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Yamanlı II Hydroelectric Power Plant and Quarries Project

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

☐ EIA Report ☒ Final EIA Report



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**JANUARY 2009
ANKARA**

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Name of the Project :	Yamanlı II Hydroelectric Power Plant and Quarries Project
Location of the Project :	Saimbeyli, Adana and Göksun, Kahramanmaraş, on Göksu River, a main tributary of Seyhan River
Description and Purpose of the Project :	Yamanlı II Hydroelectric Power Plant and Quarries Project, planned to be realized on Göksu River

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ABBREVIATIONS

EAP	Emergency Action Plan
Inc.	Incorporated
C	Celcius
CITES	Convention on International Trade in Endangered Species
EIA	Environmental Impact Assessment
dBA	A-weighted decibel
SHW	State Hydraulic Works
EMRA	Energy Market Regulation Authority
RCAPOIE	Regulation on Control of Air Pollution Originating from Industrial Establishments
g	Gram
GWs	Gigawatt per hour
ha	Hectar
HPP	Hidroelectric Power Plant
APCR	Air Pollution Control Regulation
Hz	Hertz
IUCN	International Union for Conservation of Nature
kg	Kilogram
km	Kilometer
kV	Kilovolt
kVA	Kilovolt ampere
L	Liter
m	Meter
mm	Milimeter
MRE	General Directorate of Mineral Research and Exploration
MW	Megawatt
m³/h	Cubicmeter per hour
RMR	Rock Mass Rating
Ref.	Reference
h	Hour
sec	Second
WPCR	Water Pollution Control Regulation
TPAO	Turkish Petroleum Corporation
TURKSTAT	Turkish Statistical Institute
USEPA	United States Environmental Protection Agency

I. DESCRIPTION AND AIM OF THE PROJECT

I.1 Subject of the Project and Description of the Activity

Yamanlı II Hydroelectric Power Plant (HPP) and Quarries Project will be located on Göksu River in Upper Seyhan Basin located in the east of Mediterranean Region. The major part of the Project Site lies within the boundaries of Saimbeyli, Adana, and a small part of it lies within Göksun, Kahramanmaraş.

The Project is composed of two stages: the first stage includes Yamanlı II Stage I Weir and Yamanlı II Stage I HPP with an installed capacity of 49.70 MW, and the second stage includes Yamanlı II Stage II Weir, Hocabey Weir and Yamanlı II Stage II HPP with an installed capacity of 27.96 MW. Total installed capacity of the Project is 77.66 MW. Since the installed capacity of the Project is greater than 50 MW, it is subject to Appendix I of the Environmental Impact Assessment (EIA) Regulation (no. 25318 on 16 December 2003), and hence this EIA Report has been prepared according to the format presented in Appendix A.

The first formulation proposed in the “Upper Seyhan Basin Master Plan Report” published in 1984 by the State Hydraulic Works (SHW) is composed of Yamanlı II Weir at thalweg elevation of 1,153 m, an energy tunnel with a length of 16,090 m, a surge tank, a penstock and Yamanlı II HPP at downstream elevation of 760 m at the right shore of Göksu River. However, due to long energy tunnel, difficult construction and cost of the Project, it was planned to be realized in two stages.

The two-stage Project is as follows:

Stage I : Yamanlı II Stage I Weir at thalweg elevation of 1,153.50 m, an energy tunnel with a length of 8,212 m, a surge tank, a penstock and Yamanlı II HPP.

Stage II : Yamanlı II Stage II Weir, a transmission channel with a length of 4,180 m, an energy tunnel with a length of 1,000 m (discharging into the water inlet structure of Hocabey Weir), Hocabey Weir on Hocabey Creek, a transmission channel with a length of 1,900 m, a forebay, a penstock and Yamanlı II Stage II HPP.

The main benefits of this two-stage Project proposed in the Master Plan Report are listed as follows.

- Construction of both stages can be initiated at the same time; hence construction phase will be shorter than that proposed in the Master Plan.
- Amount of water flowing into the Stage II, downstream stage, will be more, and thus there will be 47 GWh more energy generation in the two-stage Project.
- The two-stage Project is cheaper than the one proposed in the Master Plan Report.

Characteristics of the Project are given in Table I.1 (Stage I) and Table I.2 (Stage II).

Table I-1 Characteristics of Stage I

Structure	Characteristics	Unit	Quantity
YAMANLI II I. STAGE I WEIR	Drainage Area	km ²	1,696
	Annual Average Amount of Water (full development of upstream projects)	m ³	318.27x10 ⁶
	Crest Length	m	60.00
	Type	-	Reinforced Concrete, Outer Receptor
	Thalweg Elevation	m	1153.50
	Crest Elevation	m	1170.00
	Body Height (from foundation)	m	21.30
	Threshold Height (from thalweg)	m	16.50
Water Inlet Structure	Type	-	Outer Receptor
	Number and Dimension of Gates	-	2 gates, h=2.50 m, b=5.00 m
Sedimentation Tank	Length	m	60.00
	Width	m	10.00
	Number of Divisions	-	2
	Diameter of Settling Particle	mm	0.50
Transmission Tunnel	Diameter	m	3.50
	Length	m	8,212
	Type	-	Horseshoe-Pressurized
	Water Velocity in Tunnel	m/s	1.83
	Water Depth in Tunnel	m	3.50
Surge Tank	Type	-	Simple, Circular
	Diameter	m	12.00
Penstock	Length (Plan-Inclined)	m	378.00 – 479.14
	Inner Diameter	m	2.30 (Steel-coated)
	Wall Thickness	mm	20-33
Yamanlı II Stage I HPP	Water Inlet Elevation	m	1170.00
	Net Fall	m	299.25 (Q=20 m ³ /s)
	Thalweg elevation	m	858.00
	Type	-	Aboveground
	Turbine Type	-	Francis with Vertical Axis
	Installed Capacity	MW	49.70 (2x20 MW + 1x9.70 MW)
	Firm Energy	GWh	55.26
	Secondary Energy	GWh	137.04
	Total Energy	GWh	192.30
	Design Flow Rate	m ³ /s	20
Generator	Type	-	3-phase, synchronous
	Count	-	3
	Power	kVA	22,300 (Major units) 10,800 (Minor units)

Ref.: Yamanlı II Regülatörü ve HES Fizibilite Raporu, April 2005

Table I-2 Characteristics of Stage II

Structure	Characteristics	Unit	Quantity
Yamanlı II Stage II Weir	Drainage Area	km ²	2,031
	Annual Average Amount of Water (full development of upstream projects)	m ³	568.51x10 ⁶
	Crest Length	m	60.00
	Type	-	Reinforced Concrete, Outer Receptor
	Thalweg Elevation	m	841,50
	Crest Elevation	m	858,00
	Body Height (from foundation)	m	16,50
	Threshold Elevation (from thalweg)	m	21,30
Water Inlet Structure	Type	-	Outer receptor
	Number and Dimension of Gates	-	3 gates, h=2.50 m, b=5.00 m
Sedimentation Tank	Length	m	60,00
	Width	m	15,00
	Number of Divisions		3
	Diameter of Settling Particle	mm	0,50
Transmission Channel	Dimensions	m	4.00x2.80
	Length	m	4,180
	Type	-	Trapezoidal Open Channel
	Slope	-	0.0005
	Water Depth	m	2.60
Transmission Tunnel	Diameter	m	3.50
	Length	m	1,000
	Type	-	Horseshoe – free-flow
	Water Velocity in Tunnel	m/s	3.67
	Water Depth in Tunnel	m	2.80
Hocabey Weir	Drainage Area	km ²	70.1
	Annual Average Water (full development of upstream projects)	m ³	38.99x10 ⁶
	Crest Length	m	20.00
	Type	-	Concrete Weir, Outer Receptor
	Thalweg Elevation	m	844.00
	Crest Elevation	m	850.00
	Body Height (from foundation)	m	10.00
	Threshold Height (from thalweg)	m	6.00
Water Inlet Structure	Type	-	Outer Receptor
	Number and Dimension of Gates	-	1 gate, h=1.50 m, b=4.00 m
Seimentation Tank	Length	m	20.00
	Width	m	4.00
	Number of Divisions		1
	Diameter of Settling Particle	mm	0.50
Transmission Channel (Hocabey Weir-Forebay)	Dimensions	m	4.00x2.80
	Length	m	1,900
	Type	-	Trapezoidal Open Channel
	Slope	-	0.0005
	Water Depth	m	2.70

Structure	Characteristics	Unit	Quantity
Forebay	Type	-	with valve room
	Width	m	10.00
	Length	m	50.00
	Height	m	4.20-14.65
	Active Volume	m ³	825
Penstock	Length (Plan-Inclined)	m	80.99-123.31
	Inner Diameter	m	3.10
	Wall Thickness	mm	14
Yamanlı II Stage II HPP	Water Inlet Elevation	m	849.25
	Net Fall	m	88.55 (Q=38 m ³ /s)
	Thalweg Elevation	m	758.00
	Type	-	On-ground
	Turbine Type	-	Francis with vertical axis
	Installed Capacity	MW	27.96 (3x9.32)
	Firm Energy	GWh	41.76
	Secondary Energy	GWh	67.55
	Total Energy	GWh	109.31
	Design Flow Rate	m ³ /s	38
Generator	Type	-	3-phase, synchronous
	Count	-	3
	Power	kVA	10,360

Ref.: Yamanlı II Regülatörü ve HES Fizibilite Raporu, April 2005

Installed capacity of the Project is 77.66 MW, and the annual energy generation is estimated as 301.61 GWh. The Project's lifetime is 50 years. However, it can be extended 100 years upon renewal of electromechanical equipment every 35 years and maintenance of hydraulic structures.

The pre-construction period will be 14 months, and the construction phase will be 30 months long. Ser Energy Generation and Trading Inc. was given the "Production License" ("Üretim Lisansı") on 22 June 2006 with the decision of the Energy Market Regulation Authority no. 799-3, for production activities for 49 years, in compliance with the Energy Market Law no. 4628 and the pertinent legislation. The "Water Utilization Agreement" ("Su Kullanım Anlaşması") signed between the State Hydraulic Works (SHW) and Ser Energy Generation and Trading Inc. is presented in Appendix-B.

Construction materials to be needed will be primarily supplied from tunnel excavation or, if necessary, from the quarries M1 and M2, both of which constitute an area of 5.5 ha. There will be two crusher facilities, each with 50 m³/day of capacity, to be established for preparation of materials extracted from the quarries. Detailed information about the quarries and crushers is given in sections V.1.4 and V.1.7, respectively.

I.2 Purpose and Importance of the Project

Energy demand depending on industrial development is increasing day by day in our country as is in the world. Our electricity energy production is also increasing in parallel with this demand (See.Fig. I.1).

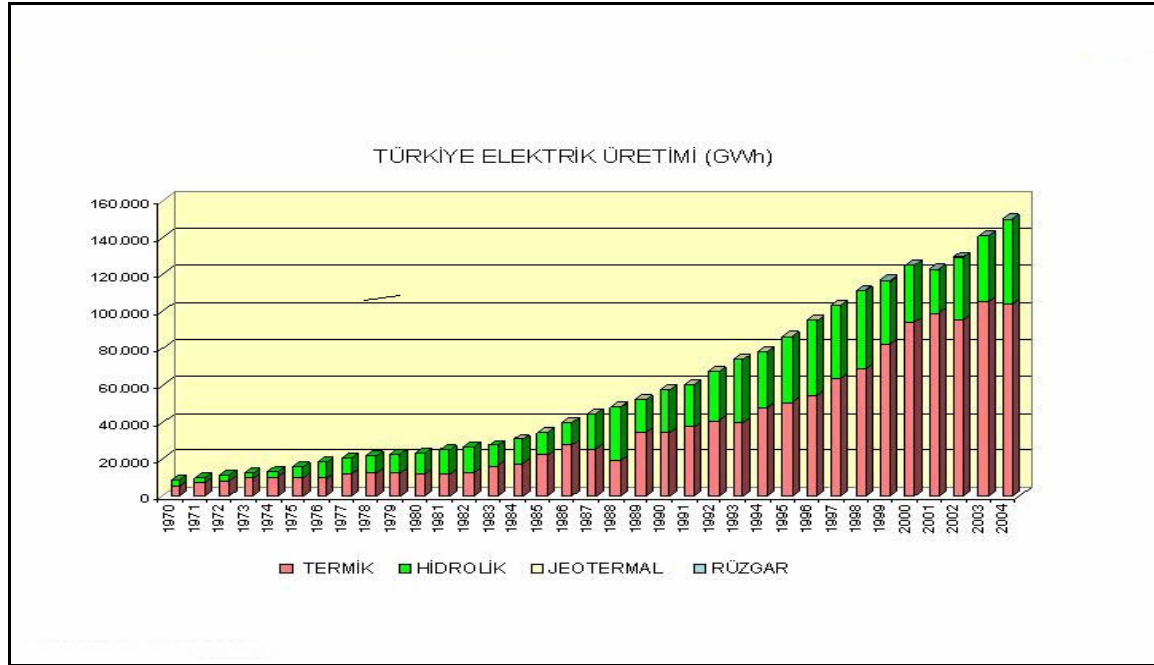


Figure I-1 Electricity Generation in Turkey (GWh)

At present, energy consumption is considered as an important parameter in determination of a society's development and civilization level. In parallel with increasing of energy consumption, improvements and developments have been observed in every aspect of life. Norway, one of the European countries, has the highest electricity consumption per annum with a consumption amount of 26,000 kWh per capita. This value is much lower in Turkey and is only 1,840 kWh. Figures showing national income and electricity consumption in Turkey and in some European countries are presented in Table I.3.

Table I-3 Income and Electricity Consumption per cap. in Some European Countries

Countries	National Income per Capita (\$/capita)	Electricity Consumption per Capita (kWh/capita)
Turkey	4,000	1,840
Germany	29,000	6,000
France	30,000	7,000
Switzerland	40,000	8,200
Norway	39,800	26,000

Ref.: EUAS Office of RPC Statistics and Research Department

Developed countries have primarily evaluated the hydroelectric potential technically and economically and in order to meet the rest of their energy demand, they have tended towards their thermal, nuclear and natural sources as secondary sources. In

our country this process has evolved in reverse order. As presented in Table I.4; in our country, the proportion of hydroelectric energy resources among the entire power generation resources is about 25%.

Table I-4 Distribution of Energy Generation to Resources (January 1st – December 31st 2005)

Sources	Production (MWh)	Contribution (%)
Thermal	121,876,842	75.46
Hydraulic	39,572,014	24.50
Wind	56,031	0.03
Total	161,504,888	100.00

Ref.: EUAS Office of RPC Statistics and Research Department

It is essential that our energy demand should be met in an uninterrupted, quality, reliable, economical and environmental friendly way. In order to obtain sustainable development, it is an obligation to use renewable energy sources which are clean and environment friendly. Hydroelectricity holds the top place in renewable sources in Turkey. As of the end of February 2005, hydroelectric potential of Turkey sums up to 129.4 billion kWh/year. 35% percent of this potential is in operation, 8% is in construction and rest of the 57% is still in planning stage and waiting to be utilised (See Table I.5).

Table I-5 Development of Turkey's Hydroelectric Energy Potential as of Beginning of 2006

Phase	Number Of Projects	Installed Capacity (Mw)	Average Annual Power Generation (Gwh)	Percent Of Total Potential (%)
Operation	137	12.846	46.191	35
Construction	39	3.004	9.770	8
Subtotal	176	15.850	55.961	43
Pre-construction	540	20.847	73.972	57
Total Economic Potential	716	36.697	129.933	100

Ref.: World Energy Council, Turkish National Committee, Electronic Bulletin, No.9, March 2006

As seen from Table I.5, only 35% of the hydroelectric potential of our country is being utilized. This ratio is 75% in Europe and 70% in the USA.

HPPs have advantages over other types of energy production systems from a variety of aspects such as they are renewable, use domestic natural sources, have low operation and maintenance costs, long physical lifetimes, cause less environmental effects and make economical and social contribution to rural areas. During construction and operation of HPPs', 80% of investment cost consists of domestic expenditures. Compared with the natural gas and imported coal-fired power plants, HPP's have lesser international dependency and foreign currency expenditure. While inertia of thermal power plants is quite high, that of HPPs' is very low. For that reason, HPPs' have functions like balancing load and frequency arrangement on interconnected power system. Besides, while thermal power plants contribute to greenhouse gases emissions stated in the Kyoto Protocol with CO₂, SO₂, coal slag and ash problems, HPPs' have no gas emissions. Behaving diligently in location selection of the plants considering the environment and

examining the possible negative impacts in feasibility and design phases of the Project will decrease the negative impacts of the HPPs' on the environment.

The realization of hydropower projects with controlled environmental impacts will enable to rely less upon the plants utilizing technologies that can create environmental problems at regional and even global scale.

In order to evaluate the hydroelectrical potentials of the streams in our country, 566 HPP projects have been prepared. 130 of them are currently under operation, 31 are under construction and 405 of them are in various project levels. The total installed capacity of these projects is calculated as 35,540 MW, and the energy potential is around 126,109 GWh/yr. Approximately 35% of this figure (44,388 GWh) is from currently operated plants, 9% (10,845 GWh) is from the ones under construction and 56% (70,767 GWh) belongs to several project (baseline, preliminary survey, planning and final project) stages. It is seen that with 126,109 GWh/yr energy capacity, Turkey has an hydroelectric potential amounting to almost 15% of economic potential of Europe countries.

Since the amount of generated secondary energy which is the energy other than reliable energy depends on precipitation conditions, though with a changing proportion every year, hydroenergy contributes 30-40% of the electricity production considering long-term average.

“Medium and Long-Term Production Investment Planning”, which is an analysis of the development of Turkish electrical systems, is under the responsibility of TEIAS and the information on HPP needed for the planning studies is provided by the SHW and the Electrical Power Resources Survey and Development Administration (EPRSDA) while the information regarding thermal power plants is provided by TEIAS. Turkey medium and long-term electricity production projections are prepared according to WASP Model. Electricity demand estimations, used for medium and long-term planning studies, are prepared by the Ministry of Energy and Natural Sources according to MAED model. Year 2020 is the target for long term estimations. In the produced scenario, it is envisaged that the HPP's which are renewable and domestic energy sources are to be of primary importance. If the HPP constructions are completed within the set period of planning, Turkey's installed hydroelectrical capacity will rise to 24,935 MW in 2010, and to 29,984 MW in 2020. As far as the distribution of installed capacity is examined according to fuel types, it is estimated that hydrolic and other renewable sources will have the largest share with 38% of total production in 2010.

Table I-6 Turkey Long-Term Electrical Energy Demand Estimation

Year	Peak Demand (MW)	Energy Demand (GWh)	Increase Rate (%)
2001	20,020	127,889	-
2002	22,870	143,500	12.2
2003	25,315	159,080	10.9
2004	28,020	176,340	10.8
2005	31,010	195,470	10.8
2006	33,466	211,000	7.9
2007	36,115	227,793	8.0
2008	38,973	245,911	8.0
2009	42,058	265,471	8.0
2010	45,387	286,586	8.0
2011	48,515	306,796	7.1
2012	51,860	328,432	7.1
2013	55,435	351,594	7.1
2014	59,256	376,389	7.1
2015	63,341	402,932	7.1
2016	67,707	431,348	7.1
2017	72,374	461,767	7.1
2018	77,364	494,331	7.1
2019	82,697	529,192	7.1
2020	88,397	566,512	7.1
2021	93,612	600,623	6.0
2022	99,134	636,788	6.0
2023	104,982	675,130	6.0
2024	111,175	715,781	6.0
2025	117,733	758,880	6.0
2026	124,022	800,375	5.5
2027	130,646	844,139	5.5
2028	137,625	890,297	5.5
2029	144,976	938,978	5.5
2030	152,720	990,321	5.5

Ref.: Electrical Energy, Production-Consumption Balance (2002-2006), TEAS, 2001

Count and installed capacity figures for power plants located in Çukurova are given in Table I-7.

Table I-7 Electricity Generation in Çukurova

Type of Power Plant	Count	Total Installed Capacity (MW)	Generation in 2005 (MWh)
Hydroelectric	21	1,541.17	4,197,193
Thermal Power	9	1,679.47	10,518,863

Ref.: Çukurova'da Enerji Sektörü, 2007

The power plants with production license in Çukurova and the power plants for which license application has been made are given in Table I-8 and I-9, respectively.

Table I-8 Power Plants in Çukurova with Production License

Type of Power Plant	Count	Total Installed Capacity (MW)
Hydroelectric	22	1,395.4
Thermal Power	9	990.73
Wind Power	9	374,6

Ref.: Çukurova'da Enerji Sektörü, 2007

Table I-9 Power Plants in Çukurova with License Application Submitted

Type of Power Plant	Count	Total Installed Capacity (MW)
Hydroelectric	8	486.5
Thermal Power	4	335.8
Wind Power	30	8,693.05

Ref.: Çukurova'da Enerji Sektörü, 2007

The count of feasible hydroelectric power projects in Çukurova is 32, and total installed capacity of these plants is 922.06 MW (Çukurova'da Enerji Sektörü, 2007).

The Project will not only contribute to energy market and Turkey's economy but it also has a great potential for decreasing unemployment percentage in the region. Besides, it will help the amount of money paid for foreign energy sources to decrease and result in more efficient utilization of governmental resources. It is also important for utilization of Turkey's renewable energy resources.

Consequently, realization of the Project is of great importance for both the region and the country. The hydroelectric energy potential in Upper Seyhan Basin will be utilized by the Project, and it will serve for the entire country through the interconnected system.

II. LOCATION OF THE PROJECT

II.1 Location of the Project (presentation of the location of the Project on Landuse Plan and Urban Improvement Plan with legend and planning notes approved by the Province Governorship and the Municipality responsible)

The Project Site is located on Göksu River, a main tributary of Seyhan River, in Upper Seyhan Basin on the north of Eastern Mediterranean Region. The major part of the Project Site lies in Saimbeyli, Adana and a minor part of it lies in Göksun, Kahramanmaraş.

Coordinates of the weirs and HPPs to be constructed in the scope of the Project are given as follows.

Yamanlı II Stage I Weir	4 211 100 N – 257 100 E
Yamanlı II Stage I HPP	4 202 975 N – 254 375 E
Yamanlı II Stage II Weir	4 201 000 N – 253 375 E
Hocabey Weir	4 197 270 N – 251 253 E
Yamanlı II Stage II HPP	4 196 925 N – 249 575 E

Yamanlı II Stage I Weir is located at thalweg elevation of 1,153.00 m on Göksu River and on the hillside of Karaçam Hill on the left shore. There is Yeniköy settlement (Saimbeyli, Adana) 2 km to the northwest of the weir, and there is Kirikkuyu Settlement of Kaleboynu Village (Göksun, Kahramanmaraş) 3 km to the south, on the left shore.

Yamanlı II Stage I HPP lies in the southern hillside of Kalebaşı Hill near Adabaşı, and there is Kaleboynu Village 1.5 km to the northeast, Eyüplü Village (Saimbeyli, Adana) 4.5 km to the west and Aksaağaç Village 4 km to the southeast.

Yamanlı II Stage II Weir is located at 841.50 m of thalweg elevation near “Sirat Köprüsü” between Gökkaya Hill on the left shore and Havlanlı Hill on the right shore. It is located 6 km upstream of the junction point of Hocabey Creek and Göksu River.

Yamanlı II Stage I HPP is located 700 m downstream of the junction point of Hocabey Creek and Göksu River. It is located near Kayabaşı. The second stage of the Project is located in Saimbeyli, Adana.

The Project Site lies within a deep canyon. General layout of the Project Site in Turkey and satellite pictures of the Project Site is given in Figures II.1, II.2 and II.3. DOKAY-EIA Environmental Engineering Ltd. conducted a site surveying in December 2006, and the pictures taken from the Project Site in this survey are given in Figures II.4 and II.5.

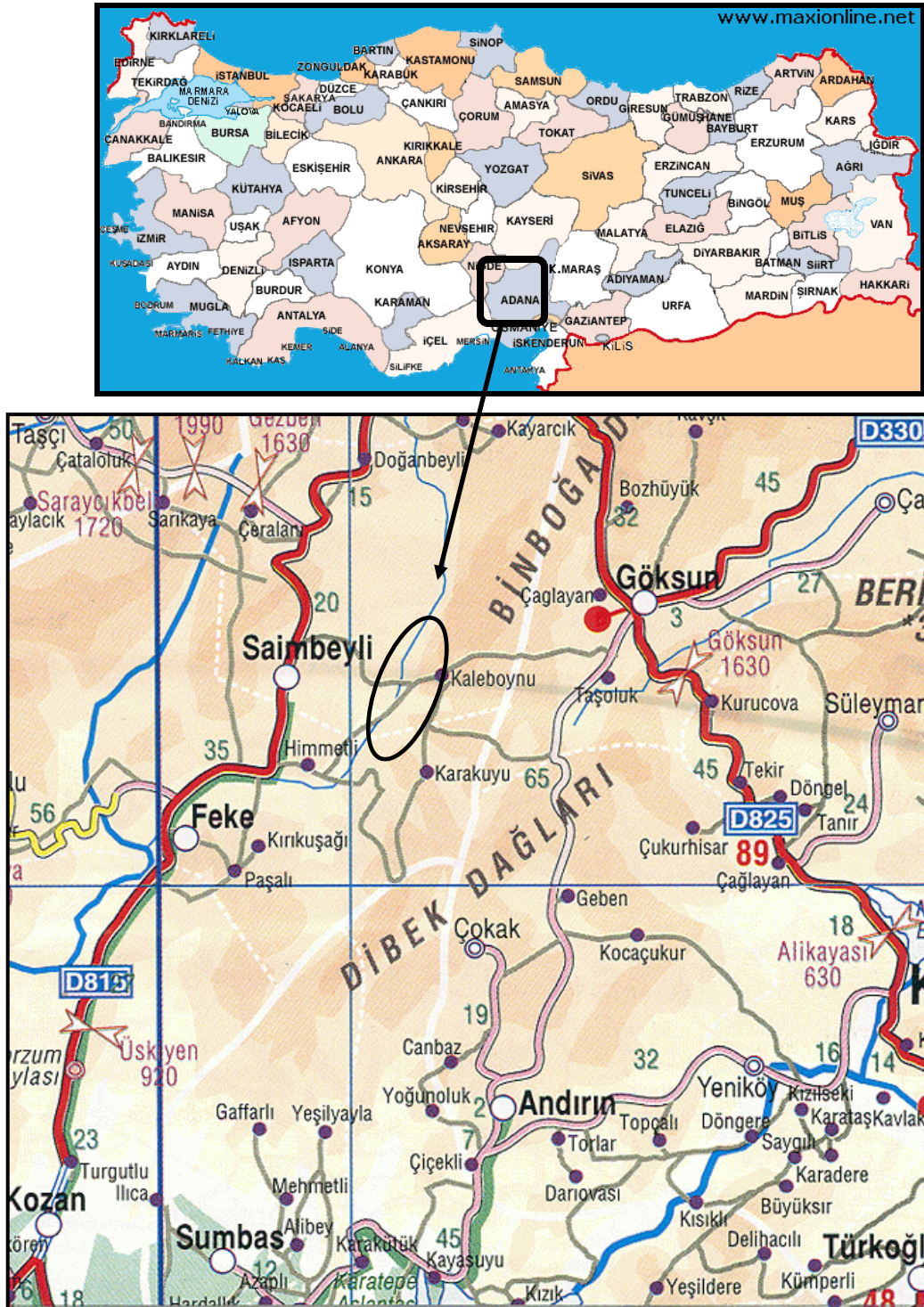


Figure II-1 The Location of the Project Site in Turkey

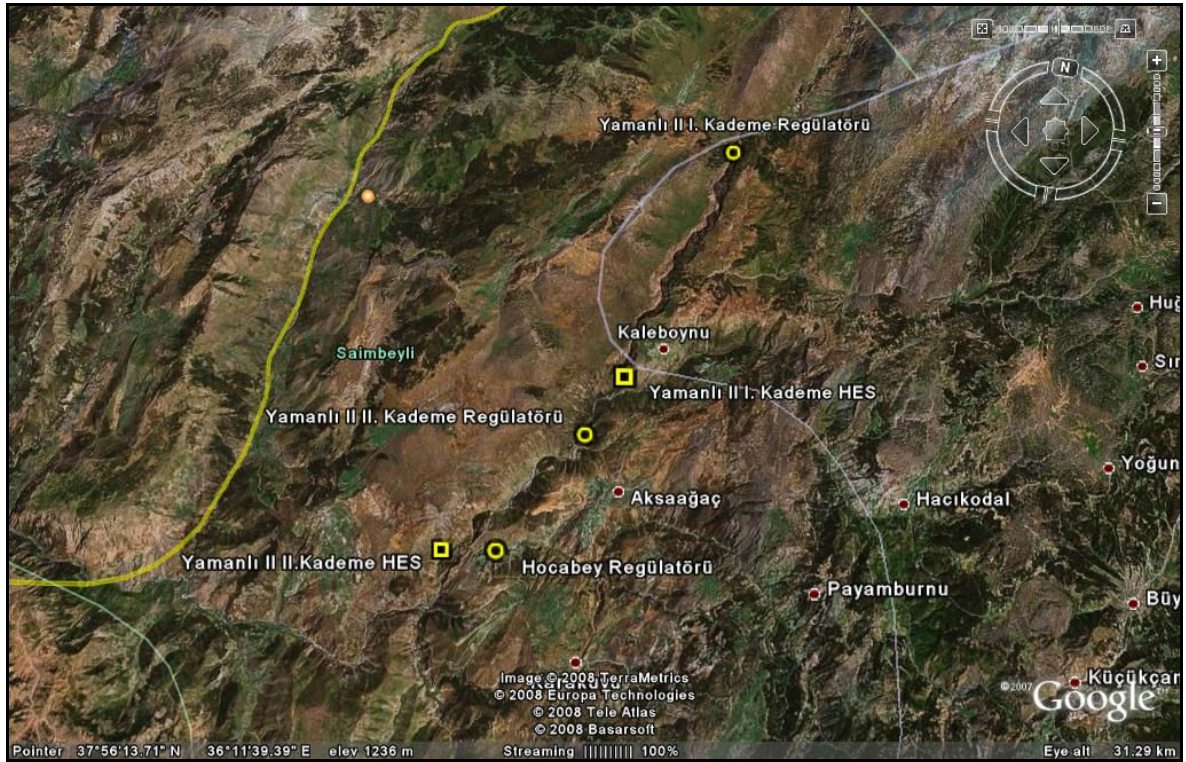


Figure II-2 Satellite Picture from the Project Site-I

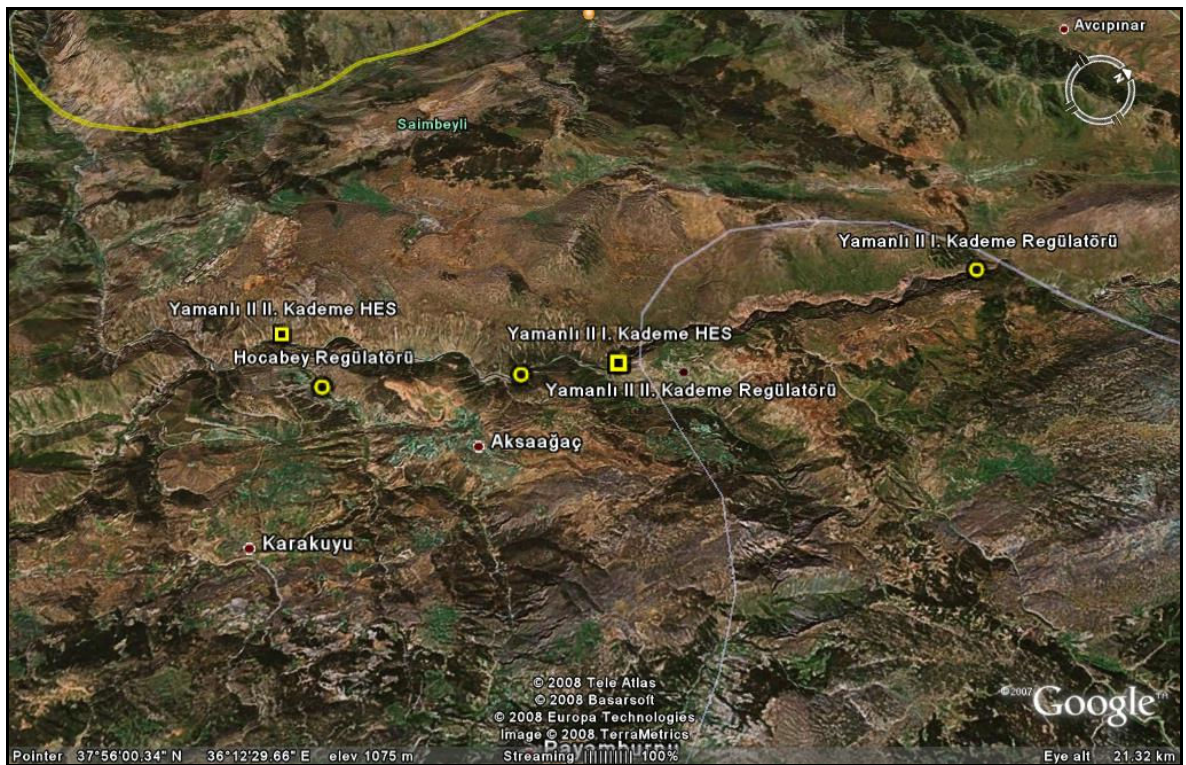


Figure II-3 Satellite Picture from the Project Site-II



Figure II-4 Picture from the Project Site-III



Figure II-5 Picture from the Project Site-IV

II.2 Location of the Project's Units (Dam body and spillway, transmission channels, facilities of the hydroelectric power plant, technical infrastructure units, administrative and social units, other units, open or closed area allocation for these units, layouts showing these units, other technical drawings or 3-Dimensional Models, maps with scale 1:25000, 1:50000 and/or 1:1000 showing temporary and final storage areas, construction site and quarries to be opened in compliance with the Mine Law)

The "Project Components and Storage Sites Map" with scale 1:25000 is presented in Appendix-C. Table II-1 presents information about land utilization for the Project units.

