This population influx and appearance of new industries has had a large impact on the socio-economic structure of the area. Nevertheless, agriculture remains the prime industry of the Study area. The bulk of secondary industries as well are agricultural related, relying on the marketing and processing of farm products.

3.3.3 Farm Scale and Land Ownership

Survey of farm household with regards to cultivable area, cropped area (irrigated and non-irrigated-wise, crop-wise, fallow area), leased area, and area by hire-farming was conducted by DSI in 1985 for the Study area and adjoining areas. (see Table 3.3-6)

Analysis of farm scale and land ownership was performed by the team for the area west of the Hurman river and one portion at the east of the Hurman river (east Tanir area), for which data was available.

6,773 farm households (Table 3.3.7) were surveyed: 3,583 on the east bank and 3,190 on the west bank. Total cultivated area is 44,913 ha. Survey of tenant farmers on the west bank (Table 3.3.6) of the Hurman river identified 27 households with farmed area of 1,698 ha. Tenant farmers accordingly are only a small fraction of the farmers in the area. One hundred eight (108) farms belong to absentee landowners (who lease their property to other farmers).

As DSI survey data is correlated hamlet-wise, it is not possible to distinguish gravity irrigated area and pump irrigated area. However, on the basis of hamlet location, the following conclusions are drawn (see Fig. 3.3-1):

① Average owned farmland per household in Tanir, Aritas and Altinelma in the area of north Afsin targeted for pump irrigation is 11.23, 11.30 and 8.95 ha/household respectively, which is higher than the average for the overall area of 10.28 ha/household.

② Average owned farmland per household in Koture, Alimpinar and Tombak in the area of south Afsin targeted for pump irrigation is 3.20, 4.68 and 3.52 ha/household, respectively, which is considerably lower than the average.

③ Average cultivated area per farm in the area targeted for gravity irrigation varies greatly from 3 to 15 ha. However, at Kerker, Kabaagas and Esence in the catchment of the Goksun, average cultivated area is a relatively high 10 ha.

Table 3.3-6 Land Holding and Land Use Condition

Name of Village	No. of Farmer	Farming Area		Cultivated Area(ha)	Land Use Condition(ha)			Tenant Farmer	N-culti. Land Owner	Tenant Area(ha)	Rent Cul. Area(ha)
		Total	Average		Irrigated	N-Irrig	Fallow				
Altinelima	358	3,373	9.42	3,231.2	185.5	2,416.0	629.7	1	0	185.5	327.0
Tanir	219	2,590	11.83	2,595.0	18.8	2,576.2	0.0	0	0	5.0	0.0
Emirilyas	100	650	6.50	649.9	102.4	526.6	20.9	0	0	0.7	0.7
Karagoz	122	701	5.75	894.7	48.9	823.3	22.5	7	3	208.7	15.0
Bakrak	238	2,089	8.78	2,090.7	17.4	1,866.5	206.8	0	0	9.0	7.0
Conanbeyli	205	2,833	13.82	2,825.7	260.1	2,306.3	259.3	0	0	0.0	7.0
Igdemlih	54	244	4.53	244.4	222.1	22.3	0.0	0	0	0.0	0.0
Tombak	147	547	3.72	546.1	36.5	509.6	0.0	3	1	10.0	10.5
Sogucak	81	749	9.25	718.2	0.0	716.2	2.0	0	1	0.0	30.7
Nadir	115	585	5.08	620.7	155.2	465.5	0.0	2	0	38.7	2.7
Kamiscih	136	575	4.23	646.6	158.4	461.0	27.2	1	46	310.4	238.8
Kargabuku	131	709	5.41	714.8	239.9	239.1	235.8	1	7	46.8	40.8
Deveboynu	58	169	2.91	168.6	97.6	60.2	10.8	5	2	6.8	6.8
Koture	74	248	3.35	248.2	118.4	104.7	25.1	0	0	0.0	0.0
Poskoflu	48	346	7.20	367.6	159.5	197.2	10.9	2	0	21.8	0.0
Alh.Kasabus	8	40	5.05	38.4	0.0	38.4	0.0	0	0	0.0	2.0
Tilavsun	180	1,359	7.55	1,240.5	359.9	880.6	0.0	0	20	19.0	137.3
Cagilhan	50	436	8.72	462.0	20.0	423.8	18.2	0	1	46.0	20.0
Altas	100	675	6.75	742.2	556.6	179.8	5.8	0	0	68.4	1.4
Kabaagac	57	691	12.12	667.8	182.5	428.5	56.8	1	1	38.3	61.2
Kerker	36	602	16.72	599.0	25.0	574.0	0.0	2	1	297.0	300.0
Ordekkoy	60	503	8.38	502.5	122.4	378.1	2.0	0	1	18.0	18.0
Koy*	30	126	4.18	99.0	38.5	60.5	0.0	0	4	0.0	26.5
Alimpinar	136	670	4.92	721.2	199.4	492.0	29.8	0	2	94.2	42.5
Ercene	9	59	6.58	59.2	3.5	55.7	0.0	1	1	11.0	11.0
Izgin	239	1,952	8.17	1,925.5	771.7	520.5	633.3	0	3	1.0	2.7
Esence	133	1,733	13.03	1,709.2	429.1	1,280.1	0.0	0	14	224.5	248.5
Kangal	41	344	8.39	362.9	134.6	219.3	9.0	1	0	23.8	5.0
Aritas	265	3,153	11.90	3,166.0	1,226.9	1,864.0	75.1	0	0	13.0	0.0
	3,430	28,751	8.38	28,857.8	5,890.8	20,686.0	2,281.0	27	108	1,697.6	1,563.1

④ Number of farm households on the east bank is 3,583. Average farm size is 5.13 ha. Farms under 5 ha comprise 80% of the total indicating that relatively small farmers are numerous.

⑤ 20% of cultivated area, or 6,008 ha, on the Hurman west bank is irrigated. With regards to the east bank, the percentage is estimated to be very high on the basis of field reconnaissance.

Farms were classified into 7 types for survey: 2 ha or less, 2.1~5.0 ha, 5.1~10 ha, 10.1~15.0 ha, 15.1~20.0 ha, 20.1~50.0 ha, and over 50.0 ha. Results are shown in Table 3.3-8 and 3.3-9 and Fig. 3.3-1.

Of the 6,773 farm households who own their land, farm scale of 2.1~5.0 ha is the most common at 37% of the total. Next is 5.1~10 ha at 26%, and 2 ha or less at 20%. Farms under 10 ha in size comprise 82% (5,564) of the total. Farms of 10.1~15.0 ha comprise 10%, and only 8% are over 15 ha.

Table 3.3-7 Farm Scale

Farm Scale	No. of Farms			%		
	East Bank*	West Bank*	Total	East Bank*	West Bank*	Total
2ha	487	867	1,354	13.6	27.2	20.0
2.1 - 5.0ha	1,132	1,359	2,491	31.6	42.6	36.8
5.1 - 10.0ha	1,146	573	1,719	32.0	18.0	25.4
10.1 - 15.0ha	402	283	685	11.2	8.9	10.1
15.1 - 20.0ha	196	48	244	5.5	1.5	3.6
20.1 - 50.0ha	205	33	238	5.7	1.0	3.5
50.1ha	15	27	42	0.4	0.8	0.6
Total	3,583	3,190	6,773	100.0	100.0	100.0

*of Hurman river

Almost all farmland in the the Study area is privately owned by the farmers themselves. Neither communal nor government run farms are seen. No well organized and active farmer groups are currently present. The only established farmer relationship at present is that traditionally existing between farmers owning irrigation pumps, and farmers borrowing the same.

Table 3.3-8 Present Farming System

Name of Village	No. of Farmer	Land Holding Classification(No. of Farmer) -2.0	2.1- -5.0	5.1- -10.0	10.1- -15.0	15.1- -20.0	20.1- -50.0	50.1- (ha)	Sub- -total	Tenant Farmer
Altinelima	358	17	107	122	55	32	25	0	358	1
Tanir	219	17	61	71	29	13	22	6	219	0
Emirilyas	100	19	45	17	10	5	4	0	100	0
Karagoz	122	32	43	34	4	5	4	0	122	7
Bakrak	238	19	76	71	41	15	15	1	238	0
Conanbeyli	205	9	37	67	32	26	30	4	205	0
Igdemlih	54	14	22	16	1	1	0	0	54	0
Tombak	147	60	46	36	5	0	0	0	147	3
Sogucak	81	6	9	38	22	5	1	0	81	0
Nadir	115	23	49	33	8	1	1	0	115	2
Kamiscih	136	42	61	28	3	1	1	0	136	1
Kargabuku	131	12	54	59	6	0	0	0	131	1
Deveboynu	58	28	23	5	2	0	0	0	58	5
Koture	74	34	28	9	3	0	0	0	74	0
Poskoflu	48	5	16	15	7	5	0	0	48	2
Alh.Kasabus	8	1	7	0	0	0	0	0	8	0
Tilavsun	180	11	66	60	26	12	5	0	180	0
Cagilhan	50	6	21	10	3	4	6	0	50	0
Altas	100	8	46	31	9	4	2	0	100	0
Kabaagac	57	1	15	21	9	3	6	2	57	1
Kerker	36	4	17	9	1	1	3	1	36	2
Ordekkoy	60	7	18	19	9	5	2	0	60	0
Koy*	30	8	16	6	0	0	0	0	30	0
Alimpinar	136	25	72	32	5	1	1	0	136	0
Ercene	9	1	1	7	0	0	0	0	9	1
Izgin	239	21	44	131	32	7	4	0	239	0
Esence	133	20	23	29	24	13	24	0	133	0
Kangal	41	8	8	14	5	2	4	0	41	1
Aritas	265	8	53	107	34	27	36	0	265	0
Total	3,430	466	1,084	1,097	385	188	196	14	3,430	27

Table 3.3-9 Present Farming System (Composed Percent)

Name of Village	No. of Farmer	Land Holding Classification (%) -2.0	2.1- -5.0	5.1- -10.0	10.1- -15.0	15.1- -20.0	20.1- -50.0	50.1- (ha)
Altinelima	358	4.7	29.9	34.1	15.4	8.9	7.0	0.0
Tanir	219	7.8	27.9	32.4	13.2	5.9	10.0	2.7
Emirilyas	100	19.0	45.0	17.0	10.0	5.0	4.0	0.0
Karagoz	122	26.2	35.2	27.9	3.3	4.1	3.3	0.0
Bakrak	238	8.0	31.9	29.8	17.2	6.3	6.3	0.4
Conanbeyli	205	4.4	18.0	32.7	15.6	12.7	14.6	2.0
Igdemlih	54	25.9	40.7	29.6	1.9	1.9	0.0	0.0
Tombak	147	40.8	31.3	24.5	3.4	0.0	0.0	0.0
Sogucak	81	7.4	11.1	46.9	27.2	6.2	1.2	0.0
Nadir	115	20.0	42.6	28.7	7.0	0.9	0.9	0.0
Kamiscih	136	30.9	44.9	20.6	2.2	0.7	0.7	0.0
Kargabuku	131	9.2	41.2	45.0	4.6	0.0	0.0	0.0
Deveboynu	58	48.3	39.7	8.6	3.4	0.0	0.0	0.0
Koture	74	45.9	37.8	12.2	4.1	0.0	0.0	0.0
Poskoflu	48	10.4	33.3	31.3	14.6	10.4	0.0	0.0
Alh.Kasabus	8	12.5	87.5	0.0	0.0	0.0	0.0	0.0
Tilavsun	180	6.1	36.7	33.3	14.4	6.7	2.8	0.0
Cagilhan	50	12.0	42.0	20.0	6.0	8.0	12.0	0.0
Altas	100	8.0	46.0	31.0	9.0	4.0	2.0	0.0
Kabaagac	57	1.8	26.3	36.8	15.8	5.3	10.5	3.5
Kerker	36	11.1	47.2	25.0	2.8	2.8	8.3	2.8
Ordekkoy	60	11.7	30.0	31.7	15.0	8.3	3.3	0.0
Koy*	30	26.7	53.3	20.0	0.0	0.0	0.0	0.0
Alimpinar	136	18.4	52.9	23.5	3.7	0.7	0.7	0.0
Ercene	9	11.1	11.1	77.8	0.0	0.0	0.0	0.0
Izgin	239	8.8	18.4	54.8	13.4	2.9	1.7	0.0
Esence	133	15.0	17.3	21.8	18.0	9.8	18.0	0.0
Kangal	41	19.5	19.5	34.1	12.2	4.9	9.8	0.0
Aritas	265	3.0	20.0	40.4	12.8	10.2	13.6	0.0
Total	3,430	13.2	30.7	31.1	10.9	5.3	5.6	0.4

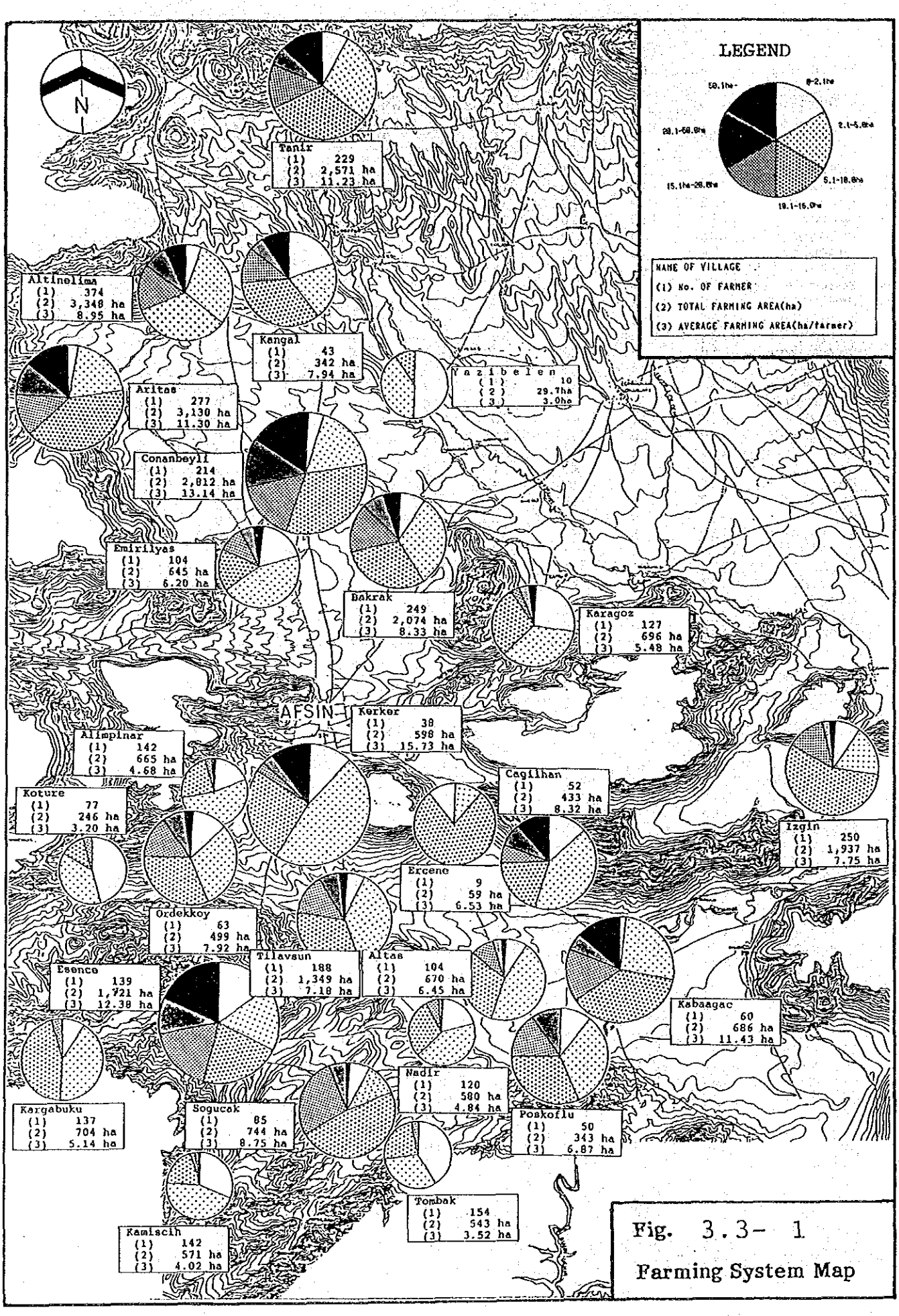


Fig. 3.3- 1
Farming System Map

In general under irrigation projects carried out by the General Directorate of Village Services, irrigation management is carried out by farmer groups under the supervision of the Directorate; however, no such organization is present in the Study area.

3.3.4 Regional Administrative Agencies

Administrative agencies in the Study area include offices for health, education, family registration, legal affairs, police and agricultural technology extension located at the district seats in Afsin and Elbistan. There are also various national government agencies including a TKY branch office at Elbistan (Trans Turkey Highway) responsible for highway construction and maintenance, a TEK (Turkish Electricity Authority) operated thermal generating plant in the area and the 204 office of DSI responsible for construction of water use facilities.

Regional agencies related to agriculture are as follows:

① The government run sugar plant is located adjacent to the Study area, and provides farm management support to sugar beet producers.

② The Afsin Fruit-tree Nursery Research Station under the Ministry of Agriculture, Fisheries and Rural Affairs provides improved seedlings to farmers.

③ Branches of the the Turkish Agricultural Supply Organization (TMO) are located at Afsin and Elbistan and provide various farm inputs to farmers.

④ The Elbistan office of the Soil Product Office (TMO) purchases cereals and beans produced by farmers in Afsin and Elbistan districts.

⑤ Branches of the Agricultural Bank and Sugar Bank at Afsin and Elbistan provide guidance to farm finance cooperatives (operated by the farmers themselves) at the village level.

⑥ An Agriculture Society, membership open to all farmers, is located in Elbistan and provides a forum for exchange of agricultural information.

In addition, the branch office of the General Directorate of Village Services at Kahramanmaras oversees construction of minor rural infrastructure.

3.4 Agriculture

3.4.1 Present Cropping Pattern

There are five major crops being grown in the Study area. They are wheat, barley, sugar beet, dry bean and chick pea, accounting for over 80% of the total area. Although limited cultivation of fruit, mainly grape, is observed in some part, most of it is on the hilly sides and very little is included in the Area.

Two pieces of information are available about the current cropping patterns in the Study area: one has been obtained from the survey results conducted by DSI, and the other by Agricultural Engineering Office (AEO). DIS's study contains the results of the survey conducted for the Project area (Table 3.4-1). The survey conducted by AEO covered the areas managed by AEO in Afsin and Elbistan covering 103,000 ha. There are no major differences observed between the two studies as to the overall cropping patterns.

From Table 3.4-2, the following cropping pattern is indicated.

① Wheat, barley and chick pea account for nearly 70% of the total crops. In particular, their cropping rate is over 80% in the highland areas (the place being planned as the pumping area) where irrigation is difficult. All three crops can be raised in farmland without irrigation facilities.

