the years 1985 to 1986 and 3 months revenues from the year 1987.

7. Inventory is assumed to be equal to the operating and maintenance costs for 4 months.

Financial Internal Rate of Return(F.I.R.R.)

The F.I.R.R., which equates the actual values of the benefits to the actual values of the costs, has been calculated on an incremental base at the constant price of the year 1984 through the project life of 40 years by the following formula.

$$\sum_{t=1}^{40} \frac{B_t}{(1+r)^t} = \sum_{t=1}^{40} \frac{(I_t + OM_t)}{(1+r)^t}$$

Where t = years: r = F.I.R.R.: B_t = Benefits in the year t: I_t = Investment costs in the year t: OM_t = Operating and Maintenance Costs in the year t

The F.I.R.R. gives a measure to assess the viability of the project taking account of the socio-economic factors. The F.I.R.R. calculated for Alternative I and Alternative II are 5 % and 10 % respectively as shown in the Table 5.3.13.

Comparison of Financial Projections of two Alternatives

Alternative - I

The water tariff is kept minimum especially for the standpipe water to reflect the present pricing policy for the water supply services and financial capability of the consumers. The continued government subsidy will be required to offset the deficits to be caused by the low level of water tariff at the operation stage of the project after the year 1991.

Although the profitability is poor, the cash flow is sufficient to maintain the water operation by securing the available internal cash at the end of every year to be sufficient to cover the next years' operation costs for 3 months.

This Alternative projects the F.I.R.R. of 5 % which is positive and sufficient for the viability of the project and if the intangible economic benefits as indicated in Chapter 6 are included, the F.I.R.R. can increase remarkably.

Alternative - 2

The more financial autonomy is emphasized setting higher level of the water tariff accompanied with decent level of the net profits as well as the higher F.I.R.R. of 10 %. The government subsidy is not required after the completion of the project since the sufficient internal funds are raised. The water tariff is assumed, however, to be beyond the financial capability of the consumers and practicability of the proposed water tariff schedule is less than the Alternative - 1.

Conclusion

After comparison of two Alternatives, the financial plan of Alternative - 1 is considered more adequate since the water tariff schedule is based on the affordable amount of the water charge of the consumers and therefore more practical than Alternative - 2 and the F.I.R.R. is considered acceptable.

The difficulty is anticipated in practical implementation of the water tariff schedule in Alternative - 2 under the social background and national pricing policy of Egypt.

The final selection from two Alternatives is, however, optional for the government and Alternative - 2 can be selected dependent on the government's own determined willingness to implement the imposition of high geared water tariff schedule.

Table-5.3.5 Projected Water Charge, 1985-1996 — Alternative-1

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Water Production (1000 m3/year)	82,828	82,828	82,828	93,052	120,136	120,136	120,136	120,136	120,136	120,136	120,136	120,136
Water Loss (%)	38	38	38	38	38	38	36	34	32	31.5	30	30
Water Sale (1000 m3/year)	51,353	51,353	51,353	57,692	74,484	74,484	76,887	79,289	81,692	82,293	84,095	84,095
House-connected (1000 m3/year)	29,818	29,818	29,818	32,569	42,112	42,420	44,455	46,402	48,364	50,487	52,499	52,499
Standpipe (1000 m3/year)	21,535	21,535	21,535	25,123	32,372	32,064	32,432	32,887	33,328	31,806	31,596	31,596
Average Water Tariff (pt/m^3):												
House-connected	2	2	5	7	9	11	13	15	15	15	15	15
Standpipe	-	-	3	3	3	5	5	5	7	7	7	7
Annual Water Charge (LE 1000)												
House-connected	596	596	1,491	2,280	3,790	4,666	5,779	6,960	7,255	7,573	7,875	7,875
Standpipe	-	-	646	754	971	1,603	1,622	1,644	2,333	2,226	2,212	2,212
Total Annual Revenue (LE1000)	596	596	2,137	3,034	4,761	6,269	7,401	8,604	9,588	9,799	10,087	10,087

Table-5.3.6 Projected Income Statement, 1985-1996 (LE 1000) Alternative-1

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Operating Revenues												
Water Charge	596	596	2,137	3,034	4,761	6,269	7,401	8,604	9,588	9,799	10,087	10,087
Operating Expenses												
Salary and Wage	1,263	1,329	1,394	1,503	1,572	1,739	1,920	2,123	2,326	2,559	2,814	3,096
Power and Chemical	678	739	806	982	1,636	1,783	1,944	2,119	2,309	2,517	2,743	2,991
Maintenance	339	370	403	491	818	892	972	1,059	1,154	1,258	1,372	1,495
Miscellaneous	114	122	130	149	176	193	212	232	254	278	304	333
Total Operating Expenses	2,394	2,560	2,733	3,125	4,202	4,607	5,048	5,533	6,043	6,612	7,233	7,915
Net Operating Income	(1,798)	(1,964)	(596)	(91)	559	1,662	2,353	3,071	3,545	3,187	2,854	2,172
Depreciation	1,224	1,224	1,224	1,654	4,374	4,374	4,374	4,374	4,374	4,374	4,374	4,374
Net Income before Interest	(3,022)	(3,188)	(1,820)	(1,745)	(3,815)	(2,712)	(2,021)	(1,303)	(829)	(1,187)	(1,520)	(2,202)
Interest	-	-	-	-	-	-	3,257	3,094	2,932	2,769	2,606	2,443
Net Income	(3,022)	(3,188)	(1,820)	(1,745)	(3,815)	(2,712)	(5,278)	(4,397)	(3,761)	(3,956)	(4,126)	(4,645)

Table-5.3.7 Project Cash Flow Statement, 1985-1996 (LE 1000) Alternative-1

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Sources of Funds												
Net Operating Income	(1,798)	(1,964)	(596)	(91)	559	1,662	2,353	3,071	3,545	3,187	2,854	2,172
Increase in Account Payable	200	13	15	32	90	34	37	40	43	47	52	57
Government Contribution	3,211	16,691	38,424	19,565	-	-	2,819	3,155	2,478	2,491	2,695	3,147
Foreign Loan	806	14,570	30,201	8,710	-	-	-	-	-	-	-	-
Total Sources of Fund	2,419	29,310	68,044	28,216	649	1,696	5,209	6,266	6,066	5,725	5,601	5,376
Application of Fund												
Capital Investment	1,368	29,257	67,699	27,691	-	-	-	-	-	-	-	-
Debt Service:												
Interest	-	-	-	-	-	-	3,257	3,094	2,932	2,769	2,606	2,443
Amortization of Principal	-	-	-	-	-	-	2,714	2,714	2,714	2,714	2,714	2,714
Total Debt Service	-	-	-	-	-	-	5,971	5,808	5,646	5,483	5,320	5,157
Increase in Current Assets (less cash)	411	10	247	255	540	401	310	330	278	87	110	41
Total Application of Fund	1,779	29,267	67,946	27,946	540	401	6,281	6,138	5,924	5,570	5,430	5,198
Net Cash Increase (Decrease)	640	43	98	270	109	1,295	(1,072)	128	142	155	171	178
Cash at Year End	640	683	781	1,051	1,160	2,455	1,383	1,511	1,653	1,808	1,979	2,157
Debt Service Cover	-	-	-	-	-	-	0.4	0.5	0.6	0.6	0.5	0.4

Table-5.3.8 Project Balance Sheet, 1985-1986 (LE 1000) Alternative-1

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Assets													
Fixed Assets:													
Utility Facility in Service	48,952	48,952	48,952	48,952	66,178	174,967	174,967	174,967	174,967	174,967	174,967	174,967	174,967
Less Accumulative Depreciation	21,185	22,409	23,633	24,857	26,511	30,885	35,259	39,633	44,007	48,381	52,755	57,129	61,503
Net Fixed Assets in Service	27,767	26,543	25,319	24,095	39,667	144,082	139,708	135,334	130,960	126,586	122,212	117,838	113,464
Construction in Progress	-	1,368	30,625	98,324	108,789	-	-	-	-	-	-	-	-
Total Fixed Assets	27,767	27,911	55,944	122,419	148,456	144,082	139,708	135,334	130,960	126,586	122,212	117,838	113,464
Current Assets:													
Cash	-	640	683	781	1,051	1,160	2,455	1,383	1,511	1,653	1,808	1,979	2,157
Account Receivable	-	298	298	534	759	1,190	1,567	1,850	2,151	2,397	2,450	2,522	2,522
Inventory	-	113	123	134	164	273	297	324	353	385	419	457	498
Total Current Assets	-	1,051	1,104	1,449	1,974	2,623	4,319	3,557	4,015	4,435	4,677	4,958	5,177
Total Assets	27,767	28,962	57,048	123,868	150,430	146,705	144,027	138,891	134,975	131,021	126,889	122,796	118,641
Equity and Liability													
Equity	27,767	27,767	27,767	27,767	27,767	27,767	27,767	27,767	27,767	27,767	27,767	27,767	27,767
Government Contribution	-	3,211	19,902	58,326	77,891	77,891	77,891	80,710	83,865	86,343	88,834	91,529	94,676
Retained Earnings	-	(3,022)	(6,210)	(8,030)	(9,775)	(13,590)	(16,302)	(21,580)	(25,977)	(29,738)	(33,694)	(37,820)	(42,465)
Total Equity	27,767	27,956	41,459	78,063	95,883	92,068	89,356	86,897	85,655	84,372	82,907	81,476	79,978
Foreign Loan	-	806	15,376	45,577	54,287	54,287	54,287	51,573	48,859	46,145	43,431	40,717	38,003
Account Payable	-	200	213	228	260	350	384	421	461	504	551	603	660
Total Current Liability	-	1,006	15,589	45,805	54,547	54,637	54,671	51,994	49,320	46,649	43,982	41,320	38,663
Total Equity and Liability	27,767	28,962	57,048	123,868	150,430	146,705	144,027	138,891	134,975	131,021	126,889	122,796	118,641
Debt/Equity Ratio	0/100	3/97	27/73	37/73	36/64	37/63	38/62	37/63	37/63	36/64	35/65	34/66	33/67

Table-5.3.9 Projected Water Charge, 1985-1996 — Alternative-2

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Water Production (1000 m3/year)	82,828	82,828	82,828	82,828	93,052	120,136	120,136	120,136	120,136	120,136	120,136	120,136
Water Loss (%)	38	38	38	38	38	38	36	34	32	31.5	30	30
Water Sale (1000 m3/year)	51,353	51,353	51,353	57,692	74,484	74,484	76,887	79,289	81,692	82,293	84,095	84,095
House-connected (1000 m3/year)	29,818	29,818	29,818	32,569	42,112	42,420	44,455	46,402	48,364	50,487	52,499	52,499
Standpipe (1000 m3/year)	21,535	21,535	21,535	25,123	32,372	32,064	32,432	32,887	33,328	31,806	31,596	31,596
Average water Tariff (pt/m3):												
House-connected	2	2	5	7	9	13	16	18	19	21	23	25
Standpipe	-	-	3	4	5	7	10	15	16	17	18	20
TotalMnual Revenue (LE 1000)	596	596	2,137	3,285	5,409	7,759	10,356	13,285	14,521	16,009	17,762	19,444

Table-5.3.10 Projected Income Statement, 1985-1996 (LE 1000) Alternative-2

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Operating Rovonues												
Water charge	596	596	2,137	3,285	5,409	7,759	10,356	13,285	14,521	16,009	17,762	19,444
Operating Expenses												
Salary and Wage	1,263	1,329	1,394	1,503	1,572	1,739	1,920	2,123	2,326	2,559	2,814	3,096
Power and Chemical	678	739	806	982	1,636	1,783	1,944	2,119	2,309	2,517	2,743	2,991
Maintenance	339	370	403	491	818	892	972	1,059	1,154	1,258	1,372	1,495
Miscellaneous	114	122	130	149	176	193	212	232	254	278	304	333
Total ,Operating Expenses	2,394	2,560	2,733	3,125	4,202	4,607	5,048	5,533	6,043	6,612	7,233	7,915
Net Operating Income	(1,798)	(1,964)	(596)	160	1,207	3,152	5,308	7,752	8,478	9,397	10,529	11,529
Depreciation	1,224	1,224	1,224	1,654	4,374	4,374	4,374	4,374	4,374	4,374	4,374	4,374
Net Income before Interest	(3,022)	(3,188)	(1,820)	(1,494)	(3,167)	(1,222)	934	3,378	4,104	5,023	6,155	7,155
Interest	-	-	-	-	-	-	3,257	3,094	2,932	2,769	2,606	2,443
Net Income	(3,022)	(3,188)	(1,820)	(1,494)	(3,167)	(1,222)	(2,323)	284	1,172	2,254	3,549	4,712
Rate of Return (%)	-	-	-	-	-	-	0.7	2.6	3.2	4.1	5.2	6.3

Table-5.3.11 Project Cash Flow Statement, 1985-1996 (LE 1000) Alternative-2

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Source's of Funds												
Net Operating Income	(1,798)	(1,964)	(596)	160	1,207	3,152	5,308	7,752	8,478	9,397	10,529	11,529
Increase in Account Payable	200	13	15	32	90	34	37	40	43	47	52	57
Government Contribution	3,211	16,691	38,424	19,565	-	-	-	-	-	-	-	-
Foreign Loan	806	14,570	30,201	8,710	-	-	-	-	-	-	-	-
Total Sources of Fund	2,419	29,310	68,044	28,467	1,297	3,186	5,345	7,792	8,521	9,444	10,581	11,586
Application of Fund												
Capital Investment	1,368	29,257	67,699	27,691	-	-	-	-	-	-	-	-
Debt Service:												
Interest	-	-	-	-	-	-	3,257	3,094	2,932	2,769	2,606	2,443
Amortization of Principal	-	-	-	-	-	-	2,714	2,714	2,714	2,714	2,714	2,714
Total Debt Service	-	-	-	-	-	-	5,971	5,808	5,646	5,483	5,320	5,157
Increase in Current Assets (less cash)	411	10	247	255	540	401	310	330	278	87	110	41
Total Application of Fund	1,779	29,267	67,946	27,946	540	401	6,281	6,138	5,924	5,570	5,430	5,198
Net Cash Increase (Decrease)	640	43	98	521	757	2,785	(936)	1,654	2,597	3,874	5,151	6,388
Cash at Year End	640	683	781	1,302	2,059	4,844	3,908	5,562	8,159	12,033	17,184	23,572
Debt Service Cover	-	-	-	-	-	-	0.9	1.3	1.5	1.7	2.0	2.2

Table-5.3.12 Project Balance Sheet, 1984-1986 (LE 1000) Alternative-2

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Assets													
Fixed Assets:													
Utility Facility in Service	48,952	48,952	48,952	48,952	66,178	174,967	174,967	174,967	174,967	174,967	174,967	174,967	174,967
Less Accumulative Depreciation	21,185	22,409	23,633	24,857	26,511	30,885	35,259	39,633	44,007	48,381	52,755	57,129	61,503
Net Fixed Assets in Service	27,767	26,543	25,319	24,095	39,667	144,082	139,708	135,334	130,960	126,586	122,212	117,838	113,464
Construction in Progress	-	1,368	30,625	98,324	108,789	-	-	-	-	-	-	-	-
Total Fixed Assets	27,767	27,911	55,944	122,419	148,456	144,082	139,708	135,334	130,960	126,586	122,212	117,838	113,464
Current Assets:													
Cash	-	640	683	781	1,302	2,059	4,844	3,908	5,562	8,159	12,033	17,184	23,572
Account Receivable	-	298	298	534	759	1,190	1,567	1,850	2,151	2,397	2,450	2,522	2,522
Inventory	-	113	123	134	164	273	297	324	353	385	419	457	498
Total Assets	27,767	28,962	57,048	123,868	150,681	147,604	146,416	141,416	139,026	137,527	137,114	138,001	140,056
Equity and Liability													
Equity	27,767	27,767	27,767	27,767	27,767	27,767	27,767	27,767	27,767	27,767	27,767	27,767	27,767
Government Contribution	-	3,211	19,902	58,326	77,891	77,891	77,891	77,891	77,891	77,891	77,891	77,891	77,891
Retained Earnings	-	(3,022)	(6,210)	(8,030)	(9,524)	(12,691)	(13,913)	(16,236)	(15,952)	(14,780)	(12,526)	(8,977)	(4,265)
Total Equity	27,767	27,956	41,459	78,063	96,134	92,967	91,745	89,422	89,706	90,878	93,132	96,681	101,393
Foreign Loan	-	806	15,376	45,577	54,287	54,287	54,287	51,573	48,859	46,145	43,431	40,717	38,003
Account Payable	-	200	213	228	260	350	384	421	461	504	551	603	660
Total Current Liability	-	1,006	15,589	45,805	54,547	54,637	54,671	51,994	49,320	46,649	43,982	41,320	38,663
Total Equity and Liability	27,767	28,962	57,048	123,868	150,681	147,604	146,416	141,416	139,026	137,527	137,114	138,001	140,056
Debt/Equity Ratio	0/100	3/97	27/73	37/63	36/64	37/63	37/63	37/63	35/65	34/66	32/68	30/70	28/72

Table 5.3.13 Financial Internal Rate of Return (F.I.R.R.)