Table II-1 Land Utilization for the Project's Units

Project's Unit	Land Utilization (m ²)
Yamanlı II Stage I Weir Sedimentation Tank	600
Surge Tank	92
Penstock (Yamanlı II Stage I HPP)	1,102
Yamanlı II Stage II Weir Sedimentation Tank	900
Transmission Channel (Yamanlı II Stage II Weir – Transmission Tunnel)	16,720
Hocabey Weir Sedimentation Tank	80
Transmission Channel (Hocabey Weir –Forebay)	7,600
Forebay	500
Penstock (Yamanlı II Stage II HPP)	382
Yamanlı II Stage II HPP	809.6
Switchyard	3,500
M1 Quarry	42,000
M2 Quarry	13,000

Ref.: Yamanlı II Regülatörü ve HES Fizibilite Raporu, April 2005

III. ECONOMIC AND SOCIAL ASPECTS OF THE PROJECT

III.1 Investment Program and Financial Resources for Realization of the Project

Construction of the Project will be completed within 30 months, and the Project will be in operation for 49 years.

The total investment cost is USD 97,375,942 according to the 2004 unit prices of the SHW. Total annual operating cost is USD 10,427,441. Annual costs include operating and maintenance costs, renewal, interest and amortization. Investment costs and operating and maintenance costs for the Project's units are presented in Table III.1 and Table III.2.

As given in Table III.1 and Table III.2, the total cost of the facility including construction works, electromechanical equipment and energy transmission line is USD 80,859,027. the cost associated with surveying, design works and expropriation is USD 5,179,613. The total investment cost is estimated as USD 97,375,942 including the financing costs of the construction phase (USD 10,797,303) calculated by taking the interest rate for the energy projects as 9.5%.

Financial sources for investment will be equity capital and bank loan.

III.2 Workflow Diagram or Time Schedule Regarding the Realization of the Project

The pre-construction phase of the Project will be 14 months, and the construction phase will be 30 months. The work schedule for the Project is presented in Figure III.3.

Table III-1 Annual Costs (Stage I)

Item	Estimated Cost (USD)	Unknown (USD)	Cost (USD)	Interest and Amortization Factor	Renewal Factor	Operating and Maintenance Factor	Annual Cost		
							Interest+ Amortization+ Renewal (USD)	Operating+ Maintenance (USD)	Total (USD)
Roads – Accomodation Facilities	1,078,617	107,862	1,186,479	0.09603	0.0000326	0.040	113,976	47,459	161,435
Transportation Tunnels	2,957,328	295,733	3,253,061	0.09603	0.0000326	0.010	312,497	32,531	345,068
Weir (Body+Gravel Passage+Water Inlet Structure)	2,561,373	256,137	2,817,510	0.09603	0.0000326	0.010	270,657	28,175	298,832
Transmission Tunnel	20,026,122	2,002,612	22,028,734	0.09603	0.0000326	0.005	2,116,137	110,144	2,226,281
Surge Tank	666,674	66,667	733,341	0.09603	0.0000326	0.005	70,447	3,667	74,113
Penstock and Valve Room	3,080,957	308,096	3,389,053	0.09603	0.0008136	0.020	328,208	67,781	395,989
Power Plant	2,905,147	290,515	3,195,662	0.09603	0.001848	0.010	312,785	31,957	344,742
Electromechanic Equipment	14,910,000	745,500	15,655,500	0.09603	0.0041376	0.015	1,568,174	234,833	1,803,006
Energy Transmission Line	400,000		400,000	0.09603	0.0041376	0.015	40,067	6,000	46,067
CONSTRUCTION INVESTMENT			52,659,340				5,132,949	562,545	5,695,495
Survey, Project Design and Review			3,660,384	0.09603	-	-	351,507		351,507
Expropriation			200,000	0.09603	-	-	19,206		19,206
PROJECT COST			56,519,724				5,503,662	562,545	6,066,207
Construction-phase financing cost			6,951,215	0.09603	-	-	667,525		667,525
INVESTMENT COST			63,470,939				6,171,187	562,545	6,733,732

Ref.: Yamanlı II Regülatörü ve HES Projesi Fizibilite Raporu, April 2005

Table III-2 Annual Costs (Stage II)

Item	Estimated Cost (USD)	Unknown (USD)	Cost (USD)	Interest and Amortization Factor	Renewal Factor	Operating and Maintenance Factor	Annual Cost		
							Interest+ Amortization+ Renewal (USD)	Operating+ Maintenance (USD)	Total (USD)
Roads-Accommodation Facilities	1,486,117	148,612	1,634,729	0.09603	0.0000326	0.040	157,036	65,389	222,425
Transportation Tunnels	2,957,328	295,733	3,253,061	0.09603	0.0000326	0.010			
Weir (Body+Gravel Passage+Water Inlet Structure)	2,561,373	256,137	2,817,510	0.09603	0.0000326	0.010	347,689	39,005	413,694
Transmission Tunnel	20,026,122	2,002,612	22,028,734	0.09603	0.0000326	0.005	206,946	10,771	217,717
Forebay	666,674	66,667	733,341	0.09603	0.0000326	0.005	61,702	3,212	64,914
Penstock and Valve Room	3,080,957	308,096	3,389,053	0.09603	0.0008136	0.020	69,203	14,292	83,494
Power Plant	2,905,147	290,515	3,195,662	0.09603	0.001848	0.010	347,587	35,512	383,099
Transmission Channel (Yamanlı II Stage II Weir – Tunnel Inlet and Hocabey Weir – Forebay)							383,740	39,947	423,687
Electromechanic Equipment	14,910,000	745,500	15,655,500	0.09603	0.0041376	0.015	882,216	132,111	1,014,327
Energy Transmission Line	400,000		400,000	0.09603	0.0041376	0.015	280,469	42,000	322,469
CONSTRUCTION INVESTMENT			52,659,340				2,763,589	382,239	3,145,827
Survey, Project Design and Review			3,660,384	0.09603	-	-	159,336		159,336
Expropriation			200,000	0.09603	-	-	19,206		19,206
PROJECT COST			56,519,724				2,942,130	382,239	3,324,369
Construction-phase financing cost			6,951,215	0.09603	-	-	369,340		369,340
INVESTMENT COST			63,470,939				3,311,470	382,239	3,693,709

Ref.: Yamanlı II Regülatörü ve HES Projesi Fizibilite Raporu, April 2005

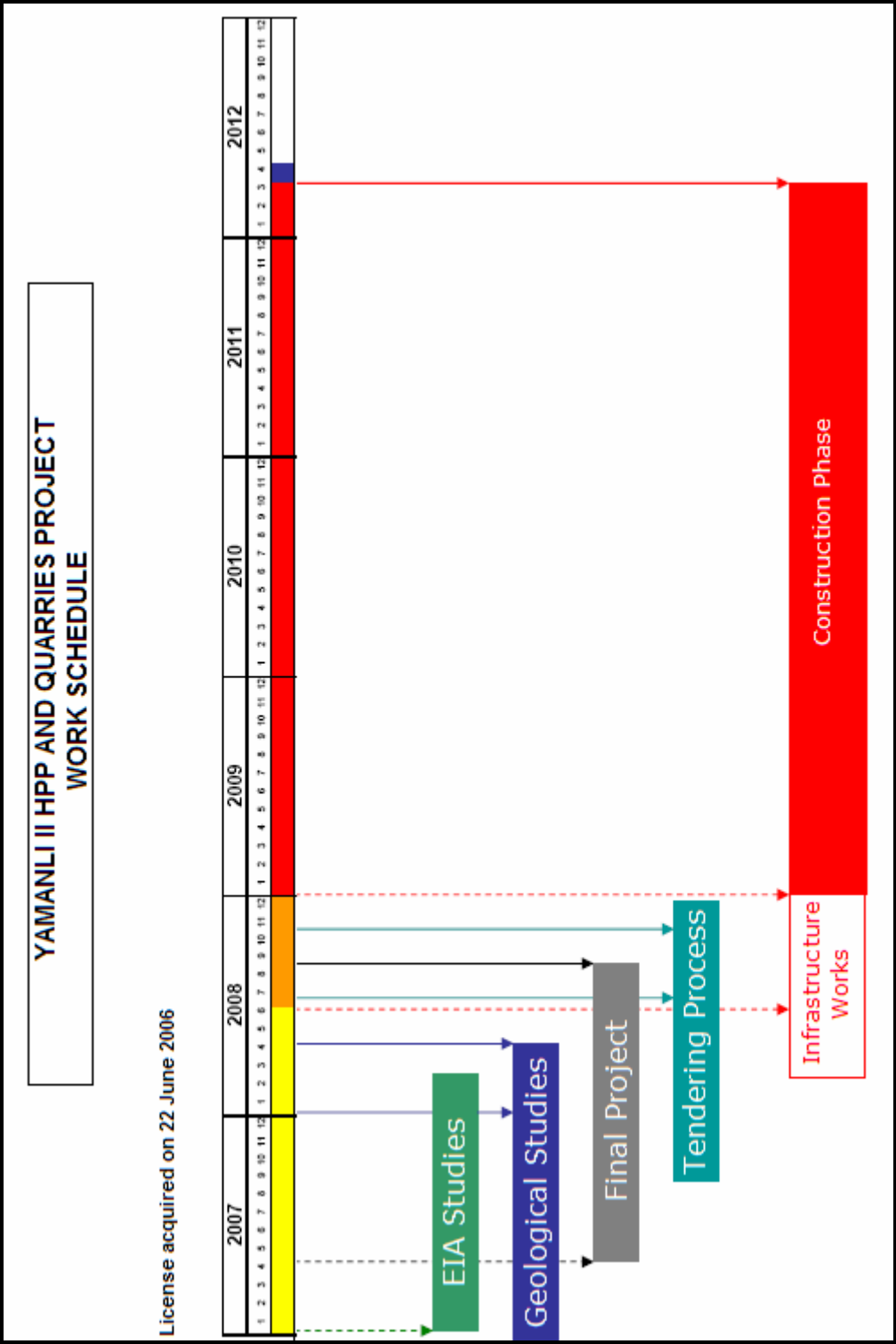


Figure III-1 Project Work Schedule

III.3 Benefit – Cost Analysis

Economic feasibility of the Project has been assessed through the internal rate of return and benefit/cost analyzes. The internal rate of return is the discount rate which equates the present worth of revenues and costs to occur throughout the Project's lifetime. Any project will be feasible provided that this discount rate is higher than the social discount rate. The benefit/cost ratio is found through carrying the present worths of revenues and costs occurring during the lifetime of the Project to the beginning of the Project. In present worth calculations, a rate of 9.5 % is used as the discount rate for energy projects. Finding a benefit/cost ratio greater than one means the Project is feasible.

The total energy benefit (firm energy benefit and secondary energy benefit) is estimated as USD 12,378,300 for the full development of upstream projects. Annual expense is composed of financing cost, amortization, renewal and operating and maintenance costs. Annual costs for the Project is USD 10,427,441.

To sum up, benefit/cost ratio, calculated taking the discount rate as 9.5 % and the total project life as 50 years, for the Project is 1.28, and the internal rate of return is 12.45% (for the full development of upstream projects). Since the benefit/cost ratio is greater than 1 and the internal rate of return is greater than 9.5 %, the Project is decided to be feasible.

III.4 Economic, Social and Infrastructure Projects not Included in the Scope of the Project but Planned to be Realized by the Project's Owner or Other Investors

Water Supply and Wastewater Treatment

Drinking water and potable water demand during the construction phase of the Project will be supplied from the surrounding springs and streams that are of sufficient quality. Necessary microbiological and chemical analyzes of drinking and potable water will be made to make sure that the water utilized is of good quality. Wastewater generated in the construction phase will be collected and treated in a package treatment plant. Wastewater will then be disposed of in the wastewater treatment plant of Kozan Municipality. Wastewater to be generated in the operational phase will be disposed of in the wastewater treatment plant of Kozan Municipality. The necessary permit will be taken from the municipality available. Unleaking Septic Tank Projects are presented in Appendix-D.

Fire Protection System

A suitable fire protection system will be established to eliminate any fire incidence. Fire alert system consisting of heat, smoke and flame detectors will be utilized within the power plant. Components of the fire protection system are given as follows.

- Fire hydrants,
- Fire fighting equipment which run on carbondioxide,
- Portable fire extinguishers,
- Fire blankets,
- Fire extinguishing dust generator,
- Fire extinguishing foam generator,
- Carbondioxide tank,
- Sand pots,
- Foam system,
- Fire hose.

Illumination

Necessary internal and external illumination facilities will be established in the Project Site. In this respect, there will be illumination external illumination for HPPs and hydraulic structures.

III.5 Economic, Social and Infrastructure Projects not in the Scope of the Project but necessary for Realization of the Project and Planned to be Realized by the Project's Owner or Other Investors

No additional facilities except the ones mentioned in Section III.4 are necessary in the scope of the Project.

III.6 Expropriation and/or Resettlement Procedures

There will be no expropriation and resettlement along the tunnel route that is a part of the transmission line between Yamanlı II Stage II Weir and Hocabey Weir and the transmission tunnel between Yamanlı II Stage I Weir and Yamanlı II HPP.

An 8 m – wide and 3,500 m – long road and a 10 m – wide and 6,000 m long transmission channel will be constructed in the second stage of the Project. A 3,000-m section of the transmission tunnel will be located in private property. Total amount of parcels to be expropriated was determined as 100, equal to 15 ha, in site surveys carried out by Ser Energy Generation and Trading Inc. Unit price for one ha of area is taken as 25,000 YTL, and hence the total expropriation cost is calculated as 375,000 YTL.

Mutual agreement with the land owners will be the primary way to be followed during expropriation of lands. In case of disagreements, land expropriation will be accomplished in compliance with Expropriation Law numbered 4650 (Official Gazette dated 5 May 2001 and numbered 24393).

Expropriation will be performed by Energy Market Regulation Authority (EMRA) as a requirement of Article 15/c (amended by Article 5 of the law no 5496) of the Energy Market Law no. 4628 and the expropriation decision will be considered as the public benefit decision and the expropriated real properties will be registered to the Treasury.

The decision of the Council of Ministers concerning the execution of Article 27 of the Expropriation Law no. 2942 in the expropriations carried out by the Energy Market Regulation Authority was published in Official Gazette dated 30 September 2004 and numbered 25599.

Article 27- In the execution of the National Defense Obligation Law, in extraordinary situations stipulated by the particular laws or conditions deemed as urgent by the Council of the Ministers or in need of country defense in expropriating the required real properties completing the processes other than value estimation with the request of the related department within seven days by the court, the value of the real property to be estimated by the expert assigned in accordance with the item 15 and principals of the item 10 by the administrative board on behalf of the owner of the property according to the invitation given in compliance with the item 10 and depositing to the bank denoted in the advertisement the real property can be confiscated. The amount deposited is the first installment in expropriating in case of situations mentioned in the 2nd clause of the 3rd item of this law. For this reason, an in-situ value estimation is performed by the expert, and the estimated amount is deposited to the declared bank account and it will be paid to the property owner through the channel of the Province Governorship. Construction will begin upon completion of this payment procedure. Afterwards a proposal of housing is directed to the former property owner. The holder of right will request for housing by giving the expropriation amount back.

The quarries, storage areas for excavated materials and crushers will be located in forest area, and the necessary permits will be taken from the General Directorate of Forestry, prior to construction, in compliance with Article 17/3 of the Forestry Law no. 6831, amended by the law no. 5192, as guided in the official letter no. 9908 on 10 August 2007, received from Adana Regional Directorate of Forestry and presented in Appendix-E. Necessary permit will be taken in compliance with the law no. 5177 for raw materials to be utilized.

The law offering adjustments in the Forestry Law no: 5192 (Official Gazette dated 3 July 2004 and numbered 25511) for the facilities located in the forest areas states that “ In case of public benefit or exigency concerning the location or construction of defense, transportation, energy, communication, water supply, wastewater, petroleum, natural gas,

infrastructure facilities and solid waste disposal sites; sanatoriums, dams, ponds and cemeteries; governmental health, education and sports facilities and related places in governmental forest areas, real and legal persons can be licensed by the Ministry of Environment and Forestry in return for the determined value. The required licenses will be acquired from the General Directorate of Forestry and value of the trees to be logged will be paid.

Permit will be taken for a forest area of 200 ha. The amount to be paid for each ha of forest area is 5,249 YTL, assuming all the forest area is comprised of the needle tree. The total amount to be paid will be 1,049,800 YTL.

There are no residential areas to be flooded. Hence, there will be no resettlement.

III.7 Other Issues

No other issues about the economic and social aspects of the Project is needed to mention here.

IV. DETERMINATION OF THE AREA TO BE AFFECTED BY WEIRS, HPPS AND QUARRIES WITHIN THE CONTEXT OF THE PROJECT AND IDENTIFICATION OF ITS ENVIRONMENTAL CHARACTERISTICS

IV.1 Determination of the Area Likely to be Affected by the Project (Explanation of How the Impact Area is Determined and Presentation of the Impact Area on Map)

The Project impact area has been determined considering the potential impacts to be posed on the residential areas surrounding the Project Site. Necessary permits will be acquired from MoEF to occupy the forest area in the Project Site. Cadastral status of the forest area to be occupied will be finalized in the “final project” stage.

Results of the surveys about cadastral status of the Project Site are presented in Figure IV.1.

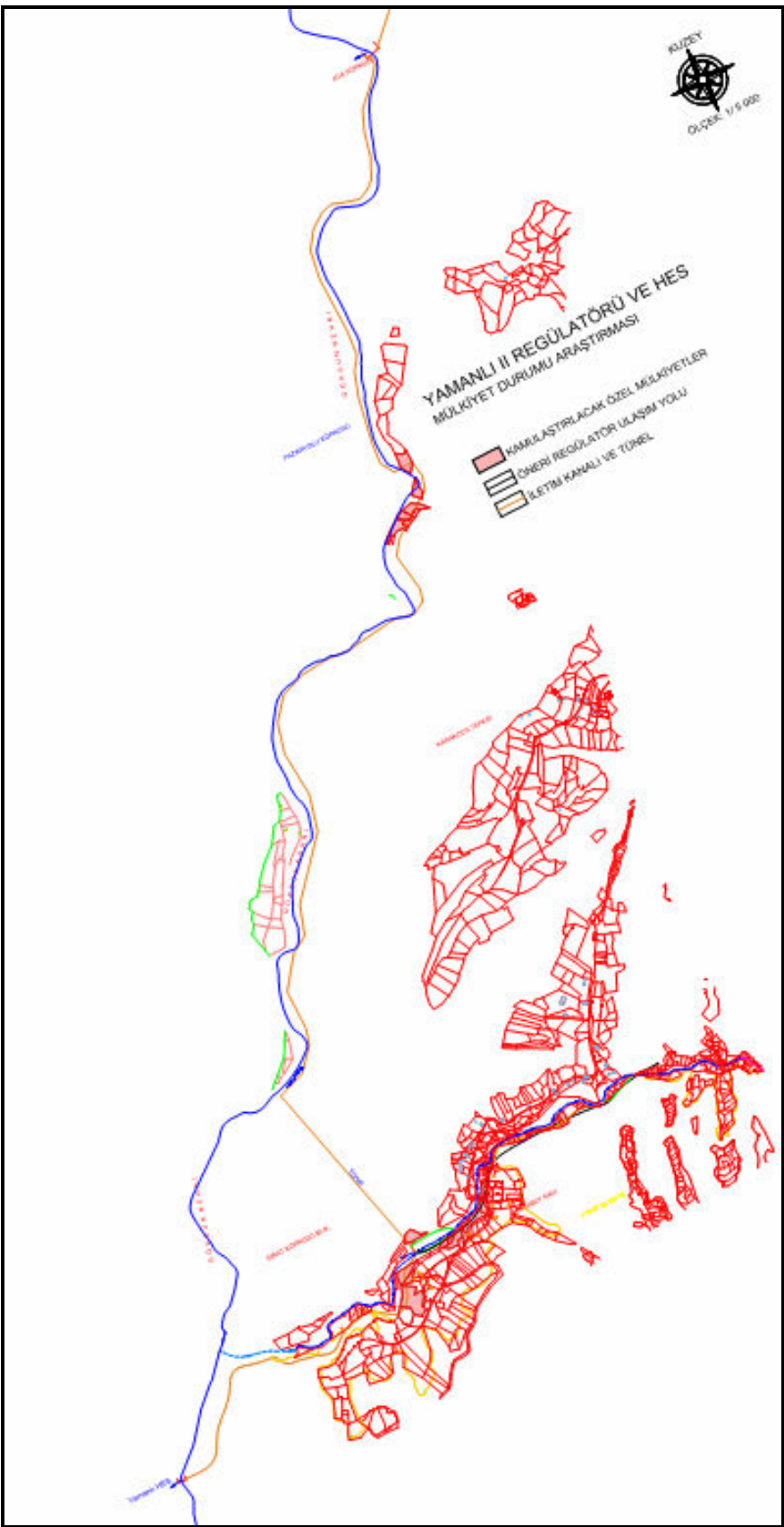


Figure IV-1 Results of the Surveys About Cadastral Status of the Project Site

IV.2 Characteristics of the Physical and Biological Environment of the Impact Area and Utilization of Natural Resources

IV.2.1 Meteorological and Climatic Characteristics

In this section, a general conclusion is made regarding the micro and macro meteorological conditions characteristic to the climate in the region. The present meteorological condition in the region is explained, and the long-term meteorological data recorded in Tufanbeyli Meteorological Station of the General Directorate of State Meteorological Works (SMW) are utilized. The Long-Term Meteorological Data (1986-2006) Recorded in Tufanbeyli Meteorological Station is presented in Appendix-F.

There are two different climate patterns observed in Adana. One is the Mediterranean climate, mostly observed in coastal zones and plains, whereas the other one is terrestrial and observed in high altitude parts of the region. In the Mediterranean climate, summers are hot and dry, and winters are warm and rainy. Mountains with high altitude surrounds Adana so that they block winds blowing from north. This results in hot summers. Half of the precipitation occurs in winters, and the other half occurs in springs and falls. There is no precipitation for two or three months in summers.

As the altitude becomes higher and as we move toward north, we observe a colder climate with more precipitation. Terrestrial climate characteristics are observed in the north of Saimbeyli.

Meteorological Station

Table IV.1 presents information about Tufanbeyli Meteorological Station.

Table IV-1 Tufanbeyli Meteorological Station

Working Period	1986-2004
Latitude	38.16
Longitude	36.13
Altitude	1,400 m

Ref.: General Directorate of State Meteorological Works – Tufanbeyli Meteorological Station (1986-2004)

Wind Conditions

The annual wind rose that is formed using the data recorded in Tufanbeyli Meteorological Station is presented in Figure IV.2. According to this, no dominant wind direction was observed in the region.

Long – term meteorological measurements show an average wind speed of 1.1 beaufort. As a result of 18-year measurements, the direction with the fastest-blowing wind was observed as southeast (SE), and the wind speed was 8 beaufort. Number of days

with storm (wind speed ≥ 8 beaufort) and strong wind (wind speed equal to 6-7 beaufort) are measured as 0.7 and 17, respectively, within the same measurement period. Conversion from beaufort unit into other units is given in Table IV.2.

Table IV-2 Conversion from Beaufort Unit into Other Units

Beaufort	Speed (knot) *	Speed (m/s)	Description
0	Below 1	0-0.2	Calm
1	1 - 3	0.3-1.5	Light Breeze
2	4 - 6	1.6-3.3	Light Wind
3	7 - 10	3.4-5.4	Breeze
4	11 - 16	5.5-7.9	Moderate Wind
5	17 - 21	8.0-10.7	Fresh Breeze
6	22 - 27	10.8-13.8	Strong Wind
7	28 - 33	13.9-17.01	Moderate Storm
8	34 - 40	17.2-20.7	Storm
9	41 - 47	20.8-24.4	Strong Storm
10	48 - 55	24.5-28.4	Heavy Storm
11	56 - 63	28.5-32.6	Extreme Storm
12	> 64	> 32.7	Thunderstorm

* 1 knot = 0.514 m/s

Ref.: www.meteor.gov.tr

Monthly and annual wind frequencies for the period of concern are given in Table IV.3. Wind rose drawn according to annual wind frequency is given in Figure IV.2. Wind frequencies for weathers are given in Tables IV.4, IV.5, IV.6 and IV.7 whereas wind roses for weathers are presented in Figures IV.3, IV.4, IV.5 and IV.6.

Table IV-3 Wind Frequencies (Monthly and Annual)

Direction	Months												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
N	126	90	114	100	134	134	126	110	101	95	113	138	1381
NE	140	157	148	66	94	148	202	126	119	105	117	147	1569
E	83	121	126	89	98	105	97	78	101	114	114	143	1269
SE	41	56	75	100	97	59	63	64	105	118	87	61	926
S	80	67	131	203	195	136	118	92	166	152	122	88	1550
SW	31	56	103	99	110	86	89	74	102	103	45	30	928
W	96	80	133	126	138	145	139	123	115	93	75	68	1331
NW	35	46	49	36	44	56	72	47	36	29	22	17	489

Ref.: General Directorate of State Meteorological Works – Tufanbeyli Meteorological Station (1986-2004)

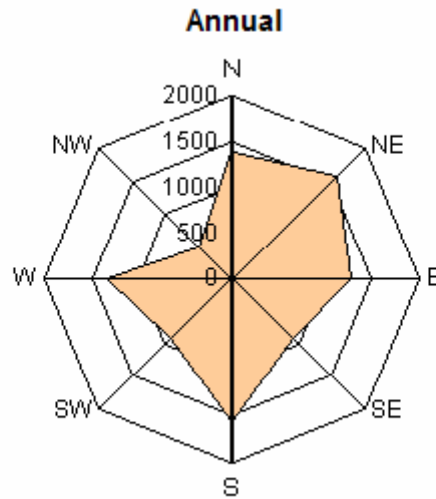


Figure IV-2 Annual Wind Rose

Table IV-4 Wind Frequency Information for Winter

Direction	December	January	February	Total
N	138	126	90	354
NE	147	140	157	444
E	143	83	121	347
SE	61	41	56	158
S	88	80	67	235
SW	30	31	56	117
W	68	96	80	244
NW	17	35	46	98

Ref.: General Directorate of State Meteorological Works – Tufanbeyli Meteorological Station (1986-2004)

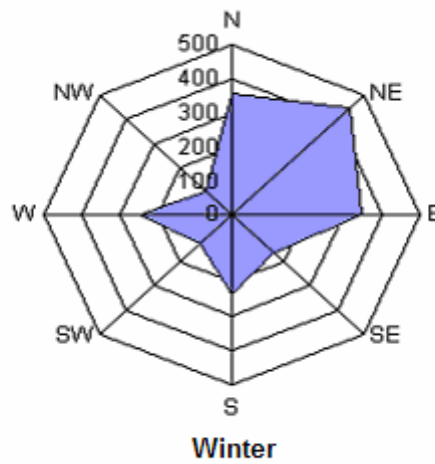
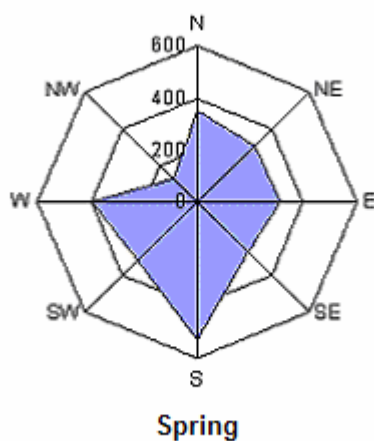


Figure IV-3 Wind Rose for Winter

Table IV-5 Wind Frequency Information for Spring

Direction	March	April	May	Total
N	114	100	134	348
NE	148	66	94	308
E	126	89	98	313
SE	75	100	97	272
S	131	203	195	529
SW	103	99	110	312
W	133	126	138	397
NW	49	36	44	129

Ref.: General Directorate of State Meteorological Works – Tufanbeyli Meteorological Station (1986-2004)

**Figure IV-4** Wind Rose for Spring**Table IV-6** Wind Frequency Information for Summer

Direction	June	July	August	Total
N	134	126	110	370
NE	148	202	126	476
E	105	97	78	280
SE	59	63	64	186
S	136	118	92	346
SW	86	89	74	249
W	145	139	123	407
NW	56	72	47	175

Ref.: General Directorate of State Meteorological Works – Tufanbeyli Meteorological Station (1986-2004)

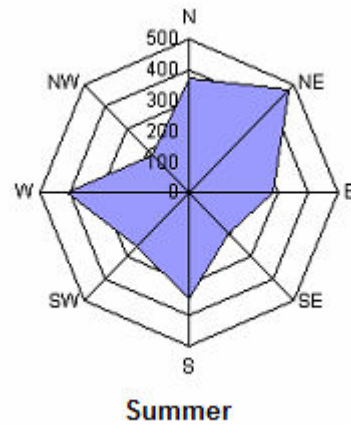


Figure IV-5 Wind Rose for Summer

Table IV-7 Wind Frequency Information for Fall

Direction	September	October	November	Total
N	101	95	113	309
NE	119	105	117	341
E	101	114	114	329
SE	105	118	87	310
S	166	152	122	440
SW	102	103	45	250
W	115	93	75	283
NW	36	29	22	87

Ref.: General Directorate of State Meteorological Works – Tufanbeyli Meteorological Station (1986-2004)