Table 3.4-1 Cropping Pattern in Irrigable Area

Dry Bean	2,473 ha (31.9%)
Wheat	1,961 ha (25.3%)
Sugar Beet	1,749 ha (22.6%)
Poplar	467 ha (6.0%)
Sunflower	417 ha (5.4%)
Other Crops	683 ha (8.8%)
Total	7,750 ha (100.0%)

② Of the ten different perennial crops seen in the pattern, only wheat and barley can be raised during winter. This fact shows how severe the climate conditions can become during that period in the area.

Table 3.4-2 Present Cropping Pattern

Crop		Gravity Area		Pump Area		Whole Area	
		Area		Area		Area	
		(ha)	(%)	(ha)	(%)	(ha)	(%)
Wheat	(DRY)	13,042	36.5	3,557	43.0	16,599	37.8
Wheat	(IRR.)	1,657	4.6	413	5.0	2,070	4.7
Balrey	(DRY)	3,307	9.2	662	8.0	3,969	9.0
Balrey	(IRR.)	323	0.9	--	--	323	0.7
Sugar beet	(IRR.)	2,583	7.2	165	2.0	2,748	6.2
Dry bean	(IRR.)	2,274	6.4	248	3.0	2,522	5.7
Chick pea	(DRY)	7,086	19.8	1,986	24.0	9,072	20.7
Lentil	(DRY)	94	0.3	74	0.9	168	0.4
Haricot	(IRR.)	402	1.1	165	2.0	567	1.3
Potato	(IRR.)	220	0.6	66	0.8	286	0.6
Vegitable	(IRR.)	123	0.3	--	--	123	0.3
Sunflower	(IRR.)	563	1.6	--	--	563	1.3
Fruit	(IRR.)	418	1.2	41	0.5	459	1.0
Vineyard	(DRY)	506	1.4	165	2.0	671	1.5
Poplar	(IRR.)	425	1.2	66	0.8	491	1.1
Follow		2,737	7.7	662	8.0	3,399	7.7
Total		35,760	100.0	8,270	100.0	44,030	100.0

*) (DRY) Non-Irrigated Area

(IRR.) Irrigated Area

To summarize the situations of the Study area, it can be said:

① Cereals and pulses are predominate. However, this appears due to constraints on cropping (mostly lack of irrigation), rather than the actual desire of the farmers to raise mainly these crops. This was also borne out in interview survey with farmers in the area.

② Excepting the perennial crops and cereals, chances are slim for successful growing of crops during winter. These points should be taken into consideration in selecting crops to be introduced in the future.

3.4.2 Labor Force

There are 6,800 farm households totaling 38,800 persons in the Study area. Latent farm family labor is estimated at 21,400 persons.

Farm family labor supply in the Study area is thus calculated as follows:

Labor population:	21,400
Actually employable labor force:	21,400 × 0.95 ≒ 20,300
Annual labor supply:	20,000 × 300 days ≒ 6,090,000 man/days

This is a monthly average of 507,000 man/days per month.

Labor demand during peak months on the basis of cropping pattern and cropping rate is as set out below: (Appendix V . Table V-2)

May	301,400 m/d	(surplus labor: 205,600 m/d;	surplus rate: 41%)
Jun	238,400 m/d	(surplus labor: 268,600 m/d;	surplus rate: 53%)
Jul	289,300 m/d	(surplus labor: 217,700 m/d;	surplus rate: 43%)
Aug	282,200 m/d	(surplus labor: 224,800 m/d;	surplus rate: 44%)

As can be seen from the above, there is excess farm labor supply in the area. There is thus ample leeway for introduction of labor intensive farming practices.

3.4.3 Cropping

Although there is approx. 400 mm of annual precipitation in the Study area, about 30% of it comes in the form of snow during December, January and February. Therefore, only less than 300 mm of precipitation from March through November can be directly used for irrigating the farm land. However, it rains very little during June, July and August where the temperature is the highest. Under such conditions, it is not possible to supply water to crops in the land without adequate irrigation facilities. Under such environmental conditions, each farming unit in the Study area decides on what crops to be grown based on such factors as the climatic conditions of the year, price of the crops and demand-supply situations. The farming in the area is basically one-crop-per-year rotation, but several variations exist. Fig. 3.4-3 shows the standard patterns.

Fig. 3.4-3 Typical Rotation Pattern (Present)

Area	First year	Second year	Third year
Irrigated Area	Sugar beet (Mar.~Nov.)	Wheat (Oct.~Jul.) Barley (Oct.~Jul.) Dry bean (Apr.~Sep.)	Dry bean (Apr.~Sep.) Wheat (Oct.~Jul.)
Dry Area	Wheat (Sep.~Jul.)	Chick pea (Apr.~Aug.) Barley (Oct.~Jul.)	Wheat (Sep.~Jul.)

As to farming of major crops in the area, information was gathered from Agricultural Engineering Office and interview survey of farmers. Although the level of cropping technology in the Study area is generally slightly lower than the nation as a whole, farm machinery is widely used. The results of survey centered on the farmers point out that some differences exist from farmer to farmer in such matters as the amount of seeds to be sown, that of fertilizer to be used, the timing of seeding and the period of harvesting. Vegetables and fruit, except grapes, are raised only in very limited areas and most of the produce is for self-consumption. An interview survey was also made on the possibility of growing apples and apricot. On the basis of findings, the Afsin Fruit-tree Nursery Research Station is of opinion that high-

grade apples and apricot can be grown in the area if provided with adequate irrigation.

The following table summarizes the results of the interview survey.

(1) Wheat

Variety	:	BEZOSTIA (Irrigated area)
		YERLIOFIS (Dry area)
Seeding	:	Oct. the 15th (allowed one month) 150kg/ha, mix seeding with agro chemical (Korthcol 15) 2 kg per 1,000 kg
Fertilizer	:	Ammonium Phosphate 200kg/ha. Apr. the 15th., Ammonium Nitrate 150kg/ha
Agro Chemical	:	Not applied (Extension Station recommended to apply herbicide in April).
Irrigation	:	Only irrigation area; The 1st time------May the 7th The 2nd time------May the 25th The 3rd time------Jun. the 15th
Harvest	:	Jul. the 15th; combine use; capacity: 10-15 ha/10hrs.
Yield	:	1987 Irrigated area ---------- 3,000 kg/ha Dry area ---------- 900 " 1988 Irrigated area ---------- 3,000 kg/ha Dry area ---------- 1,500 "
Plow	:	Plow (Tractor 65HP) ---------- capacity: 4 ha/day Disk harrow ---------- 9 "

(2) Barley

Seed	:	Same as wheat in the case of winter crop. Mar. the 20th in the case of spring crop.
Fertilizer	:	Same as wheat.
Agro Chemical	:	Same as wheat.

Irrigation : None

Harvest : Jul. the 5th.; combine use; capacity: 10-15 ha/10 hrs.

Yield : 1987 Winter harvest ---------- 1,300 kg/ha

Spring harvest ---------- 800 "

1988 Winter harvest ---------- 1,800 "

Spring harvest type occupied 70% of the total cropping area, and the remaining 30% was accounted for by the winter harvest type. However, cropping area of winter harvest type is increasing in recent years.

(3) Chick pea

Seeding : Apr. the 20th (allowed one month) 100 kg/ha

Fertilizer : Input compound 20-20-0, 150 kg/ha at seeding time.

Agro Chemical : Not applied (Extension Station is encouraged to apply fungicide and insecticide and it is expected to increase the yield 40%.

Irrigation : None

Harvest : Depend on man-power on Jul. the 20th.

Yield : 1987 ---------- 700 kg/ha

1988 ---------- 900 "

(4) Dry bean

Seeding : Apr. the 25th, 120 kg/ha.

Fertilizer : The first time : Compound 20-20-0

250 kg/ha

The second time : Ammonium Nitrate

150 kg/hag/ha

Agro Chemical : Insecticide ---------- Apr. the 15th

Terefran 1,800 g/ha

Herbicide ---------- Jun. the 5th

Malathion 2,000 g/ha

Rogor 40 1,250 "

Fungicide ---------- Dithane 2-78 2,000 g/ha

Malprex 1,500 g/ha

Irrigation : Following season (8 times)
May the 25th, Jun. the 10th, Jun. the 20th,
Jun. the 30th, Jul. the 10th, Jul. the 20th,
Jul. the 30th, Aug. the 10th

Harvest : Sep. the 15th; by man-power; requirement: 30 persons/ha

Yield : 1987 ---------- 1,750 kg/ha
1988 ---------- 1,800 "

Plow : The 1st time ---------- Oct. the 20th
Plow (tractor) 4 ha/day
The 2nd time ---------- Apr. the 15th
Plow (tractor) 5 ha/day

Ridge : *May the 25th; requirement: 30 persons/ha*

(5) Sugar beet

Variety : JULIA, BELLA

Seeding : Mar. the 15th 3.48 kg/ha (Afşin),
3.74 kg/ha (Elbistan)

Fertilizer : The 1st time Mar. the 5th
Triple Sulphate 800 kg/ha
Ammonium Sulphate *300* "

The 2nd time Apr. the 5th
Urea 150 "

The 3rd time Apr. the 25th
Urea *200* "

Irrigation : Around Jul., Aug., 5 times.

Harvest : Oct. the 15th (allowed two months);
by man-power; requirement: 30 persons/ha

Yield : 1987 ---------- 37 ton/ha
1988 ---------- 40 "

Ridge : The 1st time Mar. the 15th, requirement: 30 persons/ha
The 2nd time May the 5th, requirement: 20 persons/ha
The 3rd time May the 20th, requirement: 10 persons/ha

(6) Apple

Variety : STARKINA DELICIOUS, GOLDEN DELICIOUS, ERZINCAN

Planting

Density : 200 trees/ha

Agro Chemical : Fungicide ---------- Bordo Bulamac 2 times
Antracol 1 "

Insecticide ---------- Gusathion 4 "
Lebaycide

Herbicide ---------- Basudin 2 "

Yield : The 5th year ---------- 3,000 kg/ha
The 6th year ---------- 10,000 "
The 7th year ---------- 15,000 "
The 8th year ---------- 20,000 "
Harvest period continues about 25 years, and 90% is shipped to Afşin and 10% to Kayseri market.

(7) Apricot

Variety : HACIHAILILOLU, TOKALOGLU

Planting

Density : Dec. Flat area : 10 m × 10 m
Slope area : 6 m × 6 m or 6 m × 10 m

Fertilizer : Input of compost (2 kg) at planting, and Ammonium Nitrate (100 g) at the dig hole.
Ammonium Nitrate (100 g) input once a year.

Yield : 100 - 300 kg/one tree
The 5th year ---------- 5 kg

The 7th year ---------- 20 kg
The 9th year ---------- 50 kg
The 10th year ---------- 60 kg
The 12th year ---------- 80 kg
The 15th year ---------- 100 - 200 kg
(Harvest period continues 15 years. Kahramanmaras, Gaziantep are the main shipment areas. Apricot is shipped as fresh unit to the market).

On the basis of the above interview survey, cropping schedule for main crops is as shown in Fig. 3.4-1.

3.4.4 Yield and Production

Yields in the Study area are lower than the province as a whole due to topographical and meteorological constraints, and lack of irrigation. Yield for arid wheat, the crop with the largest cropped area in the Study area, is only 68% the national average. Yield for chick pea, the second most widely farmed crop in the area, is also below the national average.

Current unit yields and production are presented cropwise in Table 3.4-4.

The Elbistan sugar plant adjoining the Study area is currently operating at only 60% capacity due to shortages in sugar beet production. There is thus optimism for increased beet production in the area. Cultivation of apple in the Study area is also being encouraged by the Afsin Fruit Nursery.

Fig. 3.4- 1 Present Cropping Calendar

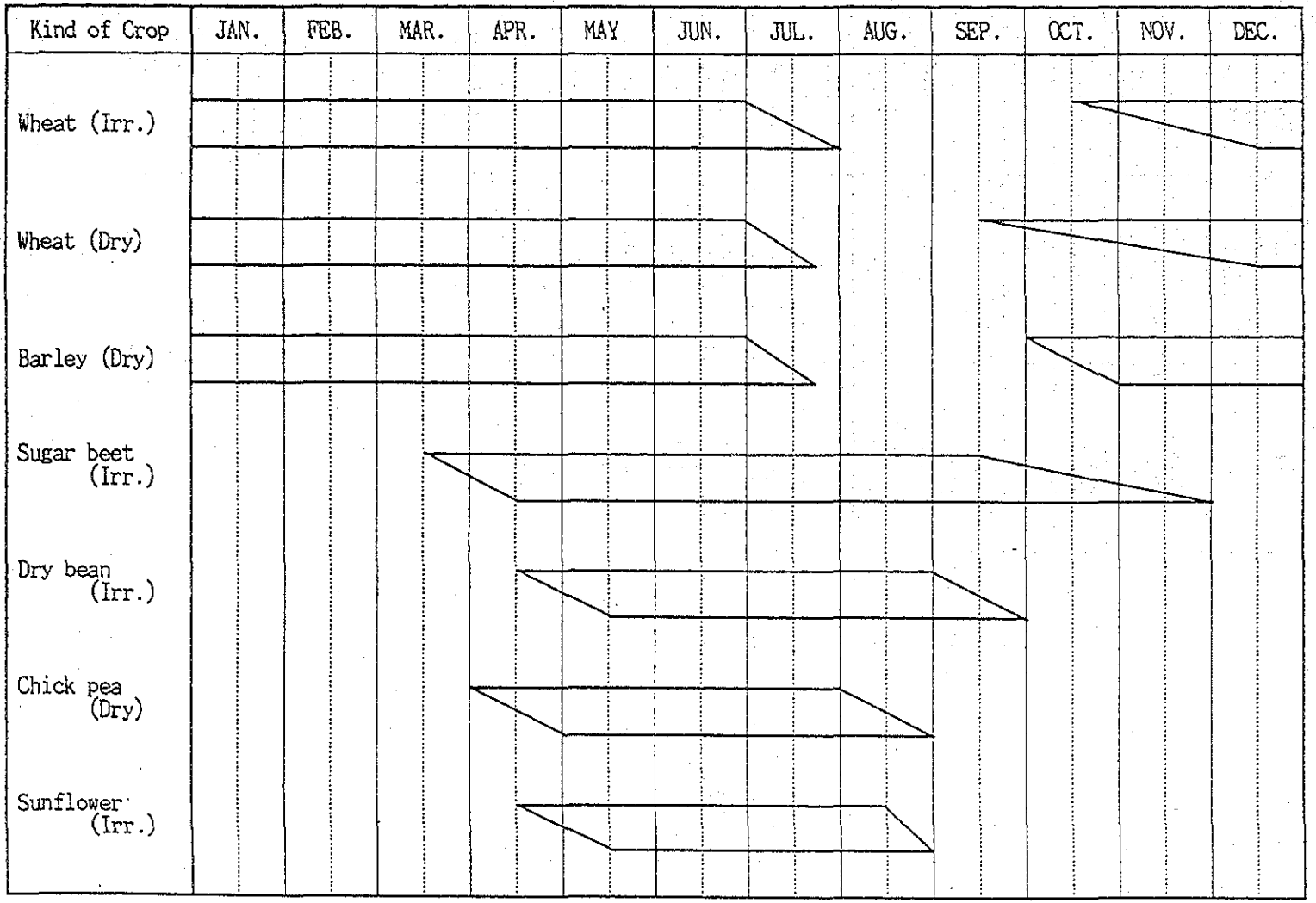


Table 3.4-4 Current Crop Unit Yield and Production

Crop	Area (ha)	Yields (kg/ha)	Production (ton)
Wheat (Dry)	14,939	1,400	20,915
Wheat (Irri.)	1,863	3,000	5,589
Barley (Dry)	3,572	1,600	5,215
Barley (Irri.)	291	3,000	873
Sugar beet	2,473	35,000	86,555
Chick pea	8,165	1,000	8,165
Lentil	151	1,000	151
Haricot	510	1,000	510
Dry bean	2,270	1,900	4,313
Sunflower (Irri.)	507	1,800	913
Potato (Irri.)	257	20,000	5,140
Vegetable (Irri.)	111	13,500	1,499
Fruit (Irri.)	413	12,000	4,956
Vineyard (Dry)	604	7,500	4,530
Poplar	442	18m^3	7,956 m^3
Fallow	3,059	0	0.0
Total	39,627		149,824 ton 7,956 m^3

Note: Fruit denotes apple

Source: Afsin, Elbistan Agricultural Engineering Office and DSI

3.4.5 Livestock

Such varieties of livestock as milk cows, sheep and very small number of horses and donkeys are raised in the Study area. In particular, most of the farming units there are raising sheep but merely on a part-time basis. No systematic large-scale grazing of sheep is seen in the area.

The sheep are put to pasture in the mountains around the Study area in summer and are kept in barns in winter. In most cases, the first floor of the farmers' houses are used for this purpose. Purchased hay is often used along with home-made fodder to feed the sheep during the winter time. Ewes are raised for breeding, milk (200 kg/year) and wool (3 kg/year) while rams are for meat to be shipped to the market on about a three-year cycle. All milk production is for self-consumption by the farmers.

Only 1~2 milk cows are kept by each farming family and most of the milk is for self-consumption.

Animal husbandry in the area at present relies mainly on labor provided by members of the farm family, and a shift to commercial based animal husbandry in the near future is not considered practical.

The Agricultural Engineering Office is in charge of giving farming instructions to each farming unit and actively conducting other related activities, including administration of inoculations to the livestock (medicine used in injection is free, with TL 50 per head charged as miscellaneous expenses) and guidance in improvement of dairy cattle breeding.

The number of the livestock in the Study area is estimated as shown in Table 3.4-5 as based on interview survey at the Agricultural Engineering Office and DSI survey data.

Table 3.4-5 Nos. of Livestock

Dairy cattle (imported breed)	4,586
Dairy cattle (indigenous breed)	6,540
Subtotal	11,126
Sheep	108,133

3.4.6 Marketing and Prices

(1) Marketing

Principal farm products in the Study area are wheat, barley, sugar beet, chick pea, dry bean and sunflower. Marketing of these products is described below.

1) Wheat

Wheat is a major export, as well as a basic staple of the national diet, and a such enjoys a major focus in national agricultural policy. The wheat market is organized and controlled by TMO (Soil Products Office) of the Government. In the Project area, the Elbistan office under the Iskenderun regional office purchases much of the wheat production each year (12% in recent years).

Almost all wheat produced in the area is destined for the domestic market. Shipping points are at Kahramanmaras, Gaziantep and Adiyaman. There are 6 cereals traders at Afsin and 15 at Elbistan which deal in wheat at these markets.

In the case of TMO, farmers bring their produce directly to the Elbistan office, or to Afsin in July and August at which time a wheat receiving station is established. In both cases, cereal traders purchase the wheat directly from the farmers.

2) Barley

Barley is an important crop in Turkey which has been traditionally used as livestock feed. The market for barley is controlled through purchase by TMO. The purchased amount, however, fluctuates markedly each year.