(LE 1,000)

Alternative - 1

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995-2004
Water Revenues	596	596	2,137	3,034	4,761	6,269	7,401	8,604	9,588	9,799	10,087
Investment Costs	1,255	24,434	51,344	18,708	-	-	-	-	-	-	-
Operating Costs	2,238	2,238	2,238	2,392	2,957	3,081	3,081	3,081	3,081	3,081	3,081
NET BENEFITS	(2,897)	(26,076)	(51,445)	(18,066)	1,804	3,188	4,320	5,523	6,507	6,718	7,006

F.I.R.R.: 4.985 % ≒ 5 %

Alternative - 2

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995-2004
Water Revenues	596	596	2,137	3,285	5,409	7,759	10,356	13,285	14,521	16,009	17,762
Investment Costs	1,255	24,434	51,344	18,708	-	-	-	-	-	-	-
Operating Costs	2,238	2,238	2,238	2,392	2,957	3,081	3,081	3,081	3,081	3,081	3,081
NET BENEFITS	(2,897)	(26,076)	(51,445)	(17,815)	2,452	4,678	7,275	10,204	11,440	12,928	14,681

F.I.R.R.: 10.114 % ≒ 10 %

6. PROJECT BENEFIT

Various aspects of the project's benefit such as the improvement of water supply service and environment and the development of regional/national socio-economy and local construction industry will be described hereto.

6.1 Improvement in Water Supply Service

6.1.1 Per Capita Consumption

The per capita consumption in 1983 shown in Table-3.3.5 is seemingly nominal and is considerably higher than the actual net delivery. Improvement by the project will ensure, by raising the production capacity (see Fig-3.5.9) and upgrading the distribution system, the delivery/consumption as listed in the table, while supplying more water to the house-connection users categorized A and B in future.

6.1.2 Served Area

Wide areas are left unserved of water in Kafr Saqr, El Huseiniya, Abu Hammad, and Faqus as seen on Fig-6.1.1 as the pipelines are not extended to them. Construction of the treatment plants in the Governorate's northern part and extention of distribution pipelines will substantially enlarge the served area and enclose them as shown on Fig-6.1.2.

6.1.3 Service Pressure

Improvement of the production and distribution capacity will raise the service pressure as it is clearly recognized by comparing Fig-6.1.1 with Fig-6.1.2. The peripheral low pressure (0-10 m) zones in Abu Hammad, Faqus, Abu Kebir, Kafr Saqr, Ibrahimiya and Diarb Nigm are relieved and most of the central and northern parts of the Governorate will be served under 10 to 20 m higher pressure than the present one.

6.2 Improvement in Environment

6.2.1 Disease

Fig-6.1.3 shows the relationship between the per capita water consumption and the incidence of amoebic dysentry and bilharzia in the Governorate. The tendency that more water effects less disease is obvious there. By expanding the served area and ensuring the planned consumption, endemic and epidemic deseases, in this connection infant mortality as well, will decrease noticeably.

6.2.2 Fire

In the Governorate, many tall buildings are inhabited, small, medium and large factories are in operation in the cities, while the roads and streets are not organized very well. A fire may cause disastrous damage on the peoples lives and properties, especially under the existing water supply conditions. The planned improvement of distribution system and installation of more firehydrants in the strategic locations will change the situation for the better remarkably.

6.2.3 Women and Children's Labor

Common and characteristic in the developing countries is the fact that laborious and fruitless work of carrying water to home takes the major part of women and children's daytime. In the Governorate where such work force could be used in more productive works, the situation should be corrected and the project is most effective for it.

6.3 Development

6.3.1 Regional and National

The geographical importance of Sharqiya Governorate in the coutry is self-evident in that it is close to Cairo, Cair-Alexandria highway and railway, located on the way from Cairo to the canal cities and in

the heart of the Nile Delta, and the capital city of Zagazig is a hub of the highway and railway system.

As Cairo is overpopulated even now and the further growth is apparently undesirable for a healthy development of the regional socio-economy, the Governorate will have to shoulder the growth impact load of Cairo partly, and it is right in an affordable and advantageous position.

Providing a sufficient and good quality water will doubtlessly activate the Governorate progress in general socio-economic situation, help solving the problems of sprawling Cairo, and eventually contribute to the national development.

6.3.2 Local Construction Industry

Construction of the waterworks facilities will present an oppotunity of utilizing the local resouces like labors, professionals, materials and products, as it is both labor and middle-level-technology intensive. It will certainly upgrade the level of the local construction industry and, at the same time, cause a chain reaction on diversified fields of the economic activity, as a large civil construction work usually affects.

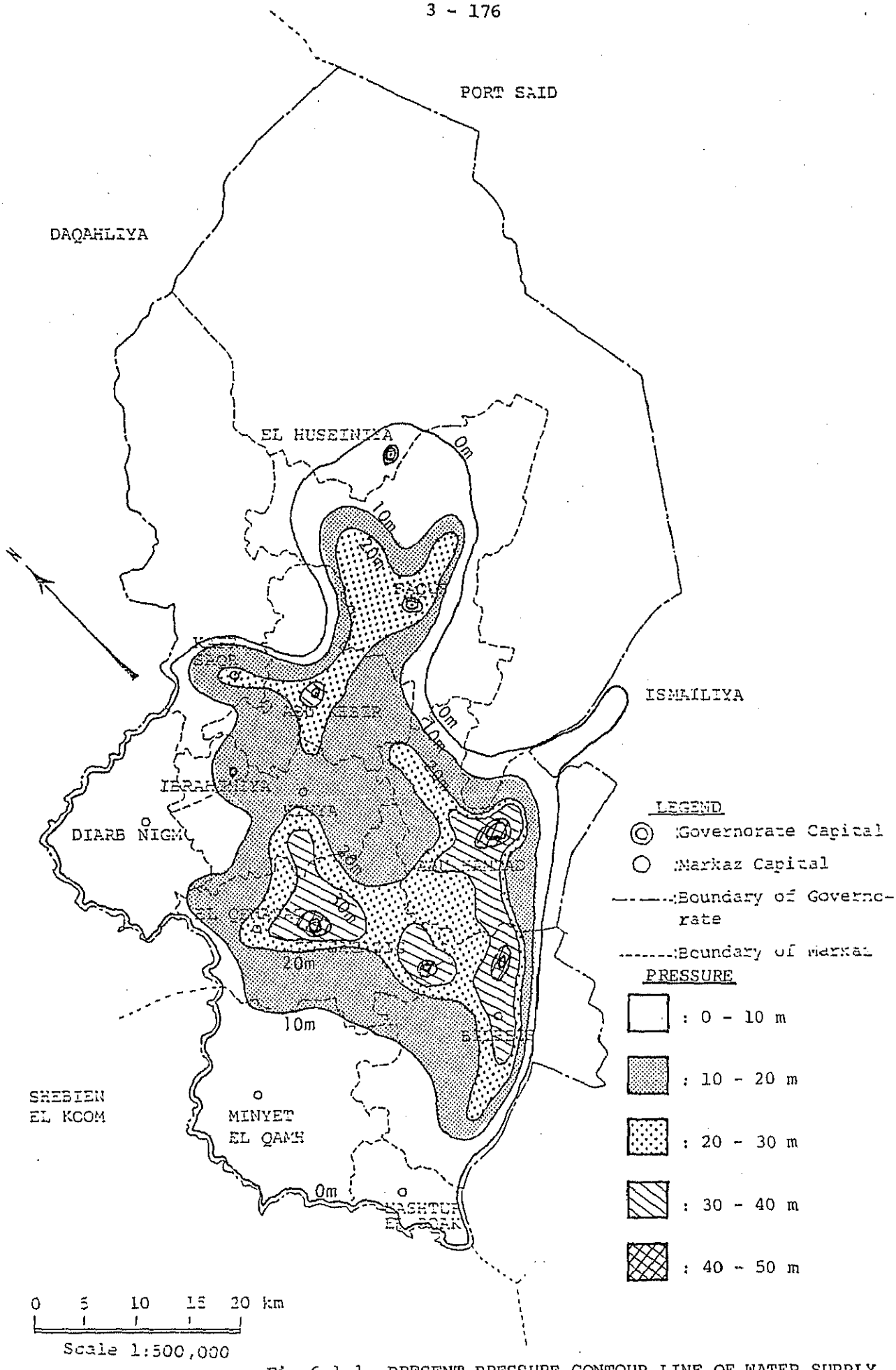


Fig-6.1.1 PRESENT PRESSURE CONTOUR LINE OF WATER SUPPLY

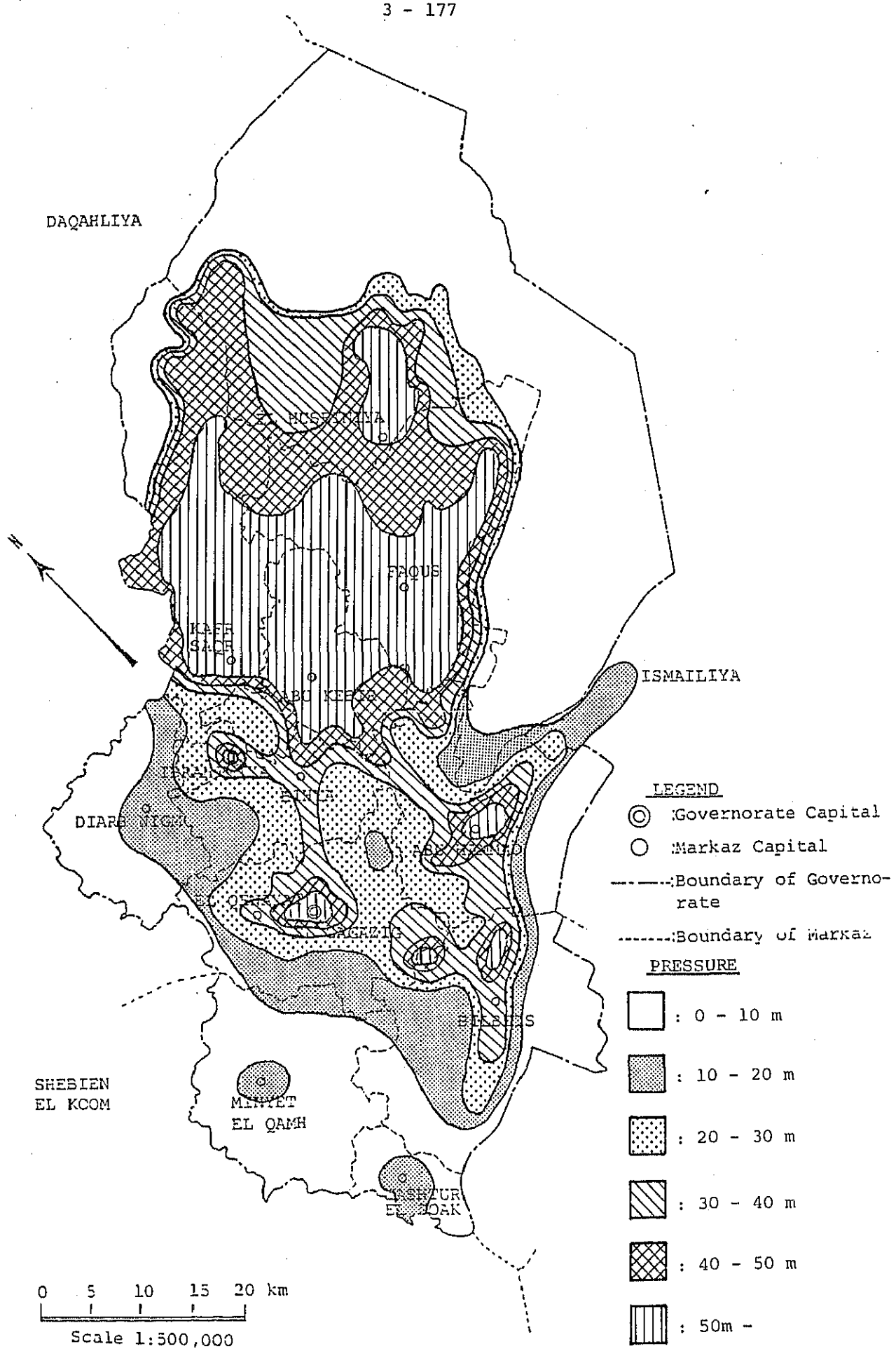
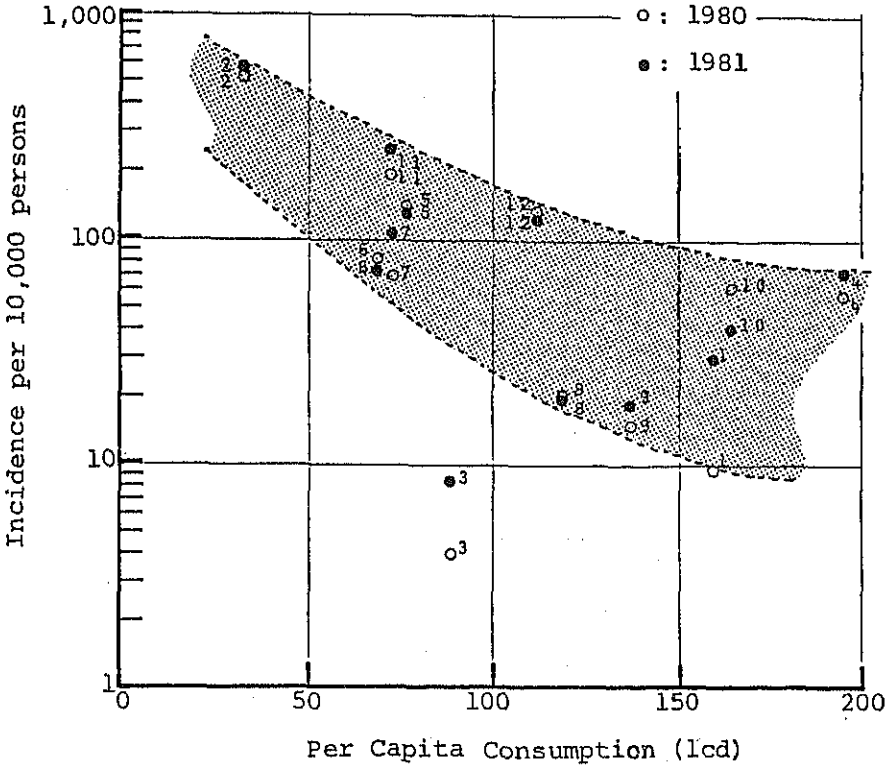