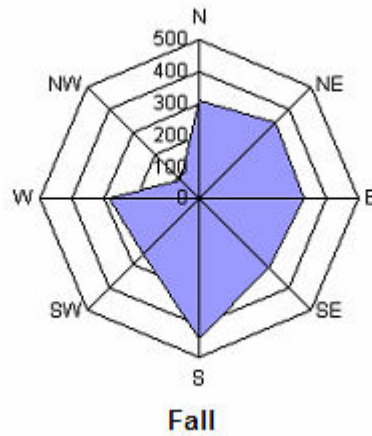
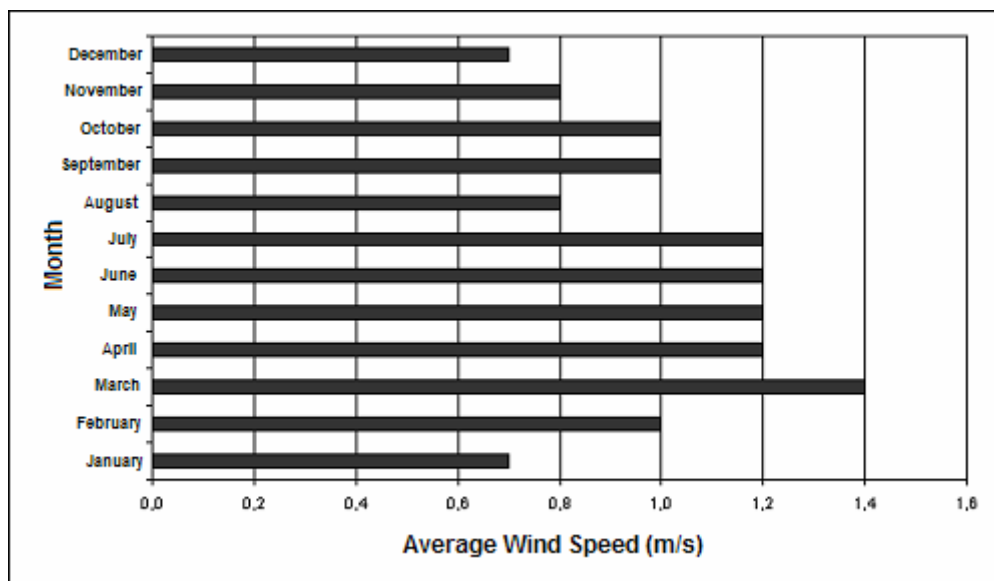
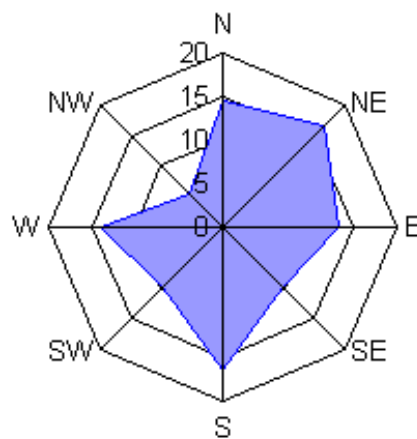


Figure IV-6 Wind Rose for Fall

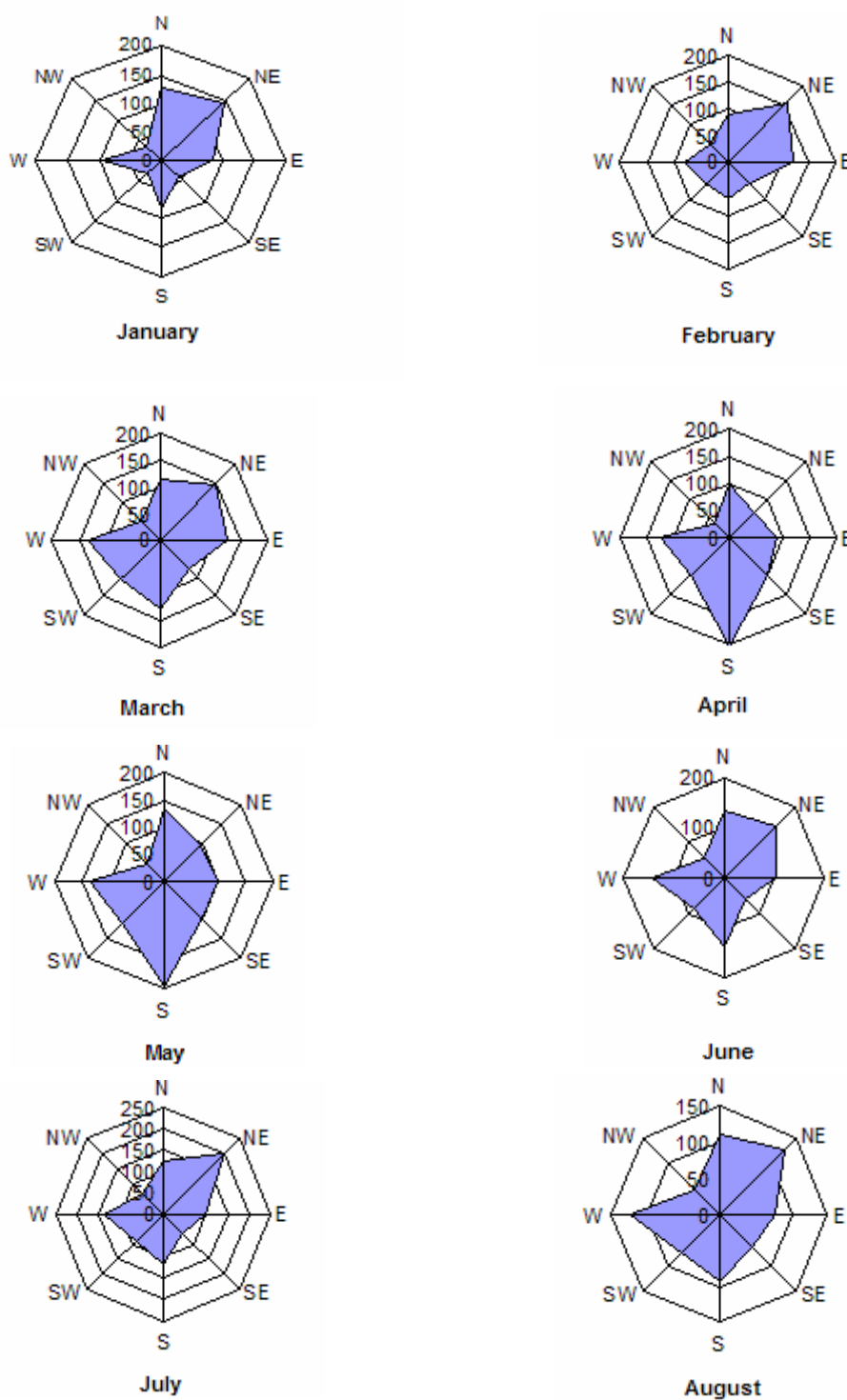
Table IV-8 Distribution of Average Wind Speed with respect to Directions (1975-2005)

		Months												Annual
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Directions	N	2.9	3.3	2.9	2.7	2.3	2.9	2.5	2.5	2.9	2.3	3.7	2.9	2.7
	NE	4.1	3.9	3.7	3.7	3.1	3.7	3.7	3.7	3.7	3.7	3.1	2.9	3.7
	E	2.0	2.1	2.1	2.0	2.0	2.0	2.0	1.8	2.0	1.7	1.8	1.8	2.0
	SE	2.1	2.5	2.7	3.1	2.5	2.5	2.3	2.1	2.1	2.3	2.1	2.1	2.3
	S	1.8	2.1	2.9	3.3	3.3	2.9	2.0	2.0	2.3	2.5	2.3	2.0	2.5
	SW	2.3	2.9	2.5	3.5	2.9	3.3	2.9	3.1	2.9	3.1	2.0	2.1	2.9
	W	2.3	2.1	2.7	2.7	2.7	2.7	2.7	2.1	2.3	2.5	2.0	2.1	2.5
	NW	3.3	4.3	3.5	2.4	2.9	2.4	3.5	2.4	2.4	2.9	2.3	2.7	3.3

Ref.: General Directorate of State Meteorological Works – Tufanbeyli Meteorological Station (1986-2004)

**Figure IV-7** Average Wind Velocity (1975-2005)**Figure IV-8** Annual Wind Rose Prepared According to Average Wind Speed

Monthly wind roses, prepared according to wind frequencies, are given in Figure IV.9.



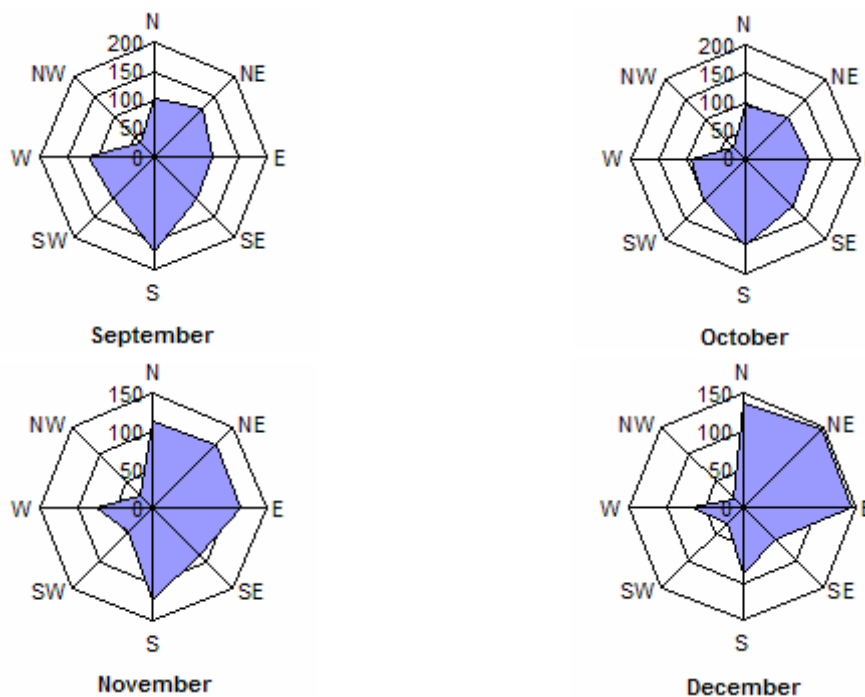


Figure IV-9 Monthly Wind Roses

Temperature

Annual average, maximum and minimum temperature recorded is 9.9 °C, 37 °C and -27.8 °C, respectively. Number of summer days in which temperature exceeds 25 °C is 97, and number of tropic days in which temperature exceeds 30 °C is 38. Table IV.9 presents monthly temperature data classified as maximum, minimum and average.

Table IV-9 Long – Term Temperature Data

Temperature (°C)	Months												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Maximum Temperature(°C)	1.9	3.1	8.3	14.7	19.1	24.6	29.4	30.2	26.0	19.4	10.4	3.5	15.9
Average Temperature(°C)	-2.9	-1.7	3.3	9.2	13.1	18.1	22.4	22.7	18.1	12.3	4.7	-0.9	9.9
Minimum Temperature(°C)	-7.9	-6.8	-2.1	3.3	6.5	10.2	13.3	13.6	9.4	5.1	-0.8	-5.6	3.2

Ref.: General Directorate of State Meteorological Works – Tufanbeyli Meteorological Station (1986-2004)

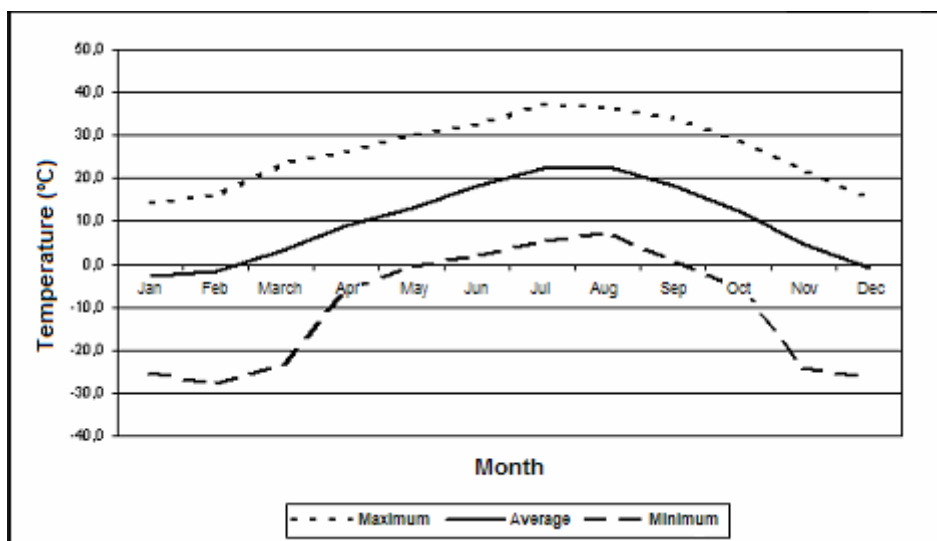


Figure IV-10 Monthly Temperature Data (1975-2005)

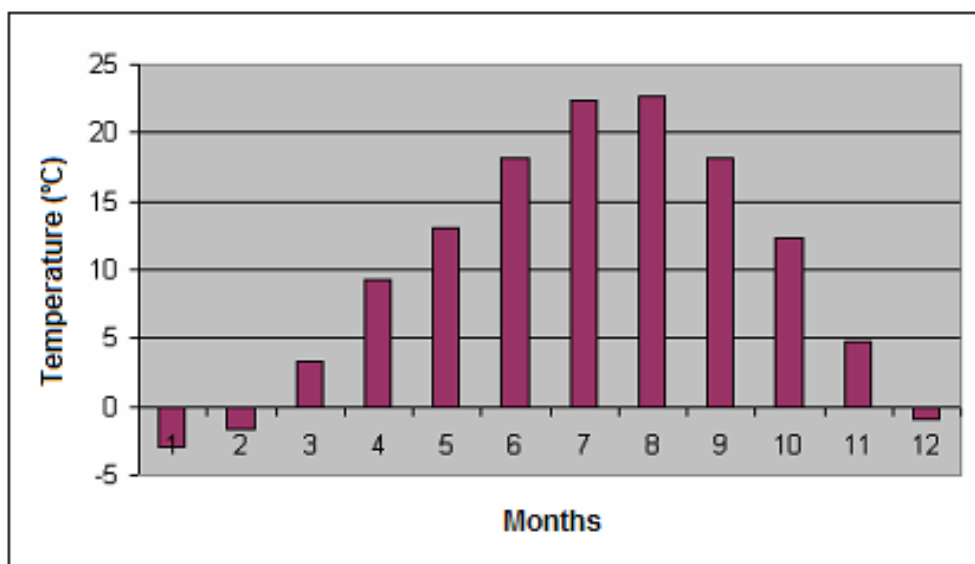


Figure IV-11 Monthly Average Temperature Values (1986-2004)

Table IV.10 presents information pertaining to the number of days with temperature given in a certain interval.

Table IV-10 Number of Days with respect to Temperature Intervals

Temperature	Measurement Period (year)	Average Number of Days
$\leq -0.1^{\circ}\text{C}$	18	114.4
$\leq -3^{\circ}\text{C}$	18	82.5
$\leq -5^{\circ}\text{C}$	18	62.5
$\leq -10^{\circ}\text{C}$	18	31.0
$\leq -15^{\circ}\text{C}$	18	13.3
$\leq -20^{\circ}\text{C}$	18	4.6
$\geq 20^{\circ}\text{C}$	18	0.1
$\geq 15^{\circ}\text{C}$	18	18.7
$\geq 10^{\circ}\text{C}$	18	91.8
$\geq 5^{\circ}\text{C}$	18	169.9

Ref.: General Directorate of State Meteorological Works – Tufanbeyli Meteorological Station (1986-2004)

Precipitation

Precipitation generally occurs in the form of rain or hail in fall, winter or spring. Number of cloudy days in Tufanbeyli is 70.7 and number of cloudless days is 133.5.

Average annual precipitation is measured as 562.1 mm according to the meteorological data recorded in Tufanbeyli Meteorological Station for 18 years. The most amount of precipitation is observed during winter.. The most and the least amount of precipitation occurs in November (79.0 mm) and August (22.0 mm), respectively, considering average monthly precipitation amounts (see Table IV.11). Heavy precipitation analysis was conducted according to the data recorded, and it is presented in Figure IV.12.

Average annual number of days with snow is 33.2. number of days with the most amount of snowfall is 8.4 in January, 8.1 in February and 7.1 in December.

Table IV-11 Precipitation Data Recorded in Tufanbeyli Meteorological Station

Amount of Precipitation (mm)	Months												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Average Amount of Precipitation(mm)	64.9	53.7	65.1	61.6	59.9	25.6	10.6	4.8	15.7	36.9	89.4	73.9	562.1
Günlük En Çok Yağış Miktarı(mm)	37.8	33.0	69.5	42.3	35.5	23.3	39.5	22.0	39.1	25.0	79.0	54.2	79.0

Ref.: General Directorate of State Meteorological Works – Tufanbeyli Meteorological Station (1986-2004)

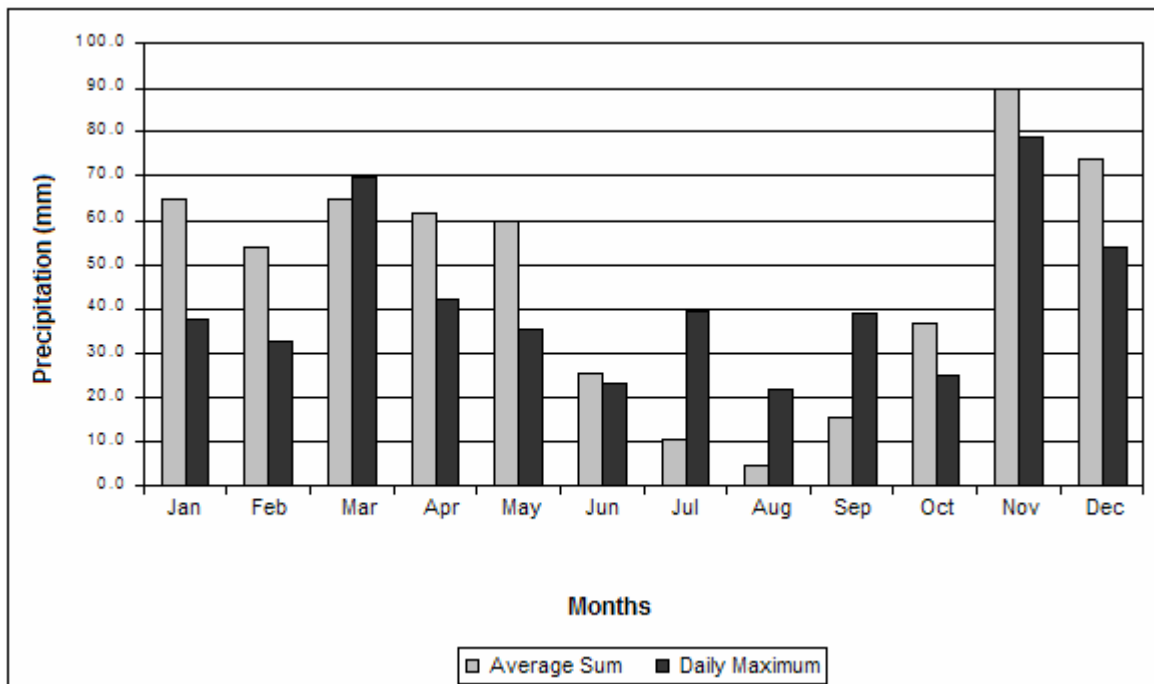


Figure IV-12 Monthly Precipitation Data (1986-2004)

Relative Humidity

The lowest level of relative humidity is measured in October as 60% in Adana Province. In July, relative humidity increases upto 68%. Average annual relative humidity is 65-66% (Adana Governorship, 2003). Relative humidity data for the region are presented in Table IV.12.

According to the data recorded in Tufanbeyli Meteorological Station between 1986 and 2004, relative humidity in the area containing the Project Site is 57%. Average maximum relative humidity (73%) is observed in February, and average minimum relative humidity (38%) is observed in August. Distribution of relative humidity according to months is given in Figure IV.13.

Table IV-12 Relative Humidity Data Recorded in Tufanbeyli Meteorological Station

Relative Humidity	Months												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Average (%)	71	73	68	60	58	50	39	38	39	53	65	72	57
Mniimum(%)	2	8	2	2	3	3	2	1	1	2	1	2	1

Ref.: General Directorate of State Meteorological Works – Tufanbeyli Meteorological Station (1986-2004)

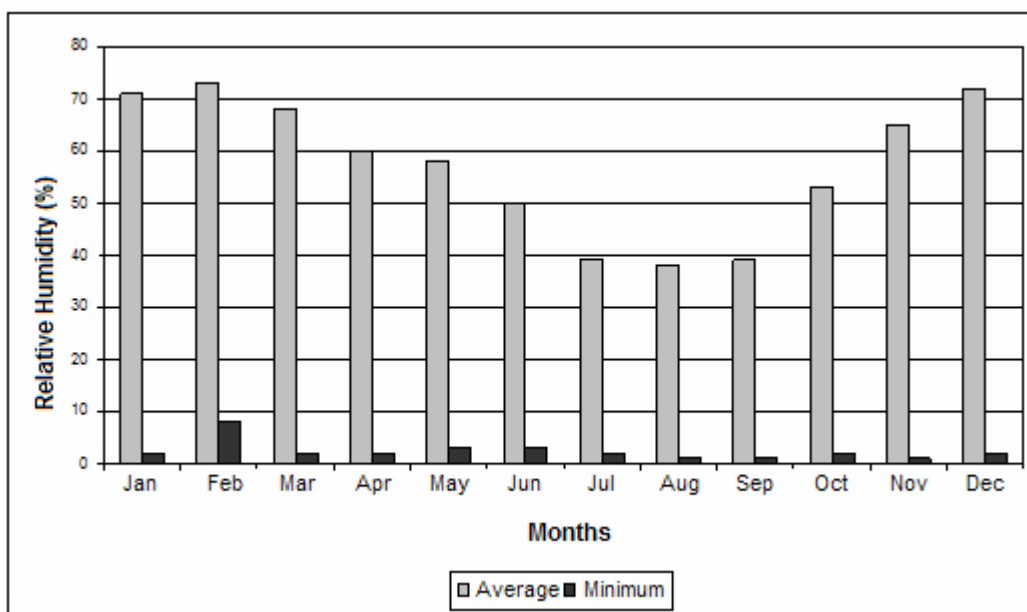


Figure IV-13 Relative Humidity Values (1986-2004)

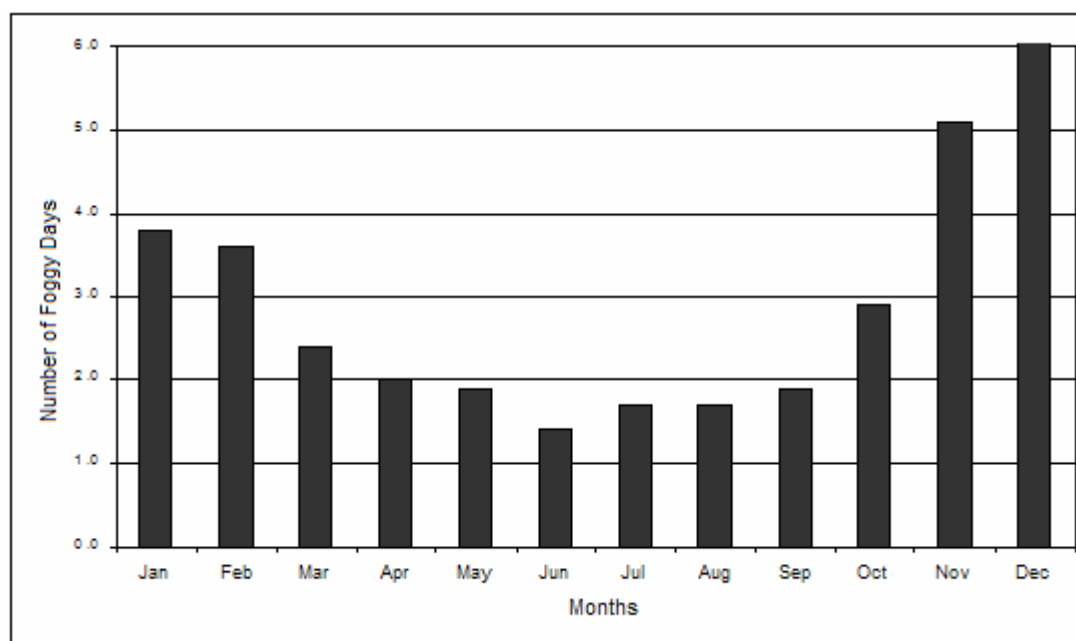
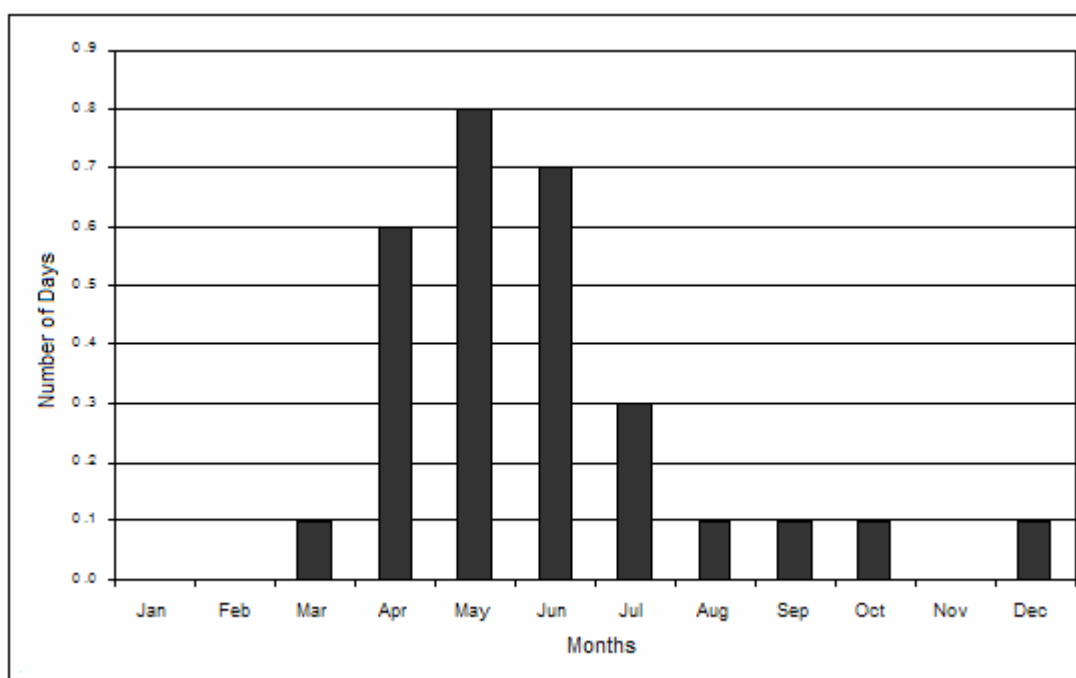
Days with Specific Meteorological Properties

Number of days with specific meteorological properties is given in Table IV.13. the profiles obtained based on these data are presented in Figures IV.14, 15, 16 and 17.

Table IV-13 Number of Days with Specific Meteorological Properties (1986-2004)

Type	Observation Period (year)	Average Annual
Average count of foggy days	17	29.9
Average count of days with hail	17	2.7
Average count of days with frost	17	24.2
Average count of days with thunderstorm	17	13.6

Ref.: SMW, 2005

**Figure IV-14** Monthly Distribution of Foggy Days (1986-2004)**Figure IV-15** Monthly Distribution of Days with Hail (1986-2004)

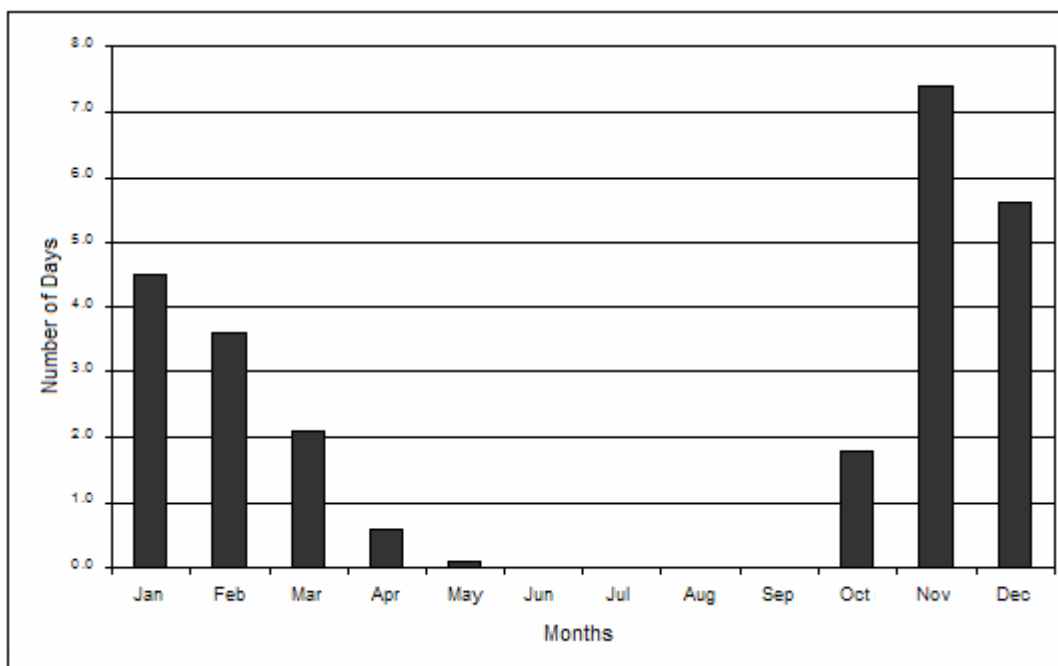


Figure IV-16 Monthly Distribution of Days with Frost (1986-2004)

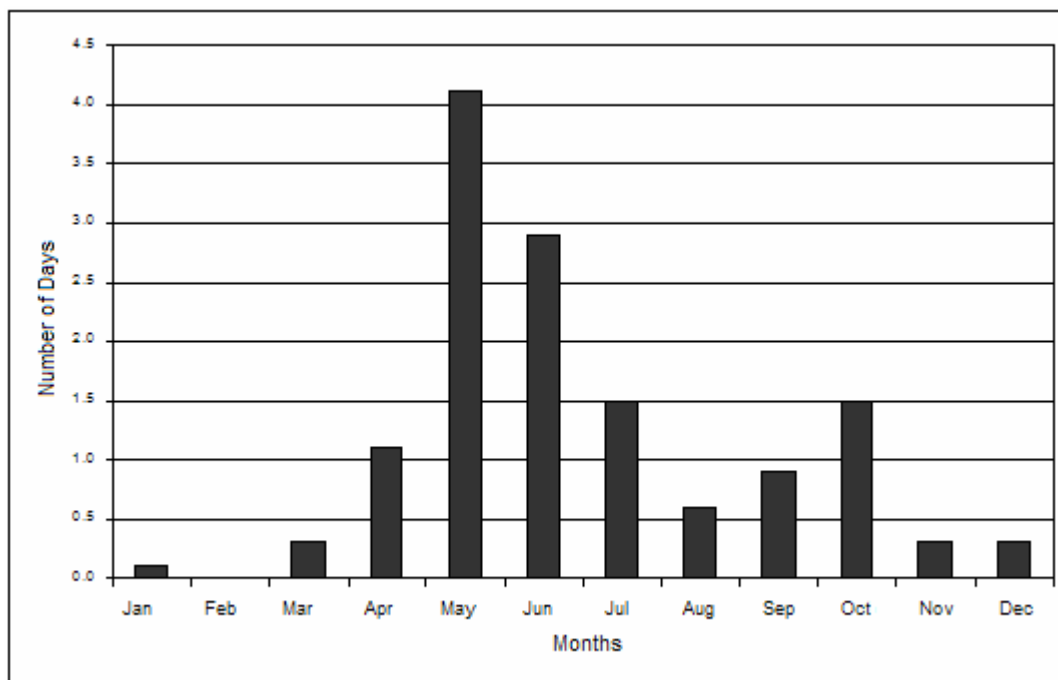


Figure IV-17 Monthly Distribution of Days with Thunderstorm (1986-2004)

Water to accumulate in the dam reservoir will not result in climate change in the region. Also, the Project facilities will not contribute to global warming.