In the Study area, barley is used as feed for sheep and dairy cattle, with very little being shipped to markets outside the area. However, a certain portion of yield is earmarked for commercial beer production, as well as for export.

3) Sugar Beet

National policy generally encourages the cultivation of sugar beet in the country, production of which is aimed primarily at meeting domestic demand.

Their is a government run sugar plant at Elbistan adjoining the Project area, and farming of sugar beet in the area is urged by the government. Farmers who cultivate sugar beet receive various assistance from the aforementioned government enterprise as Elbistan, as well as the area sugar beet cooperative. Farmers transport their produce by tractor to the sugar plant, or its receiving stations where it is directly purchased by the government.

The Elbistan sugar plant receives produce from the surrounding districts of Afsin, Elbistan, Goksun and Cobanbeyli. Total amount of sugar beet purchased in 1987 was 297,243 tons.

4) Chick Pea

The Turkish palate is particularly fond of chick peas, and the demand for this bean is high. The crop does not require irrigation, and is commonly grown in the arid parts of the Study area as a summer crop. Produce is either purchase by TMO or by cereals traders or middlemen who move it to markets throughout the country. Nevertheless, the market is under the control of TMO. Data at the TMO regional office at Iskenderun indicates that chick pea has been exported as well in the past.

5) Dry Bean

Dry bean is a major source of vegetable protein in the national diet, and demand in the domestic market is extremely high. Market system is identical to that for chick pea. Major shipping destinations at present are Kahramanmaras, Gaziantep, Adana, Hatay, Adiyaman and Malatya.

6) Sunflower

Demand for sunflower is high. It is both used for commercial production of margarine, as well as being a well liked food item. Until 1986, industrial use sunflower was purchased by the Elbistan sugar plant. However, in response to the rise in demand and price for food use sunflower, farmers in the Project area have ceased to sell their product to the Elbistan sugar plant, and instead ship it through middlemen to the food oil plants at Adana and Mersin.

7) Others

There is a fresh produce wholesale market at Elbistan. The majority of the farm products from the area shipped to the market are surplus from crops originally raised for home consumption, and amounts are insufficient to meet consumption in Afsin and Elbistan districts.

Fruits produced in the area, particularly apples, are of high quality. They are shipped to markets not only in the immediate surrounding area, but to areas in western Turkey as well.

(2) Prices

Under national policy, price supports are set each year for such crops as wheat, barley, rye, oats, maize, sunflower, soy beans, various other types of beans, cotton, tobacco, hazel nut, etc.

The GOT purchases cereals and beans to prevent market prices from dropping below the target support price, and to ensure a stable price for producers. The purchase price sugar beet by commercial enterprises is also set each year by the GOT. Other farm products are subject to free market conditions; however, their is very little regional difference in prices. This is due to staggered harvest periods depending on the region, and a well development highway system. Although farm prices rise each year as a result of inflation, increase rate is less than that for general commodities. Wholesale price indices in recent years are given in Table 3.4-6.

Table 3.4-6 Wholesale Price Indices (1981:100)

	1984	1985	1986	1987
General Index	249.1	356.8	462.3	610.4
Agricultural Sector	257.4	353.6	442.9	574.2
Cereal	252.7	333.6	425.7	505.8
Bean	220.4	436.5	647.9	759.5
Other crops	298.7	350.2	397.3	601.1
Fruits, vegetables	243.2	359.6	428.2	543.2
Livestock (fresh)	333.3	427.9	576.7	915.7
Livestock (processed)	232.2	305.3	405.4	525.8
Fish	269.6	495.9	917.9	1,008.0

Source: SIS

3.4.7 Farm Economy

Average farms were selected as a model on the basis of farm scale, land ownership, type of farm management, etc. in the Study area, and applied as a basis for study of farm economy in the area. The farm budgets for the model farms was calculated, and are shown in Table 3.4-7 (details are given in Appendix V · Table V-13). In the case of all farms, income from cultivation is relatively small, being heavily supported by income from sheep husbandry.

In the case of the southern sector of the pump irrigation design area, the fact that a portion is irrigated at present results in a comparatively high net farm income despite smaller cultivated area than other areas.

Table 3.4-7 Current Farm Economy for Model Farms (unit: TL)

	Design Gravity Irrigation Area	Design Pump Irrigation Area	
		South Sector	North Sector
1. Gross income			
a. Cultivation	2,340,600	3,450,200	3,506,200
b. Livestock	1,860,975	1,079,100	3,506,200
2. Expenses			
a. Cultivation investment	1,129,076	1,345,406	2,104,413
b. Livestock investment	474,932	297,549	809,818
3. Net Income	2,567,567	2,877,345	3,732,744
4. General farm expenses	152,051	148,107	254,150
5. Own consumption	567,840	662,480	473,200
6. Household expenses	1,500,000	1,700,000	2,000,000
7. Surplus	377,676	366,758	1,005,393

3.4.8 Present Irrigation

Results of survey of existing irrigated area are shown in Table 3.4-8 and Fig. 3.4-2. Of the cultivated land in the area, about 9,300 ha has been irrigated. Water is most frequently drawn from rivers, followed by springs and underground sources. Most of the intake facilities at the rivers, large and small, adopt longitudinal separation works, i.e. water is obtained by piling up gravels on the riverbed or construction of coarse frameworks with wood in order to dam up the river water level.

The water from springs is often utilized by constructing a small pool with stones and concrete materials.

Groundwater is pumped up with small diameter, deep well pumping facilities. The headrace canal from the water source is partly walled with concrete, but it is basically of earth canal.

However, the above described irrigated area is subject to severe effects of climate due to unstable water supply and lack of diversion facilities. Furthermore, the large expanse of non-irrigated area in the Study area is restricted to either cultivation during the rainy season or cultivation of crops with low water consumption. Cultivation during the dry season is extremely constrained.

1989 has recorded the smallest rainfall in some 20 or 30 years, and irrigated area is at only around 6,000 ha. This has prompted a shift from cultivation of sugar beet and paddy (small scale), which are relatively highly moisture consumptive, to wheat and other crops requiring less water.

Field irrigation is almost completely by the border and furrow methods. In the case of the extremely few large scale farms in the area, irrigation by pump driven, transportable sprinkler is also performed. In all cases, the crops irrigated are sugar beet and dry bean.

At the Forestry Agency seedling farm adjoining the Study area, irrigation by transportable sprinkler is performed for demonstrative purposes. Shift to more sophisticated equipment and facilities is in progress.

Intake and headrace facilities are mostly operated under the independent efforts of the farmers themselves. At Tanir, with largest diverted discharge and irrigated sector in the Study area (3,500 ha), village chiefs and their assistants of the 6 concerned villages oversee operation and maintenance of such facilities.

Table 3.4-8 Presently Irrigated Area Condition

No	Location	Area (ha)	Water Resources	Remarks
1	Goksun River	300	River	Longitudinal Diversion, Unlined Canal
2		250	〃	〃 〃
3		40	〃	〃 〃
4		120	Spring	Spring Pond, 〃
5		100*	Stream flow	Head Race 〃
	(Sub total)	(810)		
6	Afsin plan	270*	Ground Water	Pumping, Unlined Canal (Partial Concrete)
7		310*	〃	〃 〃
8		330*	〃	〃 〃
	(Sub total)	(910)		
9	Hurman River	120	Ground Water	Pumping, Unlined Canal (Partial Concrete)
10		3,500	River	Stone Diversion Unlined Canal (Partial Concrete at Upstream)
11		230*	〃	Pumping, Unlined Canal
12		1,000	〃	Longitudinal Diversion, Unlined Canal (Downstream, Dual Purpose Canal)
13		300	〃	Longitudinal Diversion, Unlined Canal (Dual Purpose Canal)
14		310	Spring	Spring, Pump, Unlined Canal (Dual Purpose Canal)
15	Sarsap River	460	Spring Stream Flow	Unlined Canal (Dual Purpose Canal)
16		630	River	Longitudinal Diversion, Unlined Canal (Dual Purpose Canal)
17		470	Drainage	Unlined Canal (Dual Purpose Canal)
18		240	〃	〃 (〃)
	(Sub total)	(1,800)		
19	Sogutlu River	180	River	Unlined Canal
20		120	〃	〃
21		20	Spring	Small Pond (Ceyhan Riv.), Unlined Canal
	(Sub total)	(320)		
	Total	9,300		

(NOTE) * Facilities of TOPRAKS

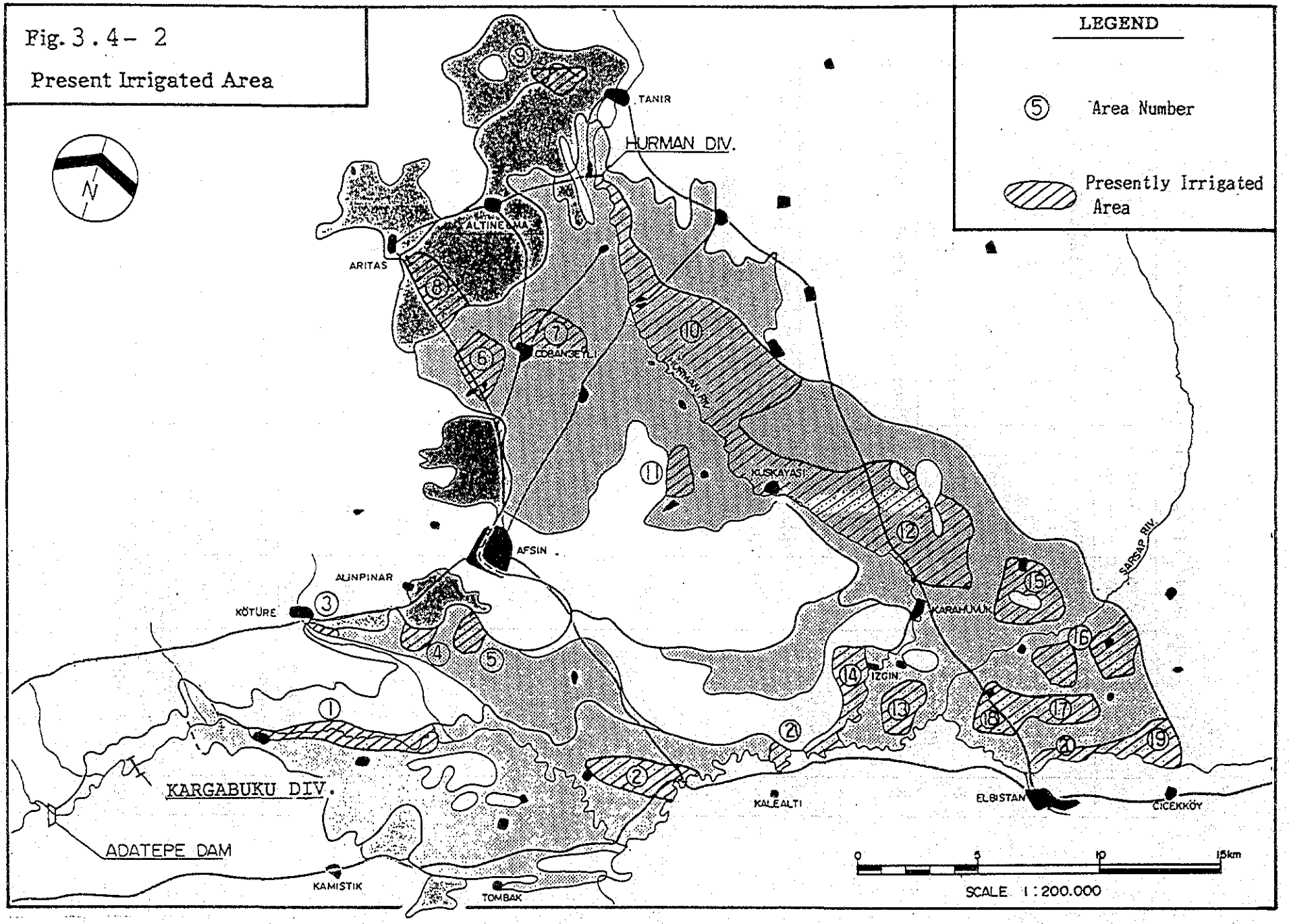


Fig. 3.4- 2
Present Irrigated Area
LEGEND
⑤ Area Number
Presently Irrigated Area
N
TANIR
HURMAN DIV.
ALTINEMA
ARITAS
ÇOBANSEYL
KÜRKAN RIV.
KUŞKAYAŞI
AFŞIN
ALINPINAR
KÖTÜRE
KARAHÜYÜK
SARSAP RIV.
IZGIN
KARGABUKU DIV.
ADATEPE DAM
KAMIŞTIK
TOMBAK
KALEALTI
ELBISTAN
ÇIÇEKKÖY
0 5 10 15km
SCALE 1:200.000

3.4.9 Present Drainage

No particular attention has been given to the drainage facilities of the Study area. Excessive water due to rainfalls in and around the area flows into the tributaries and rivers through ditches and streams. The tributaries are extremely meandering and have no artificial banking.

The lowland area along these streams is often inundated with flooding (see Table 3.4-10 and Fig. 3.4-3). During the rainy season, the function of roads connecting the villages and farm roads is often obstructed due mainly to the inadequate drainage.

Poor drainage areas are estimated at approximately 11,000 ha in the Study area. Such poor drainage areas can be divided into the following three areas:

1) Lowland areas which inundate at the time of flood, because river flow obstructs due to the extreme meandering of the river
2) Artificial marshy areas that store excessive water in the rainy season to supplement irrigation water in the dry season
3) Area recommended to be drained by subsurface drains due to the soil conditions.

Damage due to poor drainage is as shown in Table 3.4-9.

Table 3.4-9 Damage Due to Poor Drainage

Year	Area damaged	Items	Damage Amount
1973-74	5,200ha	Arable land, fruit, erosion	18,400,000,000TL
1974-75	5,900ha	Houses, livestock	24,800,000,000TL

As shown in Table 3.4-11 and Fig. 3.4-3, river improvement works are currently in progress. It is concluded that completion of these works and establishment of adequate drainage canals will eliminate damage from poor drainage for most areas.

Drainage of soil on the left bank of the Hurman river is anticipated to be somewhat difficult. However, as highly water consumptive sugar beet is currently cultivated in this type of poorly drained area, irrigation facilities are of highest priority and should be established prior to construction of drainage system.

Table 3.4-10 Ill Drained Area in the Project Area

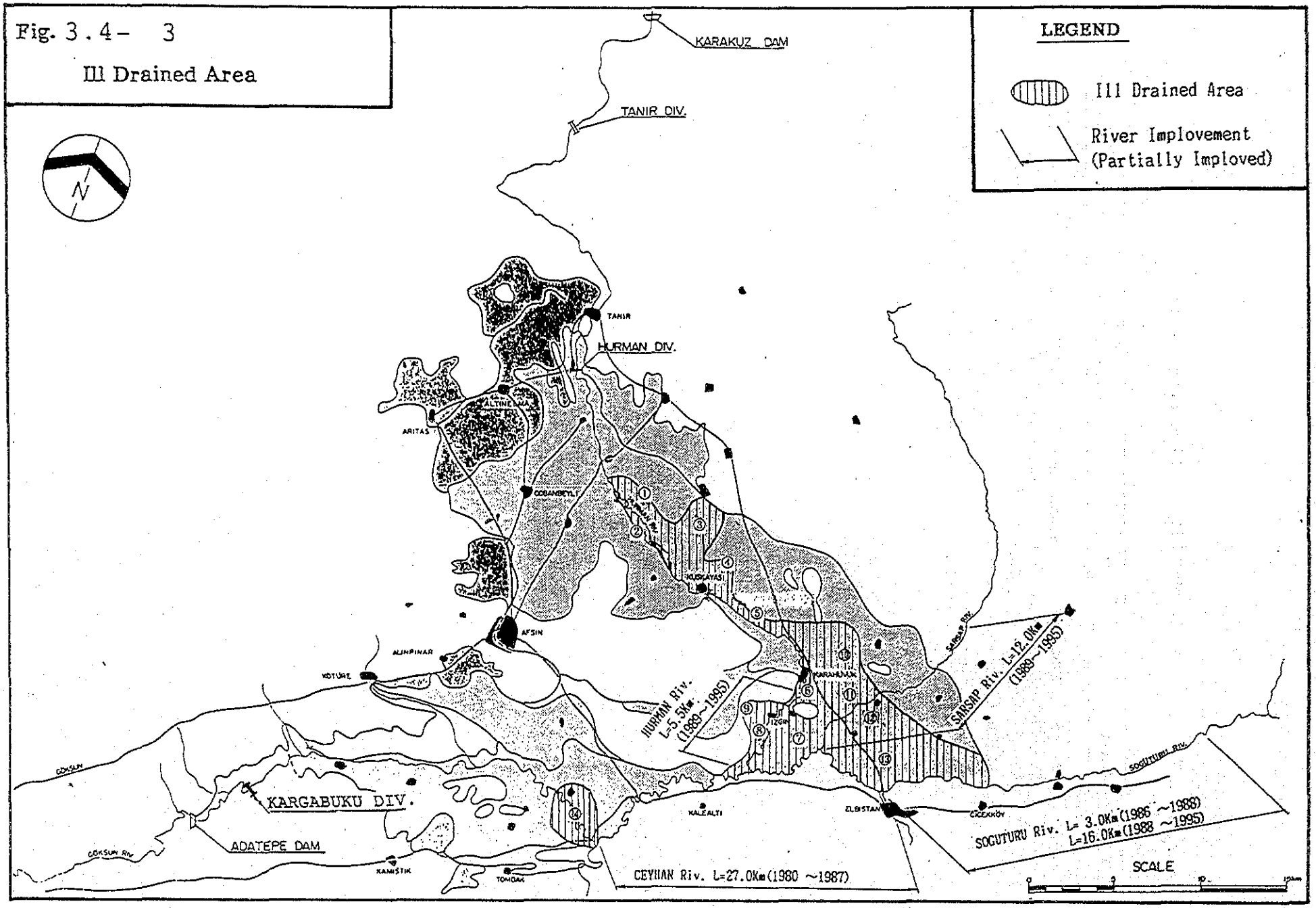
No	Location	Area (ha)	Remark
1	Hurman Riv.	340	Ill drainage due to low land. Can be improved by construction of canals to drain surface water
2		150	- do -
3		1,250	Ill drainage due to low land. Can be improved by removal of surface water and construction of canals.
4		620	- do -
5		330	Ill drainage due to low land. Can be improved by removal of surface water and construction of canals.
6		850	Canals are not properly located for drainage purpose.
7		1,000	Canals are not properly located for drainage purpose. Can be improved by improvement of Hurman river and construction of canals.
8		350	Ill drainage due to low land and springs. Improvement of Hurman river and removal of sub-soil water are necessary.
9		300	Ill drainage due to low land. *Control of springs is necessary.*
	(Sub total)	(5,190)	
10	Sarsap Riv.	580	Canals are not properly located for drainage purpose. Removal of surface water is necessary.
11		1,400	- do -
	(Sub total)	(2,290)	
13	Sogutlu Riv. & Ceyhan Riv.	2,800	Canals are not properly located. Can be improved by improvement of Sogutlu river and removal of surface water.
14	Goksun Riv.	420	Ill drainage due to low land. Can be improved by improvement of Göksun river.
	Total	10,700	

Table 3.4-11 River Improvement

Rivers		Extension (km)	Work schedule
Ceyhan	Elbistan to Göksun confluence	27.0km	Completed in 1987
Hurman	Upper reaches of Ceyhan confluence	5.5km	1995
Sarsap	The same as above	12.0km	1995
Sogutlu	The same as above	3.0km	Completed in 1988
		19.0km	1995

Fig. 3.4- 3

Ill Drained Area



3.5 Agricultural Support Agencies

3.5.1 Administrative Agencies

Government agencies engaged in agricultural support activities in the Study area are as follows:

(1) Ministry of Agriculture, fisheries and Rural Affairs

a. Agriculture Office

b. Soil Products Office

c. Village Service Office

(2) Agricultural Supply Organization

(3) Agricultural Public Corporation

(4) Agricultural Bank

(6) Sugar Bank

(7) National Dairy Product Society

(8) Afsin District Office

(9) Elbistan District Office

The above agencies are engaged in a variety of support activities including extension, research, supply of farm inputs, purchase of farm products, establishment of agro-infrastructure, financial support, etc. Close coordination is maintained between these agencies in carrying out their independent activities.