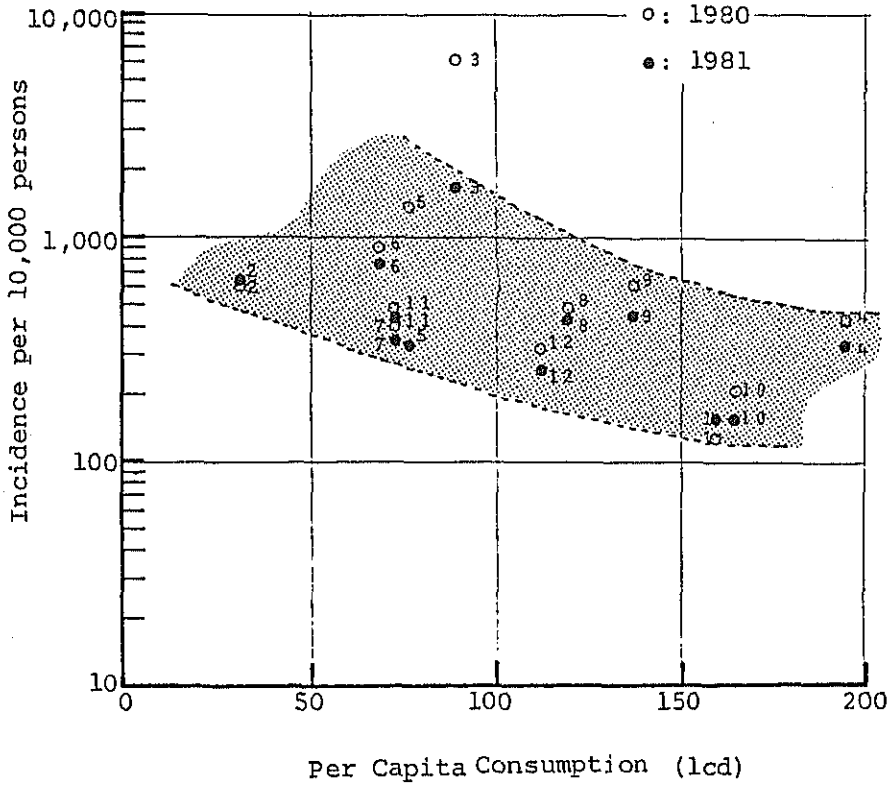
Fig-6.1.2 ESTIMATED PRESSURE CONTOUR LINE OF WATER SUPPLY IN 1995

Fig-6.1.3 TREND BETWEEN INFECTIOUS DISEASE AND PER CAPITA CONSUMPTION

AMOEBIC DYSENTRY



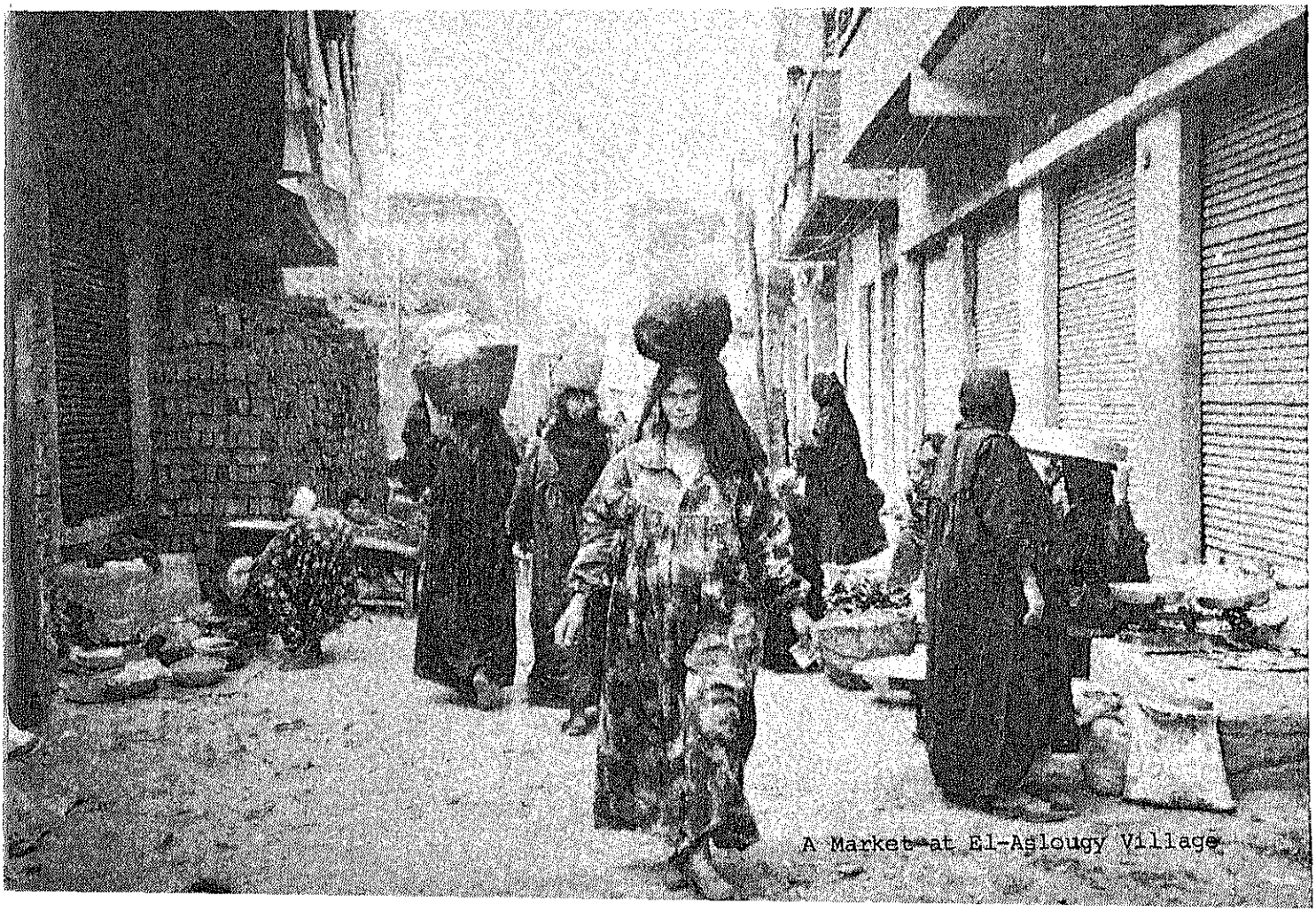
BILHARZIA



1. Zagazig
2. Huseiniya
3. Kafr Saqr
4. Faqus
5. Abu Kevir
6. Abu Hammad
7. Ibrahimiya
8. Hihya
9. Diarb Nigm
10. Bilbeis
11. Mashtul el Souk
12. Minyet el Qamh

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

APPENDIX



A Market at El-Aslougy Village

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

CONTENTS

1. Alternative Study on Distribution System

This paper is to present the results of the alternative study on the distribution systems, i.e., elevated reservoir system vs. direct pumping system. Thus, this deals with following alternatives:

Alternative 1. Elevated reservoir system:
Proposed trunk mains function as transmission mains from proposed treatment plant to elevated reservoirs which supply water to nearby villages. Total capacity of reservoirs is equivalent to 6hr flow of the daily maximum demands.

These elevated tanks save the capacities of clear water reservoirs at the proposed treatment plants to 1hr equivalent.

Alternative 2. Direct pumping system (peak factor: 1.4) : Peak hour demands are given by 1.4 times daily maximum demands.

Trunk main capacity will meet the peak hour demands, and the daily max. demand to the proposed Huseiniya booster pumping station will be covey through one of the trunk mains.

Alternative 3. Direct pumping system (Peak factor: 1.2): Peak hour demands are given by 1.2 times daily maximum demands.

Trunk mains function as distribution mains to meet peak hour demands.

The daily max. demand to the proposed Aulad Saqr booster pumping station will be conveyed through one of the trunk mains.

Design Criteria

The design criteria relevant to the study is summarized below:

i) Minimum residual pressure:
- 10 m for rural areas; and
- 20 m for urban areas

ii) Capacity of pipeline:
The trunk mains for the present project will be one of below:
- Existing mains meeting the 1995 demands;
- Existing plus proposed mains meeting the 2005 demands; or
- Proposed mains meeting the 2005 demands

iii) Capacity of Elevated tanks:
- 200 m3

iv) Capacity of clear water reservoirs of treatment plants:
- 1 hr equivalent of the daily max. demand for Alternative 1
- 6 hr equivalent of the daily man. demand for alternative 2 and 3

Project cost

The construction costs of the clear water reservoirs are also indicated to compare the project costs affected by the choice of alternatives.

The project cost of each alternative is estimated as follows:

Alternative 1.	Elevated reservoir system:	LE 61.5 million
Alternative 2.	Direct pumping system: (Peak factor: 1.4)	LE 48.3 million
Alternative 3.	Direct pumping system: (Peak factor: 1.2)	LE 46.1 million

Conclusion

Alternative I is ruled out because of its high project cost.

Alternative 3 is prefered to Alternative 2. This choice will achieve the project cost saving of about 5%. NOPWASD is to shave off the financial burden even at cost of the service level of to consumers, though NOPWASD and the study team duly recognize that employing a smaller peak factor implys less convenience among part of consumers during the peak hour period in summer.

Construction Cost
Distribution System

Alternative 1. ELEVATED RESERVOIR SYSTEM

Item	AMOUNT (LE 1000)		
	Total	F	L
Trunk mains (223.5 km)	32,046	20,326	11,720
Branches * 1 (35 km)	4,246	2,617	1,629
Service mains: Cities (36 km)	2,023	689	1,334
Rural (120 km)	2,683	1,589	1,094
Elevated Tanks (70 tanks)*2	18,900	1,890	17,010
Booster Pumping Stations:			
Huseiniya	730	234	496
Anlad Sagr	470	128	342
Sub-Total	61,098	27,473	33,625
Clear water reservoirs *3			
New Northeast Plant	260	26	234
New Kafr Saqr Plant	190	19	171
Sub-Total	450	45	405
Grand Total	61,548	27,518	34,030

*1 Transmission mains from trank mains to tanks (ø300, 0.5 km each)
*2 Total capacity of tanks: 6 hr equivalent of daily max demand
*3 Total capacity of reservoirs: 1 hr equivalent of daily max demand.

Construction Cost
Distribution System

Alternative 2. DIRECT PUMPING SYSTEM — Peak Factor: 1.4

Item	AMOUNT (LE 1,000) Total	F	L
Trunk mains (223.5 km)	41,049	27,364	13,685
Branches * 1 (- km)	-	-	-
Service mains: Cities (36 km)	2,023	689	1,334
Rural (120 km)	2,683	1,589	1,094
Elevated Tanks (5 tanks)*2	1,350	135	1,215
Booster Pumping Stations:			
Huseiniya	730	234	496
Anlad Sagr	470	128	342
Sub-Total	48,305	30,139	18,166
Clear water reservoirs *3			
Non Northeast Plant	890	89	801
Non Kafr Saqr Plant	650	65	585
Sub-Total	1,540	154	1,386
Grand Total	49,845	30,293	19,552

*1 No branch provided
*2 Emergency supply purpose
*3 Total capacity : 6 hr equivalent

Construction Cost
Distribution System

Alternative 3. DIRECT PUMPING SYSTEM Peak Factor: 1.2

Item	AMOUNT		
	Total	F	L
Trunk mains (234.1 km)	38,851	25,572	13,279
Branches * 1 (- km)	-	-	-
Service mains: Cities (36 km)	2,023	689	1,334
Rural (120 km)	2,683	1,589	1,094
Elevated Tanks (5 tanks)*2	1,350	135	1,215
Booster Pumping Stations:			
Huseiniya	730	234	496
Anlad Sagr	470	128	342
Sub-Total	46,107	28,347	17,760
Clear water reservoirs *3			
Non Northeast Plant	890	89	801
Non Kafr Saqr Plant	650	65	585
Sub-Total	1,540	154	1,386
Grand Total	47,647	28,501	19,146

*1 No branch provided
*2 Emergency supply purpose
*3 Total capacity : 6 hr equivalent

2. Alternative Water Source

As pointed out in the previous studies, the Muweis and the Saidiya Canals may be emptied for about 3 weeks during winter season. This is due to maintanance work undertaken by the irrigation authority. Unless the authority discountinues this practice, raw water abstraction at the proposed two treatment plants, namely, New Northeast Plant and New Kafr Saqr Plant may be interrupted for about 3 weeks a year. Although both NOPWASD and the Governorate endeavor to secure the minimum flow required for the First-Priority Phase project, the agreement on keeping the minimum flow with the canal authority is not reached yet.

To cope with the possible discontinuity of raw water abstraction, the present study is carried out to assess the plan to convey raw water from the Ismailiya Canal to New Northeast Plant, to treat water at the Plant, and to distribute purified water to the service area of the priority-phase program.

The study deals with 2 alternatives: i) 45,000 m3/day supply and ii) 90,000 m3/day supply. Both are assumed to operate for about 3 weeks a year at maximum if implemented.

Alternative 1 — 45,000 m3/day Supply

Objectives: To fulfil the minimum requirement of the habitants in 3 Markaz of Huseiniya, Faqus and Kafr Saqr during the winter season while the New Northeast Plant will operate to full extent of the priority phase program.

Level of Services: Approximately half of the estimated 2005 daily average demands in winter season to be met.

Service area: Huseiniya Markaz, Faqus Markaz, and Kafr Sarq Markaz.

Raw water intake: 49,500 m3/day (45,000 m3/day and 10% loss)

Raw water pumping station:

6 sets (including standby 2 sets)
Horizontal double suction volute pumps,
(ø 300 x 8.6 m3/min x 88 m x 200 kW x 1,450 rpm x 3,300 V)

Raw water transmission main:

ø 700 mm, 20 km

Treatment Plant: New Northeast Plant

Plant production: 45,000 m3/day

Trunk mains: No additional installation work required. The proposed system for the First priority Phase Program will have enough capacity to distribute the production.

Demand allocation:

Huseiniya Markaz	...	11,200 m3/day
Fawus Markaz	...	22,500 m3/day
Kafr Saqr Markaz	...	11,300 m3/day
Total		45,000 m3/day

Estimated Project Cost: LE 7,711,000

Daily Operation cost: LE 300/day

Description :

This plan is to meet the water requirement of about half of 1995 daily demands in winter season in the Markaz of Huseiniya, Faqus, and Kafr Saqr including the Cities.

Raw water of 49,500 m3/day, including 10 % loss for treatment processes, is abstracted from the Ismailiya Canal and is pumped to the New Northeast Plant through 20 km transmission main of 700 mm diameter. The raw water is treated at the plant which produces 45,000 m3/day purified water is distributed to Faqus, Huseiniya, and Kafr Saqr Markaz. Both Booster Pumping Stations located at Huseiniya and Anlad Saqr are also supplied by the plan.

Abu Kebir City is excluded from the present plan, since the City will be partly supplied by its own municipal groundwater source and the existing Abbasa Plant.

Alternative 2 — 90,000 m3/day Supply

Objectives: To fulfil 75 % of the daily average demands in the Markaz of Huseiniya, Faqus, and Kafr Saqr up to 2005 level, during the winter season when canal flow is ceased, and to use the New Northeast Plant to full extent.

Level of Services: 75 % of the average water demands will be met up to 2005 level

Service Area: Huseiniya Markez, Faqus Markez, and Kafr Saqr Markez

Raw water intake: 99,000 m3/day (90,000 m3/day and 10% loss)

Raw water pumping station:

6 sets (including standby 2 sets) of
Horizontal double suction volute pumps
(ø 350 x 17.2 m3/min x 92 m x 450 kW x
1,450 rpm x 3,300 V)

Raw water transmission main:

ø 900 mm, 20 km

Treatment plant: New Northeast Plant

Plant production: 90,000 m3/day

Trunk mains: Additional installation of ø 450 mm, 0.8 km will be required.