IV.2.2 Geological Characteristics (examination of physicochemical characteristics of the Project Site and quarries under the titles of tectonic movements, mineral resources, avalanche, unique formations, snowslide, flood and rockfall, presentation, geological map with scale of 1:100000, 1:25000 and/or 1:5000)

Geological details about the Project Site are arranged according to the Engineering Geology Report prepared by Belirti Engineering Consultancy and Trading Inc., and they are presented in this section.

General Geology

The geological study area lies in the western part of the Eastern Taurus. There has been a differentiation of various rock communities and different unions in terms of rock type and structural characteristics. The geological deposit in which the Project Site lies was named as Geyikdağı union as a result of the studies carried out by the General Directorate of Mineral Research and Exploration (MRE) and Turkish Petroleum Corporation (TPAO) and by certain scientific researches as well (Özgül et. al., 2002). This union covers geological formations containing fossils within a range from Precambrian (Infracambrian) to Cambrian and Tertiary. Geological maps, cross-sectional views and the general geological map of the Project Site are presented in Appendix-G.

Stratigraphic Geology

In this section, the geological units (formations) outcropped around the Project Site are introduced in the order from bottom to top. The stratigraphic columnar cross-sectional view of the region is given in Appendix-G.

Emirgazi Group (Ce)

This is the oldest rock unit in the Project Site and in the Eastern Taurus, and it was named as Emirgazi Formation before (Özgül et.al., 2002). This group is then redefined, and separated into two formations as Kozan (bottom) and Koçyazi (top). Besides, researchers divided Kozan Formation into two members as Oruçlu and İçmetepe. This formation is accepted to be Infracambrian – Precambrian aged, and Koçyazi Formation as Early Cambrian aged.

This group does not lie in the Project Site but since it is included in the stratigraphic deposit. Therefore it was not defined in the report. This group is spread over in a wide area in the region, and it is traceable in Feka – Saimbeyli. It is disintegrated at low-medium level, and its surfaces of dissociation are represented by greenish brown colored intermediate level of marble-dolomite and sandstone with quartz and mica and quartz sandstone with greenish-bluish grey shale and siltstone. Sandstone levels are thin-moderately stratified, include mica in patches and composed of large grains. Stratification is inapparent in some parts. It is rigid and durable thanks to its texture with quartz.

Specularite fillings are the characteristic property of it. Shale, observed in succession with sandstone, is thin grained, moderately disintegrated, thin stratified and laminated in patches. It is clay cemented and mostly rigid at low-medium level and indurable. Its indurable levels are frequently observed in slopes of highways. Limestone-marble levels are traceable generally in the form of intermediate level or glass within Emirgazi Group. Dependant on metamorphosis, these thin stratified limestone-marble levels disintegrated at low level-undisintegrated with dark green-ash-green colored are sometimes laminated with their linear fair-dark colors. They are generally rigid-very rigid and durable. The last component of the group at the top is moderately-thick stratified, purple colored quartzite with green and greenish grey siltstone in patches and intermediate level quartz sandstone (quartzite).

Middle Cambrian aged limestone of Değirmentaş concordantly overlies Emirgazi Group. According to former researches, thickness of the group is greater than 1000 m.

Emirgazi Group is traceable along Feke-Kozan highway in Feke District and in certain parts of Feke-Saimbeyli highway. It is not traceable in the Project Site.

Değirmentaş Limestone (Cd)

This unit is composed of dolomite and limestone, and it was first named by Demirtaşlı in 1967. In former researches, this formation was referred to as Değirmentaş Limestone or Değirmentaş Formation. This formation is Middle-Late Cambrian aged.

The formation is defined here since it is included in stratigraphic deposit although it is not present in the Project Site. This unit starts with a level containing dolomite and flintstone. Its components towards top are dark green-grey colored dolomite and black-dark grey colored limestone. Limestone is dominant in this formation. Limestone is disintegrated at low level or undisintegrated. It has a massive appearance with medium-thick strata, which become insignificant toward upper levels. It forms the steep slopes in the region. Cave formations due to fault lines are observed in some sections. There is reddish limestone in the topmost part of the formation.

This formation is concordantly overlaid by Armutludere Formation. Thickness of Değirmentaş Formation was measured as 100-125 m.

Değirmentaş limestone is traceable along Feke-Saimbeyli road and Feke Kozan road, in narrow areas. It is intraceable in the Project Site.

Armutludere Formation (Oa)

This formation, composed of sandstone and shale, was first named by Demirtaşlı in 1967. Name of this formation was used in all studies carried out in the region. It is Late Cambrian-Early Ordovician aged.

It is widely observed in the south of the region, and it is formed through succession of sandstone-shale-claystone-siltstone. These are generally green-greyish yellow-green and moderately disintegrated or highly disintegrated in patches. In disintegrated parts, it is indurable, brittle and faulted. These are in lateral and vertical transitions with each other. They are generally very thinly stratified and laminated. Limestone and siltstone levels contain fossil in patches. According to the scientific researches carried out in the region, this formation contains a large quantity of trilobite and graptolite fossil. Black-dark grey limestone is observed in the lower parts of this formation. Shale and sandstone were also observed within this limestone. Surface flow is frequently observed. Local avalanches were observed within this formation along Feke-Akkaya road and Akkaya-Kozan road. It was discovered that this unit loses its durability upon contact with water, and thus it causes such mass movements.

Halityayla Formation overlays this formation with angular discordance. Thickness of this formation was measured as 1500 m in former researches.

This formation is traceable along Kozan-Feke highway, near Akkaya Village. It is not traceable in the Project Site.

Halityayla Formation (Sh)

This formation was named by Demirtaşlı in 1967. It contains the conglomerate with quartzite-quartz member at the bottom and sandstone at top. Gravels of the conglomerate, which is cornered-semi cornered, poorly sorted and thickly stratified at the bottom, are mostly quartz. Moderately stratified, jointed, laminated, graded and cross-stratified sandstone is present in upper levels. This formation is purple and grey colored, and settled in a shallow and high-energy medium. Since it does not contain fossil, its age was determined as Early Silurian considering the ages of the underlying and overlaying formations.

Ayitepesi Formation concordantly overlays this formation. Thickness of this formation was measured as 300 m.

This formation is traceable in the south of Saimbeyli District, near Gürleşen Village. It is not traceable in the Project Site.

Ayitepesi Formation (Da)

This formation is named by Özgül et.al. in 1973. It may be observed in an area extending to Kayseri and Sivas. It is referred to as this name in all the studies carried out in the region. Its age is Early Devonian.

It was formed through a succession of quartzitic sandstone-limestone-shale-siltstone. There is transition into dolomite toward upper layers. Quartzitic sandstone level

is white-cream colored and is rigid-medium rigid. The formation is generally moderately-thick stratified. Limestone level is dark grey-dark green colored, and has a dense calcite vein content. It is poorly disintegrated with a yellowish green surface of disintegration, and it is rigid-durable. The formation is generally thin-moderately stratified. Shale level is dark grey and weak-indurable. In utmost parts of the formation there is a dark grey colored thin dolomite level.

Şafaktepe Formation concordantly overlays Ayitepesi Formation. Thickness of Ayitepesi Formation is given as 500 m in former studies.

The formation is observed along Feke-Saimbeyli road. It is not observed in the Project Site.

Şafaktepe Formation (Dş)

This formation was given this name by Demirtaşlı in 1967. Similar to Ayitepesi Formation, it is observed in a wide area extending to Kayseri and Sivas. It is Middle Devonian aged.

This formation is not present in the Project Site but since the stratigraphic deposit contains it, it is defined here. Şafaktepe Formation, which concordantly overlays Ayitepesi Formation, is represented by sandstone in the bottom and dolomite at top. It is dark grey and blackish in color, and it is thick-very thick stratified. It has a transition zone to dolomitized limestone. Dolomitized limestone levels are grey-dark grey, rigid at medium level, thickly stratified and has a massif appearance. The formation contains such discontinuities as medium-level joints and cracks. These levels of the unit contains a large quantity of fossil, and it generally displays coral traces.

Gümüşali Formation concordantly overlays this formation with gradual transitions. Thickness of Şafaktepe Formation was given mentioned as 750 m in former studies.

This formation is observable along Feke-Saimbeyli road. It is not observed in the Project Site.

Gümüşali Formation (Dg)

The formation was given this name by Demirtaşlı in 1967. Like other Devonian-aged formations this may also be observable in a wide area extending to Kayseri and Sivas. Its age is Late Devonian.

This formation is not present in the Project Site but since it is included in the stratigraphic deposit, it is defined in the report. The characteristic property of the formation is its intermediate levels containing a large quantity of coral and brachiopod fossil. This formation starts with thinly stratified dark green limestone level, and besides this it

contains green-yellowish green levels that are disintegrated at low-medium degree with intermediate shale levels. These levels are generally thinly stratified and densely jointed. Moving upward, the deposit displays succession of limestone-sandstone-claystone-shale-mudstone. This dark green-grey-black formation is thin-moderate-thick stratified, and it contains a large quantity of fossil.

Ziyarettepesi Formation concordantly overlays Gümüşali Formation. Thickness of Gümüşali Formation was taken as 500-600 m in former studies.

This formation may be observable along Feke-Saimbeyli road. It is not observed in the Project Site.

Ziyarettepe Formation (Cz)

The formation was given this name by Özgül in 1973. Its age is Early Carboniferous. The formation is composed of two levels: sandstone, limestone and marl at the bottom and clay-limestone at top. The levels as the succession of sandstone, limestone and marl starts with a thin bituminous shale level, and is followed by the succession of sandstone, limestone and marl strata towards the top portion. This deposit is thin-medium stratified and jointed and has a color combination of greyish yellow and brown, and there is a gradual transition to limestone levels. These levels are represented by a deposit of grey, black, medium-thick stratified, jointed limestone with cracks.

Yiğiltepe Formation overlays Ziyarettepesi Formation with angular discordance (Tutkun, 1989). Thickness of Ziyarettepesi Formation was given as 350-400 m.

This formation can be observed in a wide area in the east of Saimbeyli. It is not observed in the Project Site.

Yiğiltepe Formation (Py)

The formation was given this name by Demirtaşlı who was conducting studies for the MRE in the region in 1967. Since it contains a large amount of limestone, it is also named as Yiğiltepe Limestone. Its age is Late Permian.

The formation is observed along Feke-Saimbeyli. It starts with a white-yellowish green quartzite layer. Quartzite is medium-thick stratified and keeps its integrity. It is rigid-very rigid and moderately jointed. Its joint surfaces are planary-flat and it contains quartzite filling. It is generally observed in the form of glass, and it was traced at a width of 20-30 m.

Limestone overlaying quartzite layers is grey-black, keeping its integrity and is thinly-moderately-thickly stratified. It is moderately jointed. Joint surfaces are planary-flat, mostly free of filling and display traces of melting. Claystone and sandstone bands are

observed within limestone layers. These layers modify appearance of the formation as if it contained plates. It frequently displays a curly structure. The formation has a transition zone to dolomite, and it presents a massif structure. Dolomite in these layers is dark green-grey and some layers are carstic. Lithologic units which constitute the formation are traced as ridges of strata. Instability problems due to flow and rupture have been observed along ridges of strata.

Katarasi Formation concordantly overlays Yiğilitepe Formation. Thickness of Yiğilitepe Formation was taken as 200-400 m in former studies.

This formation may be observed along Feke-Saimbeyli road. It is not observed in the Project Site.

Katarasi Formation (TRk)

The formation was given this name by Demirtaşlı who was conducting studies for the MRE in the region in 1967. Its age is Early Trias.

The characteristic property of the formation is its thinly stratified yellow-green-grey-purple claystone-marl which is laminated in patches. It was observed on the road to Eyüplü Village (see Figure IV-18). There is a transition to yellowish green limestone in upper layers where amount of carbonate is more. These thinly stratified layers are rich in fossil content and densely jointed.



Figure IV-18 Yellow Marl-Limestone Layers Observed on the Road to Eyüplü Village

Köroğlutepesi Formation overlays Katarasi Formation with angular discordance. Thickness of Katarasi Formation was given as 200 m in former studies.

The formation may be observed near Beypinari Village in the northwest of Eyüplü Village. It is not observed in the Project Site.

Köroğlutepesi Formation (JKk)

The formation was given this name by Demirtaşlı who was conducting studies for the MRE in the region in 1967.

Köroğlutepesi Formation starts with Dogger strata where it overlays Katarasi Formation. In different parts of the study area, it transgressively overlays different and older formations. Jura-Cretaceous limestone is widely observed in the region. It is widely outcropped near Tufanbeyli in the north of Sarız (Özgül et.al., 1973), in Feke and Kozan (Ayhan, 1978; Özgül et.al., 2002), near Saimbeyli and in Bakırdağ and Alaylıdağlar (Metin, 1983).

Age of the formation is Jura-Cretaceous. It is widely observed in near Tirtat and Saimbeyli. Lithologic units of this formation is dominant in the tallest mountains in the region (Figure IV-19).



Figure IV-19 A General View from Köroğlutepesi Formation

This formation is represented by a thick carbonate deposit. There is dolomitic layers at the bottom and there is black, dark grey, dark blue and maroon limestone. It is generally poorly disintegrated or disintegrated. It is carstic along surfaces of disintegration. Traces of carstic structure are frequently observed along planes of strata and other discontinuities. There are also such carstic structures a caves in elevated sections of the

region (see Figure IV-20). Red terra rosa clay was formed through accumulation of material containing clay (doline) and gravel in flat areas through settlement of limestone along carstic zones. Thickness of the formation is about 3-10 m.



Figure IV-20 Cave Formation in K ro lutepesi Formation

The deposit contains dolomitized layers, and it includes a large quantity of foraminifer. The unit has a curvy and faulty appearance due to the tectonic occurrences it has been through. Besides, it is traceable as vertical or almost-vertical strata along G ksu Valley. Problems that may arise in the route of the energy tunnel due to this are explained in the next sections.

K ro lutepesi Formation in the study area, especially along G ksu Valley and typically between Aksaa a  and Kaleboynu villages, was observed such that it imbricated onto Paleocene-Eocene aged Hocabet Formation in the east and Late Cretaceous aged Yaniktepe Limestone in the north of the study area. There are many imbricated structures within this unit as well.

K ro lutepesi Formation is overlaid by Late Cretaceous aged Yaniktepe Limestone. Thickness of K ro lutepesi Formation is about 1500 m.

The formation may be observed in a wide area in the Project Site. It may be observed at the location of the stage I Weir, along the stage I tunnel route, stage II forebay, HPP location, transportation tunnel to Hocabey Weir and in narrow zones along transmission tunnel route.

Yaniktepe Limestone (KY)

Upper part of the unit called K ro lutepesi Formation is generally white and thickly stratified. It is composed of limestone rich in rudist shell particles. Sediments of Late Cretaceous can depart from the comprehensive sediment from this level on. This layer with rudist content was named as Yaniktepe Formation ( zg l et.al., 1973). Yaniktepe Limestone may be widely observed in the region. It covers a large area especially near G zelimk y, Tufanbeyli (Metin et.al., 1982) and in Bakirda ları (Metin, 1983).

The formation is mostly beige-white-cream-grey and is lowly-moderately disintegrated. Its surfaces of disintegration are yellowish green. It is thinly-moderately stratified with thick stratification in patches. It is densely jointed and contains cracks. As explained above, it contains a considerable amount of rudist shell. It may be identified through its carstic melting traces.

The fault lying in the NE-SW direction crossing the Project Site parallel to G ksu River is 50 km long, and it forms a structural component of significant importance. This fault was named as Kaleboynu Fault in former studies. It was formed through imbrication of Middle Jura-Early Cretaceous aged K ro lutepesi Formation onto Paleocene-Eocene aged Hocabet Formation and Late Cretaceous aged Yaniktepe Limestone lying in the north of the study area. Besides, as it may be observed in Kaleba ı Tepe in the west of Kaleboynu Village, it is inclined toward west at 50-60 degrees. The aged unit in the bottom imbricated onto the young unit inverted in the bottom block once it was pushed from west toward east. This fault cannot be traced since it is overlaid by the young units from Kirikkuyu Settlement of Kaleboynu Village to the north.

Extent of Kaleboynu fault outside and to the south of the study area was examined, and it was observed that fault plane becomes almost vertical and inclined towards east. Considering all these, the units affected as a result of this inclined structure along the 50-km path of the fault and thus the characteristics of the fault can be said continuously varying.

Considering tilting directions of the folds, which are the general tectonic structure in the study area, and inclination directions of the reverse faults, compression forces are more effective moving from the west to the east. Since the youngest unit that was affected by Kaleboynu Fault is Paleocene-Eocene aged Hocabet Formation, its age shall also be Eocene.

The borderline between K ro lutepesi Formation and Yaniktepe Limestone was not observed clearly in the studies conducted before, it was not shown on map, and an explanation including both was made. Thickness of the formation is around 200 m.

Since the borderline cannot be clearly observed, it could not be plotted on map. Thus, this formation will be observed along tunnel-channel route.

Hocabet Formation (Th)

The formation was given this name by Tutkun in 1989. Its age is Paleocene-Eocene. Similar layers are defined as Güzelinköy Formation and included in the formations grouped under Late Cretaceous age (Metin et.al., 1982).

It originally a succession of limestone-claystone-sandstone and marl. Typically, it is traceable near Yamanlı II Stage I penstock route and along the path connecting Stage II Weir to transmission channel (see Figure IV-21 and Figure IV-22). All the units composing the formation are in lateral and vertical transitions with each other.



Figure IV-21 A View from Hocabet Formation near Penstock Route



Figure IV-22 General View of Hocabet Formation along the Route of Stage I Transmission Channel

Limestone was dissociated into beige-white-cream colored small-grains at moderate level. Surfaces of dissociation are yellowish green in color. The formation is thin-very thin stratified and joints are dense in it. Joint surfaces are filled with mostly clay and FeO.

Claystone layers are green and they dissociated at low-medium level. They have a distinctive yellowish green color in their surfaces of dissociation. Joint surfaces are significantly thick (1-5 mm) and filled with clay. Along these clay-filled zones, stratification faults were observed. In such sections instable slopes are frequently observed.

Sandstone layers are pink-fair red-yellowish colored. Besides these, layers with fair grey-grey-yellow and reddish color are frequently observed as well. It is generally small-grained and densely carbonate-cemented. Grain size becomes larger and gains a conglomeratic appearance in some layers. It is thinly stratified and contains a large quantity of joints. Joint surfaces are planar-flat and unfilled.

Marl layers are mostly observed near penstock route. Marl is beige-cream-yellow-white and weak cemented and instable.

Thickness of the formation is more than 700 m, and its age was determined as Paleocene-Eocene in former studies.

The formation may be widely observed in the Project Site. It may be traced along Stage I energy tunnel route, near penstock route and the other locations where it may be traced are Stage II Weir location and reservoir area, Stage transmission channel, transmission channel to Hocabey Weir and the route of the transmission channel.

Sümbüldağı Formation (Ts)

The formation was given this name by the research group of the MRE. This formation was assessed in two separate formations as Sümbüldağı and Paşali (Ayhan, 1988). Its age is Miocene.

Paşali Formation is represented by a thick deposit of conglomerate. It is observed along the route of the Stage I energy tunnel (see Figure IV-23). There is the conglomerate, which derived from the geological formations present in the region, is composed of gravels with carbonate origin. This conglomerate contains gravels with few corners and it is round while some part of it is moderately round. Gravels are carbonate cemented. The formation is mostly medium-thick stratified.



Figure IV-23 Conglomerate Layers of Sümbüldağı Formation Observed Along the Route of Energy Tunnel

No fossil content was found in the formation in the scope of former studies. Its age was determined as Miocene considering its stratigraphic location. Thickness of the formation was given as 200 m in these studies.

It may be observed along the route of the Stage I energy tunnel and near Kaleboynu Village and Kirikkuyu Settlement.

Slope Debris (Qym)

Slope debris is generally clay-cemented and is composed of limestone blocks and gravels. It was formed completely as a result of bonding gravels and blocks of the geological units in the region tightly with clay and infrequently with tight carbonate cement. Gravels contain few corners. It is traceable in inclined slopes. Thickness of the unit is between 1 and 15 m.

Slope debris is traceable especially along the route of the Stage I penstock and different points in the transmission channel.

Alluvion (Qal)

Alluvion is the sediment composed of large and small materials transported by Göksu River. Large material is dominating in sections of the river where energy is low, and thin-grained material is dominating in sections where energy is low. It is mainly composed of gravel-sand-silt and blocks. Earth and gravel within alluvion is utilized as construction material in the surrounding villages and districts.

Alluvion may be observed near the Stage I power plant and at different points of the Stage II transmission channel.

Travertine Formations (Tr)

There are also travertine formations in the surveying area. These formations are observed especially in Hocabey Weir location and along the transmission channel (see Figure IV-24 and IV-25).



Figure IV-24 Travertine Formations at Hocabey Weir Location



Figure IV-25 Travertine Formations Observed in Hocabet Creek

Most probably, travertine formation resulted from settlement from water with carbonate coming out to ground through fault zones. Flow rate of the water resource is the main factor that determines thickness of the travertine bands. It is beige or pink colored and it is yellow in patches. It is moderately hard, and dense-textured. It is moderately jointed. Joints are separated by 1-3 m. Joint surfaces are wavy, coarse and mostly with

spaces. There is scree of loose gravel and soil cover with a thickness of 0.1-1.5 m on the unit. It is rich in fossil content in some locations.

Travertine is observed at Hocabey Weir location, reservoir area and along transmission channel, at different points.

Structural Geology

Autochthon rock units, which are outcropped in the surveying area, are located in Geyikdağı Union. Autochthon rock units present a continuous deposit from Ordovician to Miocene with some minor discontinuities. Rocks which settled between Ordovician and Early Carboniferous period and characterizes the medium of continental shelf retained over water due to compression tectonics at the end of Early Carboniferous period. After a short erosion period, the medium settled once more. In this medium, rock units with Late Permian and Trias age, showing shallow marine characteristics settled. Compression tectonics dominated again towards end of Trias and resulted in terrigenous sediments. At the end of Eocene, the geologic status of the region was governed by compression tensions in SE-NW direction, and it gained a wavy structures with faults. This is verified by reverse faults in NE-SW direction and normal and inverted folding axis in the same direction. As a result of compression tectonics building its effectiveness, there occurred terrigenous sediment while the basin was being elevated. After a short erosion period, Late Miocene-aged Sömbüldağı Formation settled with angular discordance.

Assessment of Construction Locations in terms of Engineering Geology

Geological conditions of locations of structures planned to be built in the scope of the Project are presented separately in this section.

a) Project Facilities in the Scope of Stage I

Stage I Weir Location and Reservoir Area

Limestone belonging to Jura-Cretaceous-aged Köroğlutepe Formation is present in reservoir area and location of Stage I weir, which is planned to have a height of 16.5 m.

In the light of site surveys, limestone is highly carstic in some locations. In this case, holding water by means of a 16.5-m high weir might be risky. Therefore, drilling works including pressurized water test for determining permeability of limestone in reservoir area should be conducted following opening of transportation roads.

No problem is anticipated in terms of bearing capacity of the rock (limestone) located in weir location. Yet, a drilling study is necessary for verification of this. Locations of limestone layers are vertical and/or inclined at a degree close to 90. This situation may result in rock slide, blocks breaking apart or rockfall. Therefore, excavation works in this

area shall be carried out carefully, and necessary measures shall be taken. Besides, the structure should be built on a stable rock after excavation of top soil.

Stage I Transmission Tunnel

Transmission tunnel was designed to have a diameter of 3.5 m and a length of 8,212 m. considering the new location of the weir, it would be 9,000 m long. Construction of the transmission tunnel is the most difficult and troublesome part of the Project.

The tunnel route passing on the left shore travels in parallel with an important structural fault (Kaleboynu Fault) as it is explained in the geology part above. Since this fault is covered with the young units moving toward north from Kaleboynu Village, it cannot be traced but it is known to exist. The structural discontinuity in parallel to the tunnel route is one of the undesired situations. These situations include continuous stability and water leaks, etc., and these problems may result in lags and failures during boring works. Hence, the right shore alternative for the tunnel route as planned before is worth assessing.

The transmission tunnel will be opened in Köroğlu Formation at Jura-Cretaceous age, from the beginning of the route to km 6+300. The formation can be differentiated with its thick carbonate deposit. This deposit contains dolomitic layers in the bottom and black, dark grey, dark blue and maroon limestone. the deposit is disintegrated or it keeps its integration in some parts, and its surfaces of disintegration are carstic. Traces of carstic formation were observed along stratum planes and other discontinuities. The deposit contains dolomitized layers in some parts. Due to strong tectonism that this unit has been undergone, it contains faults and cracks. This implies that many fault zones will be encountered along the tunnel route. Water leaks will be significant through these zones. Besides, the unit is traceable along Göksu Valley with its vertical stratification. This is very likely to cause important problems along the tunnel route. The expected problems are rock slides, blocks breaking apart and accumulating in the tunnel, discontinuities and continuous and effective and/or instantaneous water leaks along stratum planes.

After this point the transmission tunnel is planned to pass through Paleocene-Eocene aged Hocabet Formation. It may pass under a layer composed of avalanche and debris flow between points 6+350 km and 6+950 km. Water filtered through avalanche will inevitably leaks into the tunnel. This will cause important drainage and stability problems in the tunnel.

Surge Tank and Penstock

A surge tank with a diameter of 12 m and a penstock planned to have a length within a range between 378 and 479 m will be constructed. The surge tank will be constructed in limestone-sandstone-claystone-marl of Hocabet Formation with Paleocene-Eocene age. These units are mostly thinly stratified and lowly or moderately disintegrated,

and they have cracks. They have fragmental structure. The surge tank will be located in the disintegrated layers of the formation. Shotcrete, wire mesh and steel revetment will be utilized to support the structure.

Penstock route partially passes through limestone-sandstone-claystone-marl of Hocabet Formation.

Stage I Power Plant Location

The same type of units belonging to Hocabet Formation mentioned above lies in the power plant location. No problem is anticipated in terms of bearing capacity. Existence of different sort of lithologic layers will result in different types of consolidation.

b) Stage II Project Facilities

Stage II Weir Location and Reservoir Area

There is different lithologic layers of Hocabet Formation in the right shore near the weir location and there is slope debris and debris flow in the left shore.

In the reservoir area, there is different lithologic layers of Hocabet Formation and alluvion and slope debris in some locations. No data pertaining to permeability values for these lithologic layers are present. Therefore, drilling studies should be conducted in the reservoir area. Besides, in order to establish the stability of slope debris in the reservoir area, terracing should be applied .

Transmission Channel - Tunnel

Geological survey and mapping studies were conducted along the route of the transmission tunnel with a length of 1000 m and a transmission channel with a length of 4180 m. The geological formations through the route and potential problems were explained in these studies.

There will be slope debris to go through between km 0+000 and 0+080 of the route of the transmission channel. Slope debris was formed as a result of gravels and blocks of the geologic units in the region attached together with clay and carbonate cement. It is sometimes loose and contains no cement. It is observed as debris flow and it is completely unstable. Excavation of highly inclined slopes should be avoided when working in slope debris; all the necessary safety measures will be taken for excavation works. Moreover, channel excavation should proceed to the bed rock if it can be observed. Water leaks into surface may also take place.

The section of the transmission channel between km 0+080 and 0+825 will lie in alluvion. Alluvion is an uncemented brittle material that is composed of sand-gravel and

seldomly blocks. Therefore, excavation should be under control in this section, and forming inclined slopes should be avoided. There may be water leaks in this section as well.

The transmission channel will be located in limestone-claystone-sandstone-marl layers of Hocabet Formation between km 0+825 and 0+925. Crusher that will be available in the construction site can be utilized for excavation in this section. Blasting may be utilized in some points. No stability problem is expected to occur during excavation works. However, there may be some large blocks through the channel route. Therefore, excavation works should be kept under control.

There is alluvion between km 0+925 and km 1+420 in the channel route. Alluvion is an uncemented material that is composed of sand, gravel and blocks. Therefore, excavation should be under control in this section, and forming inclined slopes should be avoided. There may be water leaks in this section as well.

The transmission channel will be located in limestone-claystone-sandstone-marl layers of Hocabet Formation between km 1+420 and 2+600. Crusher that will be available in the construction site can be utilized for excavation in this section. Blasting may be utilized in some points. No stability problem is expected to occur during excavation works. However, there may be some large blocks through the channel route.

There is alluvion between km 2+600 and km 3+050 in the channel route. Alluvion is an uncemented material that is composed of sand, gravel and blocks. Therefore, excavation should be under control in this section, and forming inclined slopes should be avoided. Excavation can be made using such excavation equipment as excavator, etc. There may be water leaks in this section as well.

The transmission channel will be located in limestone-claystone-sandstone-marl layers of Hocabet Formation between km 3+050 and 3+200. Crusher that will be available in the construction site can be utilized for excavation in this section. Blasting may be utilized in some points. No stability problem is expected to occur during excavation works. However, there may be some large blocks through the channel route. Therefore, excavation works should be kept under control. No groundwater or surface water problems are expected to occur.

There is alluvion between km 3+200 and km 3+650 in the channel route. Alluvion is an uncemented material that is composed of sand, gravel and blocks. Therefore, excavation should be under control in this section, and forming inclined slopes should be avoided. Excavation can be made using such excavation equipment as excavator, etc. There may be water leaks in this section as well.

The transmission channel will be located in limestone-claystone-sandstone-marl layers of Hocabet Formation between km 3+050 and 3+200. Crusher that will be available

in the construction site can be utilized for excavation in this section. Blasting may be utilized in some points. No stability problem is expected to occur during excavation works. However, there may be some large blocks through the channel route. Therefore, excavation works should be kept under control. No groundwater or surface water problems are expected to occur. Moreover, there is tunnel portal in this section. Presence of highly inclined lithologic units in portal structure may result in rockfall and pertinent safety measures should be taken.

The transmission tunnel was planned to have a length of 1000 m. Geologic surveys carried out before show that it will be located in Hocabet Formation. This series formed through succession of limestone, claystone, marl and sandstone keeps its integrity. There is some disintegration in some joint surfaces. It is durable and rigid. Members of the unit are mostly crossed by joints that are shortly apart from each other. Low-flow rate water leaks coming from joint and stratum surfaces may also be encountered during tunnel excavation. This section falls into categories of mostly IV (massif, stratified and moderately jointed, fragmented with cracks) and marginally V (containing large amount of blocks and cracks) according to Terzaghi classification. According to the Rock Mass Rating (RMR) classification, it is mostly II-III (good-moderate rock), IV, disintegrated in patches, especially in fault-scissoring zones (weak rock) and NGI, mostly C (moderate) and marginally D-E (weak) according to Q classification.

There may be open joints, scissoring/fault and similar discontinuities and water leaks where joints are dense during tunnel excavation. Besides, joint groups and the instable blocks that may be formed by thin or moderately thick strata are the risks that shall be considered carefully for such media. Shotcrete and bolt will be kept present in the ceiling as a safety measure.

Hocabey Weir and Reservoir Area

The location of the Hocabey Weir and reservoir area are troublesome places as far as the geological conditions are concerned. Porous and indurable structure of travertine brings about the risk of water leaks from reservoir area. Thickness and location of travertine within Hocabet creek bed should be known regardless of the fact that a low weir is planned to be constructed. Therefore certain drillings should be made in reservoir area in order to observe the whole cross-section of travertine and underlying layers of Hocabet Formation as much as possible. Dependent on the results of these drilling studies, two options can be considered: one is removing travertine completely from reservoir area and the other is injection.