3.5.2 Agricultural Cooperatives

The only functioning cooperative in the Study area is the Sugar Beet Producer's Cooperative. This cooperative maintains direct links to the government run sugar plant at Elbistan, and operates under government supervision. Sugar beet production is permitted only by members of the cooperative. The organization procures production inputs not only for sugar beet, but for other vegetables as well. Member farm households in Afsin and Elbistan districts total 8,733 and 13,256, respectively.

Marketing and processing cooperatives for farm products are generally encouraged by GOT under the fifth 5-year plan. However, as of yet, such have not been established in the Study area.

3.5.3 Agricultural Financing Agencies

Public agencies providing financial support to farmers in the Study area consist of the Agricultural Bank, and the village Agricultural Credit Cooperatives. The Agricultural Bank provides farm financing either directly, or through the Agricultural Credit Cooperatives. Financial support for sugar beet producers is provided through the Sugar Bank.

Lending conditions of the Agricultural Bank and the Agricultural Credit Cooperatives are based on the Credit Report prepared at the agricultural Engineering Office. Interest is 40% for seed and 30% for fertilizer and agro-chemicals, in the case of cereals and beans.

The Agricultural Bank and Sugar Bank maintain branch offices in Afsin and Elbistan. There are 5 Agricultural Credit Cooperatives in Afsin and 6 in Elbistan with memberships of 7,580 and 5,176 households, respectively. Total agricultural financial support provided in Afsin and Elbistan in 1987 is TL 5.2 billion.

3.5.4 Post Harvest Facilities

There are no post harvest facilities in the Study area; however, in adjoining areas there are 1 government run sugar plant and 1 privately operated mill (Elbistan). processing some of the farm production from the Project area.

The Elbistan sugar plant is one of the 24 operated by the National Sugar Corporation, and has been in operation since 1985. Plant equipment is modern, with production capacity of 6,000 t/day. However, actual production is 3,500 t/day due to lack of sugar beet supply. Period of plant operation is 4~5 months per year. Production in 1987 was 29,600 tons (1.8% of national production). Production capacity at the private Elbistan mill is 31,900 t/year.

A large part of the milk produced in the Study area is processed by the farmers themselves for self-consumption. However, a portion is processed at the National Dairy Products Association plant at Kahramanmaras. Plant capacity is 20 t/day.

3.5.5 Research and Extension

Research on farm technology applied to the Study area is performed at the Agricultural Research Institute of the East Mediterranean Coastal Region at Erdemli, and the Agricultural Experimental Station of the Mediterranean Coastal

Region at Tarsus. These centers also train the staff of the Agricultural Engineering Offices in each region. In addition, the Agricultural Public Corporation conducts research on improved varieties and cropping technology, as well as producing guaranteed seed.

Extension activities in the Study area are performed mainly by the Agricultural Engineering Offices at Afsin and Elbistan. These include the following:

(1) Extension of agriculture related data by means of pamphlets, telephone, etc.

(2) Farm financial support planning

(3) Campaigns stressing better sanitation and pest control

(4) Farmer group training in cropping technologies

(5) Guidance in cropping techniques through selected model farmers

(6) Extension of guaranteed seed

(7) Guidance in improving rural living environment

(8) Supervision of quality control, inoculation, and marketing of livestock

(9) Improvement of dairy cattle breeds

As the area of jurisdiction of each Agriculture Engineering Office is large, it places agents in the major villages to execute extension policy. The Offices also maintain pest control and stud bull stations. However, extension activities overall are insufficient due to lack of extension materials, equipment and vehicles.

The Afsin Fruit Nursery produces improved seedlings and sells them to farmers, as well as provided extension in fruit tree cropping technology.

The Elbistan sugar plant provides guidance in cropping technology and farm management to sugar beet producers.

3.6 Environment

It is essential that careful attention be given to the impact of Project implementation on the surrounding environment.

In this light, observation of present natural and social environment of the Project area was made by the Team during the first stage field survey. During the second stage field observation, a questionnaire was prepared by the Study Team and

submitted to DSI with the request to study and evaluate the items contained therein. The said items are as follows:

a) Air pollution due to application of agro-chemicals

b) Influence on fishing, aquatics, etc. due to change of tributaries caused by construction of the Project facilities

c) Water quality pollution due to irrigation and drainage

d) Influence on rare species of animals and plants , if any

e) Influence on common animals and plants caused by construction of the Project facilities and their usage

f) Influence on the landscape

g) Influence on the historical and cultural inheritances

h) Influence on the existing infrastructures

i) Influence on traffic

j) Influence on land use and residents

k) Influence on water use in other areas

On the basis of its study, DSI concluded that no problem exists with regard to any of the above items. The Study Team examined potential impact to the environment in cooperation with the concerned counterparts from the standpoint of each sectoral plan under the Project, and concluded that implementation of the Project will have no adverse impact on the existing environment of the Project and surrounding area.

However, construction of Adatepe dam will require the resettlement of about 100 households. In other projects undertaken to date where resettlement was necessary, DSI has adopted a policy according the highest priority to the just and accurate appraisal of property and compensation therefor, as well as provision of an equitable new living situation. This will be the criteria which applies to resettlement under the Project as well.

Another subject to be taken into account is measures to minimize sediment influx to the reservoir following construction of Adatepe dam.

For reference, siltation at Adatepe dam is estimated on the basis of data from the existing nearby Sarimsakli dam. This dam was constructed in 1968 in Keyseri,

and features a catchment area of 420 km^2, and storage of 31.9×10^6 m^3. Mean annual siltation is 89,700m^3. The Fair and Geyer formula as shown below was applied in calculation.

$$Q_s = \alpha \times F^{0.77}$$

where:

Q_s = annual sedimentation (acre-ft)

F = catchment area (sq. mile)

α = sediment coefficient

On the basis of the above formula:

Q_s = 138,000 m^3/year

As a ratio to catchment area:

q_s = 190 m^3/km^2/year

From the above figure, it is concluded that there is no major problem regarding siltation at Adatepe dam. However, an aggressive afforestation program in the catchment would be desirable to suppress surface soil wash-off.

Chapter 4

Development Plan

CHAPTER 4 DEVELOPMENT PLAN

4.1 Development Objective

With the exception of a small portion where irrigation is practiced by simple means, cultivation in the Adatepe area is rainfed. Meteorology and lack of water availability constrain crop variety and farming practices. Accordingly, many farmers cannot maintain their livelihood through agriculture alone, and the area lags behind more agriculturally developed regions of the country.

In order to correct this discrepancy, it is necessary to promote more economically viable farming in the Project area by upgrading agricultural infrastructure. This will increase farm productivity, permit wider range of crop variety and improve farm product quality, helping to bring the area into line with neighboring agricultural regions in the country in terms of development level.

4.2 Basic Development Concept

The first step in achieving the above is the establishment of an irrigation system servicing the area with a stable and economic supply of water. Also, the resultant irrigated agriculture must be based on an effective combination of traditional and new farming practices.

It will also be necessary to strengthen the farmer support system which provides guidance to farmers on crops to be cultivated, farm management practices, farm inputs (fertilizer, etc.), and both domestic and international marketing data, processing and distribution of farm products, etc.

The basic development concept for the Adatepe Irrigation Project is oriented at the above goals and fully compatible with government agricultural policy under the 5th national development plan (1985~89).

In specific terms, the Project calls for diversion from Adatepe dam and conveyance to fields by a system of main, secondary and tertiary canals. Water will be brought into the fields by quaternary canals (farm ditches) and applied by the border irrigation method. Main through tertiary canals are to be concrete lined.

In cases where conveyance is topographically not possible from the water source by natural gravity, water will be first pumped to an elevated to a strategically high location for gravity feed to the field. However, from the

standpoint of cost, effectiveness, the canal network will be designed in principal to minimize the need for pumping.

On farm development will require important attention under the Project, encompassing terminal irrigation facilities including quaternary canal (farm ditch) network.

4.3 Agricultural Development Plan

4.3.1 Selection of Development Area

Selection of development area is based on factors of topography, soil conditions, availability of labor, economic viability of development and compatibility with existing projects and future development plans of the Government.

Development areas for projects either ongoing or planned for the Elbistan-Afsin plain are as follows:

Adatepe Irrigation Project	44,000 ha
Karakuz Irrigation Project	16,500 ha
Kalealti Irrigation Project	8,400 ha
Sogutlu Irrigation Project	4,300 ha
Others	26,700 ha
Total	99,000 ha

4.3.2 Land Use Plan

The land use plan strives for the optimum utilization of land under the conditions prevailing in the target area in order to maximize the economic effect of the Project.

The following items were carefully considered in formulation of the land use plan:

① Identification of soil constraints, and countermeasures therefor

② Cultivation method, soil fertility

③ Optimum cropping pattern given the environment of the target area

On the basis of the above, the land use plan was formulated as follows:

① Expansion of cultivation of other cash crops due to the relatively low yield nature of the wheat widely cultivated in the Project area

② Basic preservation of 3 crop rotation of the principal crops of the area of wheat, sugar beat and dry bean.

③ Dry bean is to be promoted as a substitute for chick pea, heretofore cultivated without irrigation in the area. Cultivation of dry bean is to be particularly emphasized in the area targeted for pump irrigation where it has been heretofore widely cultivated.

④ As a root crop, sugar beet requires much water as well as a thick top soil layer. As a result, sugar beet cultivation is to be emphasized in the area targeted for gravity irrigation, in the alluvium along the Hurman and Sarsap rivers, where it has been heretofore widely cultivated. Also, it is to be promoted in the design pump irrigation area around Aritas and northern Altinelima where soil layer is thick.

⑤ Cultivation of barley and alfalfa, both feed crops, is to be emphasized in the area targeted for pump irrigation, located at the periphery of the area where animal husbandry is widely practiced.

⑥ For the same reason as ⑤, cultivation of alfalfa is to be emphasized in areas adjacent to villages.

⑦ Cultivation of vegetables is to focus on tomato and cucumber due to their appeal to the palate of the population of the area, and cabbage and cauliflower due to relative ruggedness when transported.

⑧ Cultivation of fruit trees is to focus on apple and apricot due to their suitability to the climate of the Project area.

⑨ Due to the relative ease of cropping management for fruit trees and grapes and their suitability for cultivation on slopes, these are to be emphasized for the sloped areas at southern Afsin, southern Tanir, and southern Goksun river.

⑩ Contour farming and contour irrigation are to be adopted in principle on sloped areas to prevent soil erosion.

⑪ Application of organic substances will be encouraged among farmers due to the low organic content of the area soil of 1~2%.

4.3.3 Design Cropping Pattern and Cropping Intensity

Farmers and related agencies in the Project area were interviewed during the first stage study in order to clarify natural conditions, farmer aspirations, marketing networks, etc. During the second stage survey, discussions where held with research entities (Agricultural Experimental Station of the Mediterranean Coastal Region, Agricultural Research Institute of the East Mediterranean Coastal Region, and the Agricultural Engineering Office of the area) concerning possible cropping patterns.

On the basis of the above, the design cropping pattern was formulated.

Meteorologic and other constraints affecting the Project area prevent a major alteration of the current cropping pattern. Accordingly, cropping pattern is 1 crop per year with a maximum cropping intensity of 100%.

Conditions for each crop are as follows:

① Wheat

There is in effect no limit to cultivable area. However, as the cost effectiveness of the crop is low, cultivated area is to be restricted to 25%.

② Barley

Cultivated area is to kept at or below the current area, since barley, like wheat, is of low cost effectiveness.

③ Dry Bean

Current cultivated area is small due to need for irrigation, despite the good cost effectiveness of the crop. Cultivated area is to be expanded 3 fold to 20~25% of the total as strong domestic and export demand exist.

④ Sugar Beet

Current cultivated area in the Project area is around 2,500 ha, despite some yearly fluctuation. Sugar beet is of good cost effectiveness, and there is much eagerness among farmers to cultivate it. The current operating rate (260,000 t) of the nearby sugar plant of a little more than 60% places a constraint on economically cultivable area. Production is therefor limited to 260,000 t. If yield is assumed at 55 t/ha, an expansion of cropped area from the current 2,700 ha to 7,500 ha (an increase of 4,800 ha) is possible. This represents about 17% of the cultivated area under the Project.

⑤ Sunflower

Crop is of good cost effectiveness. However, due to need for irrigation, current cropped area is small. A 3 fold increase over the current cultivated area is considered the maximum possible.

The above described cropping pattern is shown in Table 4.3-1.

Table 4.3-1 Design Cropping Pattern

	Gravity area		Pump area		Total	
	Area (ha)	Cropping Pattern (%)	Area (ha)	Cropping Pattern (%)	Area (ha)	Cropping Pattern (%)
Wheat	8,582	24.0	2,481	30.0	11,063	25.1
Barley	1,430	4.0	827	10.0	2,257	5.1
Sugar Beet	6,437	18.0	1,075	13.0	7,512	17.1
Potato	1,430	4.0	248	3.0	1,678	3.8
Dry Bean	8,940	25.0	1,489	18.0	10,429	23.7
Sunflower	1,788	5.0	331	4.0	2,119	4.8
Alfalfa	2,146	6.0	827	10.0	2,973	6.8
Vegetable	1,073	3.0	165	2.0	1,238	2.8
Fruit	2,146	6.0	496	6.0	2,642	6.0
Vineyard	715	2.0	165	2.0	880	2.0
Poplar	1,073	3.0	166	2.0	1,239	2.8
Total	35,760	100.0	8,270	100.0	44,030	100.0

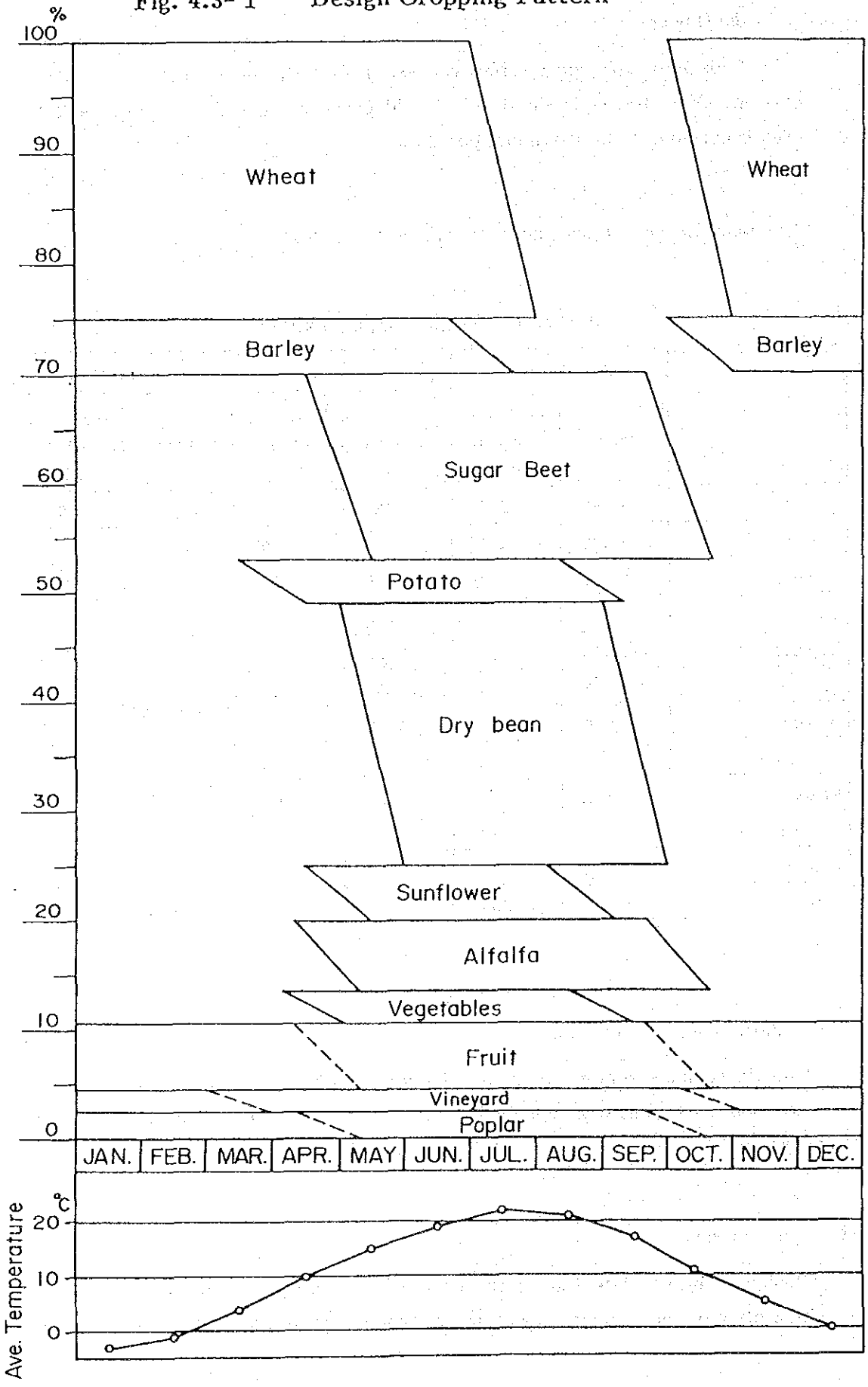
4.3.4 Farm Management Plan

The farm management plan is formulated on the basis of design crops, fertilizer and pest control techniques, past cropping performance, design animal husbandry, etc.

(1) Design Crops

Design crops are selected on the basis of the ample irrigation to result from implementation of the Project, as well as criteria of climate, soil conditions, market

Fig. 4.3- 1 Design Cropping Pattern



demand, etc. Crop pattern is to be 3 year rotational, with one crop per year (100% cropping intensity) in principle in view of the Project area climate.