Demand Allocation:

Huseiniya Markaz	22,400 m3/day
Faqus Markaz	45,000 m3/day
Kafr Saqr Markaz	22,600 m3/day
Total	90,000 m3/day

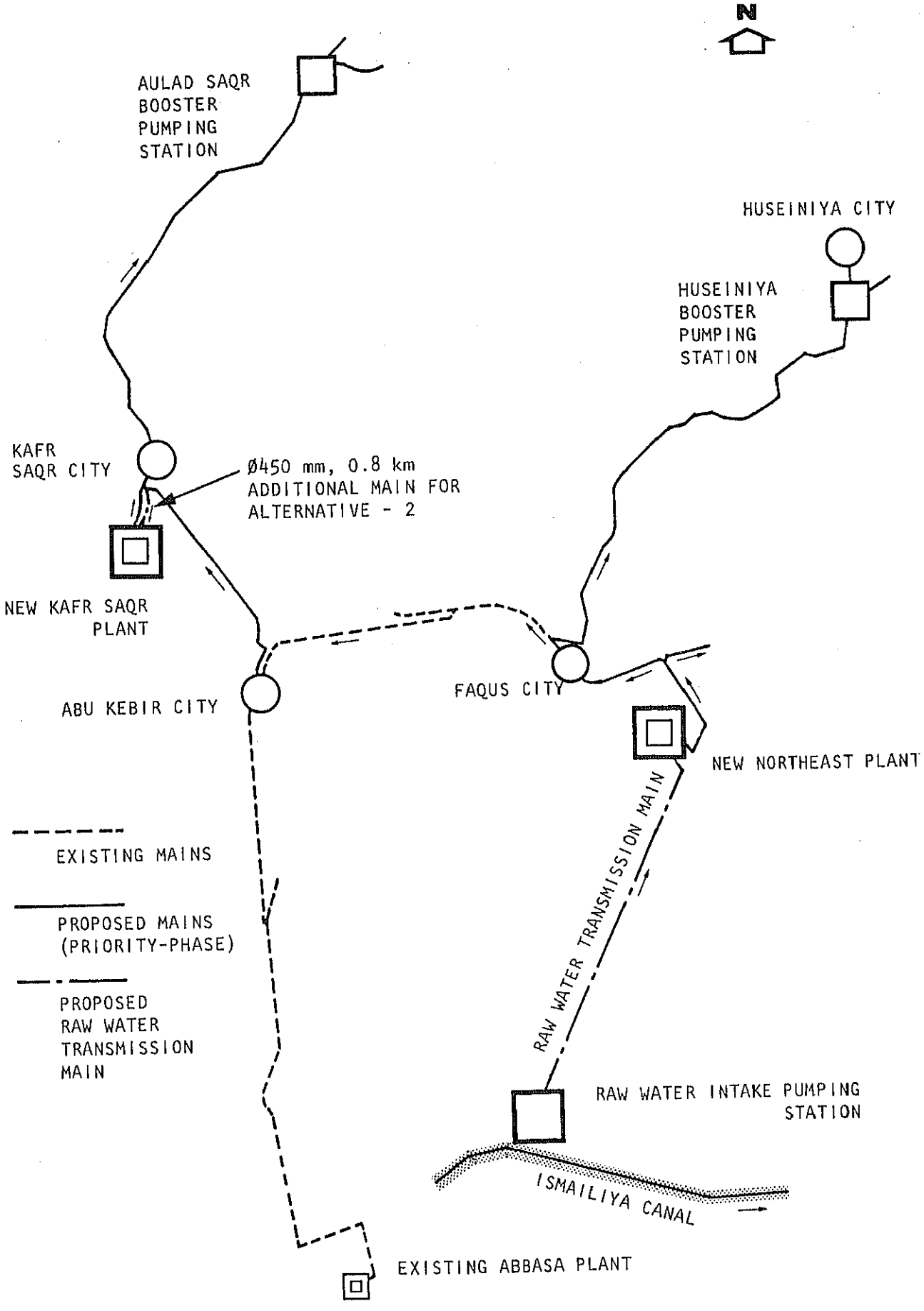
Estimated project cost: LE 11,330,840

Daily operation cost: LE 600/day

Description:

To meet the full demands during the discountinuity of raw water abstraction at the Muweis and Saidiya Canals, 99,000 m3/day raw water is pumped from the Ismailiya Canal to the New Northeast Plant. Purified water of 90,000 m3/day is distributed from the Plant to Faqus, Huseiniya Booster Pumping Station, and New Kafr Saqr Plant. The New Kafr Saqr Plant will receive 22,600 m3/day purified water through the additional 0.8 km trunk main of 450 mm diameter. The New Kafr Saqr Plant then distributes water to its service area including Aulad Saqr Booster Pumping Station.

Abu Kebir City is excluded from this plan, since the city is expected to be supplied by its own groundwater source and the existing Abbasa Plant.


N
AULAD SAQR BOOSTER PUMPING STATION
HUSEINIYA CITY
HUSEINIYA BOOSTER PUMPING STATION
KAFR SAQR CITY
Ø450 mm, 0.8 km ADDITIONAL MAIN FOR ALTERNATIVE - 2
NEW KAFR SAQR PLANT
ABU KEBIR CITY
FAQUS CITY
NEW NORTHEAST PLANT
RAW WATER TRANSMISSION MAIN
EXISTING MAINS
PROPOSED MAINS (PRIORITY-PHASE)
PROPOSED RAW WATER TRANSMISSION MAIN
RAW WATER INTAKE PUMPING STATION
ISMAILIYA CANAL
EXISTING ABBASA PLANT

3. Comparison of Alternative Water Sorce

The irrigation authority concerned has practiced the maintenance interrupting the canals for about three weeks (20 days) in winter as stated in the previous chapters. If the practice continues in future the Sharqiya Water Supply Systems have to employ some countermeasures to cope with the situation.

In this section the following countermeasures are studied :

a) Raw water is to be transmitted from Ismailiya canal to every treatment plant during the interrupted term (Raw Water transmission) , and
b) Reservoir(s) storing sufficient volume of water for the interrupted term (Raw Water Reservoir) are to be constructed.

3.1 Planned Water Demand of Water Supply

As the canals are to be interrupted in the winter, the daily demand of the water supply will be perhaps low. The planned water demand during the term is assumed as follows :

Water Demand in Winter = Average Water Demand x 75%
= Daily Max Demand x (1/1.25) x 0.75

3.2 Study Conditions

The countermeasures stated above are studied based on the following conditions :

a) The raw water transmission or raw water reservoir as stated

above is operated as the countermeasure for the winter season's interruption,

b) The location of the planned treatment plant(s) is not changed from the original location studied in Part II Long Term Project and Part III First Priority-Phase Program,

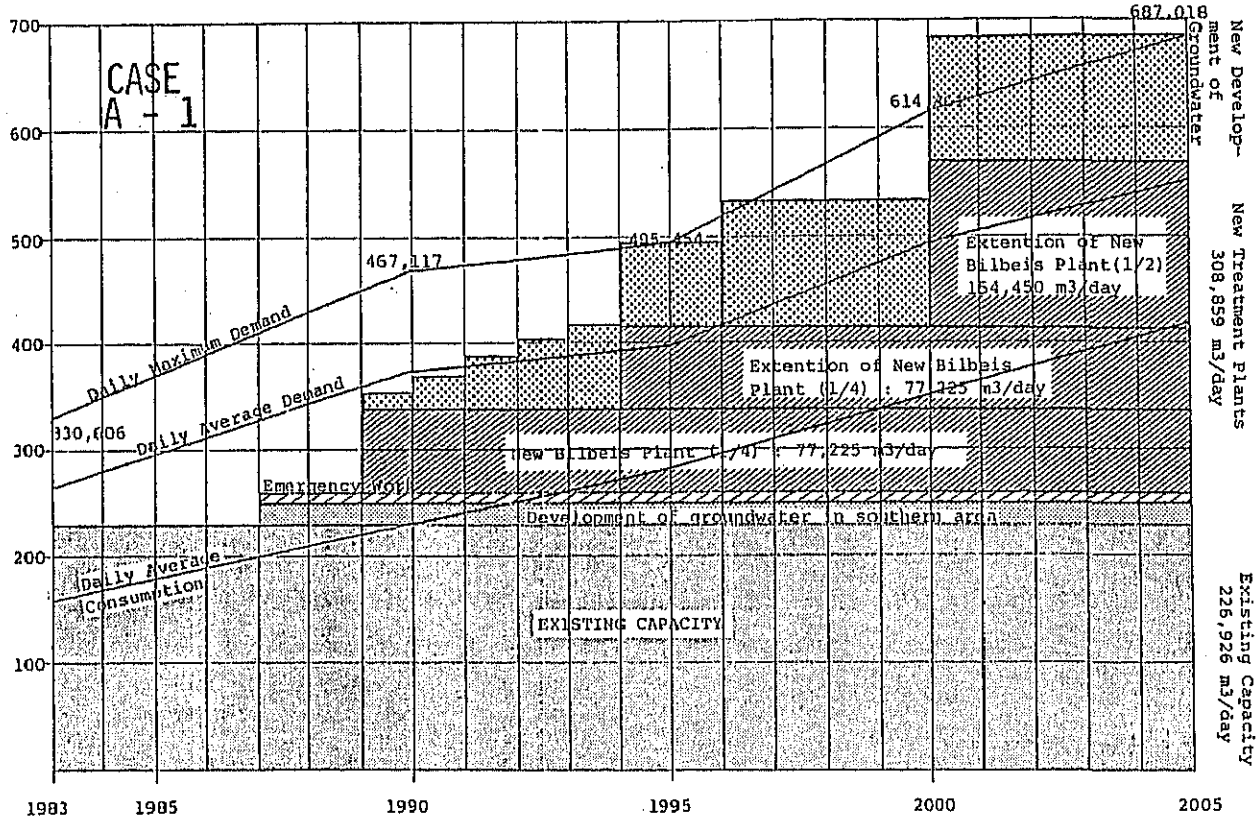
c) Treatment Plants planned in the study are constructed according to the attached figures "Extension of Treatment Plants", and

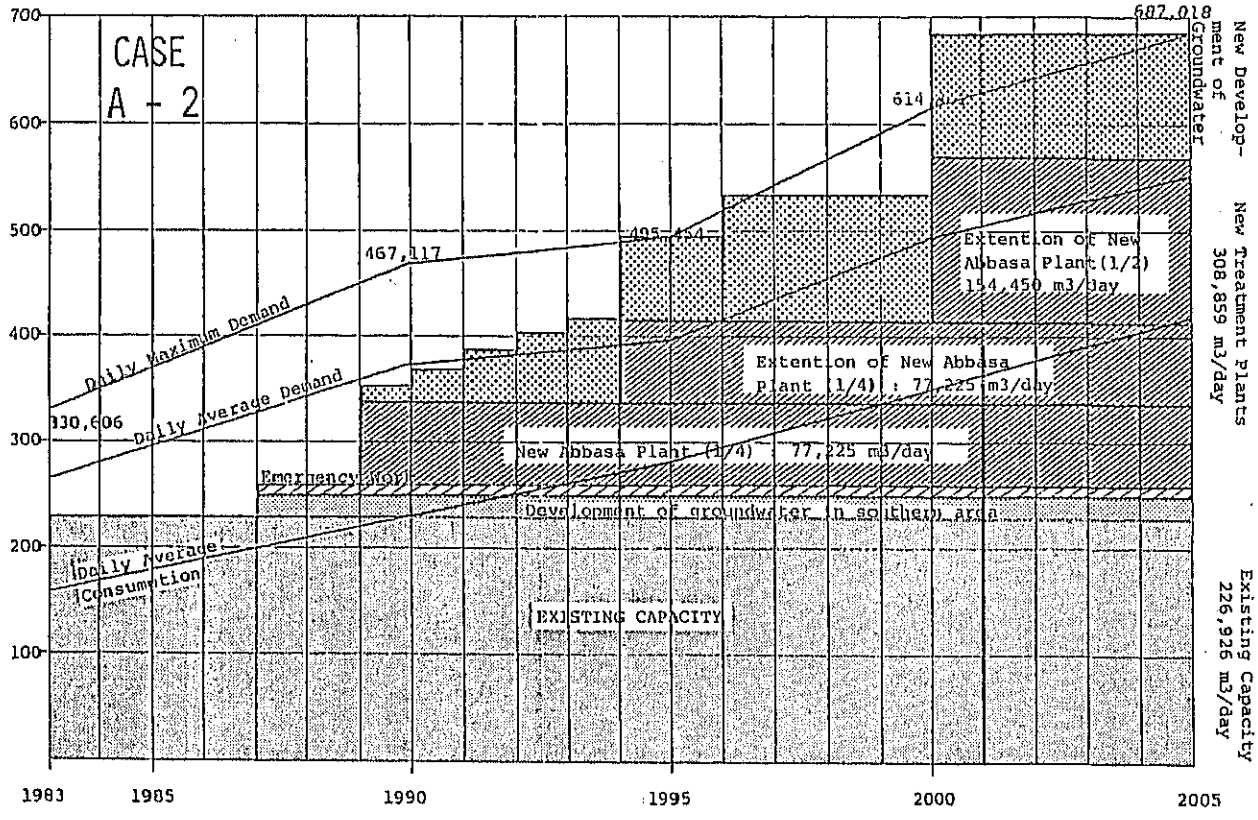
d) Present worth for 20 years and 6 % of discount rate are considered for the comparison.

3.3 Raw Water Transmission

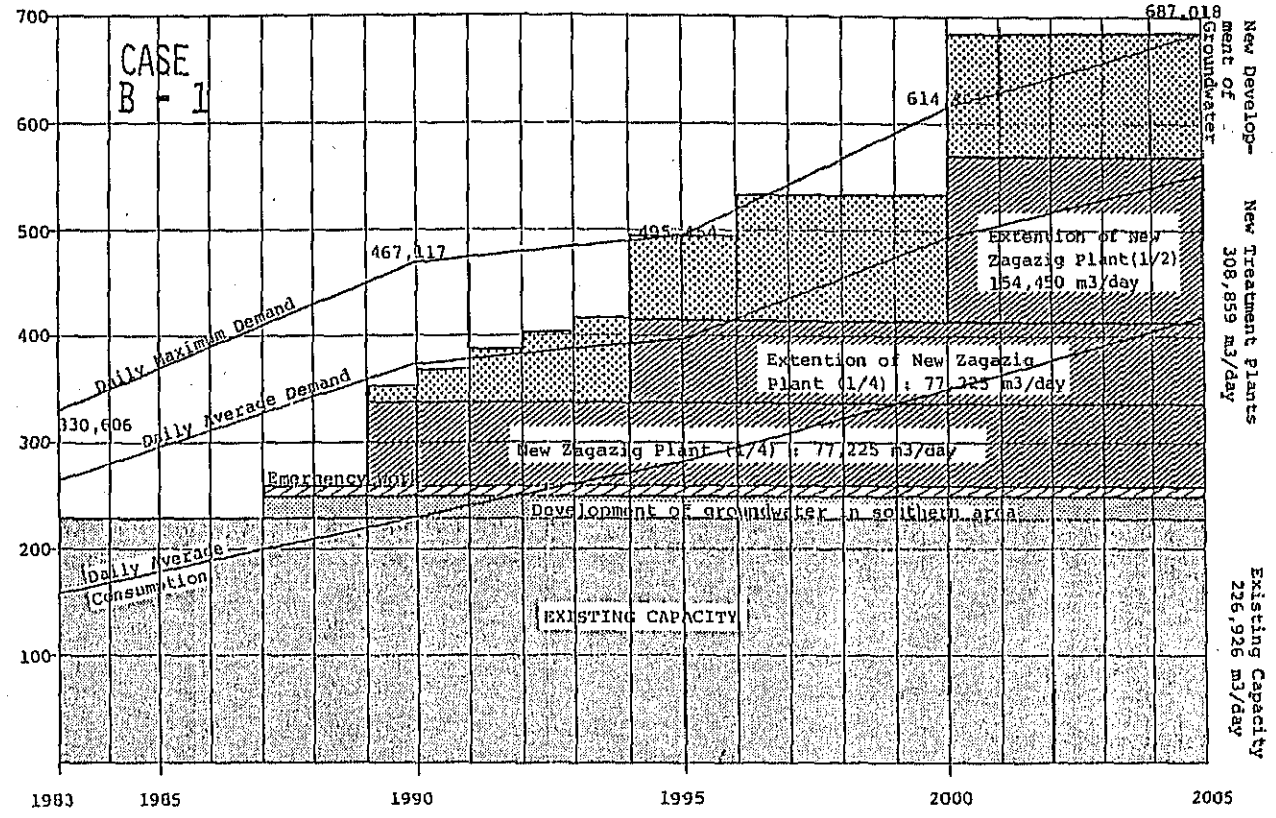
The comparative study is carried out under a general rule that the raw water is to be transmitted from Ismailiya canal to every treatment plant except for "B-5 plan", in which Kafr Saqr plant receives treated water from Northeast plant. Because it is more economical than the case that Kafr Saqr plant is supplied raw water from the canal.