Transmission Channel

The transmission channel with a length of 1900 m will be located in a 450-500-m part of travertine starting from Hocabey Weir. Travertine is indurable and porous. For this reason, the crushers available on the construction site can be employed in excavation. There may be, in some locations, soil cover and disintegrated zone on travertine. Such

sections should be excavated. The transmission channel will pass through limestone, claystone, sandstone and marl of Hocabet Formation for approximately 600 m from this point on.

Crusher that will be available in the construction site can be utilized for excavation in this section. Blasting may be utilized in some points. No stability problem is expected to occur during excavation works. However, there may be some large blocks through the channel route. Excavation will be carried out in some highly inclined areas. Therefore, keeping excavation works under control is strongly recommended. No groundwater or surface water problems are expected to occur.

Besides this section, the route of the transmission channel will also be through limestone of K ro lutepesi Formation. These sections are thinly or moderately or thickly stratified, rigid, durable and densely jointed. Crushers will be employed for excavation. There may be utilization of blasting materials as well. No groundwater or surface water problems are expected to occur.

Forebay and Penstock

There is limestone of K ro lutepesi Formation in this section. These sections are thinly or moderately or thickly stratified, rigid, durable and densely jointed. Crushers will be employed for excavation. No groundwater or surface water problems are expected to occur.

Stage II Power Plant Location

In the last section of the Project, location of the Stage II power plant, there is limestone of K ro lutepesi Formation. These sections are thinly or moderately or thickly stratified, rigid, durable and densely jointed. They also include highly karstic zones. No bearing capacity problem is expected for these sections. It is necessary to conduct drilling studies to analyze the formation in terms of stability, permeability, etc. Drilling studies to be conducted following opening of the transportation roads for the power plant will include pressurized water tests and will be designed so as to give information about thickness of disintegration zone.

Necessary measures should be taken against such occurrences as block rupture and rock slide considering such discontinuities as vertical joints and strata observed during excavation for the power plant.

Natural Disasters

According to the Earthquake Map of Turkey, the Project Site lies in the earthquake zone degree three. The Project Site lies outside Eastern Anatolian Fault and Northern Anatolian Fault zones. The Earthquake Map of Turkey, earthquake and active fault maps of Adana and Kahramanmara  provinces, prepared by the General Directorate of Disaster

Affairs of the Ministry of Public Works and Settlement are presented in Figure IV.26, IV.27, IV.28 and IV.29, respectively.

Construction of the Project will be made in compliance with the Regulation on Buildings to be Constructed in Disaster Areas, effective since publication in Official Gazette numbered 23098 and dated 2 September 1997. All the necessary measures for the risk of earthquake will be taken.

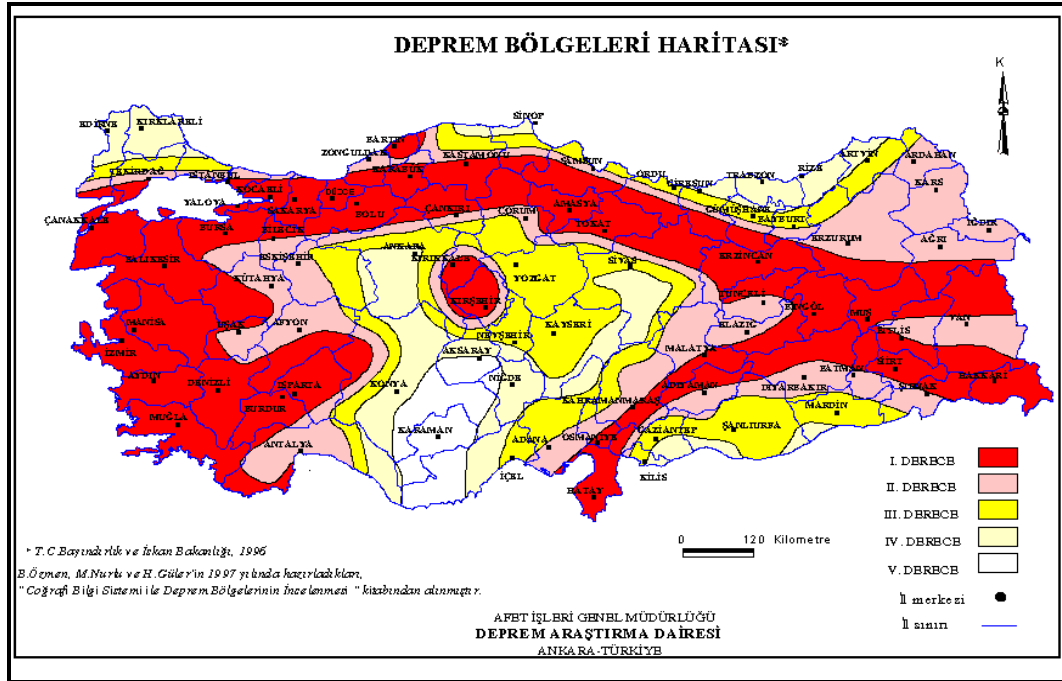


Figure IV-26 Earthquake Map of Turkey

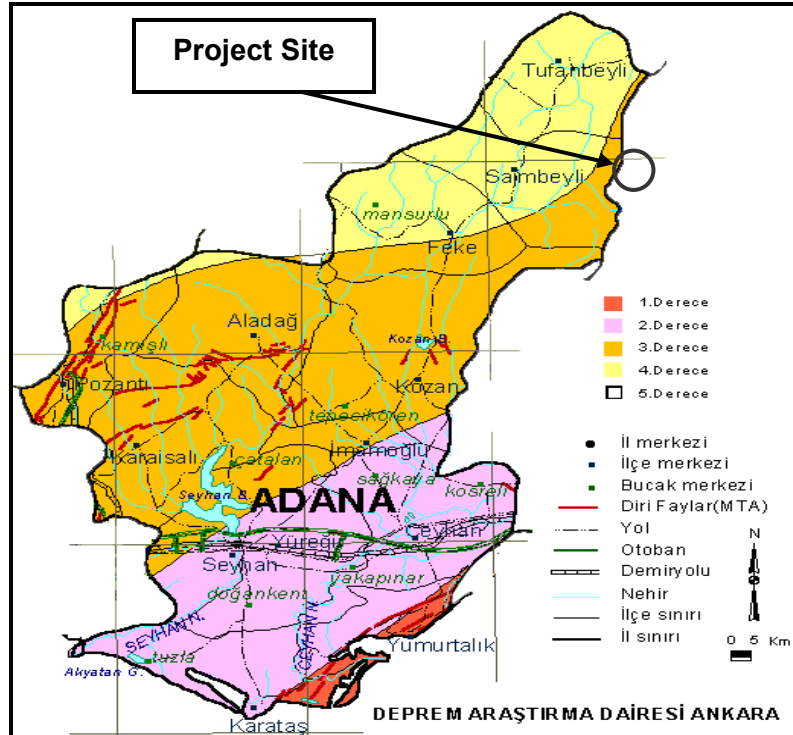


Figure IV-27 Earthquake Map of Adana Province

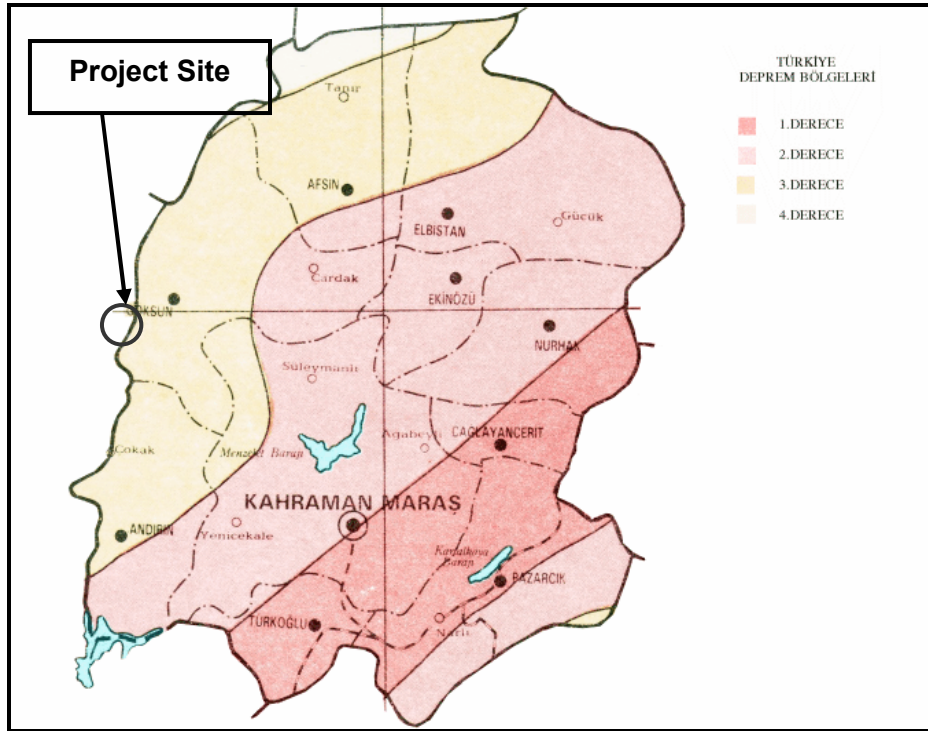


Figure IV-28 Earthquake Map of Kahramanmaraş Province

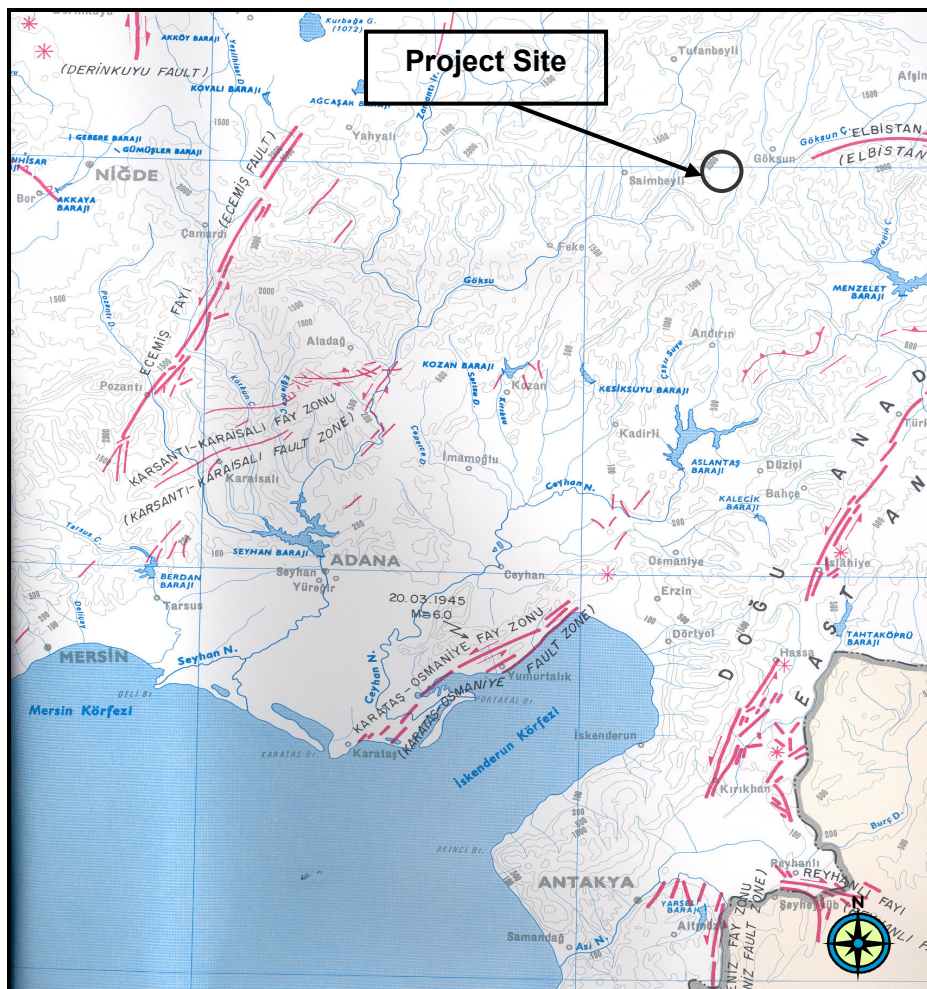


Figure IV-29 Active Fault Map of Adana Province and its Vicinity

A geological-geotechnical survey report will be prepared according to municipal plan based on the circular letter numbered 4343 and dated 31 May 1989, and it will be approved by the pertinent authority in compliance with the circular letter numbered 4256 and dated 4 April 2003.

IV.2.3 Hydrogeological Properties of Groundwater and Thermal Water Resources (water levels, safe drawing values, flow rates of resources, present and planned utilization of resources)

Adana Province has generally an elevating topography from east, south and west to north starting with 14m and rising up 160 m. Since the establishment of the province, the need of potable-usage water is supplied from groundwater, and depth of drilling wells opened for the purpose of supply potable-usage varies from 20 m to 40 m. There is rich groundwater potential in the area starting from eastern, western and southern borders of residential area to the 50 m elevation line in north. Sources are getting fewer as going to the north. For this reason, the wells used for potable water demand of the province are generally between the elevation of 50 and 150 m and their number is 41. The water demand of industrial facilities within the residential areas is supplied by their own deep wells. Groundwater Potential of Adana Province is as follows:

Yumurtalik Coomb	: 12.48 hm ³ /yr
Ceyhan Kozan Coombs	: 120 hm ³ /yr
Lower Seyhan Coomb	: 500 hm ³ /yr
Karaisali Pozanti	: 3,041 hm ³ /yr
Tufanbeyli	: 14.5 hm ³ /yr

Table IV-14 Groundwater Resources in Adana

Municipality	Source	Information about Source
Karaisali	Incirli Source Karapinar Source	Ave. Flowrate.: 5 L/s Flowrate: 40 L/s
Feke	Agcapinar Source Vanis Source Ciglipinar Source Keklikcipinar Source	Flowrate: 4 L/s Flowrate: 8,5 L/s Flowrate: 9 L/s Min. Flowrate:0,25 L/s
Aladag	Yedigoz Source	Flowrate: 65 L/s
Hamdili	Akpinar Source	Flowrate: 10 L/s
Akoren	Eynel Source	Flowrate: 700 L/s
Ceyhan	Baglama Source	Flowrate: 1000 L/s
Gecitli	Catal Source	Flowrate: 9 L/s
Tufanbeyli	Koy Source	Flowrate: 35 L/s
Akcatelikir	Sekerpinar Source	Flowrate: 600 L/s
Kozan	Goz Source	Ave. Flowrate.: 100 L/s Min. : 60 L/s Max.: 300 L/s
Pozanti	Sekerpinar Source Deligoze I Source Deligoze II Source	Ave. Flowrate:600 L/s Flowrate: 9 L/s Flowrate: 100 L/s
Saimbeyli	Soguksu I and II Source Kayapinar Source	Min.:45 L/s, Max:500 L/s Min:32 L/s, Max:1200 L/s

Source: Adana İl Çevre Durum Raporu

There is a geothermal water resource located at lower slope of Bülbül Mountain, at a distance of 15 km to Haruniye, Adana. Water from this resource spills onto ground from a location, which is 10 m elevated. Properties of this resource are given in Table IV.15.

Table IV-15 Geothermal Water Resource in Adana

Geothermal Zone	Resource			Drilling		
HARUNİYE	Temperature (°C)	Flow rate (lt/s)	Capacity (MWt)	Temperature (°C)	Flow rate (lt/s)	Capacity (MWt)
	33	10	-	33,8	1	-

Source: Türkiye Jeotermal Envanteri, 1996

There are thermal water resources in Süleymanlı and Döngöle within the borders of Kahramanmaraş Province, and spring water resources near Elbistan-Ekinözü (Cela).

Thermal water resources in Süleymanlı are gassy, clear. There is iron oxide and sulphur precipitates in the water. Its flow rate is 6.5 lt/s. Spring water resources in Ekinözü are located in three different points. Flow rates of these three resources are 0.32, 0.072 and 0.94 lt/s. Water from these resources is classified as water with calcium carbonate.

According to the records of the SHW, there are eight irrigation cooperative and 82 wells in Kahramanmaraş. These wells are utilized for irrigation of a 2,558-ha area.

Since there is no agricultural area in the Project Site, there are no activities pertaining to groundwater utilization. Hence, there are no sinkshafts or deep wells in the Project Site.

IV.2.4 Hydrologic and Ecological Properties of Surface Water Resources

There is no significant discharge of groundwater in the Project Site. Göksu River is the most important surface water resource. Göksu and Zamanti rivers are the main tributaries of Seyhan River. Goksu River rises from the Sirlak springs, at an elevation of 1,900 m, in the southern slopes of the 2,601m-elevated Govdeli Mountain in the northeast of Upper Seyhan Basin. In this first part, with Atalti, Eskiayla and Cavlak springs rising from the slopes of Keçi Mountain, other small creeks and Sarlak springs form Sariz Creek.

Sariz Creek flows through the deep valleys of Tahtali Mountains in the southwest direction and reaches in Sariz District of Kayseri Province. Subsequently Dumanli Creek and Kuru Creek join to Sariz Creek. Sariz Creek joins Teke Creek arising from the slopes of the Soganli Mountain as a part of Tahtali Mountain and it joins Damlali, Keyfinin and Demircik creeks in the south of Tufanbeyli District of Adana Province. After this region Sariz Creek is called as Goksu River and flows in the south direction. Göksu River mixes with Demircik Creek, Goksu River flows through Dibek Mountains about 50 km. It directs toward west after it joins Kazan Creek which rises from the springs in the slopes of Dibek Mountains. The most important creek of lateral creeks on the right and left shore in this region feeding Goksu River is Saimbeyli Creek joining from right shore. Goksu River flowing through to southwest again reaches in Feka District. Asmaca Creek fed by the several sources in the slopes of Tahtali Mountains joins Goksu River from right shore in the southwest of Feka District.

Having passed over Feka District, Goksu River directs toward west forming a wide arc and continues its flowing through deep and rocky valleys in Gorbıyes Mountain Region (1,943 m elevation). In this part of the region, the river is fed by many minor creeks from both sides. The major creeks of these are Salam Creek and Balik Creek from the left shore. Menge Dam is located on 4.5 km upstream of conjunction of Salam Creek and Goksu River. Goksu River forms Seyhan River by joining Zamanti River which is other main tributary of Seyhan River on approximately 2.5 km downstream of the joining point of Balik Creek.

Drainage area of Göksu River at the axis of Yamanlı II Stage I weir is 1,696 km². The average annual flow rate of Göksu River measured at Çukurkişla Flow Measurement Station (FMS) numbered 1824, very close to the weir, is 310.41 million m³. According to the data obtained from the same FMS, the months in which Göksu River carries the most flow are March and April. The average monthly flow rates in these two months are 19.5 and 24.9 m³/s, respectively.

IV.2.5 Present and Planned Utilization of Surface Water Resources (Drinking and potable water, fishery, transportation, tourism, electricity generation and other sorts of utilization)

As stated above, the major surface water resource in the region is Göksu River. Göksu and Zamanti rivers are the main tributaries of Seyhan River. There were survey, planning, projection and construction activities from 1950s until 1997. Seyhan River is the fifteenth largest basin with a precipitation area of 20,450 km² out of a total of 25 basins in Turkey (DSİ Haritalı İstatistik Bülteni).

Present Facilities

There are several power plants to be constructed on Goksu River and the facilities in operation phase on Seyhan Basin are Seyhan, Kadincik I, Kadincik II and Aslantaş dams.

Planned Facilities

The number of facilities planned to be constructed on Göksu River is three. These projects are Feke, Menge and Kopru dams. Characteristics of these facilities are given in the following paragraphs.

Feke Dam and HPP

It is planned to locate on Goksu River, at 15 km southwest of Feke District of Adana Province. It is a rockfill type dam with the purpose of energy production. Thalweg elevation of the dam will be 482,00 m, total body volume will be 8.105.000 m³, elevation will be 133,00 m, total reservoir volume will be 507,90 hm³ and its install capacity will be 170 MW.

Menge Dam and HPP

It is planned to locate on Goksu River, at 30 km air distance from the northwest of Kozan District of Adana Province. At the location of the dam, thalweg elevation of Goksu River is 441.50 m. It is a concrete gravity-type dam with the purpose of energy production. Its elevation will be 41.50 m, total body volume will be 197,800 m³, total reservoir volume will be 41.32 hm³ and its installed capacity will be 33 MW.

Köprü Dam and HPP

It is planned to locate on Goksu River, at 14 km air distance from northwest of Kozan district of Adana Province. It is a rockfill type with an elevation from the base of 141.00 m. Crest elevation of Kopru Dam will be 450.00 m, total base volume will be 8,054,200 m³ and its reservoir volume will be 260.00 hm³. The dam is designed as 3 units

and its installed capacity will be 189 MW.

IV.2.6 Soil Properties and Land Utilization (physical, chemical and biological properties of soil, capability classes for land utilization, erosion condition and present utilization of soil)

The Project Site and the impact area is mostly composed of Limeless Brown Forest Soil (N). There is also Brown Forest Soil (M). These are limeless brown forest soil (N) and red Mediterranean soil (T). Besides these, there is rock and debris (ÇK) within the impact area. Detailed information about these soil groups is given below.

Limeless Brown Forest Soil (N)

Stratified limeless brown forest soil formed on schist, serpentine and crystallized limestone. Forest and bushes have grown in this soil. It contains dark grey or brown A₁ at top, red B that has a different structure or heavier and C or R or both at the same time at the bottom. Soil on schist has a fair color. Over limestone especially B is red.

Organic matter accumulation, lime wash, oxidization, clay and movement of oxides of Fe-Al from A to B. However, there is no development other than that of poor A₁ in steep slopes.

Calcareous formed from limeless brown soil is Permian aged. Schist and serpentine belong to Devonian and Mesozoic, respectively. Material formed through dissociation of serpentine and some sorts of schist lacks free lime. Material dissociated from limestone is rich in lime content. It is washed up within long time. Soil does not produce foam although it lays on limestone. However, rapid wash of lime formed through dissociation of gravels at top will slow down the formation process.

Calcareous formed from limeless brown soil is Permian aged. Schist and serpentine belong to Devonian and Mesozoic, respectively. The material formed through dissociation of serpentine and schist lacks free lime. The lime formed through limestone is rich in lime content. It is vertically washed up under heavy precipitation and within a long time frame. Soil does not produce foam although it lies on limestone. However, the lime added into soil is rapidly washed up formation process will slow down.

Brown Forest Soil (M)

Brown forest soil forms on the main material rich of lime. It has A (B) C profiles and gradually transitional horizons. Horizon A is well developed and apparent. It is dark brown and brittle. It may either be porous or granular. Its reaction is neutral when the medium is alkaline. Horizon B is fair brown and red. Reaction is generally alkaline and sometimes neutral. Its structure is granular or soft cornered block. There may be lime deposition in trace amounts. There is CaCO₃ in lower parts of the horizon.

Soil is shallow or not too deep in sections containing this type of soil. Stoniness, rockiness and heavy erosion are the problems with this type. This soil is suitable for growth of forest and grassland. It takes up a minor part as compared to other soil types. It allows dry agriculture and fruit growth where elevation is suitable.

Rock and Debris (ÇK)

There is no soil cover on rocks. Soil and bushes are only present in cracks and hollows but this economically unsatisfactory. Rock and debris is class VIII in terms of land utilization capability.

Land property, suitability of land for agricultural use and distribution of major soil groups is given in Figure IV.30.

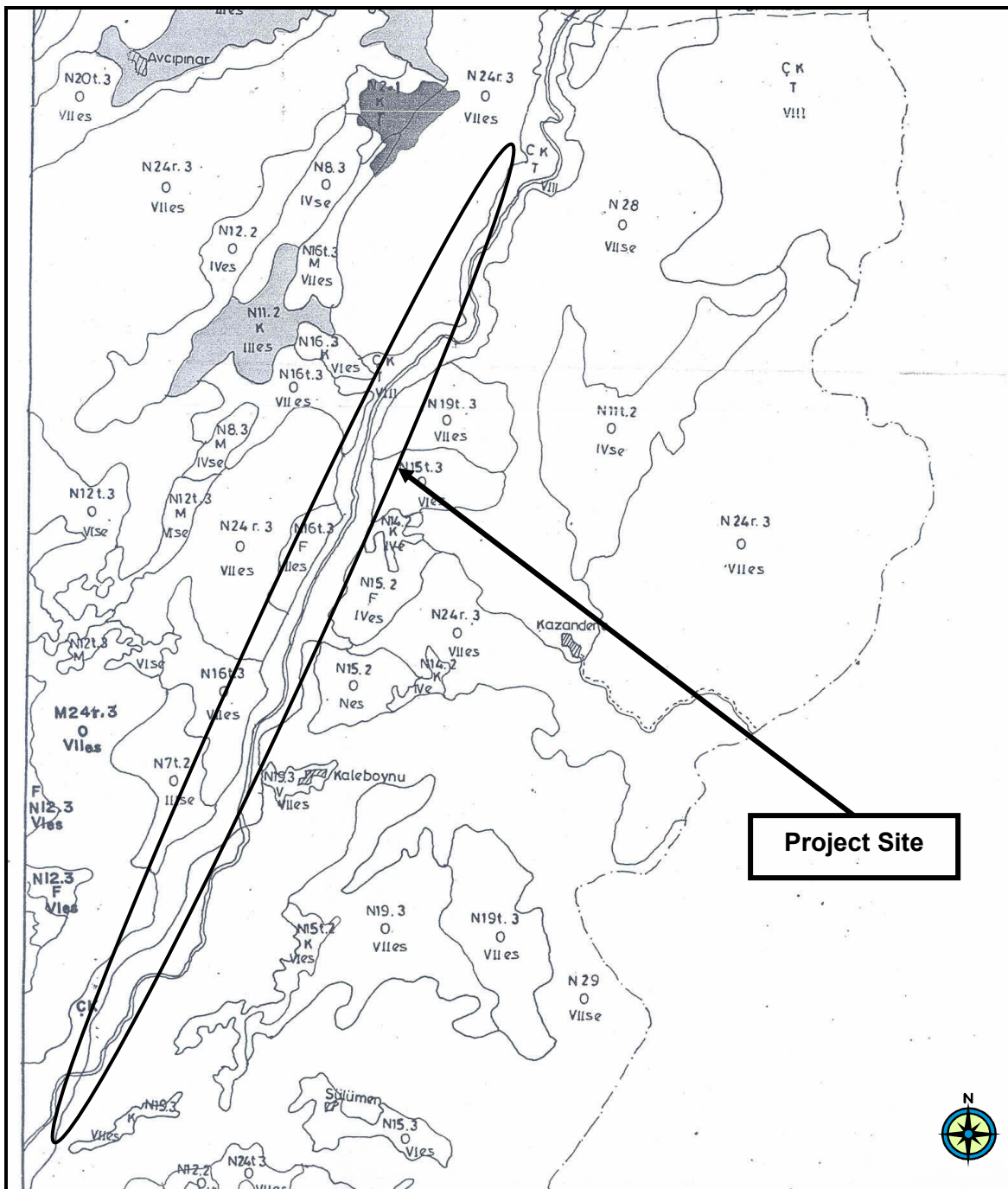


Figure IV-30 Land Property, Suitability of Land for Agricultural Use and Distribution of Major Soil Groups
Reference: Prime Ministry General Directorate of Rural Affairs "Adana İli Arazi Vartılığ 1996"

As the soil groups lying in the Project Site and the impact area are evaluated in terms of slope-depth combination, soil depth is shallow or very shallow and slope is average 20%.

In terms of other soil properties, these soil groups show deficiency due to erosion. Land use is in the form of forest, grassland, dry agriculture and abandoned land. The Project impact area contains soil with capability class of III, IV, VI, VII and VIII. Table IV.16

below gives information about suitability of these classes for agriculture and the factors limiting agricultural activities (General Directorate of Rural Affairs, 1996).

Table IV-16 Land Use Capability Classes and Land Suitability for Agriculture

Capability Class	Suitability For Cultivation	Factors Limiting Agriculture
I	Suitable for plantation of most crops	Little or no limitation
II	Suitable for cultivation over a long period of time and for a large variety of crops	Requires precautions related to conservation of soil and water
III	<i>Can be cultivated with appropriate crop selection and special preservation methods. Generally requires special attention for agricultural use.</i>	<i>Subject to erosion and requires artificial drainage when cultivated</i>
IV	<i>It may be suitable for the cultivation of a limited number of specific plants through the application of an appropriate ploughing method. When used for agricultural purposes, they require specific attention</i>	<i>It displays too many restrictions with respect to soil depth, excessiveness of stones, humidity, and inclination</i>
V	Can be used as a pasture due to a insufficient drainage.	Not suitable for cultivation and have poor drainage properties
VI	<i>Generally, not suitable for cultivation. It can be used mostly as a grassland or forestry area.</i>	<i>Restricted in terms of inclination and shallow soil depth</i>
VII	<i>Not economic in terms of agriculture. However, it is suitable for planting of poor grassland and forest trees.</i>	<i>Restrictions in terms of inclination and shallow soil depth</i>
VIII	Do not produce agricultural products. Can be used for recreational activities or a prey keeping purposes.	No soil existence

Source: Land sources of Turkey, ZMO Publications, 2003

IV.2.7 Agricultural Lands (Areas for agricultural development projects and areas for special crops) size of dry and wet agricultural lands, crop patterns and annual production amounts

The fact that 25% of the population of Adana live in rural areas, makes agricultural incomes take a major part among others. The fertile agricultural lands constitute 38% of the total surface area of Adana. Availability of agricultural lands with 1.9% of all agricultural vehicles and equipment in Turkey is the basic factor that provides the agricultural productivity. Land property of Adana and distribution of farmlands in Adana Province is given in Table IV.17. Besides this, production of citrus fruits accounts for a significant part of Turkey's total production. Information about this is given in Tables IV.17 and 18. (www.adana.gov.tr, www.adanatarim.gov.tr).

Size of irrigated farmlands in Adana is 217,562 ha and this is 40.4% of the total farmlands. Of this total irrigated farmland, 176,542 ha is irrigated by the Regional Directorate no.6 of the SHW, 36,020 ha by the Regional Directorate no.3 of the Directorate of Rural Affairs and the remaining is irrigated by wells, streams and drainage channels (www.adanatarim.gov.tr).

Detailed land utilization in Adana is given in Figure IV.31 and Table IV.17.