Selected crops include wheat and dry bean, both of which are staples of the Turkish diet, sugar beet which is economically guaranteed under national agriculture policy, sunflower for which demand is high, as well as potato, other vegetables, fruits including grape, poplar, etc. Under vegetables, particular consideration is given tomato, as a commercial crop that can be shipped to the Cukurova region in the off-season. Under fruits, focus is given high grade apple and apricot.

Design corp rotation is as shown in Table 4.3-2.

Table 4.3-2 Design Crop Rotation

First year	Second year	Third year
Sugar beat (Apr.~Nov.)	Wheat (Oct.~Jul.) Barley (Oct.~Jul.)	Dry bean (May~Sep.) Sun flower (Apr.~Aug.)

(2) Fertilizer and agro-chemicals

Once irrigation is successfully supplied to the field, fertilizers and agro-chemicals become the important factor in field productivity. At present, the Agricultural Engineering Office provides extension and guidance in application of fertilizer and agro-chemicals. As a result, the use of these inputs is spreading. However, there is still much room for improvement is utilization rates.

Under the Project, amounts of fertilizer and agro-chemicals recommended for each crop are given in Table 4.3-3.

Table 4.3-3 Fertilizer and Agro-chemical Requirement (Design Values)

	Chemical Fertilizer (kg/ha)	Manure (t/ha)	Herbicide (kg/ha)	Pesticide (kg/ha)	Germicide (kg/ha)
Wheat	300	--	0.15	--	0.50
Barley	400	--	0.20	--	0.50
Sugar beat	1,300	--	--	3.00	--
Potato	650	40	--	2.00	0.20
Dry bean	300	--	0.30	30.20	--
Alfalfa	450	5	--	--	--
Sun flower	350	--	--	--	--
Vegetable (Tomato)	450	10	--	--	0.25
Fruit (Apple)	200	7.5	0.20	0.15	0.40

(3) Animal Husbandry

The area Agricultural Engineering Office provides extension and guidance in animal husbandry. The goal of the office is to raise the level of dairy cattle raising to an average 2~3 head per farm household. At present, however, animal husbandry in the Project area remains a side activity by farmers subordinate to cultivation. In this light, animal husbandry is to be approached under the Project in the following manner:

① Scale and method of sheep herding is to be kept at current levels.

② Dairy cattle husbandry is to be increased to a target level of 2 head per household in an effort to improve farm household nutrition, and farm management. This is in line with national agricultural planning which also promotes the increase in dairy cattle husbandry.

4.3.5 Labor Demand

(1) Labor Force

Farm households in the Project area number 6,800 with a total farm population of 38,800. Latent farm family labor force is estimated at 21,400, or 507,000 man days per month.

Monthwise labor requirements calculated on the basis of cropping pattern and cropping intensity under the Project are as follows (agriculturally active months only): (see Table 4.3-4)

Table 4.3-4 Monthwise Labor-Force

	Labor Requirement		
		Surplus	Surplus rate
April	356,200 man/days	150,800 man/days	30%
May	742,800 〃	-235,800 〃	〃 -47%
Jun	445,500 〃	61,500 〃	〃 12%
July	261,400 〃	245,600 〃	〃 48%
August	384,500 〃	122,500 〃	〃 24%
September	552,700 〃	-45,700 〃	〃 -9%
October	359,200 〃	147,800 〃	〃 29%

On the basis of the above, peak labor demand occurs in May and September. Employed labor must be relied upon during these periods. The requirement in the peak month of May under the Project represents a 2 fold increase in employment opportunity over the current May requirement of 300,000 man days.

(2) Mechanized Labor

According to calculation based on DSI survey data, operation time required for farm machinery under the Project would total 1.1 million hours. At present, tractors in the Project area total 1,160 (according to the Agriculture Engineering Offices at Afsin and Elbistan). If 8 hrs / day operation for 150 days is assumed as the

requirement under the Project, operation of currently owned machinery would total 1.4 million hours, which offers some margin over the actual forecast requirement.

4.3.6 Design Yield

Design yields are indicated in Table 4.3.4. These have been forecast on the basis of discussions with personnel in DSI and other concerned agencies (Agricultural Experimental Station of Mediterranean Coastal Region, Agricultural Research Institute of East Mediterranean Coastal Region and the regional Agricultural Engineering Offices) with regards to performance of DSI projects in adjoining areas and other similar irrigation projects. Forecasts assume the use of fertilizer and agro-chemical inputs under the Project, as well as the implementation of an extension program in cropping technology (Table 4.3-5). Design crop production up to the target year under the Project is shown in Appendix V · Table V-3.

Table 4.3-5 Crop Design Yield and Production

Crop	Cropped Area	Yield(kg, m3/ha)	Production (t)
Wheat	9,658	3,500.0	33,803
Barley	1,970	4,000.0	7,880
Sugar Beet	6,558	55,000.0	360,690
Dry Bean	9,105	2,500.0	22,763
Sunflower	1,850	4,000.0	7,400
Potato	1,465	25,000.0	36,625
Green vegetables (tomatoes)	1,081	25,000.0	27,025
Alfalfa	2,595	14,000.0	36,330
Fruits (apple)	2,306	21,000.0	48,426
Grape	768	15,000.0	11,520
Poplar	1,082	35.0	37,870 (m^3)
Total	38,438		592,462 37,870 (m^3)

Design yields and productivity for animal husbandry are indicated in Table 4.3-6.

Table 4.3-6 Livestock Design Yield and Production

Product	No. of Head	Yield (kg/head)	Production (t)
Gravity and south sector pump design irrigation areas			
Milk (improved breed)	2,946	3,900.0	11,489.4
Milk (indigenous breed)	4,125	2,400.0	9,900.0
Milk (sheep)	48,912	72.0	3,521.7
Meat (improved breed)	2,946	88.0	259.2
Meat (indigenous breed)	4,125	75.0	309.4
Meat (sheep)	48,912	15.0	733.7
Wool	70,716	3.0	212.1
North sector pump design irrigation areas			
Milk (improved breed)	1,584	3,900.0	6,177.6
Milk (indigenous breed)	1,936	2,400.0	4,646.4
Milk (sheep)	21,120	72.0	1,520.6
Meat (improved breed)	1,584	88.0	139.4
Meat (indigenous breed)	1,936	75.0	145.2
Meat (sheep)	21,120	15.0	316.8
Wool	30,272	3.0	90.8

4.3.7 Net Benefit Increment Under the Project

As indicated in Table 4.3-7, increased productivity as a result of irrigated cultivation and improved livestock nutrition under the Project will total TL 41,248,546,100 annually. This net benefit increment is calculated on the basis of production costs and production amounts for each crop and type of livestock under Project "without" and "with" conditions. Net production profit for crops is 369% and 121% for animal husbandry. Details are given in Appendix V · Table V-6 and V-9.

Table 4.3-7 Net Incremental Benefit Under the Project (unit: TL 1,000)

	Total Production Amount	Total Production Cost	Net Production Profit
Present (crops)	21,710,705.4	12,901,589.8	8,809,115.6
(livestock)	11,285,315	4,066,559	7,218,756
Subtotal (1)	32,996,020.4	169,681,488	16,027,871.6
With Project (crops)	71,107,524.0	29,756,644.3	41,350,879.7
(livestock)	23,598,598	7,673,060	15,925,538
Subtotal (2)	94,706,122	37,429,704.3	57,276,417.7
Increment (2) - (1)	61,710,101.6	20,461,555.5	41,248,546.1

Note: Production amount takes into account value of straw and bean stalk as feed, and the value of livestock in terms of meat and manure.

4.3.8 *Extension of Agricultural Technology*

(1) *Strengthening of Agricultural Extension Organizations*

Under the Project, vehicles and audio visual equipment will be procured for the Agricultural Engineering Offices at Afsin and Elbistan. The lack of such has been the major obstacle to effective extension activities in the Project area by these agencies.

Extension and guidance to farmers provided by the staffs at the Agricultural Engineering Offices in cropping technology, irrigated agriculture technology, creation and operation of farmers' organizations (particularly marketing cooperatives on a villagewise basis), etc. are to be strengthened.

(2) Agricultural Training Center

Farmers in the Project area have almost no experience in irrigated agriculture. To ensure the success of the Project, instruction and guidance in cropping technologies and mechanized farming appropriate to conditions under the Project will be essential.

To provide such instruction, and Agricultural Training Center is to be established under the jurisdiction of the Agriculture Engineering Office.

The envisaged Center will make use of the facilities at the Afsin Agricultural Engineering Office and the Fruit Nursery Research Station. Operation of the Center would be performed jointly by the Agricultural Engineering Offices at Afsin and Elbistan, in cooperation with the area branch of DSI. Materials, equipment and machinery for instruction in irrigated agriculture will be procured.

4.3.9 Farmers' Organizations

The only farmers' organization in the Project area at present is the Sugar Beet Producers' Cooperative.

Under the Project, annual crop area for potato and green vegetables (mainly tomato) is to be greatly increased. Creation of a farmers' organization is therefore planned for quality control and coordinated shipping of produce to ensure the most favorable price possible to the farmer.

Such groups would be created on a villagewise basis for ready acceptance and participation by farmers. The organizations would be run by the farmers themselves, with guidance from the Agricultural Engineering Offices. Cooperative officers would include a president, treasurer and secretary elected by the farmers.

These marketing cooperatives would establish communal storage facilities (refrigerated) for fruits, milk and other dairy products. Production and shipping policy for the various farm products would be coordinated for the area as a whole through a committee comprised of representatives from each village cooperative. If possible, a professional would be employed to provide advice and direction to the committee.

4.4 Irrigation Development Plan

4.4.1 Irrigation Systems

In demarcation of the Project area, arable area which stretches between Afsin-Elbistan, plain has been considered avoiding such area where there are existing projects in operation and where development plans are considered in the Master Plan. Through the demarcation, the area located at the raised portion situated at the left bank of the Hurman river has been considered as the Karakuz project area and the other as the Adatepe project area. In demarcation of the Adatepe project area, attention has been paid to expand gravity irrigation area to the maximum extent, and where gravity irrigation will technically be difficult, pumping irrigation has been taken into account.

In the irrigation development plan, maximum and economically irrigable area in consideration of the Adatepe Dam size have been studied. Based upon this, the following irrigation systems, size of development area and other related engineering factors are proposed, as below:

Irrigation Systems (See Fig. 4.4.1)

Water stored at Adatepe dam is to be diverted by tunnel for distribution to the various farm blocks through the following 3 irrigation systems.

① Firstly, a main canal which directly draws water from Adatepe Dam will be planned. Under the main canal, there will be 3 diversion canals and 3 pumping stations, with which Tombak, Afsin, Kalkaya, Cobanbeyli and Tanir area will be irrigated.

② Secondly, water released from Adatepe Dam will be taken at Kargabuku diversion work and it will irrigate arable area located at the downstream of the Goksun river.

③ Thirdly, the water stored at Adatepe Dam will be drawn into the main canal through which water is released into the Hurman river and it will be taken at Hurman diversion work site to irrigate Elbistan area, located downstream on the left bank of the Hurman river.

These canal systems will consist of main diversion, secondary and tertiary canals and water will be carried to farms by the earth canals, which are to be connected to the tertiary canals. Main, secondary and tertiary canals are to be concrete lined. Irrigation of farms will be carried out by border and/or by ditch irrigation methods. Minimum irrigation unit at the terminal will be of 80 to 160 ha

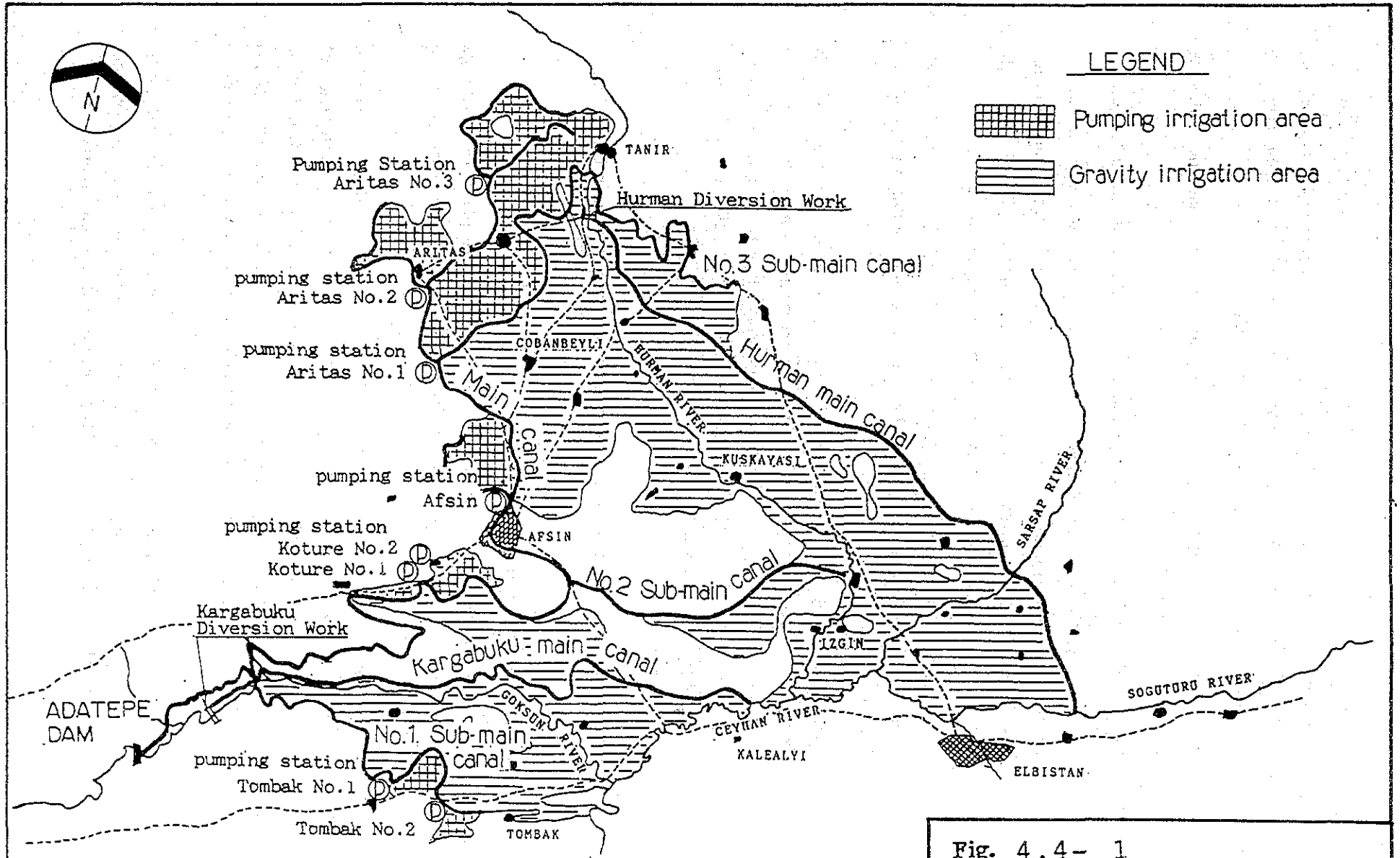


Fig. 4.4- 1
Design Irrigation Canal System

(8 ha x 10 farm households, or 8 ha x 20 farm households), and tertiary canals will be located adjacent to each irrigation unit. Canals to be located within the irrigation unit itself are to be earthen, and are considered changeable.

In formulation of the irrigation planning for the Project area the following factors were taken into account:

① Beneficial area is located at a high place i.e. at EL. 1,130 m. to 1,215 m.

② Accordingly, there exists limitation in deciding the dam site at Goksun river from the engineering point of view. Judging from the detailed design of Adatepe dam, the water stored between EL. 1,310.50 m. to EL. 1,270.50 m. can be utilized for irrigation of the project area.

③ This means that the available head for drawing water is very limited. Thus, it is required to minimize the head loss in planning the irrigation systems.

④ Also, as the length of canals from Adatepe dam to the beneficial area is fairly long, it will be necessary that irrigation water be carefully controlled by appropriate facilities according to water consumption at farms, and safety facilities to protect canals such as spillways and water-releasing works will also be necessary.

The above described irrigation system is schematically presented in Fig. 4.4-2.

4.4.2 Irrigation Water Source

Potential water sources for irrigation in the Afsin-Elbistan plain are discharge from the Ceyhan and its tributaries, and limited groundwater from springs in the area.

Springs are located at 8 points in the area. Discharge is closely linked to precipitation, and fluctuates greatly from year to year. In addition, discharge at springs tends to decrease during June~September when irrigation requirement is greatest. For these reasons, springs are not considered to offer a stable irrigation source. Also, topographically, special measures would be necessary in many cases to utilize discharge.

Based on the Master Plan, use of discharge from Pinarbasi and Tanir springs, although large and relatively stable, is to be avoided for irrigation under the Project as these springs constitute the headwaters of the Ceyhan and Hurman rivers.

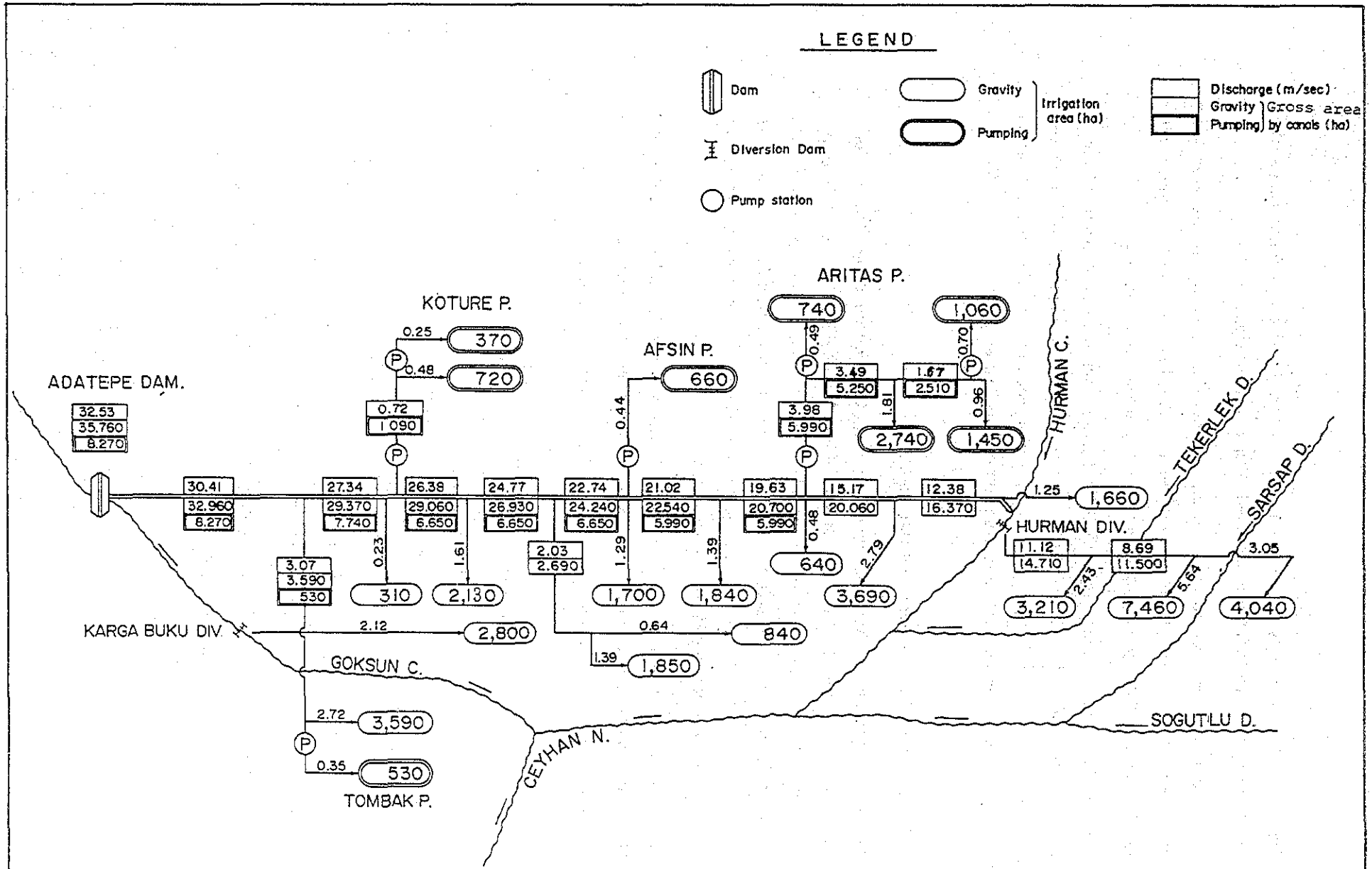


Fig. 4.4- 1
DIAGRAM of IRRIGATION SYSTEM

Other springs offer only small discharge, which is already being used for domestic purposes, and are therefore excluded from consideration.