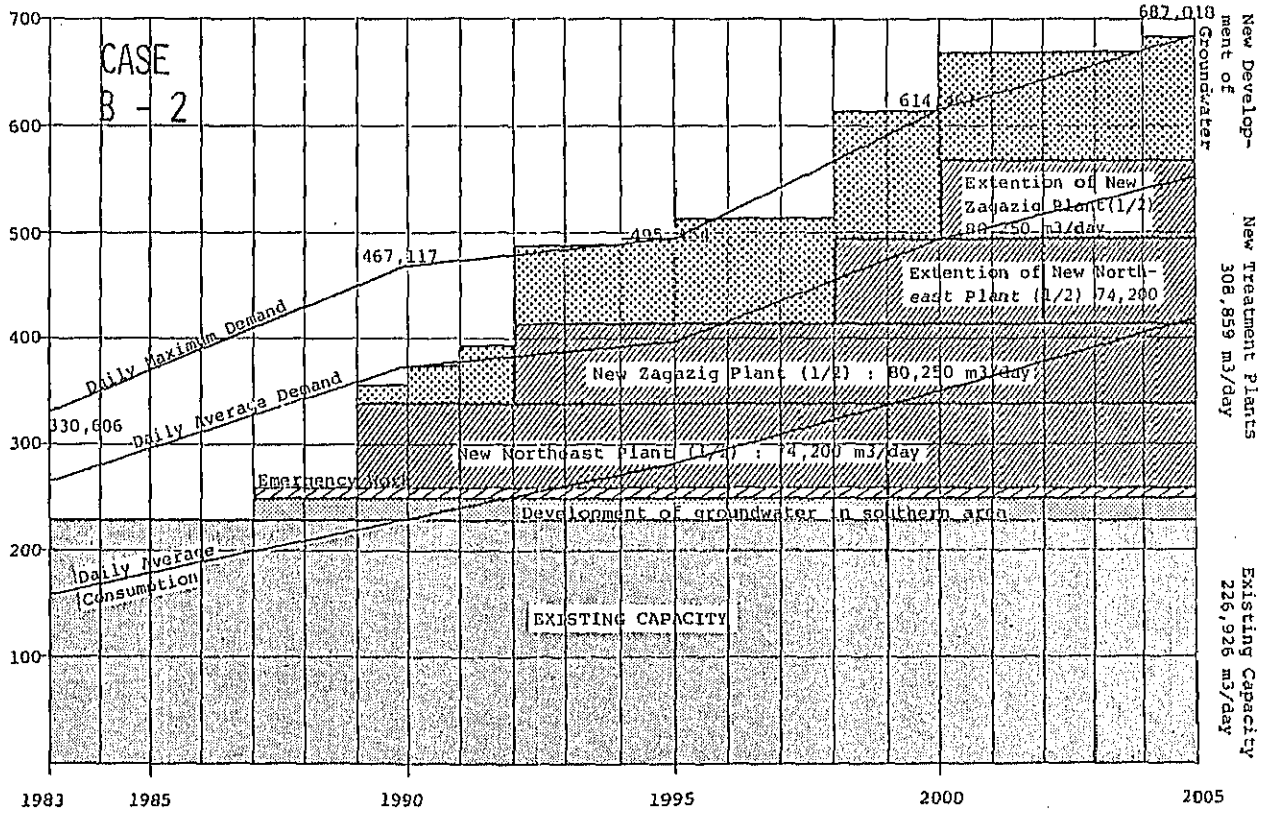
Every plan of the raw water transmission for the comparison is shown in the attached drawings, and the study results are as the following table.



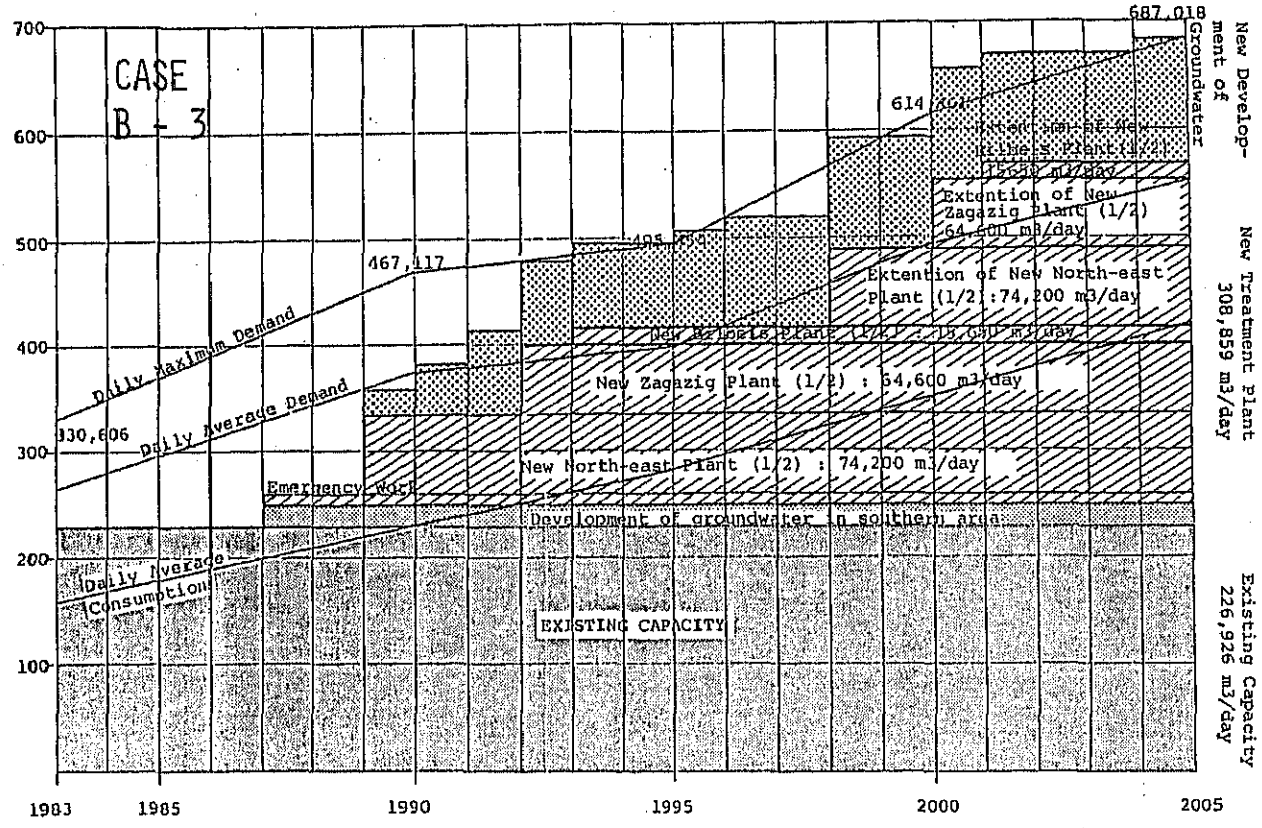


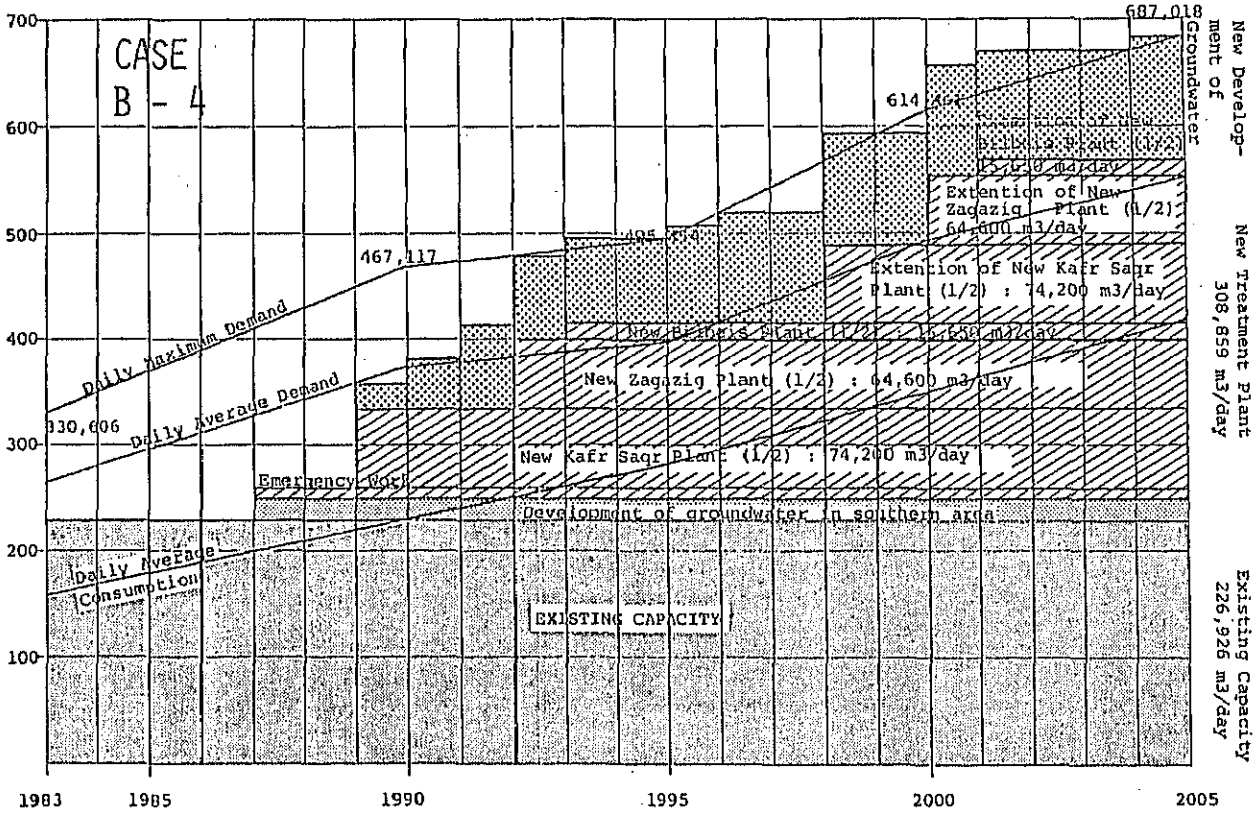
EXTENTION OF TREATMENT PLANTS (1)



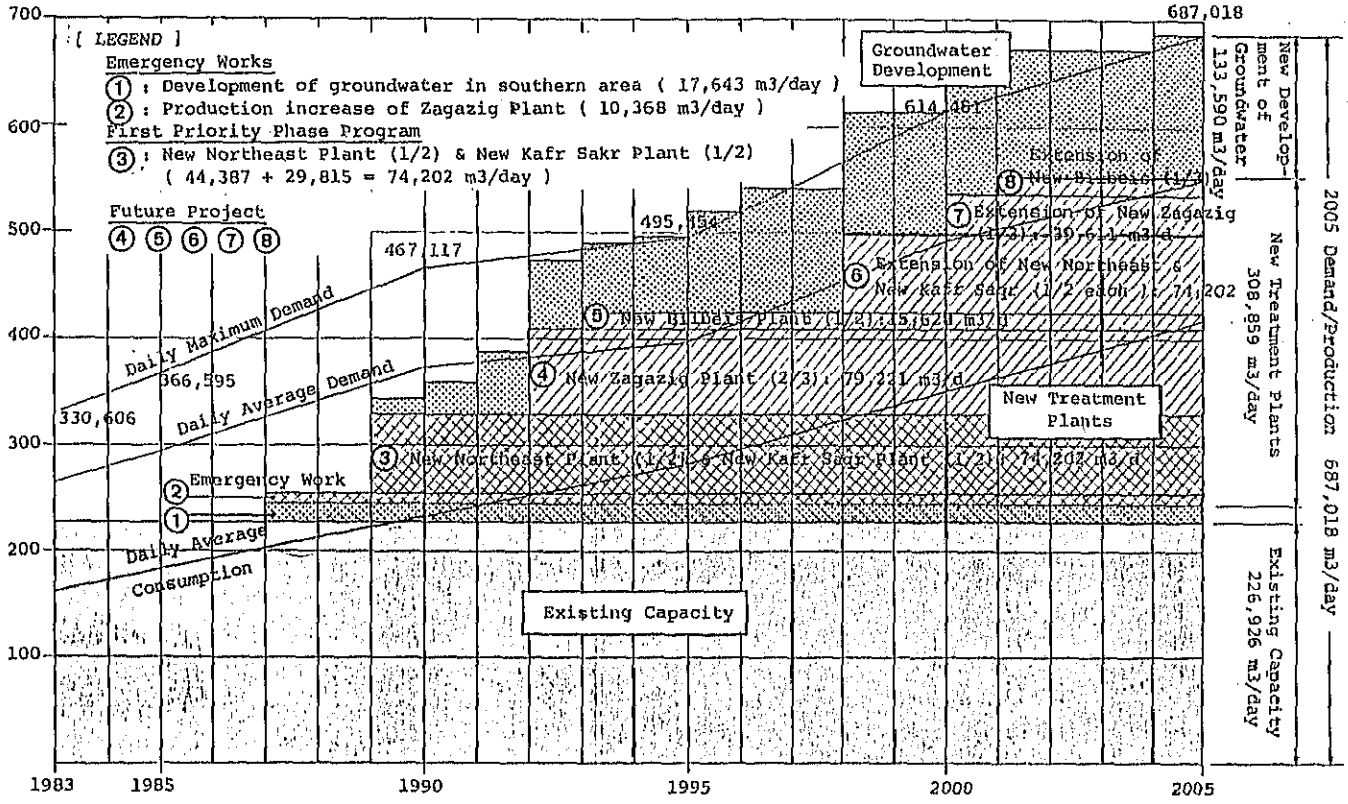


EXTENTION OF TREATMENT PLANTS (2)





EXTENTION OF TREATMENT PLANTS (3)