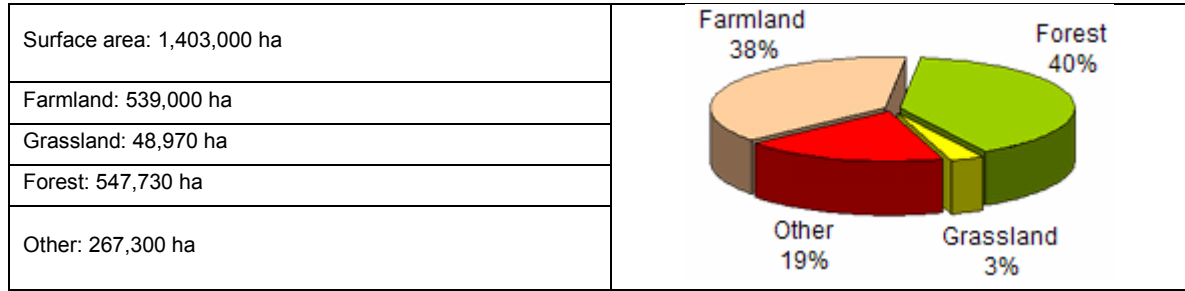


Figure IV-31 Land Utilization in Adana

Table IV-17 District-based Land Property

District	Surface Area (ha)	Total Farmland (ha)	Grassland(ha)	Forest (ha)	Other (ha)
ALADAĞ	138,000	7,800	1,600	85,794	42,806
CEYHAN	142,600	111,700	5,000	4,343	21,557
FEKE	133,500	14,200	5,000	92,773	21,527
İMAMOĞLU	42,400	34,750	250	6,897	503
KARAİSALI	149,742	29,550	3,400	81,023	35,769
KARATAŞ	92,200	57,000	4,000	2,041	29,159
KOZAN	169,000	60,320	1,770	98,707	8,203
POZANTI	77,200	4,980	3,500	55,615	13,105
SAİMBEYLİ	113,200	11,700	11,700	69,547	20,253
SEYHAN	42,000	32,000	500	804	8,696
TUFANBEYLİ	97,300	32,000	10,600	26,910	27,790
YUMURTALIK	50,100	31,000	650	2,636	15,814
YÜREĞİR	155,758	112,000	1,000	20,640	22,118
TOPLAM	1,403,000	539,000	48,970	547,830	267,300

Ref.: Adana İl Çevre ve Orman Müdürlüğü, 2003

Table IV-18 Agricultural Production in Adana

Crop	Production in Adana (ton)	Turkey's Total Production (ton)	Adana's Share in Turkey's Total Production (%)
Corn	1,035,000	2,300,000	45
Cotton	168,000	2,293,745	7
Soya	25,478	50,000	50
Wheat	1,235,000	19,000,000	6.5
Water Melone	653,789	5,795,000	12
Olive	10,894	600,000	0.6

Ref.: www.adanatarim.gov.tr, 2005

Table IV-19 Citrus Fruit Production in Adana

Crop	Production in Adana (ton)	Turkey's Total Production (ton)	Adana's Share in Turkey's Total Production (%)
Orange	358,850	1,250,000	29
Tangerine	198,417	580,000	34
Grapefruit	89,502	135,000	66
Lemon	106,690	510,000	21
Citrus	1955	3000	65

Ref.: www.adanatarim.gov.tr, 2005

People in Saimbeyli emigrate to other provinces to work in some part of the year. There are no important agricultural and industrial establishments in the district. The most important crops are wheat, barleycorn, chickpea, grape, apple, plum, persimmon and cherry. There is Agricultural Credit Cooperative in Saimbeyli, and it provides local people with fertilizer and pesticide. There are 14 agricultural development cooperatives. Farmlands are infertile. Therefore fruit and vegetable growing is more popular. Most of the cherry is grown in Gürleşen and Kalesekisi villages. However, since there is no irrigation supply in Kalesekisi area, production amount is lower in this area (www.saimbeyli.gov.tr).

A part of the Project Site lies within Göksun, Kahramanmaraş. Figure IV.32 and Table IV.20 depict land usage.

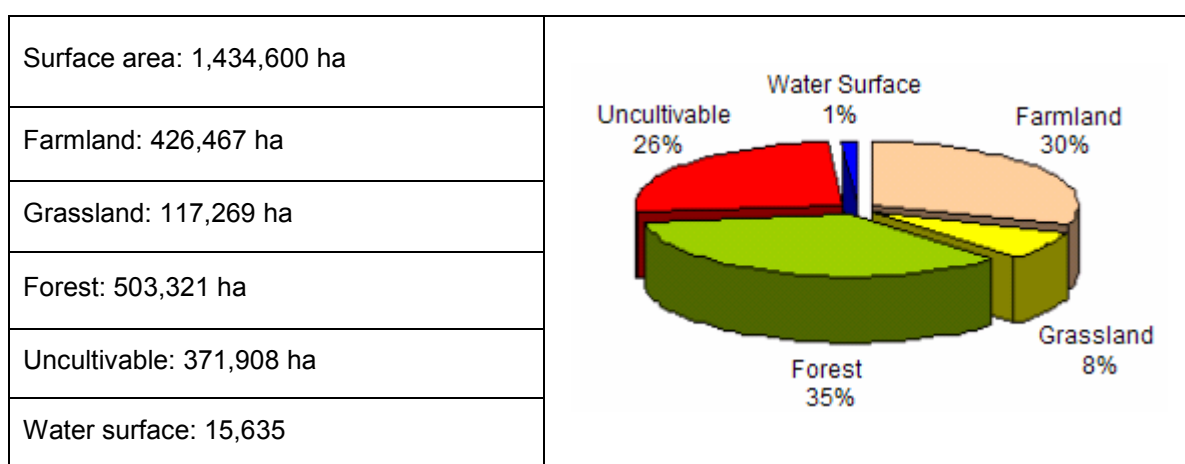


Figure IV-32 Land Use in Kahramanmaraş

Table IV-20 Land Use in Göksun

Land Use Status	Area (decares)
Irrigated farmland	264,500
Dry agriculture	170,300
Fruit growing	26,900
Vegetable gardening	4,470
Grapery	7,100
Fallowed land	6,730
Grassland	261,300
Non-agricultural land	6,600
Residential area	2,085.5
Toplam	749,985.5

Ref.: www.goksuntarim.gov.tr

Agricultural products such as wheat, industrial crops, fruit and vegetable are grown in Kahramanmaraş. Wheat is grown in unirrigated farmlands whereas cotton and red pepper is grown in irrigated areas. Crop range and production amounts in Kahramanmaraş is given in Table IV.21.

Table IV-21 Crop Range and Production Amounts in Kahramanmaraş

Crop	Area (ha)	Yield (kg/da)	Production Amount (ton)
Wheat (Durum)	128,008	353	452,501
Wheat(Other)	77,250	254	196,730
Barleycorn(for beer production)	8,000	330	26,400
Barleycorn (Other)	26,124	348	90,938
Rye	120	200	240
Corn	9,831	1,045	102,932
Panicum	16	365	58
Rice	5	350	18
Mahlut	50	180	90
Broad Bean	1	600	6
Chickpea	19,640	100	19,745
Bean	12,700	169	21,562
Green Lentil	20	100	20
Red Lentil	3,650	138	5,019
Vetch	1,229	148	1,819
Clover	2,902	1,190	34,545
Trefoil	69	1,100	760
Sugar Beet	11,724	4,782	560,690
Cotton	9,012	382	34,439
Sesame	100	45	45
Groundnut	680	295	2,010
Soya	278	311	865
Sunflower (for oil production)	-	-	-
Sunflower (Snack)	15,801	184	29,196
Potato	800	1,761	14,090
Pear	174	116,810	2,887
Quince	28	23,245	361
Apple (Golden)	721	259,325	9,811
Apple (Starking)	1,401	252,355	11,708
Apple (Amasya)	181	18,795	1,382
Aapple (Grannysmith)	89	41,815	1,359
Apple (Other)	165	314,390	10,161
Plum	46	36,609	897
Apricot	6,266	1,105,150	156,515
Cranberry	-	26,600	368
Cherry	591	173,350	2,611
Peach (Nectar)	26	11,960	166
Peach (Other)	100	35,370	775
Sour Cherry	66	34,470	760
Wild Apricot	3	1200	30
Pistachio	3,400	1,962,000	5,260
Almond	14	38,490	236
Walnut	137	180,970	5,412
Hazelnut	40	16,500	150
Strawberry	47	-	495
Mulberry	3	54,050	1,344
Fig	90	39,100	904

Crop	Area (ha)	Yield (kg/da)	Production Amount (ton)
Pomegranate	14	9,150	124
Persimmon	76	45,250	873
Grape	20,609	-	94,130
Raisin	4,538	-	31,235
Thyme	6	-	16
Red Pepper	1,114	-	3,817
Olive	1,885	413,600	1,538
Olive (for oil production)	2,996	535,630	6,301
Cabbage	265	4,396	11,650
Black Cabbage	2	1,000	20
Kale	11	1,900	210
Lettuce	100	3,437	3,437
Spinach	40	687	275
Mangold	8	1,550	124
Parsley	32	840	269
Dill	3	800	24
Mint	22	681	150
Marrow	344	1,756	6,042
Pumpkin	5	2,500	125
Pumpkin (Snack)	-	-	-
Cucumber	918	2,417	22,197
Gherkin	179	1,793	3,210
Aubergine	533	1,186	7,389
Okra	4	500	20
Tomato	2,530	3,239	81,950
Pepper	355	916	3,070
Bell Pepper	358	1,013	1,225
Pepper (for pepper paste)	112	1,093	15,930
Watermelon	408	3,904	15,930
Sweetmelon	185	2,367	4,380
Green Bean	401	786	3,154
Cow Pea	1	440	4
Shell Bean	50	600	300
Garlic	14	892	125
Garlic (Dried)	493	1,221	6,020
Green Onion	32	1,525	488
Onion	2,335	2,760	64,457
Carrot	50	2,000	1,000
Radish	213	880	1,880

Ref.: Kahramanmaraş Valiliği, 2005

Yield and production amounts of crops grown in Göksun are presented in Table IV.22 and IV.23.

Table IV-22 Crop Yields in Göksun

Crop	Area (da)	Production (ton)	Yield (kg/da)
Wheat	269.000	43.200	160
Barleycorn	11.000	2.200	200
Rye	1.200	192	160
Bean	55.000	8.250	150
Chickpea	34.000	5.100	150
Sugar Beet	4.000	12.000	3.000
Potato	5.300	6.890	1.300
Sunflower	28.000	5.600	200
Onion	650	780	1.200
Garlic	300	240	800
Clover	18.250	23.725	1.300
Vetch (Grass)	5.000	1.500	300
Vetch (Grain)	1.000	80	80
Lathyrus	200	60	300
Trefoil	600	660	1.100
Corn (Grain)	900	225	250
Corn (Silage)	400	1.600	4.000
Pepper	330	216	650
Tomato	1.500	1.500	1.000
Broad Bean	500	300	600
Cucumber	290	218	750
Green Bean	650	390	600
Cabbage	1.200	2.500	3.000

Ref.: www.goksuntarim.gov.tr**Table IV-23** Fruit Yield in Göksun

Fruit Garden	Area (da)	No. of Fertile Trees	No. of Infertile Trees	Yield (ton)	Yield (kg/tree)
Apple (Golden)	2,000	45,000	35,000	450	10
Apple (Starking)	7,000	49,000	7,000	490	10
Apple (Amasya)	1,800	11,410	2,800	114	10
Apple (Grannysmith)	300	500	9,500	5	10
Apple (Other)	14,780	139,500	160,200	1,395	10
Pear	--	28,000	4,500	280	10
Quince	--	250	150	4	15
Apricot	500	1,700	7,500	5	9
Cherry	100	1,100	600	17	15
Peach	120	1,250	4,500	13	10
Sourcherry	---	2,000	1,100	20	10
Walnut	---	2,400	400	0	0
Mulberry	---	3,000	350	0	0
Strawberry	300	--	--	135	450
Grapery	7,100	--	--	2,275	350

Ref.: www.goksuntarim.gov.tr

IV.2.8 Forest Areas (type and amount of trees, size of forest areas and their coverage, their present and planned protection and/or usage purposes)

Land assets of Adana Province are presented in Figure IV-33. As it is seen the figure, 59% of the province is unforested areas, 24% is forested areas and 17% is damaged forests.

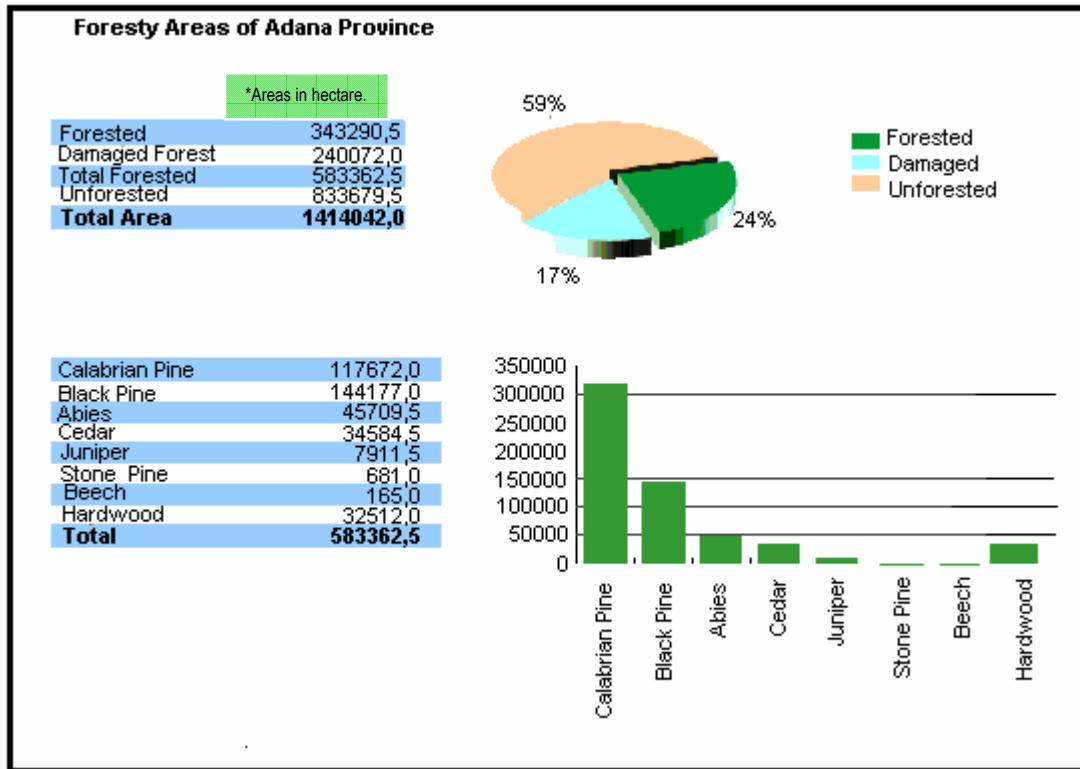


Figure IV-33 Forest Asset of Adana Province

Source: R. T Ministry of environment and forestry, General Directorate of Forestry, Forestry assets inventory 2006.

Land assets of Kahramanmaraş Province are presented in Figure IV-34. As it is seen in the figure, 65% of the province is unforested areas, 11% is forested areas and 24% is damaged forests.

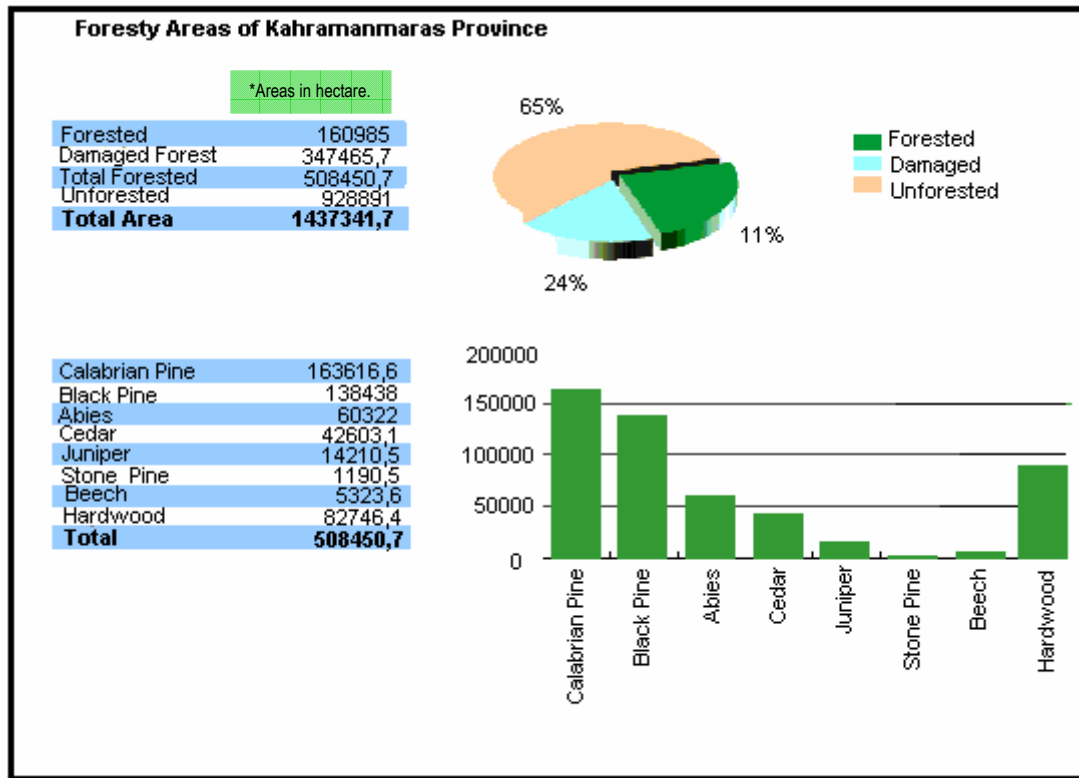


Figure IV-34 Forest asset of Kahramanmaraş Province

Source: R. T Ministry of environment and forestry, General Directorate of Forestry, Forestry assets inventory 2006.

Saimbeyli Forestry Department (central) and Ayvacik Forestry Department are responsible for the 9.9-ha part in the border of Saimbeyli District of the Project Site. The whole Project Site has characteristics of forest. According to the “Land Investigation and Evaluation Form” prepared by Adana Forest Regional Directorate (see App.-H), the site with 9.9 ha includes juniper, hardwood and calabrian pine species of trees. Existing stand types in the area are Bar-T, BAR-BKBt, OT, Çzd1, BKBt, Z ve BÇzAr’dır.

The forest area on which a part of the Project Site, excluding regeneration areas of Saimbeyli Forestry Department (central) and Ayvacik Forestry Department, including protected areas named as Kaleboynu, Necropolis and Örülü Cave, is not completely sensitive to forest fires. All these subjects are stated in the official letter from Adana Forest Regional Directorate dated 16.11.2007 and numbered B.18.1.OGM.1.01.00.03.200/2508-14196, and related Land Investigation and Evaluation Form is presented in Appendix-H.

Göksun and Yagbasan Forestry Departments are responsible for the 423,8 ha of the Project Site and bu 365,6 ha of this part has characteristics of forest. This area includes juniper, cedar, black pine and calabrian pine species of trees. Existing stand types in the area are CBArS, CBAr, Gckbc2, CBCK, CBCz (See App. H) according to the “The Land Investigation and Evaluation Form” prepared by Kahramanmaraş Forest Regional Directorate.

According to the “Investigation and Evaluation Form”, the forestry lands in the Project Site do not include any regeneration or forestation areas of related forestry departments. It is stated in the form that the Project Site is partially in hunting production area and has no drawback on forestry works and forest-public relations and it is obliged to take necessary measures against forest fires. The official letter from Kahramanmaraş Regional Forest Directorate dated 16.11.2007 and numbered B.18.1.OGM.1.01.00.03.200/2508-14196, and related Land Investigation and Evaluation Form is presented in Appendix-E.

It is stated in the investigation and evaluation forms that the Project has no drawback from the point of Adana and Kahramanmaraş Regional Forest directorates.

IV.2.9 Protected Areas (National Parks, Natural Parks, Wet Lands, Natural Monuments, Nature Protection Areas, Wildlife Conservation Areas, Biogenetic Reserve Areas, Biosphere Reserves, Natural Site and Monuments, Historical and Cultural Sites, Special Environmental Protection Regions, Special Environmental Protection Areas, Tourism Area and Centers, Areas in the content of Pasture Law)

As a compilation of the information gathered from land surveys, official comments of the related departments, web sites and literature research, the Project Site and its impact area

- does not include any national parks, natural parks, nature protection areas and natural monuments defined in the 2nd item and determined in the 3rd item of the National Parks Law no. 2873,
- does not include any wild life placement zones determined by MoEF according to the Law on Terrestrial Hunting no. 4915,
- includes Adana Kahramanmaraş Hancerderesi Wild Life Improvement Zone determined by MoEF according to the Law on Terrestrial Hunting no. 4915. The 788,5 ha zone which is identified as wild life improvement zone by the Decision of the Council of Ministers published on the Official Gazette dated 05.10.2006 and numbered 26310 is a zone on which wild goats are protected. Yamanlı II Stage I Weir and the transmission tunnel connecting it to the Yamanlı II Stage I HPP are in the Hancerderesi Wild Life Protection Zone on which wild goats are protected. The official comment of the General Directorate of Nature Protection and National Parks in relation to this zone is presented in Appendix-E. The Project Site and Hancerderesi Wild Life Improvement Zone are presented on Appendix-I
- includes first degree archeological sites (see App.-I for “Archaeological Sites Near the Project Site”) according to the Article 2 of the Law on Protection of Cultural and Natural Assets no. 2863. However any of the Project units are on these sites. Protection zones are;
 - Kaleboynu Castle in Kahramanmaraş Province, Göksun District Kaleboynu Village (nearly 400 m to Yamanlı-II 1st Stage HPP),

- Karakuyu Caves in Adana Province, Saimbeyli District, Karakuyu Village, Dere Quarter, Kale Location (nearly 600 m to Yamanlı-II 2nd StageHPP)
- Karakuyu Necropolis in Adana Province, Saimbeyli District, Karakuyu Village, Kepen Location (nearly 2,7 km to quarry M1)
- Hocabey Necropolis in Adana Province, Saimbeyli District, Karakuyu Village, Hocabey Quarter (nearly 1,1 km to Hocabey Regulator)
- Karakuyu Mausoles in Adana Province, Saimbeyli District, Karakuyu village, Köyiçi Location (nearly 2,7 km to M1)

There is no objection to the project provided that required cautions are taken, according to the official letter of Adana Regional Committee of Cultural and Natural Assets Protection of the Republic of Turkey Ministry of Culture and Tourism dated 11.07.2007 and numbered B.16.0.KVM.4.01.00.03/01.10/122-1884 (see Appendix-E). It is not possible that Karakuyu Necropolis and Monument will not be affected by the Project due to their distance (nearly 3.6 km) to the Project Site. There is not going to be any blasting for tunnel construction around Kaleboyu Castle which is nearly 350 m to Yamanlı II Stage I HPP building and all the measures defined by Adana Regional Committee of Cultural and Natural Assets Protection. For the Hocabey Necropolis at a distance of 400 m to Hocabey Weir and Karakuyu Caves at a distance of 150 m to transmission tunnel of Hocabey Weir, there is not going to be any blasting to affect the archaeological sites and excavation wastes are going to be deposited at appropriate areas.

Furthermore, the Project Site

- does not include any reproduction and production sites of fishery products areas determined by Fishery Products Law numbered 1380.
- does not include any Special Environmental Protection Area (SEPA) defined in the Article 9 of the Environment Law numbered 2872
- There is a prohibited hunting zone according to “Central Hunting Commission Decision 2007-2008 hunting period” published in the Official Gazette dated 06.07.2007 and numbered 26574.
- Does not include areas defined in the Law on Olive Reclamation and Vaccination of Wild Species no.3573,
- Does not include any areas defined in the Pasture Law no. 4342,
- Areas determined in the scope of 1st degree restricted military zones according to the Law on Restricted Military Zones no. 2565,
- Does not include any area defined in the Mining Law no. 3213 (5177).
- areas defined in the Regulation on Protection of Wetlands, published in Official Gazette no. 24656 on 30.01.2002.

The areas that are required to be protected as a necessity of the pacts that Turkey have signed including the following are not present in the Project Site:

- ✓ areas defined under the topic of important first and second degree caretta-caretta reproduction zones and Mediterranean seal living and reproduction zones according to Convention on Protection of European Wildlife and Habitats (Bern Convention),
- ✓ areas defined under Barcelona Convention (Convention on Protection of Mediterranean against Pollution),
- ✓ protected areas defined in the protocol related to the Exclusive Protected Areas in Mediterranean ,
- ✓ areas in the list of 100 coastal historical places in the Mediterranean with common importance published by the UN Environment Program,
- ✓ coastal zones which are the living places of endangered Mediterranean species,
- ✓ areas protected in the status of cultural and natural assets by the Ministry of Culture as a requirement of the convention on protection of cultural and natural assets,
- ✓ protected wetlands of international importance defined in Ramsar Convention,

Areas required to be protected;

- ✓ Biogenetic Reserve Areas, Geothermal Areas are not present.
- ✓ Agricultural areas; areas with land use capability classes of I, II, III and IV abd special product plantation areas are not present in the Project Site. Land with utilization capability and suitability for agriculture of classes VII and VIII are present in the Project Site and the project-affected area.

IV.2.10 Species Living in Inland Water Bodies (Lakes, streams) (Natural characteristics of these species and species protected by national and international legislation, their feeding, reproduction, sheltering and living zones, protective decisions for these areas, land investigation and evaluation form)

Studies were conducted on the species living in inland water bodies to determine the different species living in upper, medium and lower part of the basin, their habitats and reproduction terms. In this context, the species living not only in the area in question but also the species likely to be encountered in the examined area have also been listed in order to be at the safe side.

Generally, this high-flow rate streams form waterfalls and pans composed of deep pits. Bottom is generally covered with gravel and stone. These waters are always cool and rich in oxygen 1-2 km downstream from the spring. Invertebrate bottom fauna is qualitatively poor. Besides, there are also various insects surviving under stones and in the nests where they build by sticking small soil particles together. The major species having these characteristics are Tricopter, Ephemerit and Sialis larvas. The flora characteristic of the project site is presented in Figure IV-35.

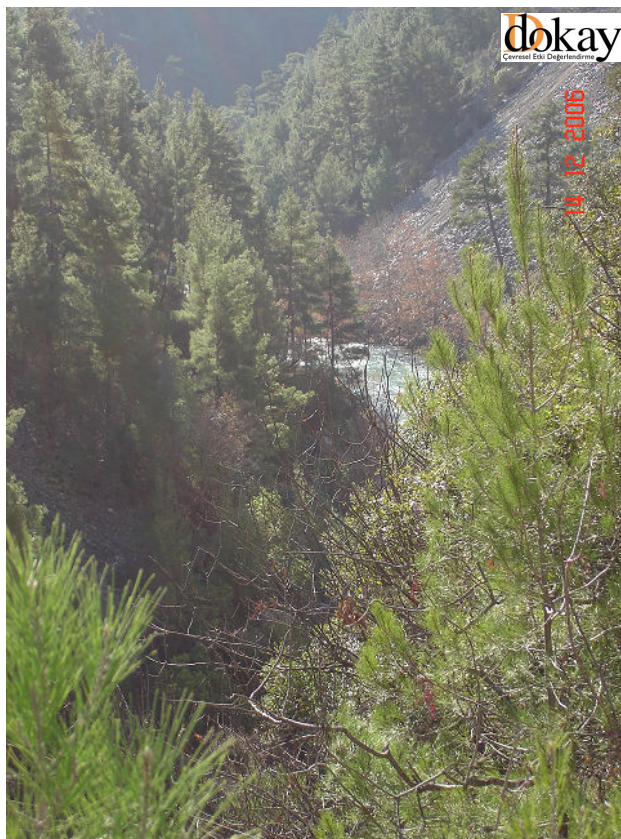


Figure IV-35 A view of the flora structure from the Project Site

Fishes

The typical fish species in the streams in the Project Site is *Salmo trutta macrostigma* (Brown Trout). As the morphology of the Brown Trout is examined, it will be seen that it has 10-12 big spots on, composed of small dots gathering in a lateral string. There is always a black spot on probecular. They are generally considered as miniature form with their maximum 30 cm of length. They are a sedentary of character form which they live in the streams throughout their life and never reach down to the sea. They especially prefer fast flowing and oxygen-rich, cold mountain waters. November – December term is their spawning period. In this period, they always climb up to the higher basins, which are shallow, and they spawn especially in in gravely bases (Turkey Freshwater Fish, Ege University, Faculty of Fisheries, publication no. 46.1999)

All trouts in Turkey belongs to the *Salmo trutta* species. *Salmo trutta* species is observed in a large scale. Starting from the Northern Europe, they can be found in Corsica, Sardinian Islands and Algeria and Caucasia, Himalayas and Iran in the east. *Salmo trutta* is represented by many sub-species over this large territory.

Seyhan, Catalan and Mentas Dams, constructed on Seyhan River, have blocked the migration routes of the fishes. Fishes, which could not migrate, have stayed in the reservoir and have adapted to the environment.

According to the “Red List 2006 Risk Classification” published by IUCN, *Salmo trutta macrostigma* (Brown Trout, big spotted trout) and *Cyprinus carpio* (carp fish) species are classified as DD (DD:sufficient information on species is not available)

The list of the fish species living in the Project Site has been prepared after in-situ surveys and literature research, and is presented in Appendix J.

Amphibians

The region is rich in Amphibians considered as the species living in inland waters. The following amphibian species are present according to both survey studies of the EIA team and literature records (see Appendix-J).

- *Urodela* (tailed frog):

Triturus vittatus cilicensis (striped Salamander), *Salamandra salamandra* (spotted Salamander)

- *Anura* (frog):

Pelobates syriacus (eastern spadefoot), *Bufo viridis viridis* (night frog), *Hyla arborea* (tree frog), *Rana ridibunda ridibunda* (marsh frog)

General Evaluation

There are 17 fish and 6 amphibian species in the Project Site as total. Some species have been observed in the Project Site and the remaining has been listed considering their high probability of existence in the Project Site. All species also exist outside the Project Site and they reproduce by leaving thousands of eggs once. The species in question have a high potential of reproduction, and they are not considered as endangered species yet. However, hunting (except for barb-hunting) all the fish species especially the trout is restricted in reproduction periods.

IV.2.11 Flora and Fauna (species, endemic and particularly local endemic flora species, fauna species living naturally at the site, species protected under national and international legislation, scarce and endangered species and their locations at the Project Site, name and population of game hunting animals, and Central Hunting Commission Decision taken for them, marking of vegetation types in the Project Site on the map. Protection measures required to be taken for the living to be impacted from the project and studies (during construction and operation). Realization of flora studies to be carried out on the site during the vegetation period and determination of this period).

In addition to the flora species observed directly in the Project Site, the species, which are registered in the literature for the Project Site and its vicinity and has a high

probability of existing at the Project Site according to their biotype characteristics, are also included in the report. These species are explained comprehensively in the sections of fauna and flora.

Flora

The flora species of the proposed Project Site and its vicinity are determined in the consequence of the site surveys and literature studies. On the other hand, the sampling studies and site surveys of EIA team were carried out at all sites probable to be impacted from the project. In addition, considering the richness of flora in Turkey, some species might have been missed out during the local flora studies. In this context, to prevent the likely oversights in this study, all flora species registered for the region in the reference named “Flora of Turkey” were examined and the species, especially the endemic ones, probable to be encountered according to the characteristics of the habitat, are considered;.

The flora inventory is prepared in the light of the site surveys and literature studies. The reference named “Flora of Turkey and the East Aegean Islands, Volume 1-10, 1965-1988” of P. H. Davis is utilized in the determination of species. This book is also the reference for the authors of the taxon stated in the list. The regional flora list is prepared in alphabetic order. For each species, the information such as their habitat, flora region, endemism status, relative abundance and risk classes given in Turkish Red Book of Flora are presented. The scale and abbreviations stated in the list are defined below. The Turkish Dictionary of Flora Names is used for the Turkish and local names of species (Baytop, T., 1997). And The Turkish Plants Data Service (TPDS) prepared by The Scientific And Technological Research Council of Turkey is used for literature studies.

According to the pertinent literature and field studies conducted on the Project Site, 95 plant families and 724 plant species are recorded within the study area. As a result of the same studies, 37 families, 129 species and 292 plant classes were detected to be endemic. In accordance to the results obtained from the literature review and site surveys, the flora list of the Project Site, flora regions of the species, their distribution in the country, endemism statuses and their abundances are given in Appendix-K.

Fauna

The fauna inventory is prepared based on a comprehensive literature review and observations of the local residents as well as the site surveys. As for the population density of the birds, it is assessed in terms of the biological (particularly reproduction, feeding and adaptation) and ecological characteristics (especially biotype suitability) of the species besides for the observation, questionnaire and literature information. Kiziroglu (1993) is used for the birds under risk. IUCN (2007) is given for other fauna species, the scale for the risk class areas follows.