There are 3 aquifers located in the area, but these systems are all isolated and scales are small. Application of pumps to develop groundwater on such a small scale would not be cost effective given pump operation and maintenance costs.

Accordingly, river discharge is the only irrigation source to be considered under the Project. In the case of areas currently irrigated with groundwater, water source will be shifted to river discharge. Sufficient water requirement for the irrigation period is to be secured through dam construction on the Goksun river.

4.4.3 Irrigation Development Area and Dam Scale

The detailed design of Adatepe dam, the irrigation source under the Project, has already been completed under the Master Plan for development of the Upper Ceyhan. This detailed design is to be adopted as well under the Project. Cost effective scale for a dam to irrigate the envisaged benefit area was studied, and with due consideration given to the development objectives of the Government, the planned dam scale was concluded to be appropriate.

Review was also made of the envisaged Karakuz project, and dam scale and development area as determined by DSI is likewise considered appropriate.

Irrigated area for the envisaged Adatepe dam scale was calculated at 44,030 ha.

Adatepe dam scale is as follows:

Height:	89.0 m.
Length:	651.0 m.
Type:	Center cored zone type rock-fill dam
Available storage:	423 x 106 m3
Total storage:	500 x 106 m3
Full water level:	EL. 1,310.52 m.
Lowest water level:	EL. 1,270.50 m.

4.4.4 *Design Irrigation Requirement*

(1) Selection of Irrigated Area

Total developable area is 44,030 ha. Of this, 35,760 ha is to be irrigated by gravity and 8,270 ha by pump.

Irrigation blocks were determined on the basis of topographical factors and grouping of farms within the benefit area.

(2) Irrigation Water Requirement and Irrigation Canal Systems

a) Planned Unit Irrigation Water Requirement

Based upon the proposed cropping pattern and using climatic data collected, irrigation water requirement for years 1955 to 1988 (34 years) has been calculated using the Blaney-Criddle method, and the results obtained are utilized for deciding unit irrigation water requirement for the Project.

Thus, the gross irrigation water requirement for deciding the cross-sectional area of each canal has been decided as follows, considering the maximum irrigation water requirement over the past 34 years (value for July 1986) (see Table 4.4-1).

i) For total project area: 0.8462 l/sec/ha.

ii) For gravity irrigation area: 0.8660 l/sec/ha.

iii) For pumping irrigation area: 0.7605 l/sec/ha.

b) Maximum Irrigation Water Requirement

This can be obtained as follows:

Area	Gross (ha)	Net Irrigable Area (ha)
Total	44,030	38,438
Gravity Irrigation	35,760	31,218
Pumping Irrigation	8,270	7,220

From the above, maximum irrigation water requirements (Q) are obtained as follows:

$$Q = (31,218 \times 0.8660 + 7,220 \times 0.7605)/1,000$$

$$= 33.53 m3/sec.$$

Calculation criteria for irrigation requirement are shown in Appendix VI · Table-1.

Table 4.4-1 Design Unit Irrigation Requirement

<Irrigation Requirement>
--Module-- Area> Whole Area [unit:l/sec/ha]

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	[MAX]
1955	0.0000	0.0000	0.0000	0.0000	0.1488	0.5440	0.7584	0.6132	0.2409	0.0634	0.0000	0.0000	0.7584
1956	0.0000	0.0000	0.0000	0.0000	0.3888	0.7349	0.7606	0.6291	0.2135	0.0360	0.0000	0.0000	0.7606
1957	0.0000	0.0000	0.0000	0.0000	0.1981	0.3838	0.7230	0.6388	0.2340	0.0526	0.0000	0.0000	0.7230
1958	0.0000	0.0000	0.0000	0.0005	0.2508	0.6422	0.7606	0.6388	0.2409	0.0335	0.0291	0.0000	0.7606
1959	0.0000	0.0000	0.0000	0.0000	0.2794	0.5529	0.7438	0.6383	0.2132	0.0013	0.0000	0.0000	0.7438
1960	0.0000	0.0000	0.0000	0.0000	0.1228	0.6486	0.7438	0.6388	0.2189	0.0494	0.0000	0.0000	0.7438
1961	0.0000	0.0000	0.0000	0.0288	0.3193	0.7107	0.7606	0.6379	0.1717	0.0247	0.0000	0.0000	0.7606
1962	0.0000	0.0000	0.0000	0.0039	0.2392	0.7396	0.7606	0.6339	0.2403	0.0419	0.0174	0.0000	0.7606
1963	0.0000	0.0000	0.0000	0.0000	0.0892	0.4953	0.6825	0.6388	0.1506	0.0000	0.0000	0.0000	0.6825
1964	0.0000	0.0000	0.0000	0.0269	0.2872	0.6440	0.7694	0.5944	0.2389	0.0642	0.0000	0.0000	0.7694
1965	0.0000	0.0000	0.0000	0.0000	0.3960	0.6134	0.7526	0.7083	0.2117	0.0000	0.0000	0.0000	0.7526
1966	0.0000	0.0000	0.0000	0.0110	0.3963	0.6969	0.7934	0.6845	0.2125	0.0538	0.0000	0.0000	0.7934
1967	0.0000	0.0000	0.0000	0.0000	0.1825	0.5147	0.5672	0.6172	0.2100	0.0000	0.0000	0.0000	0.6172
1968	0.0000	0.0000	0.0000	0.0010	0.2884	0.5215	0.7916	0.5551	0.1574	0.0246	0.0000	0.0000	0.7916
1969	0.0000	0.0000	0.0000	0.0000	0.0200	0.5342	0.6960	0.6187	0.2170	0.0285	0.0000	0.0000	0.6960
1970	0.0000	0.0000	0.0000	0.0675	0.3399	0.7135	0.7142	0.6137	0.2138	0.0000	0.0000	0.0000	0.7142
1971	0.0000	0.0000	0.0000	0.0000	0.2166	0.6148	0.7989	0.5299	0.2660	0.0017	0.0000	0.0000	0.7989
1972	0.0000	0.0000	0.0000	0.0000	0.1182	0.3078	0.7989	0.5912	0.2211	0.0073	0.0000	0.0000	0.7989
1973	0.0000	0.0000	0.0000	0.0000	0.2847	0.6142	0.7728	0.6641	0.2154	0.0409	0.0000	0.0000	0.7728
1974	0.0000	0.0000	0.0000	0.0000	0.3089	0.7994	0.7782	0.5735	0.1513	0.0402	0.0030	0.0000	0.7994
1975	0.0000	0.0000	0.0000	0.0000	0.1407	0.7111	0.8103	0.6157	0.2286	0.0630	0.0000	0.0000	0.8103
1976	0.0000	0.0000	0.0000	0.0000	0.0349	0.4028	0.6103	0.6238	0.1908	0.0000	0.0000	0.0000	0.6238
1977	0.0000	0.0000	0.0000	0.0000	0.1574	0.6637	0.6857	0.6479	0.2226	0.0227	0.0379	0.0000	0.6857
1978	0.0000	0.0000	0.0000	0.0000	0.2348	0.6405	0.8141	0.6017	0.2204	0.0000	0.0000	0.0000	0.8141
1979	0.0000	0.0000	0.0000	0.0259	0.2633	0.6293	0.5489	0.7039	0.2756	0.0139	0.0000	0.0000	0.7039
1980	0.0000	0.0000	0.0000	0.0000	0.0491	0.6314	0.8270	0.6431	0.2364	0.0229	0.0000	0.0000	0.8270
1981	0.0000	0.0000	0.0000	0.0000	0.2226	0.5738	0.7524	0.6308	0.2264	0.0147	0.0000	0.0000	0.7524
1982	0.0000	0.0000	0.0000	0.0000	0.1435	0.6682	0.6644	0.6148	0.2348	0.0367	0.0000	0.0000	0.6682
1983	0.0000	0.0000	0.0000	0.0000	0.1198	0.4109	0.7112	0.6014	0.2226	0.0000	0.0000	0.0000	0.7112
1984	0.0000	0.0000	0.0000	0.0000	0.2099	0.6196	0.7470	0.5319	0.0746	0.0290	0.0000	0.0000	0.7470
1985	0.0000	0.0000	0.0000	0.0095	0.4719	0.6303	0.7040	0.6946	0.2401	0.0000	0.0000	0.0000	0.7040
1986	0.0000	0.0000	0.0000	0.0577	0.0682	0.4441	0.8462	0.7238	0.2627	0.0000	0.0000	0.0000	0.8462
1987	0.0000	0.0000	0.0000	0.0000	0.4066	0.6795	0.8009	0.6077	0.2413	0.0005	0.0000	0.0000	0.8009
1988	0.0000	0.0000	0.0000	0.0000	0.0000	0.1835	0.6919	0.6529	0.2352	0.0000	0.0000	0.0000	0.6919
												[MAX]	0.8462

4.5 Principal Irrigation Facilities

4.5.1 Adatepe Dam and Intake

(1) Adatepe Dam

On the basis of 1st and 2nd stage survey, it was concluded that 44,030 would be the appropriate development area given the detail design completed by DSI for Adatepe dam.

(2) Intake (Proposed):

Features are designed as follows to ensure that head sufficient for diversion of 32.53m^2/s is achieved even at the dam low water level of EL. 1,270.50 m.

Intake: Drop inlet with inner diameter of 4.0m and bottom elevation of EL. 1,265.5 m.

Tunnel: Pressure tunnel (D = 4.0 m, L = 475 m.) with circular shape, equipped with operation room for high pressure discharge regulating valve.

Standard horse shoe type tunnel (D = 4.3 m., L = 770 m.)

Outlet: Reinforced retaining wall with bottom elevation of EL.1,262.7 m.

4.5.2 Headworks

(1) Location and Numbers

The following two diversion works will be constructed in the Project area.

i > Hurman Diversion Work

Irrigated area: A=14,710 ha

Intake discharge: Q=11.46 m3/sec.

Location: on the Hurman river

ii> Kargabuku Diversion Work

Irrigated area: A=2,800 ha

Intake discharge: Q=2.18 m3/sec.

Location: on the Goksun river

The location of these diversion works has been decided on the basis of topomap study and field survey, and with consideration to the following engineering view.

a) The diversion work should be located at such place where water surface elevation at diversion works are properly maintained for leading water to the area to be irrigated, and it should be located as close as possible to the area to be irrigated.

b) The diversion work should be located as close as to the center of river flow and be located at the place where river flow is stable.

c) Structural stability and economy in construction.

d) Minimized back water effect and effect on upstream and downstream of the river.

(2) Selection of Type

i> According to trial excavation results at the proposed Hurman diversion work, rock foundation has been found 1.5 to 2.0 m. below the river bed. Accordingly, the floating type will be adopted for the Hurman diversion work.

ii> At the proposed Kargabuku diversion work site, rock foundation has not been confirmed because of thick gravel layer, but there will be no problem with regard to its bearing capacity, as such, the floating type is to be adopted for the Kargabuku diversion work.

(3) Decision of Water Level Raising Method at the Diversion Works

At both proposed diversion work sites, as it is judged that water level raising by both diversion works will not create any bad effect on the downstream of the Hurman and Goksun rivers, a fixed type weir across the rivers will be constructed. Also, gates to flush the sediments will be provided in the diversion works.

(4) Decision of Top Elevation of Weir

Theoretically, top elevation of the weir can be determined as follows:

Top of elevation of weir = Intake water level - {(overflowing water depth at drought discharge) - (overflowing water depth at diverting discharge)} + Freeboard.

However, considering the safety side, the top elevation of the weir will be decided as below:

Top of elevation of weir = Intake water level + Freeboard.

(5) Weir

The weir of the diversion work will be made of reinforced concrete. The cross-sectional shape of the weir will be trapezoidal, which is structurally as well as hydraulically advantageous to the weir.

(6) Apron

In the case of floating type diversion work, the downstream apron length will be calculated using Bligh's formula and seepage length will also be calculated by the same.

(7) Sluice

Sluice will be provided at intake side of the diversion work to maintain the center of river flow and will be designed with sufficient flow velocity to flush the sediments in front of the intake.

(8) Intake

The bottom elevation of the intake will be set at 0.5 to 1.0 m higher than that of the sluice. Width of the intake will be such that the velocity at the entrance of the intake will be maintained within 0.6 to 1.0 m./sec. A screen will be put just in front of the control gate of the intake.

(9) Other Related Facilities

A stilling basin will not be constructed judging from the river flow condition of both rivers during irrigation period.

4.5.3 Irrigation Canal

(1) Type of Canal

Canals will be of reinforced concrete and plain concrete. For small discharge precast U-type flume will be used. The canal types will be trapezoidal and rectangular.

a) Trapezoidal canal will be used in case the canal passes flat area and the canal must carry a big discharge. In this case, the side slope of the canal will be of 1 : 1.5 and lined with thin plain concrete. The maximum velocity in the canal shall be within 1.5 m/sec.

b) On the other hand, rectangular canal will be used in case the topographical condition is steep to the direction of cross-section of the canal and canal discharge is large, or at locations where a succession of drop works render discharge condition unstable.

(2) Hydraulic Concept: Manning's formula will be used for the hydraulic calculation. The slope of canal will be 1/4,000 for main canal and 1/650 to 1/2,000 for secondary and tertiary canal. In this case, maximum velocity in the canal will be kept within 1.5 m./sec.

(3) Freeboard (F.b.)

i> For trapezoidal canal:

$$F.b. = 0.05d + hv + (0.05 \sim 0.15)$$

Where;

F.b = Freeboard (m)

d = Water depth corresponding to design discharge(m)

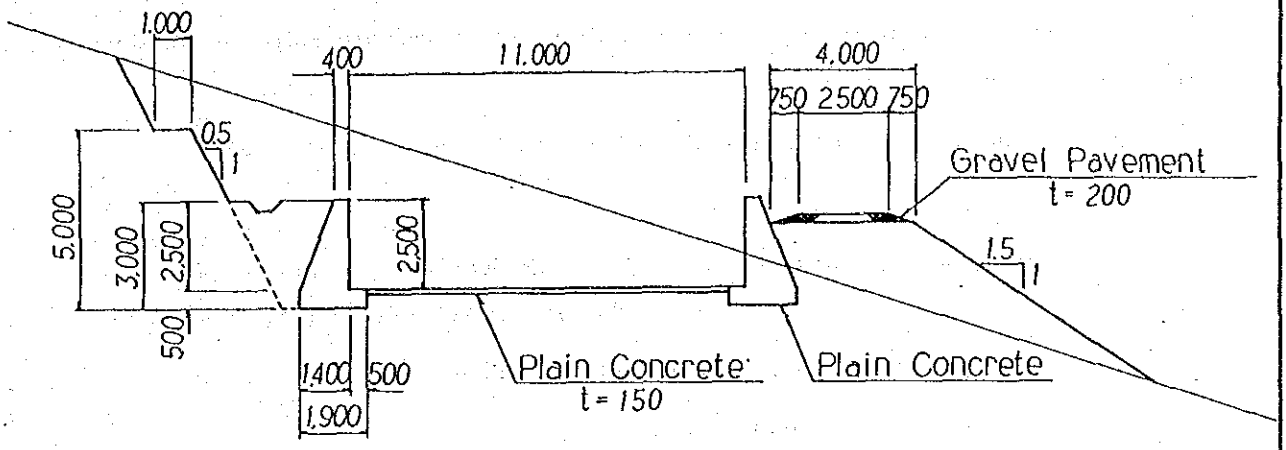
hv = Velocity head (m)

ii> For rectangular canal:

$$F.b. = 0.07d + hv + (0.05 + 0.15)$$

(4) Typical Cross-Section of the Canal

Regarding the canal section, see Fig. 4.5-1.