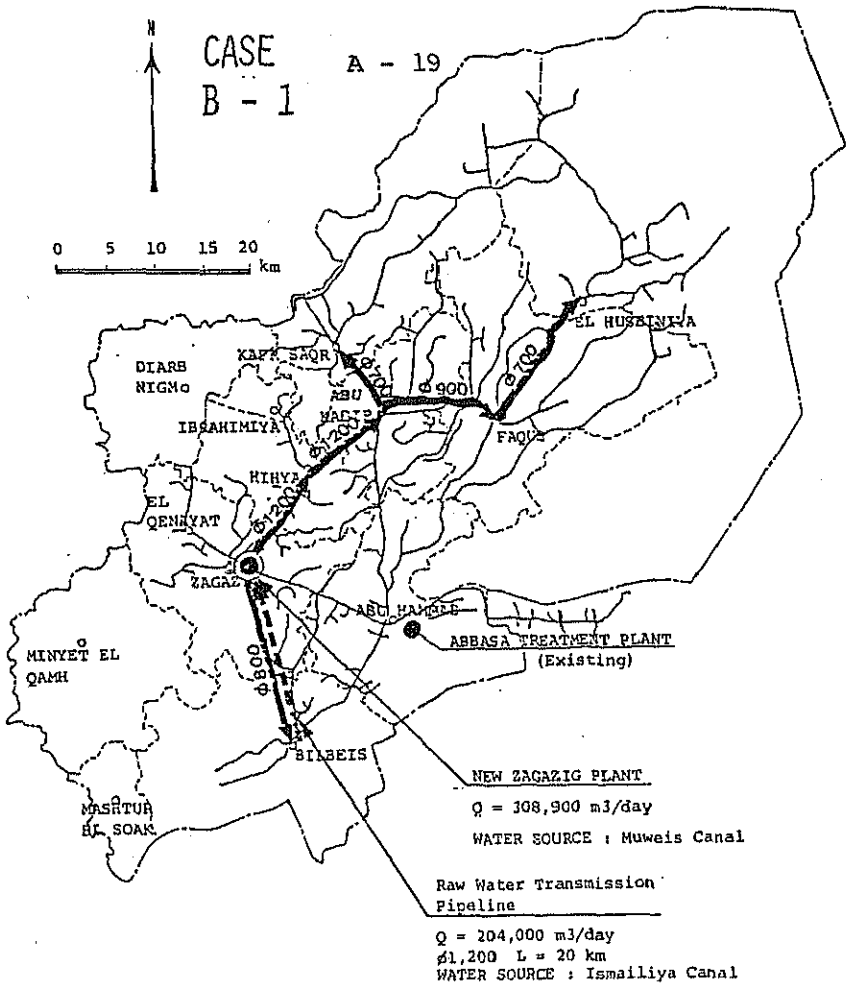
CASE B - 5

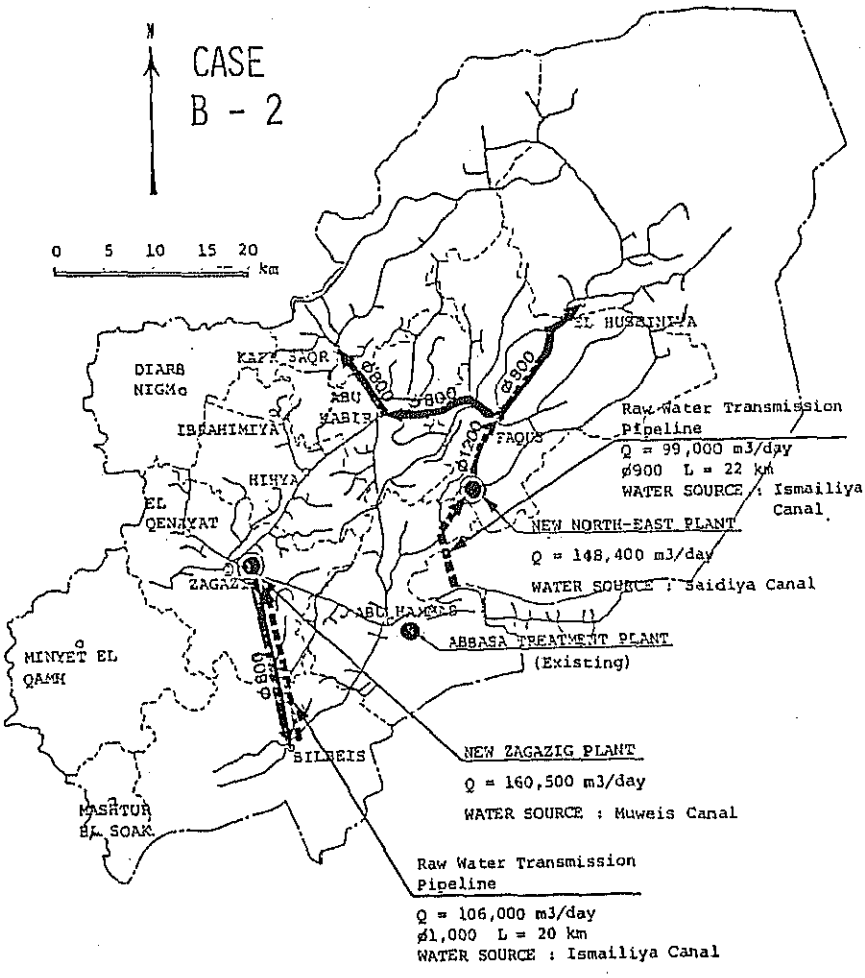
EXTENTION OF TREATMENT PLANTS (4)

COMPARISON OF RAW WATER TRANSMISSION PLANS AND TREATMENT PLANTS

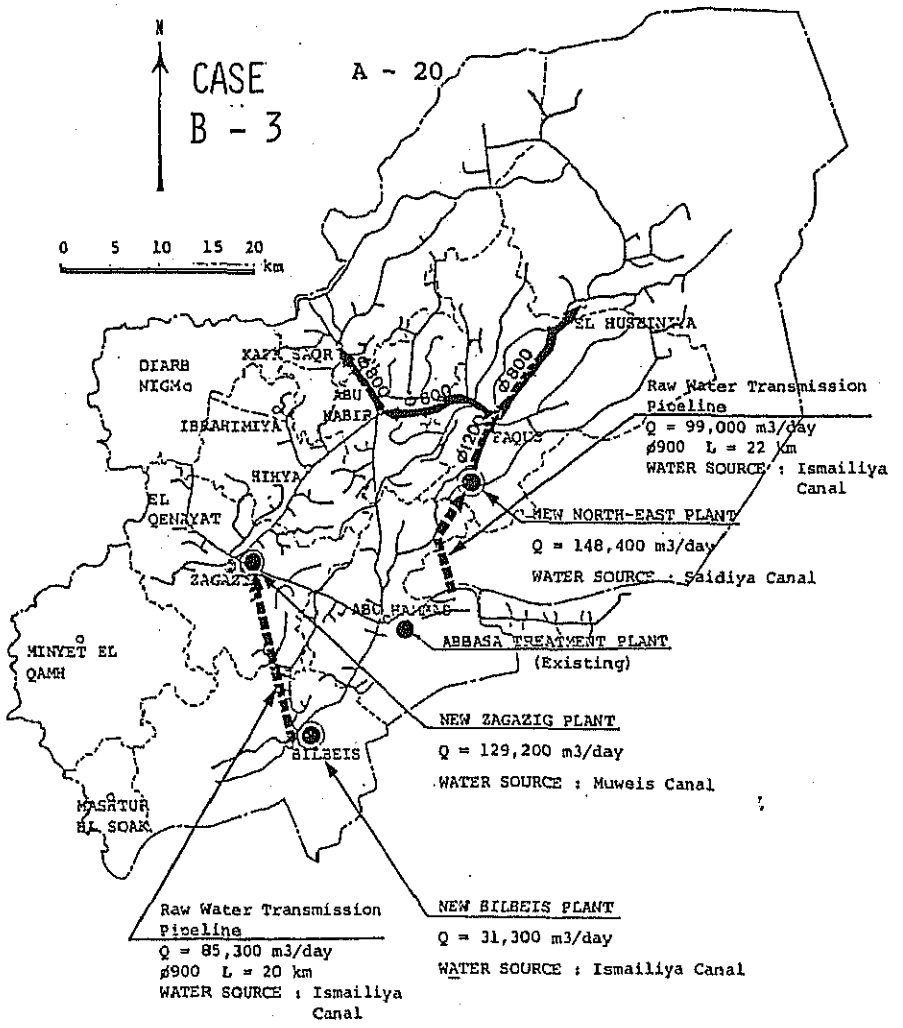
(Unit : Million LE)

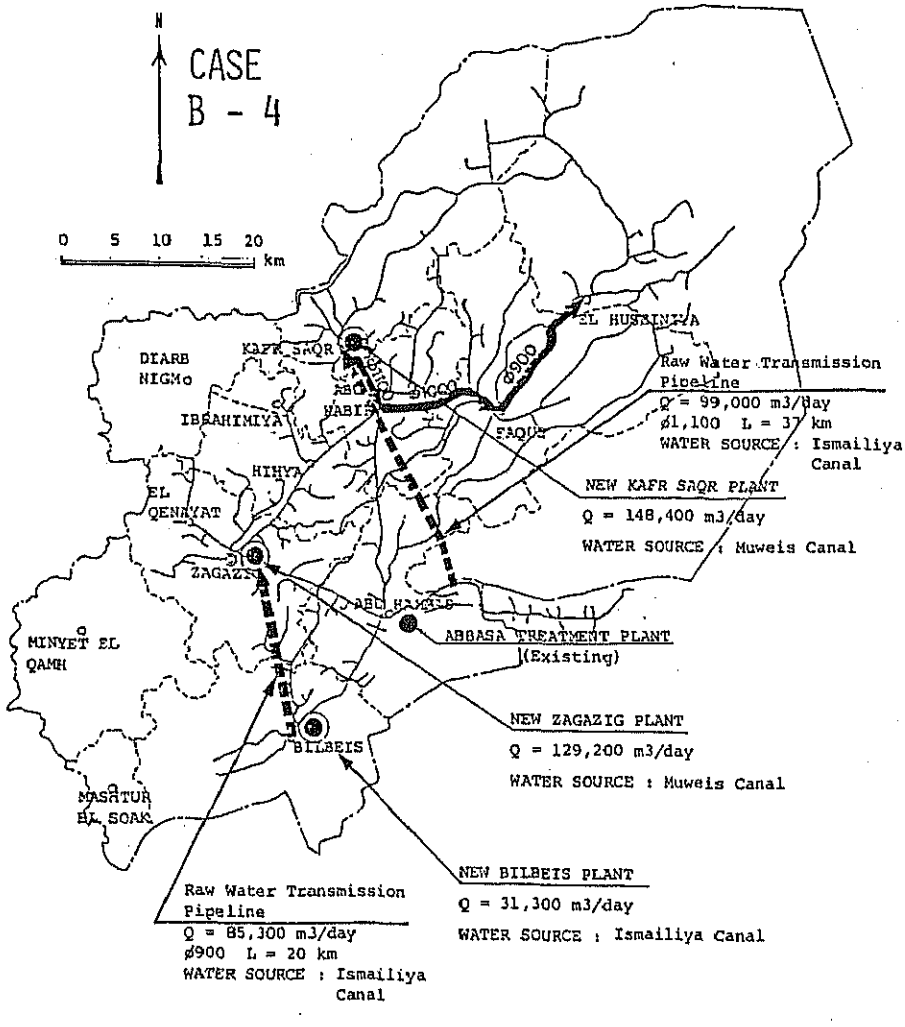
Item \ Case	A-1	A-2	B-1	B-2	B-3	B-4	B-5
1. Plant & Pipeline							
Construction Cost	151	150	125	120	117	123	115
Electric Power Required (kW)	10,200	8,736	7,506	5,733	5,733	3,051	4,311
No. of Personnel for Plant Operation (capita)	109	108	105	198	273	271	365
Operation Cost	3.1	2.9	2.8	2.7	2.8	2.5	2.7
Present Worth	104.3	103.9	87.9	86.2	85.4	86.1	85.0
2. Raw Water Transmission							
Costruction Cost	-	-	27	34	31	45	26
Electric Power Required (kW)	-	-	4,000	3,280	3,240	2,500	3,240
No. of Personnel for Operation (capita)	-	-	90	89	82	82	82
Operation Cost	-	-	0.2	0.2	0.2	0.2	0.2
Present Worth	-	-	21.9	24.9	22.2	34.0	19.4
3. Total							
Construction Cost	151	150	152	154	148	168	141
Present Worth	104.3	103.9	109.8	111.1	107.6	120.1	104.4



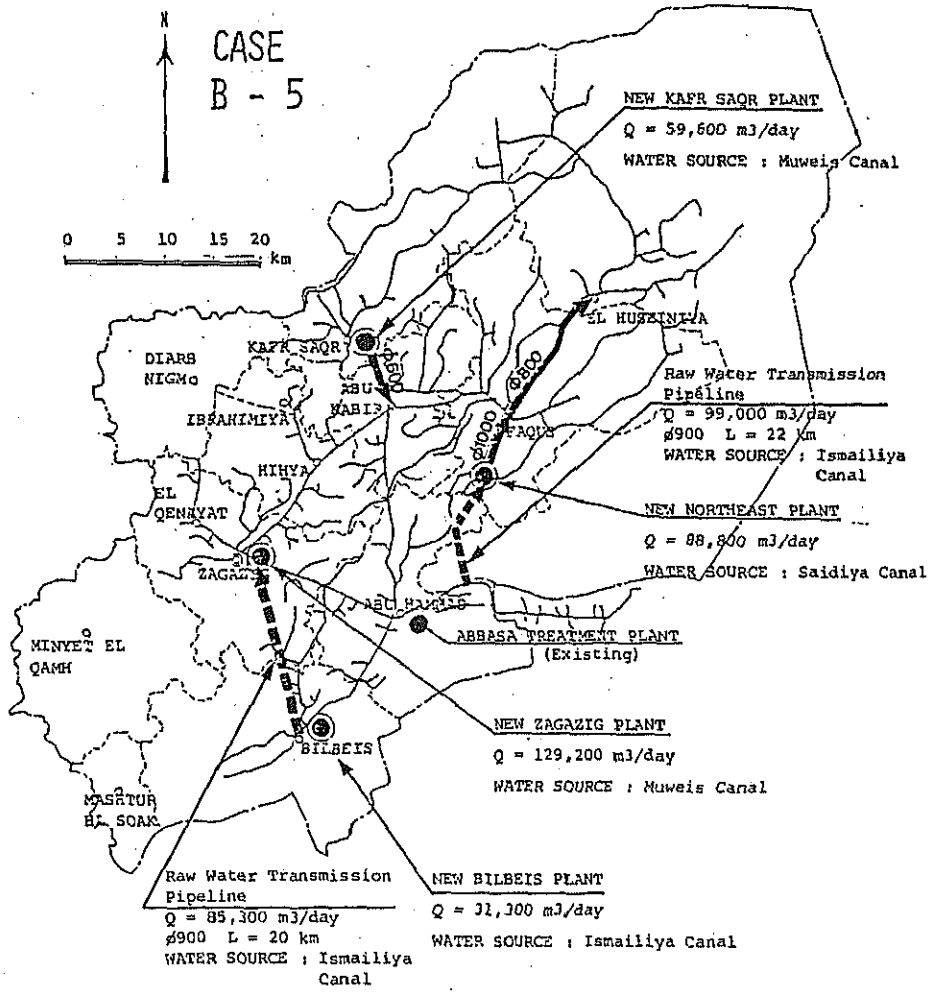


RAW WATER TRANSMISSION (1)





RAW WATER TRANSMISSION (2)



RAW WATER TRANSMISSION (3)

3.4 Raw Water Reservoir

The raw water reservoir(s) are planned based on the following conditions :

a) The reservoir(s) are to be filled for 2 months prior to the interruption,

b) The loss during the storage is assumed as 20 % of the stored capacity,

c) The remaining excavated material is transported to a desert area for the disposal, and

d) The land acquisition cost is estimated as follows :

Suburbs of Zagazig city	:	@ LE 15/m2
Other area	:	@ LE 8/m2

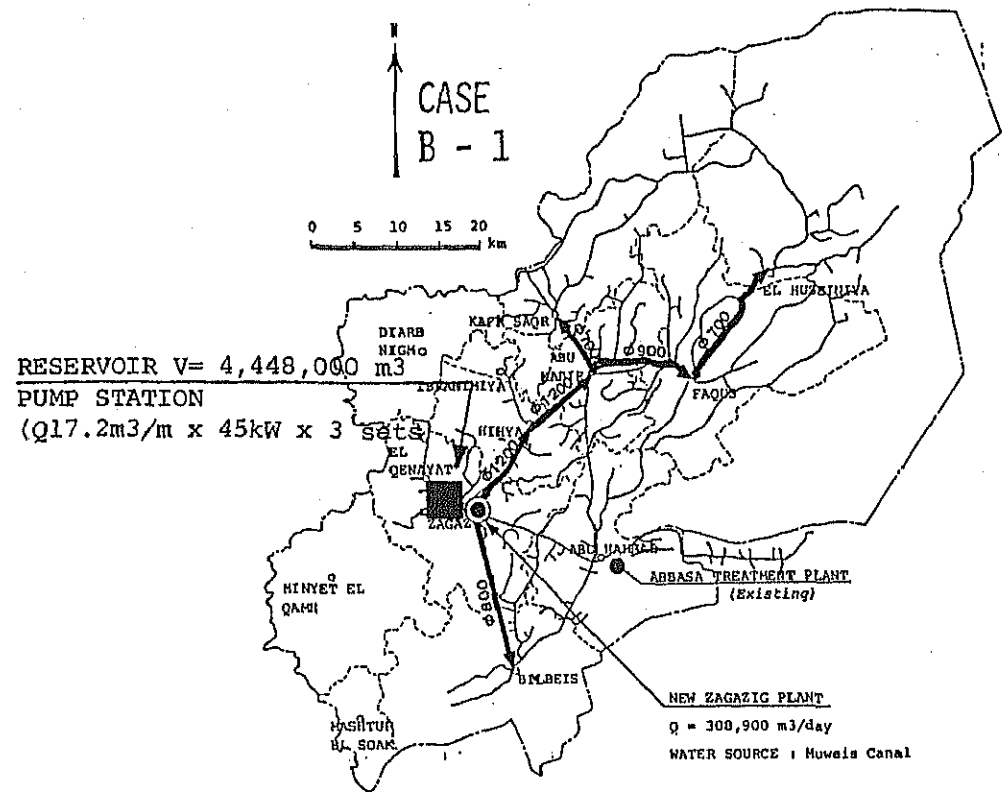
The outline of the raw water reservoir(s) are as the attached drawings and the comparison is shown in the following table.