The species given in Appendix II of Bern Convention are the species that are definitely protected, whereas the ones included in Appendix III are the species that are protected for specific periods. In the content of the lists, the status of the fauna species according to Bern Convention and the condition of the birds and mammals according to “Central Hunting Commission Decision 2006-2007” are stated. In the column of Central hunting Commission Decision, the abbreviations KK and BZ mean always protected and hunted in defined periods (especially expect for reproduction period), respectively.

The terrestrial fauna of the Project Site and its vicinity comprises 17 fish, 6 amphibian, 16 reptiles, 153 birds and 18 mammal species at species and sub-species level (sub-species and variety). The fauna inventory is prepared by an extensive perspective and includes many species not observed directly within the Project Site. In order to assess the impact, the information such as the habitat (biotype) and risk status of the species is also included (see Appendix -J).

Otter (*Lutra lutra*) is in the NT category according to IUCN (The World Conservation Union), and its population status in Turkey is not very clear. Otter is among “Protected Wild Animals” determined by MoEF.

The list of the animals which are restricted to hunt by MoEF and Central Hunting Commission according to the Decisions of the Central Hunting Commission (2007-2008) are presented in Appendix List-I and Appendix List-II.

Appendix III includes the animals, hunting of which is allowed by the Central Hunting Commission for certain periods, and they are shown in Table IV.24 and IV.25. Especially Seyhan River is on the migration routes of many bird species. Aladaglar, located in the northwest of the Project Site is one of the Important Areas of Turkey for the Bird. The considered area has gained this status due to the populations of “Lammergeier (5 pairs), Griffon Vulture (10 pairs), Golden Eagle (4 pairs) and also “shy” population.

Table IV-24 Mammals

Latin Name	Common Name
Canidae	Dogs
<i>Canis aureus</i>	Jackal
<i>Vulpes vulpes</i>	Fox
Leporidae	Rabbits
<i>Lepus europaeus</i>	European Brown Hare
<i>Oryctolagus cuniculus</i>	European Rabbit
Mustelidae	Martens
<i>Martes martes</i>	Pine Marten
<i>Martes foina</i>	Beech Marten
Suidae	Boars
<i>Sus scrofa scrofa</i>	Wild Boar
Viverridae	Viverrids
<i>Herpestes ichneumon</i>	Egyptian Mongoose

Source: Central Hunting Commission Decisions 2007-2008, Appendix-III

Table IV-25 Birds

Latin Name	Common Name
Anatidae	Ducks
Anser albifrons	White-Fronted Goose
Anas penelope	Wigeon
Anas strepera	Gadwall
Anas crecca	Green-Winged Teal
Anas platyrhynchos	Mallard
Anas acuta	Pintail
Anas querquedula	Garganey
Netta rufina	Red-Crested Pochard
Aythya ferina	Pochard
Aythya fuligula	Tufted Duck
Aythya marila	Greater Scaup
Melanitta nigra	Common Scoter
Bucephala clangula	Common Goldeneye
Phasianidae	Pheasants
Alectoris chukar	Chukar
Alectoris geraeca	Rock Partridge
Ammoperdix griseogularis	See-See Partridge
Coturnix coturnix	Common Quail
Rallidae	Rails
Fulica atra	Eurasian Coot
Charadriidae	Plovers And Lapwings
Gallinago gallinago	Gallinago Snipes
Scolopax rusticola	Eurasian Woodcock
Columbidae	Doves
Columba livia	Rock Pigeon
Columba palumbus	Wood Pigeon
Streptopelia turtur	Turtle Dove
Turdidae	Thrushes
Turdus merula	Common Blackbird
Corvidae	Crows
Garrulus glandarius	Eurasian Jay
Pica pica	European Magpie
Corvus monedula	Jackdaw
Corvus frugilegus	Rook
Corvus corone corone	Carrion Crow
Corvus corone pallescens	Hooded Crow
Passeridae	Songbirds
Passer domesticus	House Sparrow

Source: Central Hunting Commission Decisions 2007-2008, Appendix III

IV.2.12 Mines and Fossil Fuel Resources (reserve amounts, present and planned operating attitudes, annual productions, importance for regional and country economy)

Due to its geological location, Adana Province has variety of significant underground resources. In the first instance Iron, many mineral source like ; chromium, lead, zinc, gold, silver, bauxite, manganese, barite, phosphate, quartz and quartzite, gypsum, salt, cement feedstock, construction stone, oil, coal, asbestos, meerschaum etc. are among the natural resources of the region. (www.adana.gov.tr).

Moreover, according to Adana Environmental Performance Report, 334,481 million ton lignite reserve exists in Tufanbeyli. Mining facilities are taking place in Saimbeyli District of Adana and Göksun District of Kahramanmaraş, in context with Mining Law numbered 3213 (5177). The mentioned facilities are given in Table IV.25 and Table IV.26. Mine maps of Adana and Kahramanmaraş provinces are given in Figure IV-36 and Figure IV-37 respectively.

Table IV-26 Mining Activities in Saimbeyli

Name Of Reserve	Location	Amount (Ton)	Activeness
Aluminium	Saimbeyli-Gümüçlektepe	4.500.000	Active
	Saimbeyli – Kızılcatepe	5.500.000	Active
	Saimbeyli – Küçükakçal Tepe	1.500.000	Active
	Saimbeyli- Elpen	22.000.000	Active
	Saimbeyli – Kolumbeyli	200.000	Active
Iron	Saimbeyli – Aşilik	3.200.000	Inactive
Phosphate (Iron Phosphate)	Saimbeyli – Beypinari	148.500	Active

Source : Adana 2003 Environmental Situation Report

Table IV-27 Mining Activities in Göksun

Name Of Reserve	Location	Amount (Ton)	Activeness
Lead- Zinc	Göksun Büyükkizilcik Village	No significant reserves	-
Iron	Göksun – Çardak (Beritdağı)	57.300	Active
Copper	Between Karahmet Quarter and Findik Village	Not Calculated	-

Source : Adana 2003 Environmental Situation Report

There is no mining activity at or around the Project Site (www.mta.gov.tr).

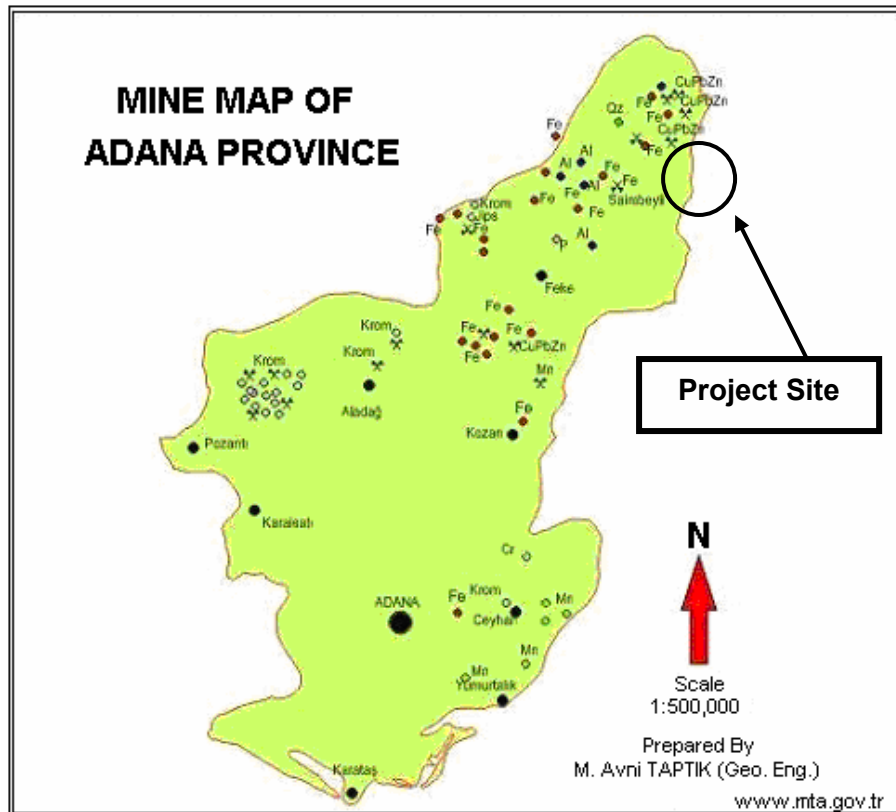


Figure IV-36 Mine map of Adana Province

Source: General Directorate of MRE

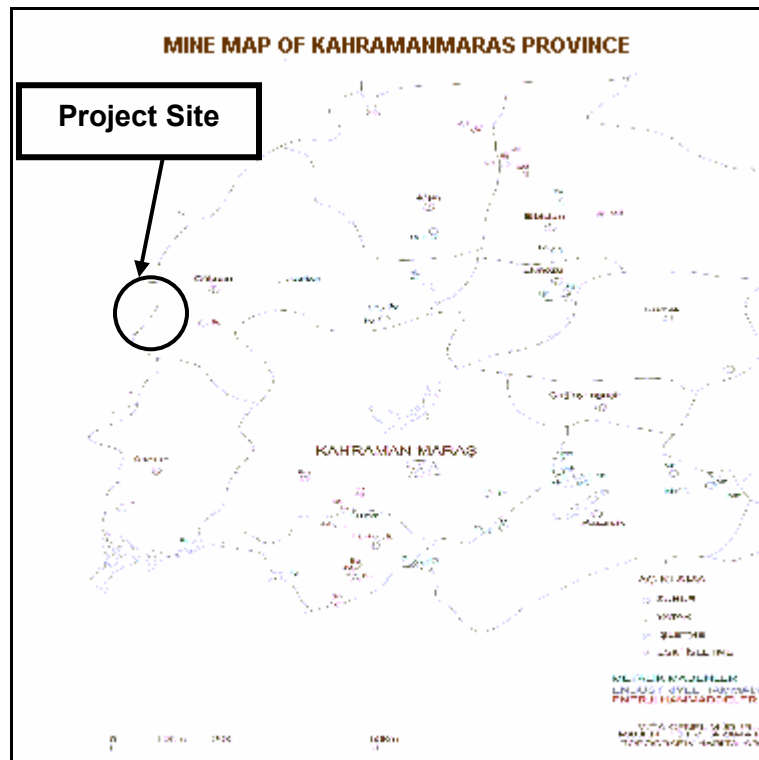


Figure IV-37 Mine map of Kahramanmaraş Province

Source: General Directorate of MRE

IV.2.13 Animal Husbandry (Species, feeding zones, amount of annual production, contribution and value of these products to Turkish economy)

Animal husbandry and industry of animal products are among the major means of living for the local people living in rural areas throughout Adana Province. Cattle and small cattle husbandry, poultry farming, fish breeding farms and apiculture are the main animal breeding activities of the region. The related data is given in Tables 28,29,30,31.

Table IV-28 Small Cattle Property of Adana Province and Districts

Districts	Sheep	Sheep (Merinos)	Goat	Total
SEYHAN	4,300		900	5,200
YÜREĞİR	23,400		7,060	30,460
ALADAĞ	17,238		31,864	49,102
CEYHAN	14,290		3,910	18,200
FEKE	21,150		26,600	47,750
İMAMOĞLU	7,700		7,000	14,700
KARAIŞALI	21,150		38,850	60,000
KARATAŞ	9,081		220	9,301
KOZAN	42,250		28,000	70,250
POZANTI	9,800		9,500	19,300
*SAIMBEYLİ	18,500	600	42,000	61,100
TUFANBEYLİ	6,900	1,660	6,300	14,860
YUMURTALIK	5,090		960	6,050
TOTAL	200,849	2,260	203,164	406,273

Source : www.adanatarim.gov.tr, 2005

Table IV-29 Cattle Property of Adana Province and Districts

Districts	Pure Culture	Hybrid Culture	Native	Total Cattle	Buffalo	Horse	Mule	Donkey
SEYHAN	1,800	6,600	230	8,630	75	120	150	35
YÜREĞİR	1,158	31,600	267	33,025	46	540		290
ALADAĞ	796	2,738	3,563	7,097	0	490	750	700
CEYHAN	793	16,306	557	17,656	47	177		110
FEKE	1,240	3,220	4,600	9,060	0	760	550	820
İMAMOĞLU	685	6,000		6,685	0	46	5	215
KARAIŞALI	1120	6,090	2,035	9,245	0	630	305	390
KARATAŞ		10,022	0	10,022	0	50		6
KOZAN	5,260	17,300	1,800	24,360	20	1,105	401	1,700
POZANTI	83	227	990	1,300	0	307	107	449
*SAIMBEYLİ		1,210	6,040	7,250	0	1,060	580	2,100
TUFANBEYLİ	2,430	3,980	3,150	9,560	0	93		1,250
YUMURTALIK	312	4,095	290	4,697	0	11		7
TOTAL	15,677	109,388	23,522	148,587	188	5,389	2,848	8,072

Source : www.adanatarim.gov.tr, 2005

Table IV-30 Numbers of Beehives and Amounts of Production of Adana Province and Districts

Districts	Beehives		Production	
	Number of Beehives of Old Type	Number of Beehives of New Type	Honey (kg)	Beeswax (kg)
SEYHAN		6,586	54,200	6,586
YÜREĞİR		15,000	190,000	17,540
ALADAĞ	140	1,300	21,600	4,300
CEYHAN	130	1,540	33,100	3,310
FEKE	500	7,000	75,000	6,000
İMAMOĞLU		45,000	675,000	90,000
KARAIŞALI	30	9,900	120,000	12,000
KARATAŞ		1,200	18,000	
KOZAN		92,100	2,302,500	138,150
POZANTI		13,500	337,500	2,300
*SAİMBEYLİ	125	11,200	185,000	13,900
TUFANBEYLİ		3,500	52,500	4,775
YUMURTALIK	140	1,321	27,000	4,800
TOTAL	1,065	209,147	4,091,400	303,661

Source : www.adanatarim.gov.tr, 2005**Table IV-31** Poultry Property of Adana Province and Districts

Districts	Chicken		Duck (Number)	Goose (Number)	Turkey (Number)	Chicken Eggs (Number)
	Broiler Adet	Egg Producer				
SEYHAN	1,120,000	6,000	450	700	1,700	1,200,000
YÜREĞİR	530,000	202,000	800	1,200	14,500	40,400,000
ALADAĞ	72,500	6,000				600,000
CEYHAN	50,000	35,000	1,290	375	405	6,200,000
FEKE		5,000				700,000
İMAMOĞLU	60,000	60,000		200		3,600,000
KARAIŞALI	230,000	65,000				11,700,000
KARATAŞ		10,000	700	700	40	2,000,000
KOZAN	90,000					
POZANTI	11,200	5,000				1,000,000
*SAİMBEYLİ		51,000	50	35	70	4,500,000
TUFANBEYLİ		7,000	270			560,000
YUMURTALIK		28,800	1,032	364	140	5,184,000
TOTAL	2,163,700	480,800	4,592	3,574	16,855	77,644,000

Source : www.adanatarim.gov.tr, 2005

The Animal Asset and production amounts of Kahramanmaraş Province and Goksun District, which include a part of the project site, are given in Tables IV.32,34, and IV.33,35 respectively.

Table IV-32 Small Cattle, Cattle and Poultry Property of Kahramanmaraş Province

Production	Species	Number
Cattle	Horse	6,500
	Donkey	7,623
	Mule	5,303
	Buffalo	51
	Cattle	116,866
Small Cattle	Sheep	409,976
	Goat	196,881
Poultry	Chicken	497,800
	Turkey	41,850
	Duck	18,610
	Goose	9,870

Source : Kahramanmaraş Province 2003 Environmental Situation Report

Table IV-33 Numbers of Beehives and Amounts of Production of Adana Province and Districts

	BEEHIVES			PRODUCTS	
	Number of Beehives of Old Type	Number of Beehives of New Type	Honey (kg)	Beeswax (kg)	Number of Villages
MERKEZ	200	7.000	84.000	1.000	25
AFSİN	140	7.000	76.000	8.000	35
ANDİRİN	360	3.710	63.000	4.650	32
CAĞLAYANCERİT	55	3.500	34.000		7
EKİNOZÜ	200	2.900	46.500	800	17
ELBİSTAN	180	6.350	128.000	7.100	50
GÖKSUN	90	13.500	150.000	3.200	26
NURHAK	30	1.500	30.000		4
PAZARCIK	970	2.030	57.000	22.000	38
TÜRKOĞLU	145	3.789	75.780	1.894	21

Source : Kahramanmaraş Province 2003 Environmental Situation Report

Table IV-34 Animal Asset of Göksun District

Species	Number
Cattle	11.450
Sheep	46.000
Goat	16.000
Mule	260
Horse	590
Donkey	1.200
Chicken-Cock	58.600
Other birds	6.550
Beehives of New Type	13.500
Beehives of old Type	90

Source: www.goksuntarim.gov.tr.

Table IV-35 Amount of Animal Products of Göksun District

Ürün	Amount
Eggs	8.300.000
Meat	480 tons
Milk	1.950 tons
Salmon	12.8 tons
Honey	180 tons
Honeywax	3.25 tons

Source: www.goksuntarim.gov.tr

IV.2.14 Lands Under Control and Responsibility of Authorized Governmental Agencies (Military Forbidden Zone, areas allocated to public institutions and corporations for special purposes, etc.)

The Proposed Project Site and the neighbouring area do not include any Military Restricted Zones, areas assigned to governmental institutions on purpose and areas restricted by the decision no. 7/16349 of the Council of Ministers.

IV.2.15 Determination of Baseline Pollution Load in Terms of Air, Water, Soil, Noise of Project Location and Its Impact Area

Residential areas near the Project site are;

- Yenikoy (Adana-Saimbeyli) at neraly 2 km NW of Yamanli-II 1st stage Regulator,
- Kaleboynu Village (Kahramanmaras-Göksun) at nearly 1,5 km NE of Yamanli-II 1st stage HPP,
- Aksaagac Village (Adana-Saimbeyli) at nearly 3,5 km SE of Yamanli-II 2nd Stage Regulator,
- Hocabey Houses at nearly 1,5 km NE of Hocabey Regulator,
- Hocabey Houses at nearly 4,5 km NE of Yamanli-II 2nd stage.

No industrial facilities, which may contribute to environmental pollution, are not located in these villages. 90% of the villagers deal with animal husbandry, agriculture and forestry regardless of trading purposes. Therefore the soil and air pollution in the Project Site and project-affected area is out of question

Noise measurement results done at nearest places to the most noisy units and areas of construction and operating periods, and Baseline noise Load measurements are presented in "Acoustic Report" at Appendix-J.

Present Water Quality

Population density at the Upper Seyhan Basin is not so much and only Kayseri Province has little residential areas. However this region is very rich in terms of mineral deposits. Chromium is extracted at Pinarbasi District and Karabogaz, Buyukkaramoklu, Kilicahmet, Demircili and Yahyali District Karakoy and Delialiusagi Villages, iron is extracted at Yahyali-Karakoy, Feke and Develi-kalekoy, and lead and zinc are extracted at Yahyali-Tashan, Develi-Kalekoy, Havadan and Aysepinar regions. (Adana Province 2003 Environmental Situation Report)

As the maps prepared according to the “Quality Criteria According to Intercontinental Water Source Classess”, given in Table-I of “Water Pollution Control Regulation” (WPCR) which became effective upon publication in Official Gazette no. 25687 on 31.12.2004, the water quality of the Project Site and project-affected area will be declared as follows:

In terms of **Group A** parameters, the water quality in the first 3 stations on Zamanti River (upstream to downstream) is 4th class and it raises up to 2nd class due to the tributaries and nitrogen conversion. Seyhan River, formed by the joint of Zamanti and Goksu River, possessing a water quality of 2nd class, has a water quality of 2nd class until Egner Bridge but it decreases down to 4th class there on due to heavy agricultural activities.

In terms of **Group B** parameters, the water quality of the rivers and tributaries in the basin is determined as 2nd class. However, the water quality rises up to 1st class after joining of Goksu and Zamanti in Egner Bridge area where clean tributaries join.

In terms of **Group C** parameters, it has been realized that the parameters were not measured with the same frequency, and thus, the column C in the map, to be prepared in compliance with the regulations, has been drawn only according to iron and manganese to establish continuity considering that there would be gaps otherwise. As explained before, there are different mines at Upper Seyhan Basin and due to these mines the water quality is 4th class at Origin of Zamanti River. The cause of the 4th class quality of Saricam River is high industrial activities.

In terms of **Group D** parameters, the water quality in the Upper Seyhan Basin is determined to be 2nd class due to low population.(Adana Province Environmental Condition Report, 2003).

The maps prepared according to the results obtained in compliance with the SKKY are given in Figure IV.38.

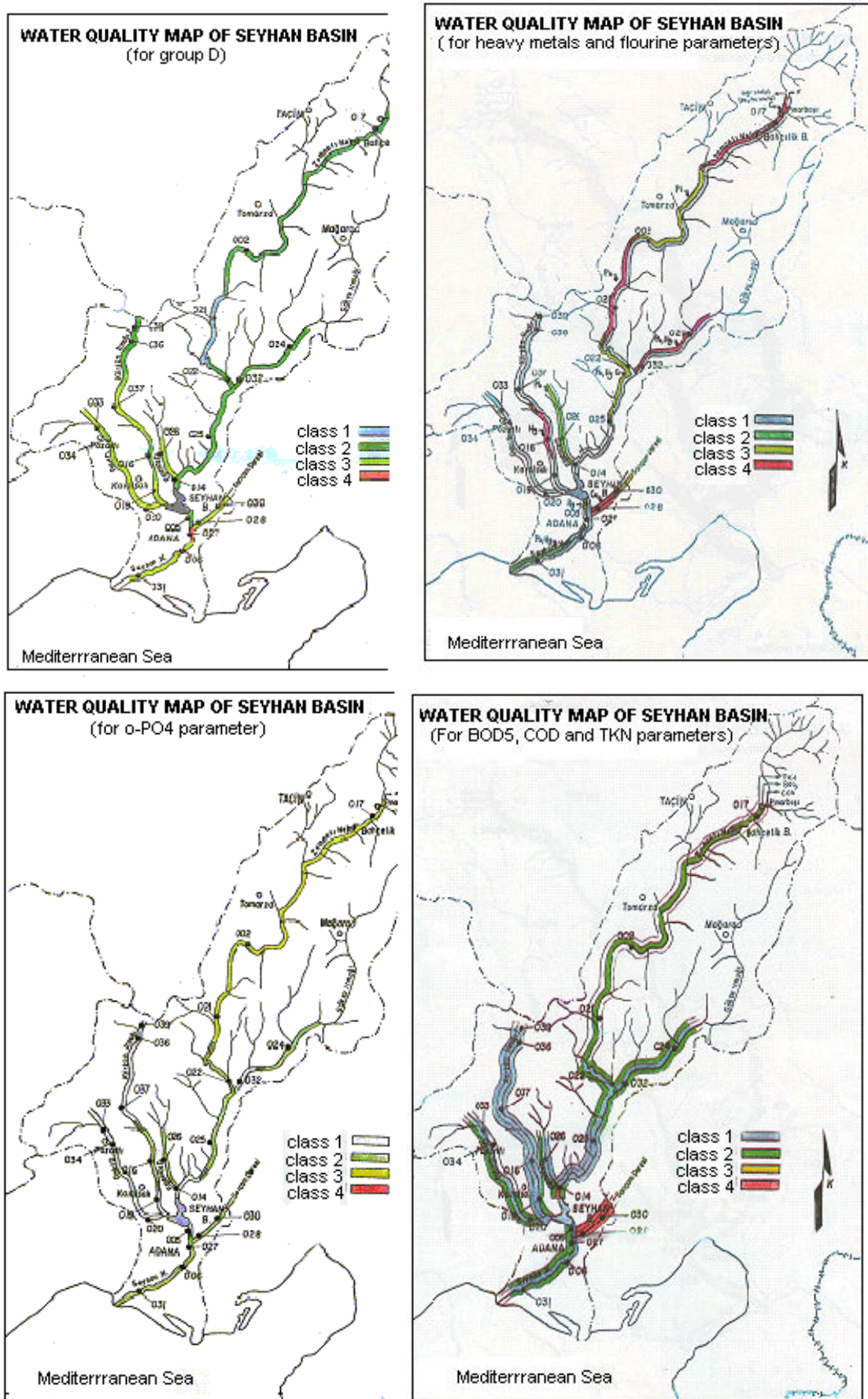


Figure IV-38 Seyhan Basin Present Water Qurality

Source: Adana Province Environmental Condition Report, 2003

IV.2.16 Other Characteristics

There are no subjects to include in this part concerning the utilization of natural resources and the characteristics of the physical and biological environment.

IV.3 Characteristics of Socio-Economic Environment

In this chapter, general information regarding the socio-economic status of Project Site and its vicinity (settlements defined at chapter IV.2.15) is presented.

While it is examined of the socio-economic characteristics, a method of common-to-specific/from whole to part has been followed and the determinations related to territories starting from Adana and Kahramanmaras Provinces continuing with Saimbeyli (Adana) and Göksun (Kahramanmaras) Districts and finally finishing with “Yenikoy” and “Kaleboynu” and “Aksaagac” Villages are given in the following sections.

IV.3.1 Economical Characteristics (major sectors constituting the economic structure of the region, distribution of local labor force to these sectors, the status and significance of the property and service production in these sectors in the regional and national economy, other information)

Adana city, seventh largest province of Turkey, is both the economic and urban center of Cukurova region. According to the data(2003) from State Planning Organization (DPT), Adana is the eighth province in the socio-economic development ranking in Turkey. Data collected in 2000 states that Adana has a share of more than 3% among total Gross Domestic Product (GDP) of Turkey and it is the sixth province. According to the same data, it was the 19th richest province with 2,057 YTL GDP per capita level.

Kahramanmaras city, eleventh largest province of Turkey, Kaleboynu Village of which is at the project impact area. Kahramanmaras is the forty eighth province in the socio-economic development ranking in Turkey.

The major sectors that contribute to Adana economy are agriculture, manufacturing and commerce which totally constitute 65% of the economy. Adana Province and especially Cukurova Region is one of the leading agriculture-industry-commerce areas of Turkey and industrial activities have gained importance by agricultural raw material processing/evaluation.

If the 872 districts in Turkey are considered, Saimbeyli and Göksun are 672th and 713th and 572th in the rankings respectively in terms socio-economic development (DPT, 2003).

Major Sectors Constituting Economic Structure

The information on the major sectors constituting the economic structure of the region is discussed in the following sections.

Agriculture

Adana Province, where is a door opening to sea, is situated at the middle of Cukurova formed by Ceyhan and Seyhan Rivers. Seyhan, Kozan and Catalan Dams are constructed on these rivers and formed the fertile alluvial soils. Geographical position and meteorological conditions of the region earns the province a very advantageous position in terms of agricultural productivity. 7.8% share of total national agricultural production belongs to Adana.

Total area of Adana Province is 1,403,000 ha. 539,000 ha of this land are cultivated agricultural areas, 48,970 ha are pasture and meadows, 547,730 ha are forest and shrub lands, 235,300 ha are abandoned lands, 13,000 ha are residential areas and the remaining 19,000 ha are water surfaces.

Cultivation of corn, peanut, soy bean and sunflower is increasing on the productive soil of the Cukurova Region. In addition, by the application of modern techniques in fields, cultivation of grape, cherry and some other fruits has improved. Distribution of agricultural lands is given in Table IV-36.

Table IV-36 Distribution of Agricultural Areas of Adana Province

Distribution	Hectar
Field	445.180
Fruit	44.406
Vegetable	37.435
Fallow	11.979
Total Agricultural Areas	539.000

Source: Adana Province Environmental Condition Report, 2003

Besides its being the most developed agricultural region in Turkey, Adana is also the province with the highest usage of modern agricultural machinery. 39% of Adana is suitable for agriculture and very fertile.

Fertile fields of Adana give more than one time yields in a year provided that tractors and other modern agricultural machines are utilized along with proper irrigation, fertilization, rehabilitated seeds and pesticide application. Irrigated areas increase every year.

By the production of 250,000 ton pure cotton, especially Akala and Cocker type, one forth of national cotton production is achieved in Adana. In addition to cotton, cereal, sesame, melon, watermelon, early vegetables, barley, oat, leguminous seeds, sugar

cane, grape, fig, tobacco, rice, peanut and citrus are the other important agricultural products.

Kahramanmaraş is the thirteenth province in terms of agriculture by its agricultural potential Kahramanmaraş. Distribution of agricultural areas of the Province is given in Table IV.37.

Table IV-37 Distribution of Agricultural Areas of Kahramanmaraş Province

Distribution of Agricultural Areas	Hectar
Various Crops	361,496
Fruit	31,263
Vineyard	23,362
Vegetable	10,346
Total	426,467

Source: www.kahramanmarastarim.gov.tr

Animal Husbandry

Animal husbandry is not as important as agriculture for the province. There are limited amount of meadow and pasture lands in the province so animal husbandry facilities are observed in slopes of Taurus Mountains. Sheep, cow, goat, horse and camel breeding are the main animal husbandry facilities of the province. In addition, apiculture is also developed.

In Kahramanmaraş, horse, donkey, mule, buffalo, cow production in terms of Cattle; sheep and goat production in terms of small cattle; chicken, turkey, duck and goose in terms of poultry; salmon production in terms of fishery, apiculture and sericulture activities are present.

Industrial Activities

Adana is a highly developed province in terms of industrial sector. Adana with its airport, highway projects, biggest Industrial Zone of Turkey, small industrial estates, recently announced housing zones, health and education institutions, is the sixth out of 81 provinces in terms of GDP.

The number of businesses operating in the province, registered to the Adana Chamber of Industry and employing 10 or more workers is 732. Most of the enterprises are large scaled with high employment rates. 18 of Turkey's top 500 industrial enterprises are located in Adana. The number of enterprises with more than 1000 employees is five. In Adana province, 55 companies with foreign capital are operating. Haci Sabancı Industrial Zone and small industrial estates established on Adana-Ceyhan highway are significant institutions for the development of industry. In Adana, where population and economy grow continuously, "Regional Development Plan" requiring a coordinated study for the solution of infrastructural, unplanned urbanization and other problems as well as for the prevention of possible future problems is included in the scope of DPT's

investment plan. In order to guide the industrialists, prepare projects and determine alternative investment opportunities, Adana Investment Research and Development Center-AYEGEM was established by the collaboration of Adana Governorship, Adana Metropolitan Municipality, Cukurova University, Chamber of Commerce, and Adana Cooperation Foundation.

In Adana, the number of small and medium-scale enterprises is 1,023. Number of enterprises in manufacturing sector and repair and commercial activities are 525 and 550 respectively.

Textile is so advanced that it is able to compete world markets in terms of technology and quality. So it contributes to employment in kahramanmaras province and enables exchange inputs as does Clothing sector that has an importance in Kahramanmaras's economy in parallel with textile. In addition to these two sectors, steel kitchen utensile sector has a significant growth and contributes to economy of the province together with pepper and ice-cream production.

Industrial sites at Kahramanmaras province centre and Districts are given in Table IV.38.

Table IV-38 Small Industrial Sites at Kahramanmaras province centre and Districts

District	The Name of Small Industrial Site	Establishment Date	Operation Beginning	Number of Businesses	Number of Employees
Merkez	Kahramanmaras Small Industrial Site	1966	1981	1908	7.500
Afsin	Afsin 100. Yil Industrial Site	1981	1990	100	300
Göksun	Göksun Small Industrial Site	1985	1994	106	320
Elbistan	Elbistan Small Industrial Site	1975	1992	348	1.650

Source: Kahramanmaras Province Environmental Condition Report

There are not any industrial establishments or activities in the vicinity of the Project Site or its vicinity.

Mining

Adana is rich in terms of mine deposits. Chromium is extracted in Karsanti, quartz is extracted in Karaisali and quartzit and zinc are extracted in Kozan in addition to iron, coal, manganese, quartz, zinc, barite, copper and lead extraction from the districts in the vicinity.