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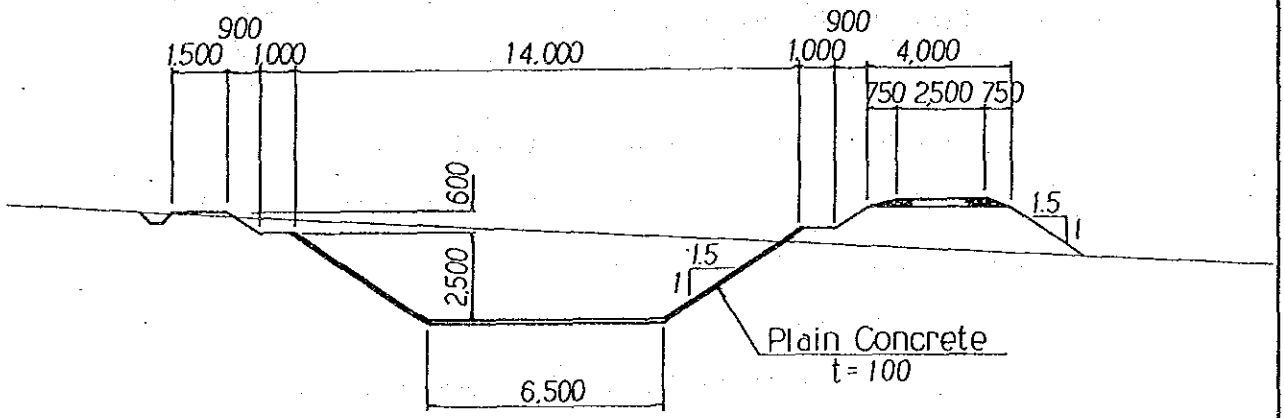


TYPE - B
Scale 1:200

Fig. 4.5- 1 Typical Cross-section of Main Canal

4.5.4 Pump Stations

(1) Locations and Numbers

Following pumping stations have been proposed to irrigate 8,270 ha of land in the Project area.

i> Location : Terminal area of No.1 diversion canal (Tombak area)

Irrigated area : 530 ha (Total)

Name of pumping stations : Tombak No.1(A=290 ha,Q=0.22m3/sec.)
Tombak No.2(A=240 ha,Ql=0.18m3/sec.)

ii> Location : No.3 diversion canal and its branch canal (Koture area)

Irrigated area : 1,090 ha (Total)

Name of pumping stations :

Koture No.1 (A=1,090 ha, Q=0.84m3/sec.)
Koture No.2 (A=370 ha*, Q=0.28m3/sec.)
(*included in Koture No.1)

iii> Location : No.8 diversion canal (Afsin area)

Irrigated area : 660 ha

Name of pumping station : Afsin (A=660 ha, Q=0.051m3/sec.)

iv> Location : No.11 diversion canal and its branch canal (Aritas area)

Irrigated area : 5,990 ha

Name of pumping stations:

Aritas No.1 (A=5,990 ha, Q=4.61m3/sec.)
Aritas No.2 (A=740 ha*, Q=0.57m3/sec.)
Aritas No.3 (A=1,060 ha*, Q=0.82m3/sec.)
(*included in Aritas No.1)

(2) Basic Design Concept

i> Discharge capacity of each pump is determined with consideration to the overall irrigation network, and total head of each pump (T) will be decided as follows :

$$T = T1 + T2 + T3$$

Where : T1 = Actual head to be decided from the topographical map (1/25,000)

T2 = Head loss in suction pipe by Hazen formula

T3 = Head loss in the pump (Approx.2m.)

ii> Control Method

Pumps will be operated by one-man control method. Control of discharge will be done by adjusting running hours of pumps and not by discharge control.

iii> Selection of Pumps

Centrifugal pumps will be adopted judging from required pumping head, discharge and its location. For each pumping station, 2 pumps will be settled at least.

iv> Type of Pump House and Its Size

Each pump house will be of reinforced concrete made and the area of pump house will be decided considering DSI standards for numbers of pumps and discharge capacity of pump, etc.

4.6 Drainage Plan

4.6.1 General

(1) Drainage Area

Drainage area under the Project comprises 11,000 ha of relatively flat and broad farm land between the Ceyhan and Hurman rivers. Inundation along the Ceyhan, Sogutlu, Sarsap and Hurman rivers is steadily being reduced through river training works.

Accordingly, drainage under the Project will focus on surface water, and no measures to forcibly reduce the soil moisture content will be made. Furthermore, no saline prevention measures will be taken either, as saline contamination is not seen in the Project area with the exception of one small portion. From the standpoint of soil and water characteristics, the danger of such occurring is absent.

(2) Drainage Discharge

a) Rainfall Intensity

Daily rainfall with return periods of 2.33 years (tertiary drainage canals), 5 years (secondary drainage canals) and 10 years (main drainage canals) are 28.6 mm/day, 34.6 mm/day and 39.2 mm/day, respectively, on the basis of data from Elbistan weather station.

Average rainfall intensities in each catchment at flood period are calculated on the basis of the Sherman distribution formula below, and shown in Table 4.6-1.

Table 4.6-1 Blockwise Average Precipitation Intensity

Block	Flood Period T	RT	Rt	
	hr	mm	mm	mm/hr
Cultivated area (tertiary canal command area)	2	28.6	8.3	4.1
Cultivated area (secondary canal command area)	4	34.6	14.1	3.5
Runoff into Project area from adjoining blocks 1,2,3	6	39.2	19.6	3.3
Runoff into Project area from adjoining blocks 4,5,7	10	39.2	25.3	2.5
Runoff into Project area from adjoining block 6	22	39.2	37.5	1.7

(Drainage blocks in the above table are described in Attached Drawings, Exhibit-34 .)

$$R_t = R_T (t/T)^K$$

Where:

R_t = Maximum rainfall for time t

R_T = Standard rainfall for time T

K = Constant $(\frac{1}{2} \sim \frac{1}{3})$

b) Design Drainage Discharge

Drainage discharges were computed using the theorem below, and are shown in Table 4.6-2.]

$$Q = \frac{1}{3.6} \times f \times \times R_t \times A$$

Where:

Q = Peak discharge (m^3/s)

f = Peak runoff coefficient (0.45~0.60)

R_t = Rainfall intensity during flood period

A = Catchment area (km^2)

Table 4.6-2 Blockwise Drainage Discharge

Cultivated area (tertiary canal)	$\frac{1}{3.6} \times 0.45 \times 4.1 \times 1.0$	$0.51 m^3/s$
Cultivated area (secondary canal)	〃 3.5 × An	0.43 × Am
Adjoining block 1	〃 3.3 × 9.0	3.70 (1.85 / 1.85)
Adjoining block 2	〃 3.3 × 10.0	4.12
Adjoining block 3	〃 3.3 × 20.0	8.24
Adjoining block 4	〃 2.5 × 40.0	12.50
Adjoining block 5	〃 2.5 × 37.0	11.56
Adjoining block 6	〃 2.5 × 40.0	12.50
Adjoining block 7	〃 1.7 × 76.0	16.15

c) Canal-wise Discharge

The canal network will consist of tertiary, secondary and main canals.

Block divisions for drainage are the same as those for irrigation. Also, drainage canals will be aligned parallel to and roughly alongside irrigation canals. This is to make the canal network as simple as possible.

Discharges calculated on the basis of Table 4.6-2 for tertiary, secondary and main canals are indicated in Table 4.6-3.

Table 4.6-3 Drainage Canal Discharges

	Command area	Discharge	Runoff from adjoining area	Total	Upstream	Down-stream
	km^2	m^2/S	m^2/S	m^2/S		
Tertiary canal	1.0	0.51	-----	0.51	0.25	0.51
Secondary canal 1	2.5	1.07	-----	1.07	0.53	1.07
2	7.0	3.01	-----	3.01	1.50	3.01
4	2.5	1.07	-----	1.07	0.53	1.07
5	6.0	2.58	-----	2.58	1.29	2.58
6	4.0	1.72	-----	1.72	0.86	1.72
7	3.5	1.50	-----	1.50	0.75	1.50
8	6.0	2.58	-----	2.58	1.29	2.58
10	13.0	5.59	-----	5.59	2.78	5.59
11	4.0	1.72	-----	1.72	0.86	1.72
12	8.0	3.44	(12.50)	3.44	1.72	3.44
16	3.0	1.29	-----	1.29	0.64	1.29
Main canal 3	16.0	6.88	3.71	10.59	7.15	10.59
9	9.5	4.08	4.12+8.24	16.44	6.16 10.28	16.44
13	9.5	4.08	11.56	15.64	13.60	15.64
14	13.0	5.59	16.15	21.74	9.46 9.46	21.74
15	6.0	2.58	12.50	15.08	13.79	15.08

4.6.2 Drainage Canal Scale

All drainage canals are planned as earthen. Maximum canal depth will be standardized at 1.80 m. Standard flow velocities will be 0.5 m/s for tertiary and 1.0

m/s for secondary canals. Canal cross section will be designed to handle even a peak flood where the water surface is equivalent to the drainage command area.

Drainage canal plan is shown in the Attached Drawings.

4.7 Summary of Irrigation and Drainage Facilities

a) Adatepe dam

b) Intake

Diversion to main canal is to be by pressure tunnel.

c) Pump Station

8 pump stations are planned for the pump irrigation area totaling 8,270 ha. All pumps are to be the centrifugal type.

d) Irrigation Canal

Main, secondary and tertiary canals will be constructed. These canals will be concrete lined. Appurtenant facilities will include siphon, tunnel, aqueduct, turnout, wasteway, spillway, drop works, etc.

e) Headworks

Headworks are planned at 2 locations, i.e. Hurman and Kargabuku.

f) Drainage Canal

Drainage canal is designed for surface water drainage only.

g) Land Improvement Works

Gravel removal and leveling works will be carried out for the surface layer (classified as Class 2 and Class 3 soils as a result of the soil survey during the 1st and 2nd stage field works).

Details regarding the above facilities are presented in in Attached Drawings.

4.8 Project Cost

Project cost has been computed on the basis of specifications established from the results of field survey. Computation was by the cost breakdown method.

Project cost is comprised of direct and indirect construction costs. Direct construction cost was calculated on the basis of construction items determined from design drawings, and their corresponding work quantities multiplied by unit cost.

Indirect construction costs include land acquisition costs, compensation and engineering and construction supervision costs.

Contingency was calculated at a set percentage of direct construction cost.

(1) Criteria

Criteria applied to Project cost calculation are as follows:

① Both foreign and local currency portions are expressed in Turkish Lira (TL), and costs are calculated applying 1988 prices designated by DSi.

② Exchange rate applied is: US$ 1 = TL 1,220.7 (as of first quarter 1988)

③ Construction is to be performed on a contract basis. The contractor is expected to supply all machinery, equipment and facilities necessary for construction, and to incorporate the operating and other related depreciation costs for such into the contract price.

④ DSI is to be the executing agency for the project. Actual construction is to be carried out by contractor(s) selected by international tender under guidelines set by DSI and the lending agency.

⑤ Construction unit costs are based on standard unit costs advised by DSI. Cost calculation also takes into consideration the results of market price survey for equipment and materials. Work quantities are determined for each construction item on the basis of the basic Project plan and design drawings. Reference was also made to similar projects. (see Appendix VII)

⑥ Indirect construction costs are calculated at 15% of direct construction cost.

⑦ Engineering and construction supervision cost is calculated at 15% of total for direct and indirect construction cost.

⑧ Contingency is calculated at 15% of total construction cost.

⑨ Interest rates and price increase during the construction period is not included in calculation.

(2) Construction Unit Cost

Construction unit costs are based on computation data obtained in Turkey, as well as reference materials in Japan.

Turkish data are:

① Birim Fiyat Cetveli, 1988

② T. C. Bayindirlik Ve Iskan Bakanligi Rayic Listesi, 1988

③ DSI Sulama Tesislerine Ait Maliyet Abaklari

④ *DSI Pompa Istasyonlari Maliyet Abaklari*

⑤ DSI Birim Fiyat Analizleri Cilt: 1 and Cilt: 2

⑥ Adatepe Baraji Kati Poje Raporu 5. Cilt: Insaat Planlanasi Ve Maliyet

Japanese reference materials are:

⑧ "Construction Prices", Construction Price Survey Society, August 1988

⑨ "Manual for Civil Construction Costing Standards", Construction Price Survey Society, 1988

⑩ "Civil Construction Costing Standards", Ministry of Construction

(3) Labor Cost

Labor cost was computed with reference to "Labor Wages" and "Operator Wages for Major Machinery" (table) contained in the appendixed standard unit costs of the Turkish Government.

(4) Equipment and Materials Cost

Equipment and materials are to be procured both locally and off-shore (steel, machinery) as required.

(5) Transportation Cost

DSI's distance-wise unit cost index was applied for transportation cost. Standards of the Turkish Government for unit transportation costs are given in Appendix-VII · Table VII-4.

(6) Construction Machinery Cost

Cost for major construction machinery is according to the machinery depreciation cost index given in Appendix-VII · Table VII-4. However, Japanese standards were applied for the per-hour depreciation cost.

(7) Fuel Cost

Fuel consumption is computed on the basis of hourly consumption rate for machinery and equipment operation. Lubricating oil is calculated at 20% the fuel cost.

(8) Construction Materials Cost

Unit cost for construction materials is calculated with consideration to import/export performance in Turkey for raw materials, as determined from market survey. Costs are classified into foreign currency costs and local currency costs. (see Appendix-VII · Table VII-3: foreign currency portion of overall construction cost)

On the basis of the above criteria, total Project cost is calculated at TL 187,210,000,000. Foreign currency portion is TL 57,360,000,000 and local currency portion is TL 129,850,000,000.

4.9 Engineering and Management Costs

Engineering and administrative costs in conjunction with Project implementation are considered as follows:

a) Cost for administration by DSI during construction

b) Cost for land survey and supplemental studies for Project construction

c) Cost for detail design and construction supervision

d) Cost for testing equipment necessary for construction

Engineering and construction supervision cost including consultant cost in c) is calculated at 15% of construction cost. Engineering and construction supervision cost under the Project is TL $18,802 \times 10^6$.

Chapter 5

Project Implementation Plan

CHAPTER 5 PROJECT IMPLEMENTATION PLAN

5.1 Executing Agency

The Adatepe Irrigation Project will be implemented by DSI except for the terminal on-farm development to be implemented by the General Directorate for Village Services under the Ministry of Agriculture, Forestry and Rural Affairs.

The dam and hydro-electric sections of the headquarters of DSI will be responsible for the construction of the proposed Adatepe Dam, and the design and construction sections will be responsible for the construction of the proposed irrigation facilities. The soil and machinery sections of the same will technically support the said sections during implementation of the project. The headquarters of DSI will be responsible for biddings and payments.

DSI branch at Kahraman Maras which has jurisdiction over the region containing the Project area will perform overall supervision of construction and report progress to DSI headquarters.

The Site Office will be established at the DSI Branch at Afsin. The proposed organization chart has been drawn up as shown in Fig. 5.1-1 through discussions with DSI officials. As is seen from this Figure, the organization consists of 3 main sections i.e. dam, irrigation and pump station sections. The dam section is responsible for supervision of construction of the proposed Adatepe dam; the irrigation section for supervision of construction of the diversion works, irrigation canals and related structures; and the pump station section for supervision of construction of the proposed 8 pump stations.

Each section will be responsible as well for maintenance of the facilities during Project implementation.

The construction works for the proposed Project will be carried out on a contract basis.

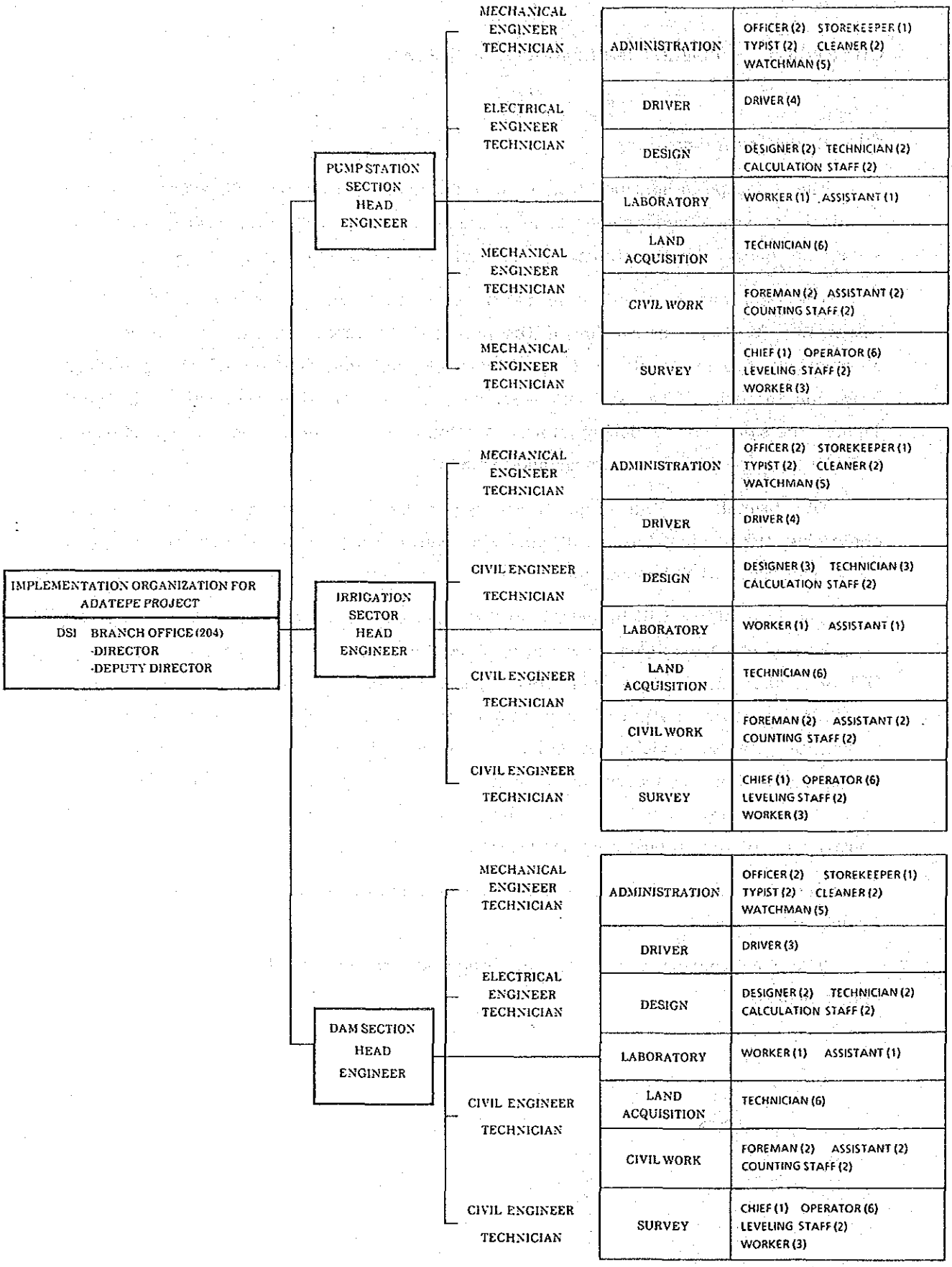


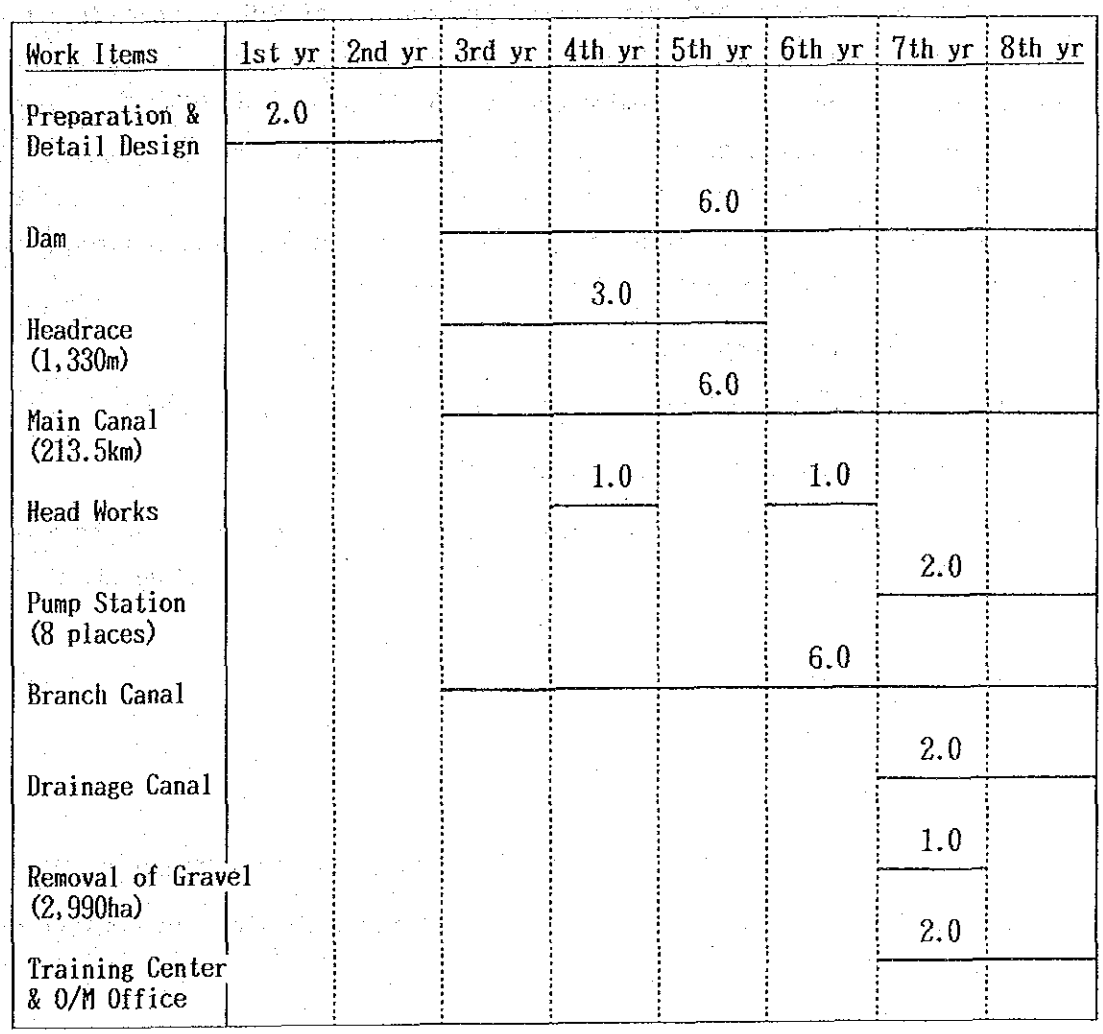
Fig. 5.1-1 Project Implementation Organization

5.2. Implementation Schedule

At present, it is anticipated that about 8 years will be required to complete the Project, judging from the scale of manpower, equipment and material, and funding input required for construction, as well as experience of DSI on previously implemented projects.