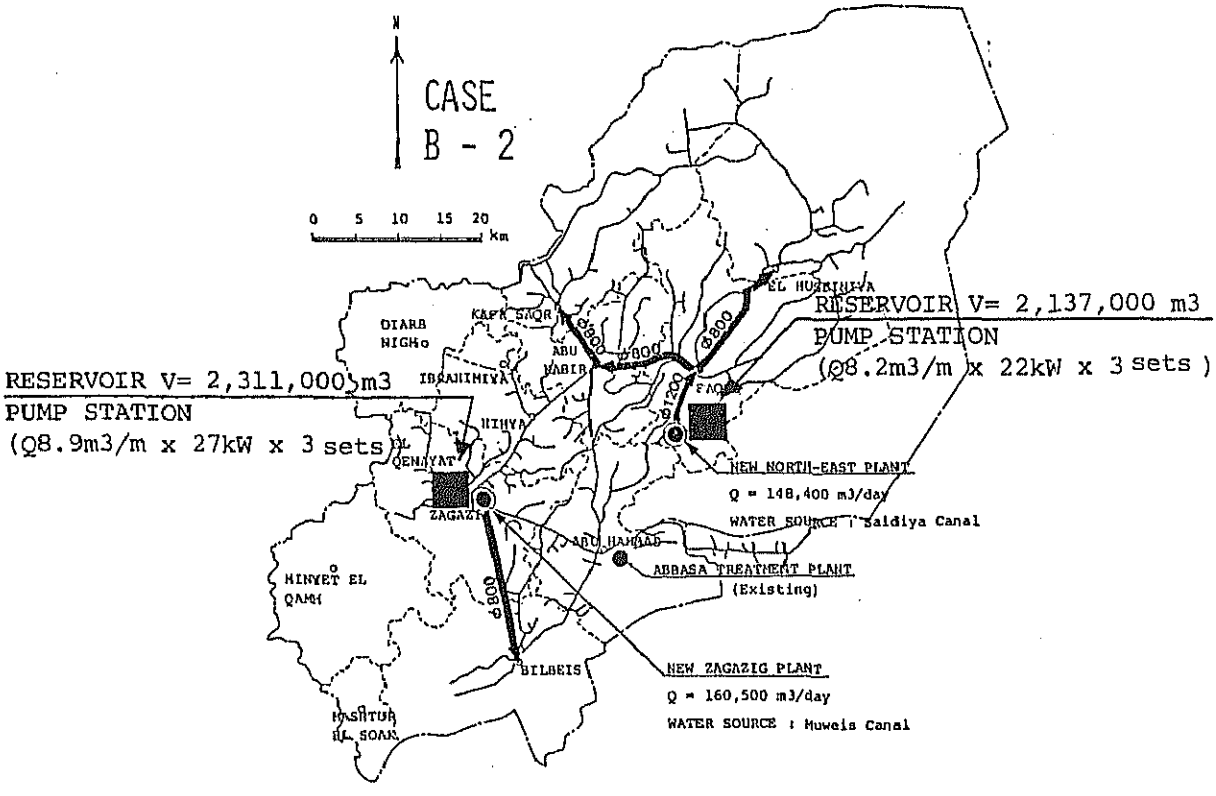
COMPARISON OF RAW WATER RESERVOIR PLANS AND TREATMENT PLANTS

(Unit : Million LE)

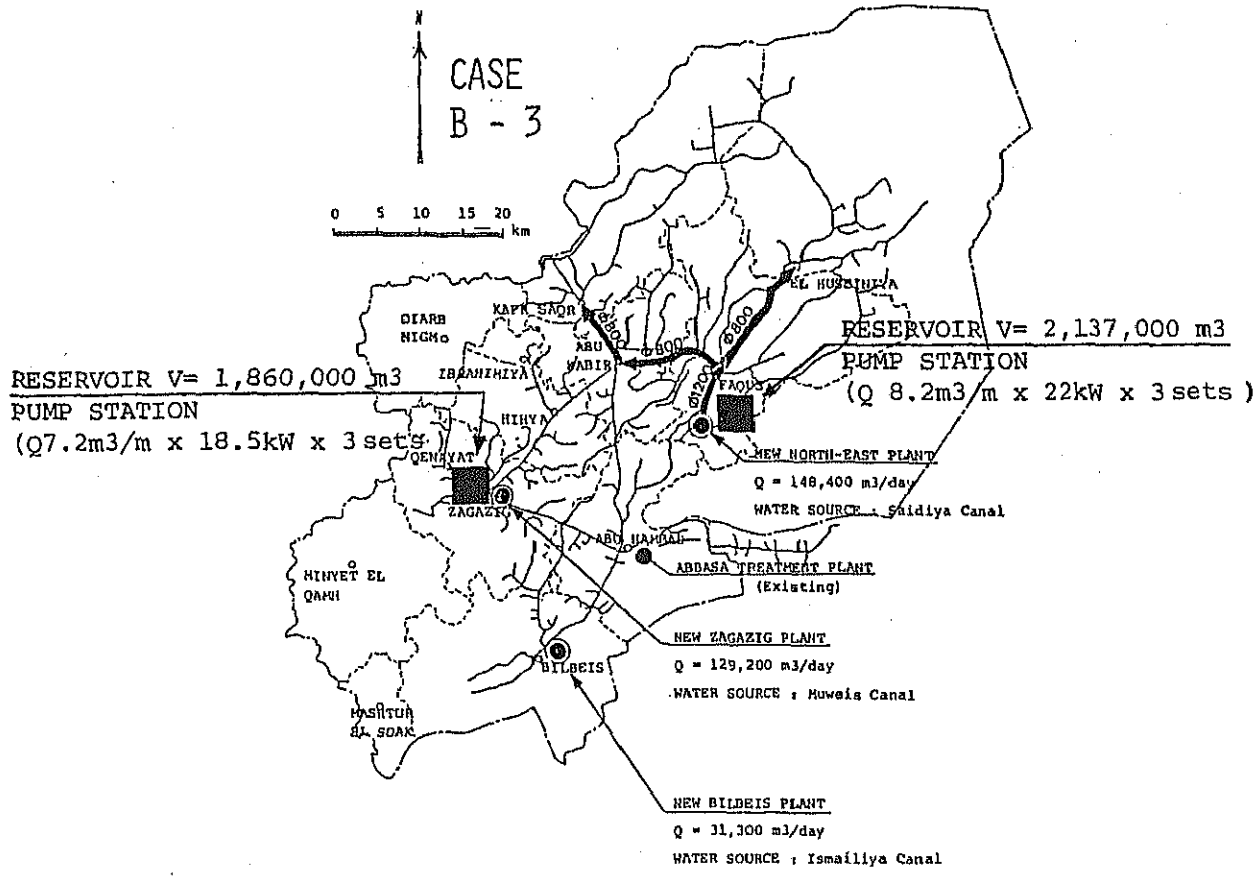
Item \ Case	A-1	A-2	B-1	B-2	B-3	B-4	B-5
1. Plant & Pipeline							
Construction Cost	151	150	125	120	117	123	115
Operation Cost	3.1	2.9	2.8	2.7	2.8	2.5	2.7
Present Worth	104.3	103.9	87.9	86.2	85.4	86.1	85.0
2. Raw Water Reservoir							
Construction Cost	—	—	33	29	26	26	25
Operation Cost	—	—	*	*	*	*	*
Present Worth	—	—	24.8	19.6	17.5	17.5	17.0
3. Total							
Construction Cost	151	150	158	149	143	149	140
Operation Cost	3.1	2.9	2.8	2.7	2.8	2.5	2.7
Present Worth	104.3	103.9	112.7	105.8	102.9	103.6	102.0

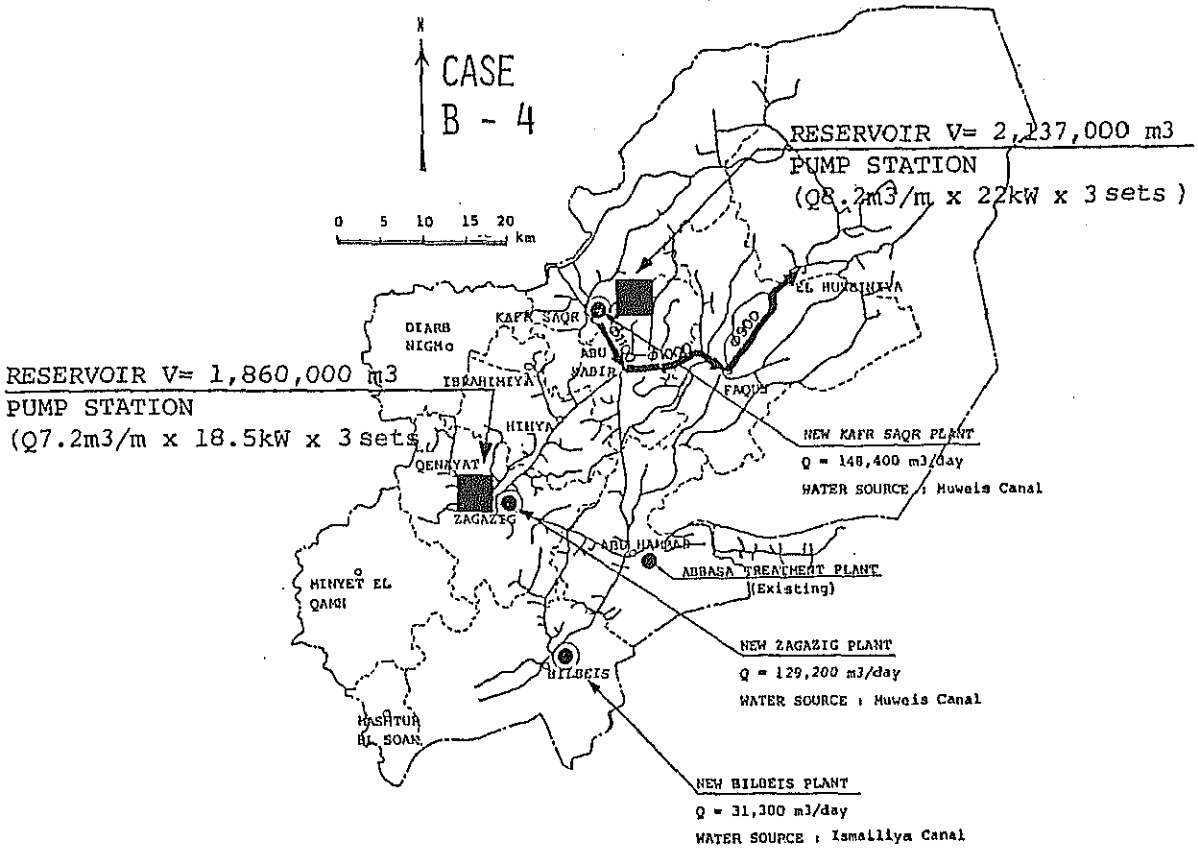
(Note) * means "negligible".



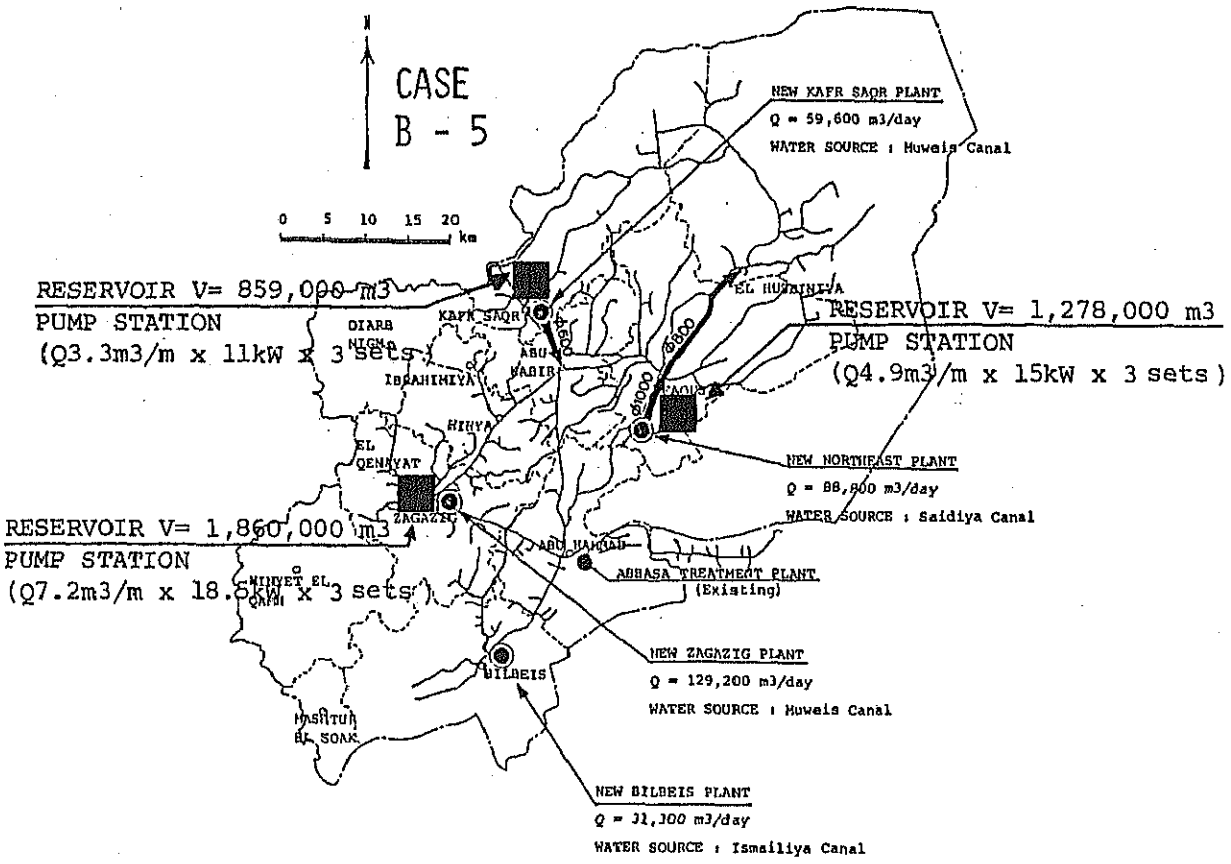


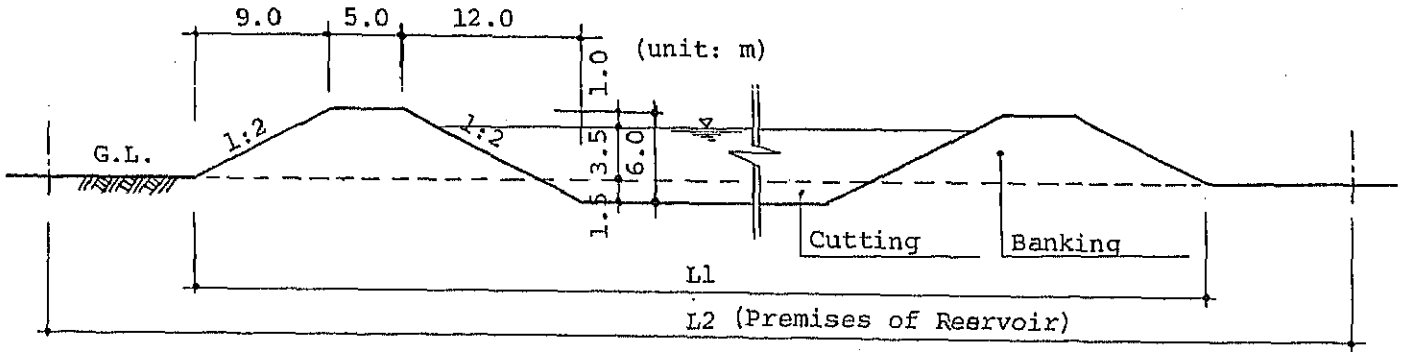
RAW WATER RESERVOIR (1)





RAW WATER RESERVOIR (2)





SCEMATIC SECTION

CACE	PLANT (m3/d)	V ('000 m3)	L1 (m)	L2 (m)
CASE B-1	308,900	4,448	985	1,010
CASE B-2	160,500	2,311	722	750
	148,400	2,137	695	720
CASE B-3	129,200	1,860	652	680
& B-4	148,400	2,137	695	720
CASE B-5	129,200	1,860	652	680
	88,800	1,279	548	570
	59,600	858	457	480

RAW WATER RESERVOIR (3)

3.5 Conclusion

The construction costs of the Raw Water Transmission are estimated in the aforenamed table, and the lowest one amounts to LE 27 million in Case B-5. In case of the Raw Water Reservoir as well, Case B-5 shows the lowest cost, LE 25 million. Even though considering the operation cost, Case B-5 of the Raw Water Reservoir is lowest.

In both cases of Raw Water Transmission and Reservoir, 20 days are employed for their operation term in winter for the comparison. However it will be worthwhile to utilize the Raw Water Reservoir all the year round to improve the raw water quality. In addition the operation cost for such continuous operation is negligibly small.

From matters stated above, Case B-5 of the Raw Water Reservoir will be most applicable to the alternative water source. Since the broad assumptions are employed to simplify the comparison, however, the followings should carefully be studied in detail when necessity arises :

a) Possibility of land acquisition,
b) Contamination originating from wastewater of livelihood and/or livestock farming, and
c) Technical data for the Reservoir construction.

3. SCOPE OF WORK

FOR

THE FEASIBILITY STUDY ON

SHARQIYA WATER SUPPLY SYSTEM

IN

THE ARAB REPUBLIC OF EGYPT

AGREED UPON BETWEEN

THE NATIONAL ORGANIZATION FOR POTABLE

WATER & SANITARY DRAINAGE

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

March 3, 1983

issued in Cairo

Dr. Keiji Goton
Team Leader,
Japanese Preliminary Survey Team,
Japan International Cooperation
Agency

Eng. Abdel Kader M. Abdel Kader
Chairman,
National Organization for Potable
Water & Sanitary Drainage

I. Introduction

In response to the request of the Government of the Arab Republic of Egypt, the Government of Japan has decided to conduct a feasibility study on Sharqiya Water Supply System in the Arab Republic of Egypt (hereinafter referred to "the Study").

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of technical cooperation programmes of the Government of Japan, will carry out the Study, in accordance with the laws and regulations in force in Japan, and in close cooperation with the authorities concerned of the Government of the Arab Republic of Egypt, in particular with the National Organization for Potable Water & Sanitary Drainage (hereinafter referred to as "NOPWASD").

II. Objective of the Study

The objective of the Study is to examine and assess the technical and economical feasibility of the Sharqiya Water Supply System up to year 2005 as a long-term programme. Within the long-term programme, a priority first-phase programme is to be identified, which is to be studied including the preparation of financial projection and reorganization of local water authorities to be more effectively managing its facilities for a period of ten (10) years from commencement of the project implementation.

III. Scope of the Study

1. Study Area

The Study Area will cover Sharqiya Governorate.

2. Outline

The Study will be composed of field surveys and data collection in the Arab Republic of Egypt and of analysis works in both Egypt and Japan. The items to be covered by the Study are as follows:

(1) Long-term programme

a) Collection of data and information
b) Study of present status of water supply systems
c) Study of socio-economic and health aspects
d) Estimation of population
e) Definition of service area and service level.
Consideration should be made for the service level as defined in the provincial water supply project.

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f) Estimation of population to be served
g) Estimation of water demand
h) Study of improvement of existing facilities
i) Study of water sources
j) Study of rough required facilities and their layout
k) Study of design criteria
l) Rough cost estimation for construction, operation and maintenance
m) Study of organization, operation and maintenance plan
n) Rough economic and financial analysis

(2) First priority-phase programme
a) Estimation of population to be served
b) Estimation of water demand and consideration of alternative schemes to meet production requirements
c) Survey of leak levels and measures taken to reduce leak losses
d) Preliminary design
e) Study of construction materials, labour force, ability of local contractors and construction methods
f) Preparation of construction method and procurement method of materials and equipment
g) Cost estimation for construction, operation and maintenance
h) Estimation of benefits
i) Economic and financial analysis
j) Study of tariff systems
k) Study of organization, operation and maintenance plan including training programmes
l) Preparation of implementation programme

IV. Schedule of the Study

The Study will be conducted in accordance with the Study schedule shown in appendix.

V. Reports

JICA will prepare and present the following reports in English to NOPWASD in the course of the Study.

(1) Inception Report
20 Copies-
within one (1) month after beginning of the field survey.

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(2) Progress Report (I)

20 Copies-

at the end of the field survey (I).

(3) Interim Report

20 Copies-

within three (3) months after completion of the field survey (I). NOPWASD will provide JICA with their comments within one (1) month after receipt of the Interim Report through the Japanese Embassy.

(4) Progress Report (II)

20 Copies-

at the end of the field survey (II).

(5) Draft Final Report

20 Copies-

within two (2) months after completion of the field survey (II). NOPWASD will provide JICA with their comments within one (1) month after receipt of the Draft Final Report through the Japanese Embassy.

(6) Final Report

40 Copies-

within two (2) months after receipt of comments on the Draft Final Report.

VI. *Undertaking of Government of the Arab Republic of Egypt*

1. To provide the Study Team with available data, maps, information necessary for the execution of the field survey and the Study
2. To exempt the Study Team from taxes and duties for materials, equipments and personal effects brought into Egypt by the Study Team. This exemption would be only temporary cental re-exporting equipment back to Japan
3. To assign counterpart personnels (officials/engineers) to the Study Team during their stay in the Arab Republic of Egypt.
   The number of counterpart personnels and their respective assignment periods should be decided by prior consultation by the Study Team with the authorities concerned at the commencement of the Study.
   The necessary cost of counterpart personnels should be borne by the Government of the Arab Republic of Egypt.

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4. To provide the Study Team with suitable office spaces, with its equipments and services in Sharqiya Governorate.
5. To secure permission to photo and to enter into private properties and restricted areas to the Study Team for the implementation of the Study.
6. To secure permission to bring out data, maps, and materials relating to the Study from the Arab Republic of Egypt to Japan.
7. To bear claims, if any arises, against the members of its Study Team resulting from, occuring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence of willful misconduct of the above mentioned individuals.
8. To provide the security for the Study Team.

VII. Undertaking of the Government of Japan

1. To send a Study Team to conduct the Study and submit the output of the Study to be the ownership of NOPWASD at its own expense.
2. To transfer technical knowledge and know-how to Egyptian counterpart personnel in the course of the Study.

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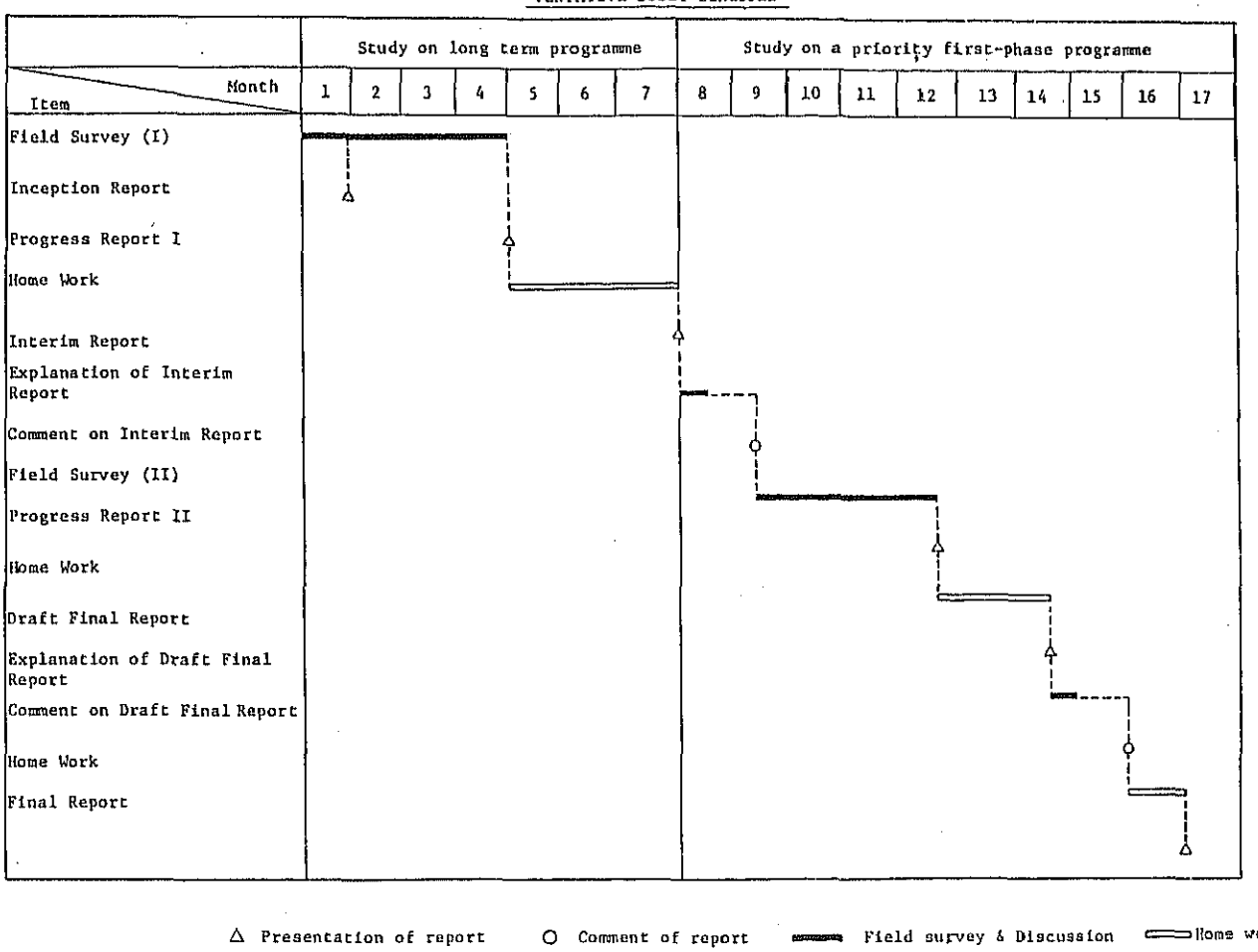
TENTATIVE STUDY SCHEDULE



5. Organization for Implementation of the Study

The present Study was carried out by the Government of Japan through JICA and JICA organized a project team for the study which consisted of an Advisory Committee and a Study Team.

The members of the Advisory Committee and the Study Team are shown below:

Advisory Committee

(1)	Dr. Keiji GOTOH (Chairman)	Professor of Civil Engineering, Engineering Faculty, Toyo University
(2)	Dr. Kiyoshi KAWAMURA (Member)	Senior Researcher, Department of Sanitary Engineering, The Institute of Public Health, Ministry of Health and Welfare
(3)	Mr. Muneaki TOMITA (Member)	Chief Engineer of Investigation Group, Technical Management Section, Kyoto City Water Works Bureau
(4)	Mr. Sadao SEKIGUCHI (Member)	Engineer, Engineering Section, Engineering Department, Yokohama City Water Works Bureau
(5)	Mr. Junji ISHIZUKA (Coordinator)	Second Development Survey Division, Social Development Cooperation Department, JICA

Study Team

(1)	Mr. Osamu WAKAMOTO (Team Leader)	Managing Director, Overseas Services Department, Nihon Suido Consultants Co., Ltd.
(2)	Mr. Hiroshi MACHIDA (Co-Team Leader Water Supply Engineer)	Deputy General Manager, Water Supply Division, Overseas Services Department Nihon Suido Consultants Co., Ltd.
(3)	Mr. Chifumi YAMASHITA (Hydrogeologist)	Section Chief, Water Resources Section, Water Supply Department, Overseas Services Department, Nihon Suido Consultants Co., Ltd.
(4)	Mr. Takeshi UENO (Hydrochemist)	Deputy Director, Central Laboratory, Nihon Suido Consultants Co., Ltd.
(5)	Mr. Hideki YAMAZAKI (Water Supply Engineer)	Section Chief, Water Supply Engineering Section, Overseas Services Department, Nihon Suido Consultants Co., Ltd.
(6)	Mr. Yoshiki OMURA (Water Supply Engineer)	Water Supply Division Overseas Services Department, Nihon Suido Consultants Co., Ltd.
(7)	Mr. Seibun MINAMI (Water Supply Engineer)	Water Supply Division, Overseas Services Department, Nihon Suido Consultants Co., Ltd.
(8)	Mr. Akira HAYASHI (Mechanical Engineer)	Mechanical Engineering Section, Water Supply Division, Overseas Services Department, Nihon Suido Consultants Co., Ltd.
(9)	Mr. Hiromichi YUASA (Management Analyst)	Section Chief, Operation Section, Overseas Services Department, Nihon Suido Consultants Co., Ltd.
(10)	Mr. Masao TERUI (Leakage Engineer)	Section Chief, Water Supply Engineer Section, Overseas Services Department, Nihon Suido Consultants Co., Ltd.
(11)	Mr. Takemasa MAMIYA (Water Supply Engineer)	Water Supply Division, Overseas Services Department, Nihon Suido Consultants Co., Ltd.

6. Work Schedule

The Study Team carried out field survey twice, as follows:

1) The first field survey : Jul. 1983 to Nov. 1983 for Long Term Program, and
2) The second field survey : May 1984 to Aug. 1984 for First Priority-Phase Program.

When having left Egypt in each survey period, the Team presented progress report which contained study results and preliminary Long Term Program/ First Priority-Phase Program. After field survey, the Team finalized the reports and submitted them in March 1984 in the form of Interim Report; and in Dec. 1984, Final Report.

The submitted reports are listed below:

1) Inception Report:
   20 copies
   At the beginning of the field survey (Aug. 1983)
2) Progress Report (I) : Preliminary Long Term Program
   20 copies
   At the end of the first field survey (Nov. 1983)
3) Interim Report : Long Term Program
   20 copies
   Within three months after completion of the first field survey (March 1984)
4) Progress Report (II) : Preliminary First Priority-Phase Program
   20 copies
   At the end of the second field survey (July 1984)
5) Draft Final Report : Long Term Program and First Priority-Phase Program (Draft)
   20 copies
   Within two months after completion of the second field survey (Sep. 1984)

6) Final Report : Long Term Program and First Priority-Phase Program (Final)

40 copies (Dec. 1984)

The Final Report consists of Main Report, Working Report and Executive Summary.

JICA