As such, the following implementation schedule for the Project is formulated as shown in Fig. 5.2-1 below.

Fig. 5.2-1 Implementation Schedule



5.3 Operation and Maintenance Organization

After completion of the Project, the following O&M organizations will be established at the project site.

a) Organization for distributing and regulating irrigation water.

b) Organization for operation and maintenance of the project facilities.

c) Organization for setting and collection of irrigation water charges

There are two kinds of operation and maintenance organizations for the projects implemented by DSI: ① DSI establishes an O/M entity which directly carries out operation and maintenance, and ② although DSI carries out implementation of the Project, the General Directorate of Village Services attends to operation and maintenance of facilities after construction. Judging from the scale of the Project, a new operation and maintenance organization will be established solely for Adatepe under DSI. An operation and maintenance organization chart for the Adatepe irrigation project has been formulated in discussion with DSI, paying attention to the data on the same for existing projects of DSI (Fig. 5.3-1). This organization is divided into three parts i.e.

a) Department in charge of operation and maintenance

b) Department in charge of distribution of irrigation water

c) Department in charge of administrative matters

The operation and maintenance department will oversee the completed Project facilities. The irrigation water distribution department will be further divided into three i.e.:

a) dam section

b) pump section

c) irrigation section

Each section will cooperate in distributing and regulating the irrigation water.

The administrative department will attend to administrative matters related to the operation and maintenance organization.

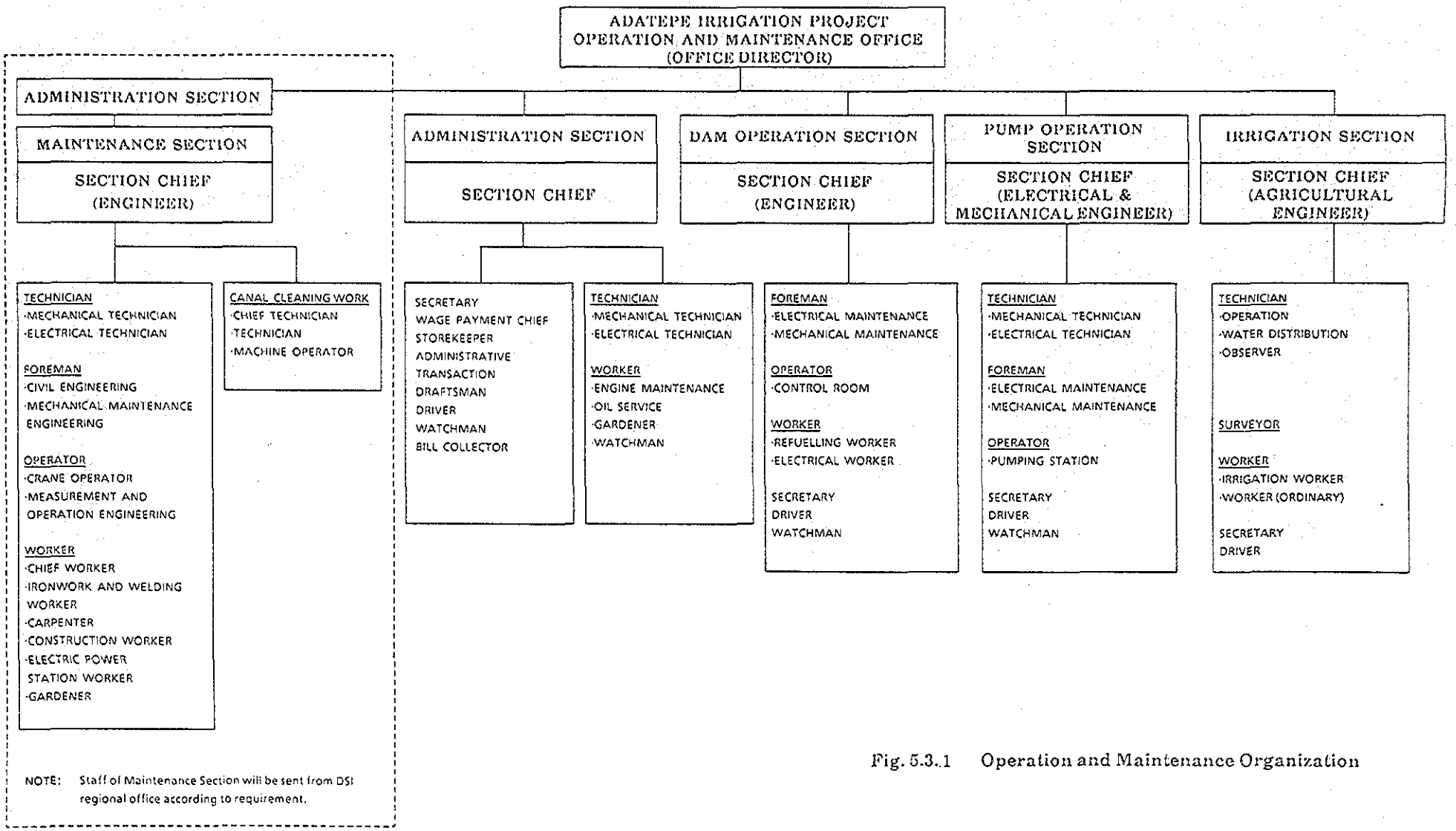


Fig. 5.3.1 Operation and Maintenance Organization

Chapter 6

Project Justification

CHAPTER 6 PROJECT JUSTIFICATION

6.1 General

Project justification examined the economic, financial and socio-economic viability of the Project. Economic viability was assessed in terms of the Economic Internal Rate of Return and net present value. Sensitivity analysis was performed for effects on the Internal Rate of Return of fluctuations in Project cost and benefit resulting from various combinations of Project objectives not being achieved within the scheduled period.

Financial analysis analyzed Project viability in terms of effect on farmer economy.

6.2 Economic Evaluation

6.2.1 Basic Criteria

Basic assumed conditions in economic evaluation of the Project are as follows:

① Project life is 58 years from 1990 to 2047.

② Project construction period is 8 years including detail design.

③ Prices as of 1988 are adopted as standard costs in calculating economic cost and benefit.

④ Exchange rate adopted is the official rate as of the first quarter of 1988: US$ 1 = TL 1,220.7

6.2.2 Economic Cost

(1) Standard Conversion Factor

The value of 0.8 adopted for the Standard Conversion Factor was taken from the Second Agricultural Credit Project Report (Report No. 4394-TU) prepared by the World Bank in May 1983.

(2) Economic Cost for Farm Products and Farm Inputs

Economic cost for the principal farm products of wheat and beans was calculated as follows on the basis of the Drainage and On-farm Development Project Report (Report No. 5869-TU) prepared by the World Bank in June 1988.

Wheat	TL 211/kg (US$ 173/t)
Lentil bean	TL 357/kg (US$ 292/t)
Sugar beet	TL 609/kg (US$ 499/t)

(3) Economic Opportunity Cost of Farm Labor

Economic opportunity cost of farm labor was calculated applying an opportunity cost conversion rate of 0.5% (see Appendix VIII · Table VIII-6), taking into consideration labor surplus rate.

(4) Construction Conversion Factor

The conversion factor of 0.5 for labor cost (which accounts for 25% of construction cost) was adopted from the above described Report No. 4394-TU. A conversion factor of 1.0 was adopted for other construction inputs.

The above described Standard Conversion Factor of 0.8 was adopted for seed, while the conversion factor of 0.86 adopted for fertilizer, agro-chemicals and other consumable inputs was taken from the above Report No. 4394-TU. A conversion factor of 1.0 was adopted for machinery, transport cost and other sundry costs.

6.2.3 Economic Project Cost

Project construction cost comprises the following:

① Facility construction cost

② Land acquisition cost

③ Engineering cost

④ Contingency

Of the above, all are net costs for economic evaluation with the exception of taxes and land acquisition costs. These net costs are corrected to the economic project cost by application of the construction conversion factor.

Annual outlay for economic project cost is calculated as shown in Table 6.2-1.

Table 6.2-1 Yearwise Outlay For Economic Project Cost

(unit: TL 10^6)

1st year	2	3	4	5	6	7	8	Total
3,604	3,604	16,076	26,533	23,222	27,541	26,499	26,799	153,878

6.2.4 Operation and Maintenance Cost, and Replacement Cost

(1) Operation and Maintenance Cost

Operation and maintenance cost is calculated on the basis of the O&M plan presented in the previous chapter. The standard conversion factor has been applied. Operation and maintenance cost was computed on this basis at TL 901 million (US$ 738,000).

(2) Replacement Cost

Replacement is based on the assumption that gates and pumps will require replacement after 25 years. A conversion factor of 1.0 was applied. Operation and maintenance cost was computed on this basis at TL 5,061 million (US$ 4,215,000).

6.2.5 Project Benefit

Project benefit was evaluated in terms of economic cost. On this basis, forecast annual benefit increment is indicated in Table 6.2-2.

Table 6.2-2 Yearwise Benefit

(unit: TL 10^6)

9th year	10	11	12	13	14	15	16	17	18
18,532	26,255	34,129	34,211	34,293	36,137	39,923	41,059	42,573	44,087

By the time of achievement of objectives under the project in the 18th year, benefit from agriculture is estimated at TL 42,989,000,000 (US$ 35,220,000). Net annual income from farm products was compared for 'with' and 'without' the Project.

6.2.6 Economic Evaluation

(1) Economic Internal Rate of Return

EIRR for the Project is calculated at 15.0%, indicating that the Project is justified. (see Appendix-VIII · Table VIII-1).

(2) Sensitivity Analysis

EIRR was computed for the conditions below to test Project sensitivity to possible changes in economic conditions.

(a) 30% rise in construction cost: EIRR = 12.7%

(b) 20% decrease in production: EIRR = 11.2%

(c) 20% rise in production cost: EIRR = 13.7%

(d) Combination of (a)~(c): EIRR = 9.7%

Table 6.2-3 Economic Cost and Benefit

Unit: 10^6 TL

Year	No.	Cost	O/M	Replacement	Total	Benefit
1990	1	3,604	--	--	2,918	0
1991	2	3,604	--	--	2,949	0
1992	3	16,076	--	--	15,524	-138
1993	4	26,533	--	--	24,978	-272
1994	5	23,222	--	--	25,439	-393
1995	6	27,541	--	--	25,713	-543
1996	7	26,499	--	--	24,558	-652
1997	8	26,799	--	--	16,017	-813
1998	9	--	901	--	901	18,532
1999	10	--	901	--	901	26,255
2000	11	--	901	--	901	34,129
2001	12	--	901	--	901	34,211
2002	13	--	901	--	901	34,293
2003	14	--	901	--	901	36,137
2004	15	--	901	--	901	39,923
2005	16	--	901	--	901	41,059
2006	17	--	901	--	901	42,573
2007	18	--	901	--	901	44,087
2008	19	--	901	--	901	44,087
2009	20	--	901	--	901	44,087
2010	21	--	901	--	901	44,087
2011	22	--	901	--	901	44,087
2012	23	--	901	--	901	44,087
2013	24	--	901	--	901	44,087
2014	25	--	901	--	901	44,087
2015	26	--	901	--	901	44,087
2016	27	--	901	--	901	44,087
2017	28	--	901	--	901	44,087
2018	29	--	901	--	901	44,087
2019	30	--	901	--	901	44,087
2020	31	--	901	--	901	44,087
2021	32	--	901	--	901	44,087
2022	33	--	901	5,061	5,962	44,087
2023	34	--	901	--	901	44,087
2024	35	--	901	--	901	44,087
2025	36	--	901	--	901	44,087
2026	37	--	901	--	901	44,087
2027	38	--	901	--	901	44,087
2028	39	--	901	--	901	44,087
2029	40	--	901	--	901	44,087
2030	41	--	901	--	901	44,087
2031	42	--	901	--	901	44,087
2032	43	--	901	--	901	44,087
2033	44	--	901	--	901	44,087
2034	45	--	901	--	901	44,087
2035	46	--	901	--	901	44,087
2036	47	--	901	--	901	44,087
2037	48	--	901	--	901	44,087
2038	49	--	901	--	901	44,087
2039	50	--	901	--	901	44,087
2040	51	--	901	--	901	44,087
2041	52	--	901	--	901	44,087
2042	53	--	901	--	901	44,087
2043	54	--	901	--	901	44,087
2044	55	--	901	--	901	44,087
2045	56	--	901	--	901	44,087
2046	57	--	901	--	901	44,087
2047	58	--	901	--	901	44,087

(e) 2 year delay in construction completion:

EIRR = 12.7%

The above indicate that the Project is most sensitive to a decline in farm production. It is thus important that focus be given under the Project to maintaining farm production at targeted levels after Project implementation.

6.3 Financial Evaluation

6.3.1 General

The financial capacity of farmers was analyzed on the basis of average farm scale in the the benefit area, in order to evaluate the viability of the Project from the view point of farm economy. Study was then made of water use charges which will serve to repay construction loan and offset O&M costs and replacement costs.

6.3.2 Financial Cost

(1) Project Cost

Project cost was calculated on the basis of market prices and costs as of 1988, and is indicted in Appendix VIII · Table VII-1. Total Project cost is TL 187,215,000,000 (US$ 153,370,000). Of this, foreign currency portion is TL 57,364,000,000 (US$ 46,990,000) and local currency portion is TL 129,851,000,000 (US$ 106,380,000).

Contingency cost at 15% of construction cost is included in the total Project cost.

(2) Operation and Maintenance Cost

Annual cost for operation and maintenance of irrigation facilities and the Agricultural Training Center is calculated at TL 1,126,000,000 (US$ 920,000).

(3) Replacement Cost

Replacement cost after 25 years for gates, valves and pumps is calculated at TL 5,061,000,000 (US$ 4,150,000).

6.3.3 Farm Economy

The financial capability of the average farmer in the Project area was studied. Results are indicated in Appendix VIII · Table VIII-15.

Upon achievement of the objectives under the Project, annual farmer economic surplus (financial capability) would increase as shown below. This further supports the conclusion that the Project is justified.

This increase will have the further benefit of directing farmer enthusiasm towards active participation in future development projects to be undertaken.

Table 6.3-1 Annual Farmer Surplus Amount

	Without Project	With Project
Model A (6.0 ha)	394,265	7,111,753
Model B (4.5 ha)	341,791	3,301,148
Model C (10.0 ha)	1,369,630	12,534,868

Results of study of financial capacity according to the DSI formula are shown in Appendix-VIII · Table VIII-18.

6.3.4 Amortization and Irrigation Cost

Project financial viability was also examined from the standpoint of capacity to amortize Project funding. Necessary funding and Project income stream is shown in Appendix VIII · Table VIII-16. It is assumed that necessary funding would be procured under the following conditions.

1) Foreign currency portion would be repayable over a 30 year period, including grace period of 10 years, at 3% interest.

2) Local currency portion would be repayable over a 50 year period, including grace period of 10 years, at 5% interest.

As shown in Appendix-VIII · Table VIII-16, annual amortization would total TL 10,813,000,000 (US$ 8,860,000,000). This is equivalent to annual average of TL 250,000 (US$ 201) /ha. This is shown on a cropwise basis (water consumption basis) in Appendix VIII · Table VIII-17.

On this basis, irrigation cost for the average scale farm in the Project area is calculated as follows:

Table 6.3-2 Irrigation Cost for Average Size Farm

	O/M Cost	Amortization Amount
Model A	TL 148,700 (US$ 122)	TL 1,210,500 (US$ 992)
Model B	TL 140,600 (US$ 115)	TL 1,144,400 (US$ 937)
Model C	TL 278,900 (US$ 228)	TL 2,271,300 (US$ 1,861)

6.4 Indirect Benefit and Socio-Economic Impact

The following secondary benefit can be expected under the Project.

(1) Generation of Employment Opportunity

Farm production will increase greatly under the Project. This will result in expanded employment opportunities in fields of transportation, farm product storage and marketing. This in turn will stimulate the rural economy. Personnel involved in Project implementation will increase their farm management and farm technology skills. Such experience can be applied to other future projects to be implemented in the region.

(2) Expansion of Regional Economy and Correction of Regional Disparity in Level of Economic Development

Increased farm production will stimulate investment in seed, fertilizer, agro-chemicals, livestock and other farm inputs. This in turn will expand the agricultural market in the region. Increased production translates into increased wages and profits for the rural population, which can be expected to be directed towards consumption and savings. Savings promote investment, again functioning to expand the regional economy.

These developments will help bring the level of development in the area into line with that of neighboring agricultural regions of the country.