The mainly extracted mines in Kahramanmaras are copper, iron, chromium, manganese, lead and zinc. There are copper and lead deposits in Göksun District and the Afsin-Elbistan lignite deposits provide coal demand of Afsin-Elbistan Thermal plant.

No mining activity, mine or fossil ores exist in the immediate vicinity of the Project Site according to mining maps of the MTA (Mineral Research and Exploration Institute).

Tourism

Thousands of years of history, countless historical artifacts, natural beauty of Yumurtalik and Karatas shores, green plateaus of the Taurus, healing waters and diverse flora and fauna earn Adana a high tourism potential.

The Taurus, surrounding the province in the north and east has a very suitable natural environment for mountain sports, trekking and hunting tourism. Furthermore, it is also very suitable for the development of plateau tourism with its numerous plateaus. Lagoons and marshes created by Seyhan and Ceyhan Rivers provide unlimited opportunities for eco-tourism.

Since summers are too hot in Adana, local people prefer spending summer months in plateaus. There are so many alternative tourism activities as camping, health, river and canoe, cave and hunting tourisms.

Tuzla and Akyatan lagoons created by Seyhan, and Akyatan Lagoon created by Ceyhan, the other remaining lagoons as well as lagoons of Yumurtalik form ideal sheltering and reproduction areas for rarely seen birds along with terrestrial and fresh water species. Areas other than these lagoons are also appropriate for "Coastal Tourism" and "Yatch Tourism".

Other than these, dynamic economical life is another potential of inner Cukurova. Adana holds an important potential for "Business and Conference Tourism" through its university and its traditional social activities. It is the biggest city and business center of the region as well.

Tepebag Artificial Mound, historical Big Clock, mosques, courtyards, covered bazaars and mosaic museum are spectacular places in Adana which is rich in historical artifacts.

A total of 65 large-scale protection areas were determined and declared. Urban protection areas like Kozan Center and Seyhan District Center, archeological production areas like Misis, Magarsus and Anavarza and natural protection areas like Agyatan-Akyatan Yumurtalik Lagoon are among these protection areas.

Civilizations in Adana formed a cultural mosaic through translation of their cultural diversity to next generations. Hittites, Romans, Arabians, Seljuks, Ottomans, Turkomans and clan in the region contributed to the cultural diversity. Especially in 19th and 20th centuries, considerable development in agriculture and industry due to increasing density of population in Adana Plain lead to important changes in the culture of the region.

Cukurova has a rich folklore as it harboured many different civilizations. It is not possible to determine which folklore products of old civilizations exist until present and which of them were integrated with folklore production. General characteristics of

Anatolian folklore are observed in locale folklore except some changes. Dress code which is widespread in some villages of Adana, weddings, folk dances such as javelin, wrestling and “sinsin” are surviving characteristics of folklore.

Plateau Tourism forms an important part of economy of Kahramanmaras province which includes a part of the project site. It is an alternative summer place for Adana, Hatay and Osmaniye since it is cooler than other East Mediterranean Cities. In addition to countless historical structures and findings belonging to Ottoman and Byzantine Histories Kahramanmaras Castle, Ulu Mosque, Tas Medrese in city centre; Evri and Tilkiler Derelicts at Pazarcik Region and Gökahmet and Cokak Derelicts at Andirin Region increases touristic importance of Kahramanmaras.

Dongel, Gumuskaya, Savruk and Bulut Deligi Caves are the geological wealths of Kahramanmaras and important for regional tourism. Guvercinlik, Tekir and Pinarbasi Regions, Firniz Canyon, Ali Stone and Kumasir Lake are the wealths of the Province's geographic tourism in addition to Zeytin Thermal Spring and Ekinozu Mineral Springs which are parts of health and thermal tourism.

Distribution of Local Labor Force

In Adana province, the labor force participation rate of economically active population (12 years and older) is 49% and this ratio varies significantly according to sex. Male labor force participation rate is 66% whereas the rate is 32% for their female counterparts. Female labor force participation rate varies significantly according to place of residence. While 84 out of 100 women are employed in villages, the female labor force participation rates are 16% and 12% in province and district centers, respectively.

In Adana province, the labor force participation rate of economically active population is 58% .Male labor force participation rate is 69% whereas the rate is 45% for their female counterparts. Male labor force participation rate in villages is 82%, in province centre is 61% and in district centres is 55%. Female labor force participation rate in villages is 85% and in province and district centres is 9%.

In the district centers impacted by the Project, Saimbeyli (Adana) and Goksun (Kahramanmaras), labor force participation rates are 24% and 21% respectively and these rates does not differ from the average of all district centers in the provinces (33% for Adana and 23% for Kahramanmaras).

The labor force participating in the province economy and its sectoral breakdown according to TUIK classifications with country level statistics are given in the table below (Table IV .39). As it can be seen in the table, the sectoral breakdown of labor force in Adana displays a parallel pattern with that of Turkey. The leading sector on which economy depends is agriculture, followed by community, social and personal services .

The sectoral breakdown of the active population for Adana and Kahramanmaras provinces are given in Table IV.39.

Table IV-39 Sectoral Distribution of Economically Active Population (%)

Location	A	B	C	D	E	F	G
Adana Province	43,08	8,28	7,97	6,52	1,32	8,45	24,39
Kahramanmaraş Province	35,48	2,64	1,79	1,52	0,35	2,94	8,96
Turkey	35,20	9,50	11,00	6,10	2,40	8,00	27,80

Source: TUIK 2000.

A: Agriculture, animal husbandry, forestry, hunting and fishery

B: Service works

C: Trade and Sale Personnel

D: Executive Personnel etc.

E: Entrepreneurs, directors and senior managers

F: Scientific and technical personnel, self-employed person

G: People working in jobs except for agriculture and People using transportation vehicles

IV.3.2 Population (Urban and rural population in the region, population variations, migrations, population growth rates, average household size and other information)

Administrative Division

Distribution of population of Adana and Kahramanmaraş provinces for the year 2000 is given in Table IV.40 and Table IV.41. As seen from the tables, there are 13 and nine districts in Adana and Kahramanmaraş, respectively. The surface area of the two districts representing the characteristics of the Project Site best, i.e. Saimbeyli and Göksun is 467 km² and 1,920 km², respectively. There are 25 villages in Saimbeyli and seven counties and 51 villages in Göksun.

According to the population census in 2000, the population of Adana and Kahramanmaraş is 1,849,478 and 1,002,384, respectively whereas the population of Saimbeyli and Göksun is 17,149 and 76,033. The populations of the Project-impacted villages, Yeniköy, Eyüplü and Akşaağaç in Saimbeyli and Kaleboynu Village in Göksun are 456, 361, 784 and 1,183.

Table IV-40 Distribution of Adana's Population into Districts for the year 2000

District	Total Population	Urban Population	Rural Population
Total	1,849,478	1,397,853	451,625
Seyhan	849,283	807,934	41,349
Yüreğir	453,799	322,776	131,023
Aladağ	23,579	6,674	16,905
Ceyhan	178,543	108,602	69,941
Feke	20,890	4,632	16,258
İmamoğlu	43,361	30,428	12,258
Karaisalı	35,122	6,883	28,239
Karataş	32,375	9,189	23,186
Kozan	130,875	75,833	55,042
Pozantı	21,756	9,627	12,129
Saimbeyli	17,149	5,198	11,951
Tufanbeyli	20,171	5,332	14,839
Yumurtalık	22,575	4,745	17,830

Reference: TURKSTAT, 2000.

Table IV-41 Distribution of Kahramanmaraş's Population into Districts for the year 2000

District	Total Population	Urban Population	Rural Population
Total	1,002,384	536,007	466,377
Merkez	465,370	326,198	139,172
Afşin	92,718	35,834	56,884
Andırın	41,051	8,311	32,740
Çağlayancerit	29,580	12,642	16,938
Ekinözü	17,102	6,880	10,222
Elbistan	128,27	71,500	56,767
Göksun	76,003	30,232	45,801
Nurhak	17,260	8,118	9,142
Pazarcık	72,628	24,374	8,254
Türkoğlu	62,375	11,918	50,457

Reference: TURKSTAT, 2000.

Urban and Rural Population

As seen from Table IV.42, the total population of Adana is 1,849,473. Of this total, 1,397,853 (75.6%) live in urban areas whereas 451,625 (24.4%) live in rural areas.

There is such a rapid urbanization in Adana that urbanization rate grew over the Turkey's overall urbanization rate. The annual population growth rate is 21.70‰ for 1990-2000 term. Variations in urban and rural populations in Adana are given in Table IV.42.

Table IV-42 Annual Population Growth Rate in Adana and its Districts (‰)

District	Total	Urban	Rural
Seyhan	23.39	22.93	32.75
Yüreğir	20.54	16.44	31.41
Aladağ	1.59	29.07	-7.47
Ceyhan	10.29	24.14	-8.01
Feke	-7.74	-0.80	-9.63
İmamoğlu	17.04	34.80	-15.37
Karaisali	20.21	-4.99	-6.35
Karataş	-6.08	1.8	28.56
Kozan	12.8	33.11	-9.77
Pozantı	-5.73	19.87	-22.22
Saimbeyli	-7.95	10.09	-14.88
Tufanbeyli	-11.69	-6.02	-13.64
Yumurtalık	7.44	28.08	2.59

Reference: TURKSTAT, 2000.

The population of Kahramanmaraş is 1,002,384 and 536,007 (53.5%) of this total population live in urban areas whereas 466,377 (46.5%) live in rural areas.

The urbanization rate in Kahramanmaraş is also high. It grew faster with respect to Turkey's total population. However, there was a decrease in rural population. The urban population growth rate was 27.47% in 1990-2000 term while the decrease in rural population was 4.34% in the same term.

The distribution of urban and rural population is 30% by 70% in Saimbeyli whereas it is 40% by 60% in Göksun. Population growth rate in urban and rural areas of the districts of Kahramanmaraş is given in Table IV.43.

Table IV-43 Population Growth Rates of the Districts of Kahramanmaraş (‰)

District	Total	Urban	Rural
Central District	25.70	35.75	5.49
Afşin	-6.88	22.81	-21.87
Andırın	-7.70	10.18	-11.77
Çağlayancerit	9.44	19.18	2.75
Ekinözü	-16.87	-17.35	-16.55
Elbistan	12.31	26.70	-3.30
Göksun	4.70	28.00	-8.15
Nurhak	14.10	13.58	14.56
Pazarcık	-11.70	-3.15	-15.75
Türkoğlu	2.24	-20.35	8.41

Reference: TURKSTAT, 2000.

Migrations

Çukurova is suitable for growing cotton in terms of soil quality and climatic properties. This gained the attention of France and Germany, and the first agricultural machinery was utilized in Çukurova. Economic development affected social life, and seasonal workers began to immigrate to Adana for cotton yield. There have been a growing number of people migrating to Adana, especially from the Southeast Anatolian Region in 70s. A part of 38.6% of people migrating to Adana was from the Southeast Anatolian Region, and the remaining 61.4% is from the eastern Anatolia and other regions of Turkey. The terror problems after 1990 increased the migration from the east. The migration to Adana resulted from problems in living by 75%, safety reasons by 17%, educational concerns by 6% and health problems by 2%.

According to the results of the population census in 2000, the number of people migrating to Adana was 92,684 whereas the number of people emigrating from Adana was 133,181. These numbers give the net migration rate as -23.97‰ for the year 2000 (TURKSTAT, 2000). According to the same census results, the number of people immigrating to Kahramanmaraş was 33,684 whereas the number of people emigrating from Kahramanmaraş was 59,394. As a result, the net migration rate in Kahramanmaraş is calculated as -28.27‰ for the year 2000.

Population Growth Rate

There was a five times increase in the population of Turkey between 1927 and 2000. In this period, there was an eight times increase in the population of Adana, and it reached 1,849,478. Adana had a share of 1.7% in Turkey's total population in 1927 whereas its share was 2.7% in 2000.

The population of Adana was 1,849,478 according to the results of the census in the year 2000, and the annual population growth rate for 1990-2000 period was 17.71‰. the population growth rate of Adana is nearly the same as that of Turkey with a growth rate of 18.28‰.

The population of Kahramanmaraş, in which part of the Project Site lies, was 1,002,384, and the population growth rate for 1990-2000 period was 11.41‰.

Populations of Saimbeyli and Göksun are 17,149 and 76,033, respectively. Population growth rates for these districts for 1990-2000 period were -7.95‰ and 4.70‰, respectively. The populations of the Project-affected villages, Yeniköy, Eyüplü, Aksaağaç and Kaleboynu are 456, 361, 784 and 1,183, respectively.

Average Household Size

The total number of household in Adana was 402,243, and the average household size in the province was 4.7 whereas the total number of household in Kahramanmaraş was 185,792 and the average household size was 5.6.

The total number of household in Saimbeyli and Göksun is 3,675 and 11,841, respectively whereas the average household size is 5.3 and 6.6 for Saimbeyli and Göksun, respectively.

Distribution of Age Groups

Distributions of age groups in Adana, Kahramanmaraş, Saimbeyli and Göksun are presented in Figures IV.39, 40, 41 and 42, respectively. Young population prevails in Adana and Kahramanmaraş. The most dominant age groups are 10-14 and 15-19 according to the results of the census in 2000, and they are 11.18 and 11.21%, respectively. The most dominant age groups in Kahramanmaraş are 0-4 and 15-19, and their shares are 12.1 and 12%, respectively. The most dominant age group in Saimbeyli and Göksun is 15-19.

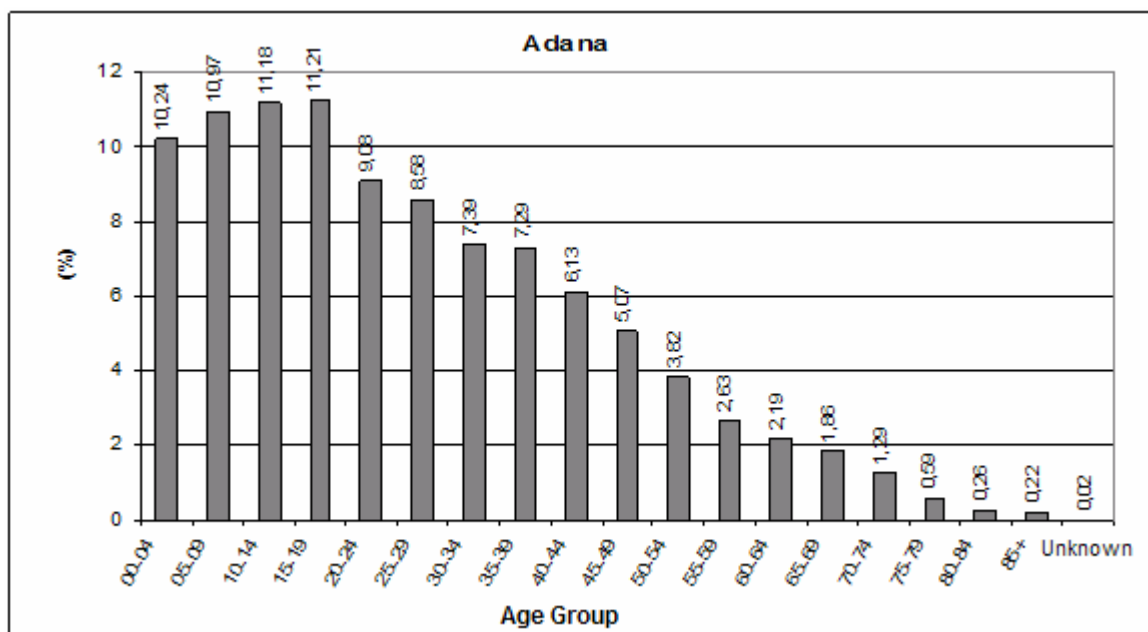


Figure IV-39 Distribution of Age Groups in Adana

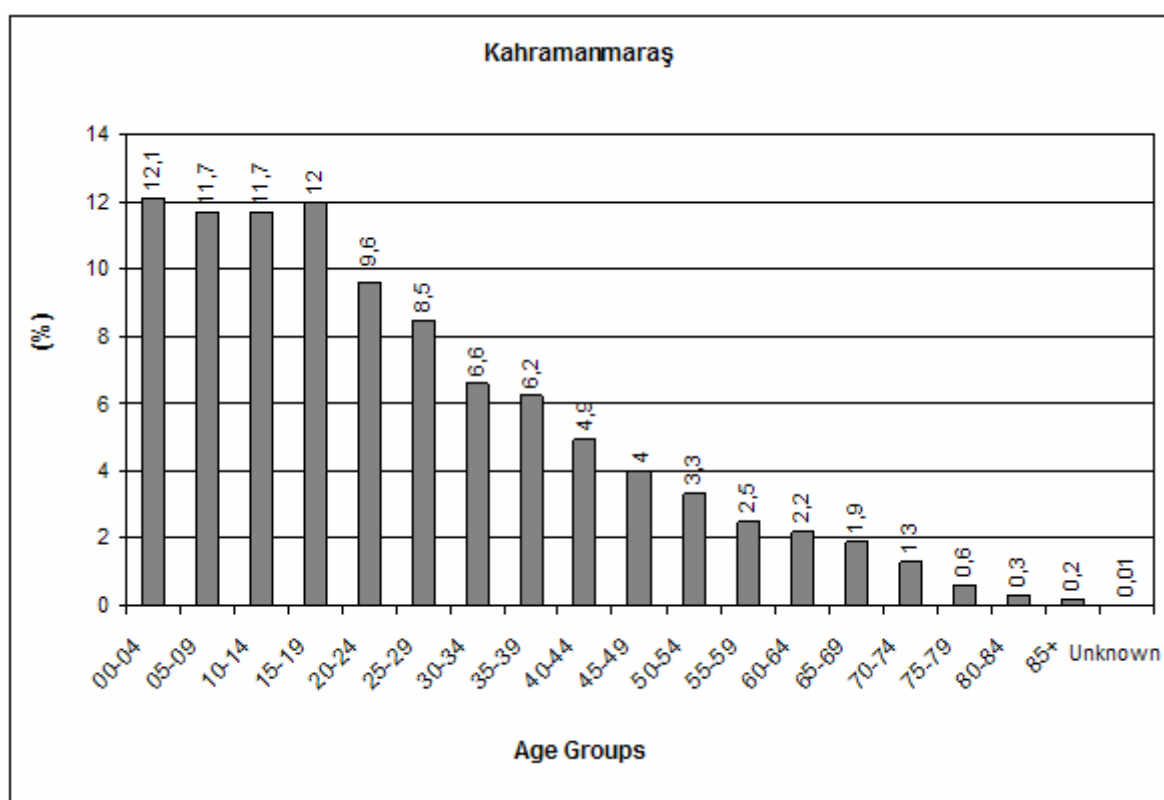


Figure IV-40 Distribution of Age Groups in Kahramanmaraş

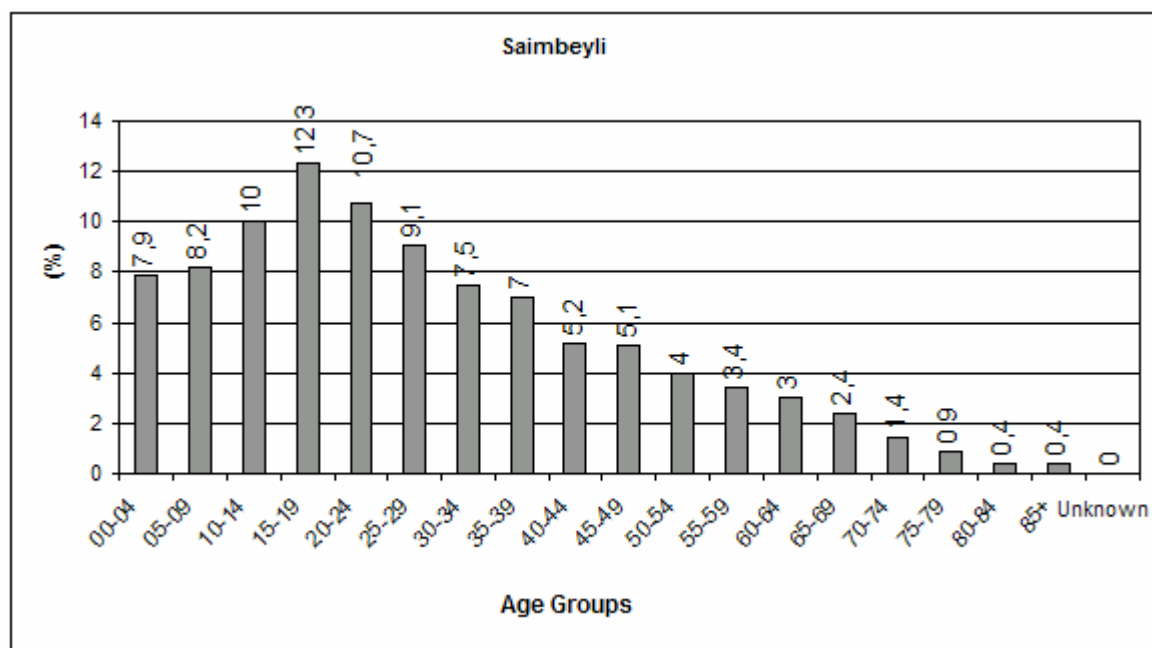


Figure IV-41 Distribution of Age Groups in Saimbeyli

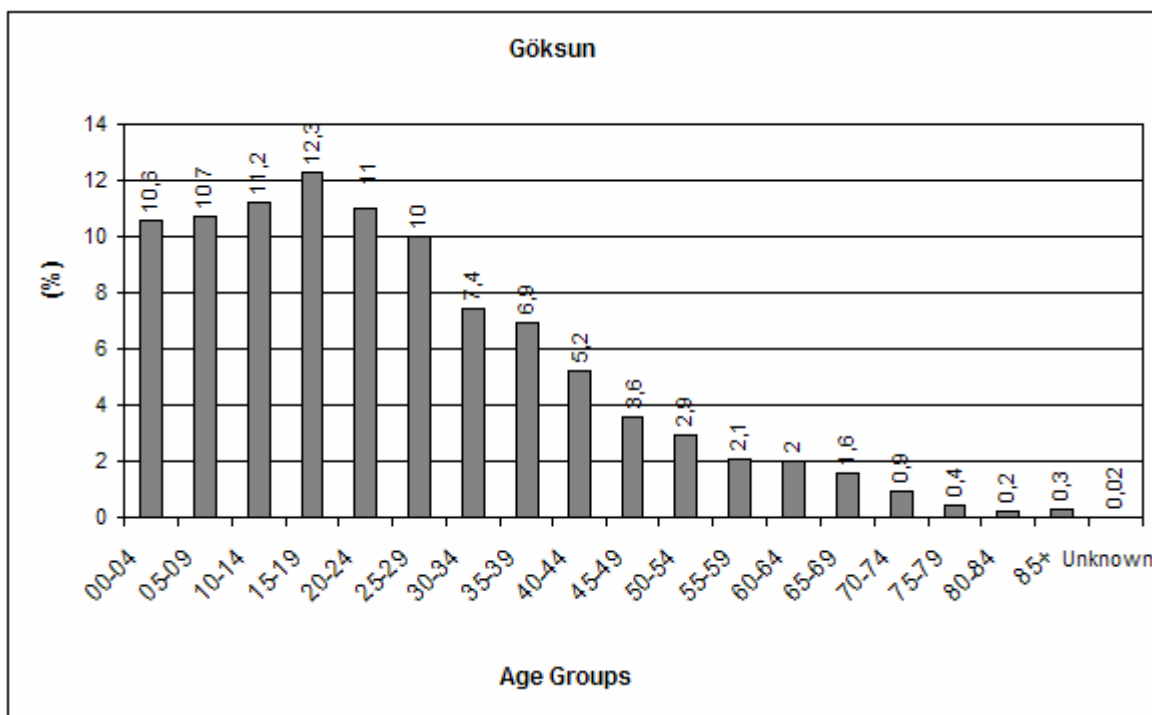


Figure IV-42 Distribution of Age Groups in Göksun

Population Density

The population density is 133 and 70 in Adana and Kahramanmaraş, respectively whereas it is 15 and 39 in Saimbeyli and Göksun, respectively.

Fertility Rate

According to the results of the population census in 2000, the sex ratio in Adana, which is the number of men per 100 women, is 98.98. This is the lowest one that has recorded in the province since 1927.

The total fertility rate is 2.68 and the average age to have a baby was calculated as 28.22. The child/woman ratio, namely the number of children in the age range of zero to four per thousand women in the age range of 15 to 49 is 368.

The sex ratio for Kahramanmaraş Province is 103.85 and the total fertility rate is 3.54. The average age to have a baby is 29.06. the child/woman ratio is 474. The pertinent indicators are presented in Table IV-44.

Table IV-44 Fertility Indicators

Region	Sex Ratio	Total Fertility Rate	Average Age to have a Baby	Child / Woman Ratio
Adana	98.98	2.68	28.22	368
K.maraş	103.85	3.54	29.06	474
Türkiye	102.66	2.53	28.08	362

Ref.: TURKSTAT, 2000.

IV.3.3 Income (Distribution of income as well as maximum, minimum and average income per capita on sectoral breakdown)

Adana Province, seventh largest province, is the eighth in the socio-economic development ranking in Turkey according to data from SPO (2003), Adana. Data collected in 2000, states that Adana Province produces approximately 3,05 % of total GDP of Turkey and has the sixth rank. According to data collected in 2001 Adana has 2,833 YTL GDP per capita level. The sectoral distribution of the GDP of Adana Province is given in Figure IV.43.

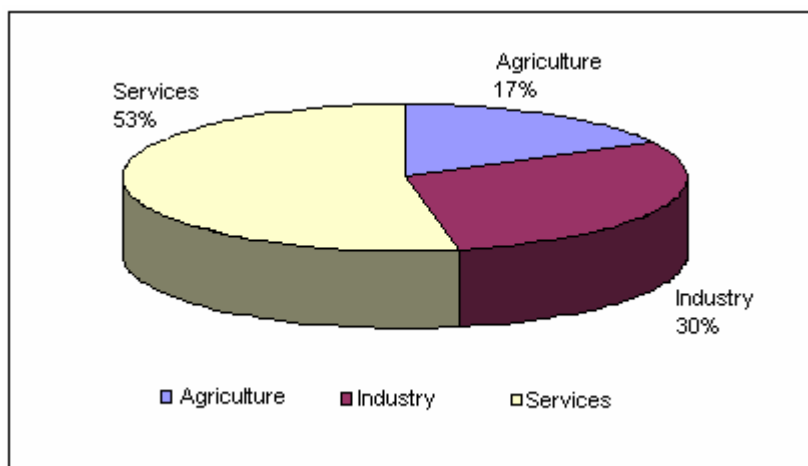


Figure IV-43 Sectoral Distribution of Gross Domestic Products in Adana Province in 2001

Kahramanmaraş Province, forty eighth province in the socio-economic development ranking in Turkey according to data from SPO (2003). Data collected in 2000, states that Adana Province produces approximately 0,98% of total GDP of Turkey and has the twenty fourth rank. According to data collected in 2001 Kahramanmaraş has 1,918 YTL GDP per capita level.

IV.3.4 Unemployment (Unemployed population in the region and its ratio to economically active population)

By definition, economically active population is the ratio of population who are older than 12 to the population who are employed, have ongoing relevance with work or seeking a job.

According to the TUIK data of the year 2000, the unemployment rate of Adana Province has increased to 14.3% in 2000 while it was 5.5% in 1980. This ratio is 15.0% for the male population in 2000, while it is 12.8% for females. The unemployment rate of Kahramanmaraş Province is 7,8 % in 2000. this ratio is 10,3 % for the male population and 4,1 % for the female population. Unemployment rates by sex of Adana and Kahramanmaraş Provinces are presented in Figures IV-44 and IV-45.

The unemployment rates in Saimbeyli and Goksun Districts which are the most probable regions to be affected by the project are 34,14 and 23,67 %.

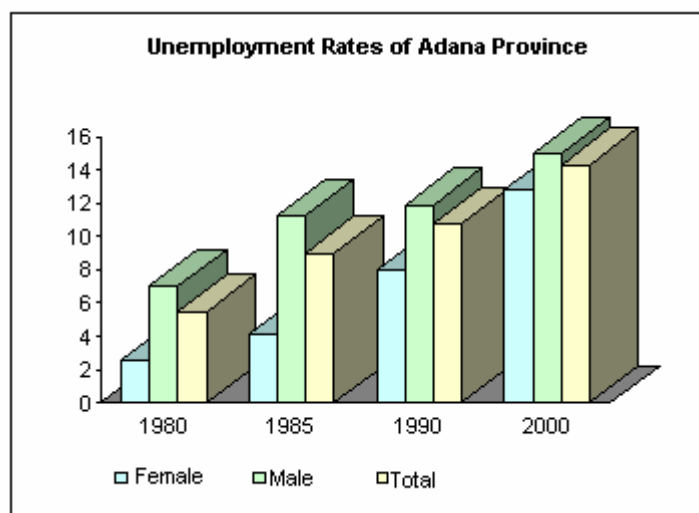


Figure IV-44 Unemployment Rates by sex in Adana Province

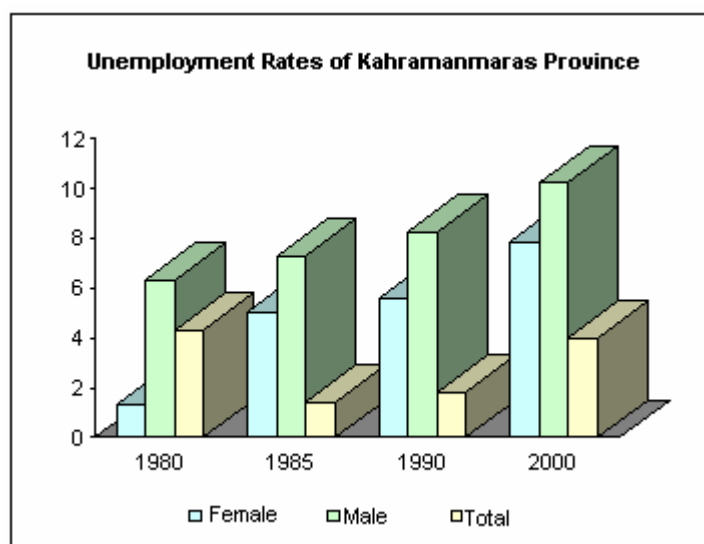


Figure IV-45 Unemployment Rates by sex in Kahramanmaraş Province

IV.3.5 Social Infrastructure Services in the Region (Education, health, cultural services and utilization from these services)

Education and Cultural Services

According to data of TUIK for the year of 2000, literacy ratio is 87% in Adana Province and this ratio is 94% for males and 80% for females. Literacy ratio in Kahramanmaraş is 83%, this ratio is 92% for males and 75% for females. Literacy ratios in Saimbeyli and Goksun Districts are 89% and 88% respectively.

Education is achieved by 460,315 students and 17,380 teachers are charged. there are 411 nursery school, 718 primary school, 125 secondary school and 96 vocational and technical school in the province. Besides, 4 Public Libraries, Adana Archeology Museum, Ethnography Museum, Ataturk Science and Cultural Center and Misis Mosaic Museum do exist in Adana Province. Cukurova University is the only higher

education institution of the Province. The University has 10 faculties, 12 vocational schools, 27 research centers, 3 insitutes and 1 state conservatory and 32,700 students.

According to the same years data Kahramanmaras province has 315 nursery school, 8816 primary school, 48 secondary school and 64 vocational and technical schools. 232,831 students achieve education and 9,606 teachers are charged at these schools. Kahramanmaras Sutcu Imam University is the higher education institution of the Province. The University has 7 faculties, 2 vocational schools, 6 research centers and 3 insitutes.

Literacy rate and schooling ratios in Adana and Kahramanmaras Provinces are presented in Figures IV.46-47 and Tables IV.45-46 respectively.

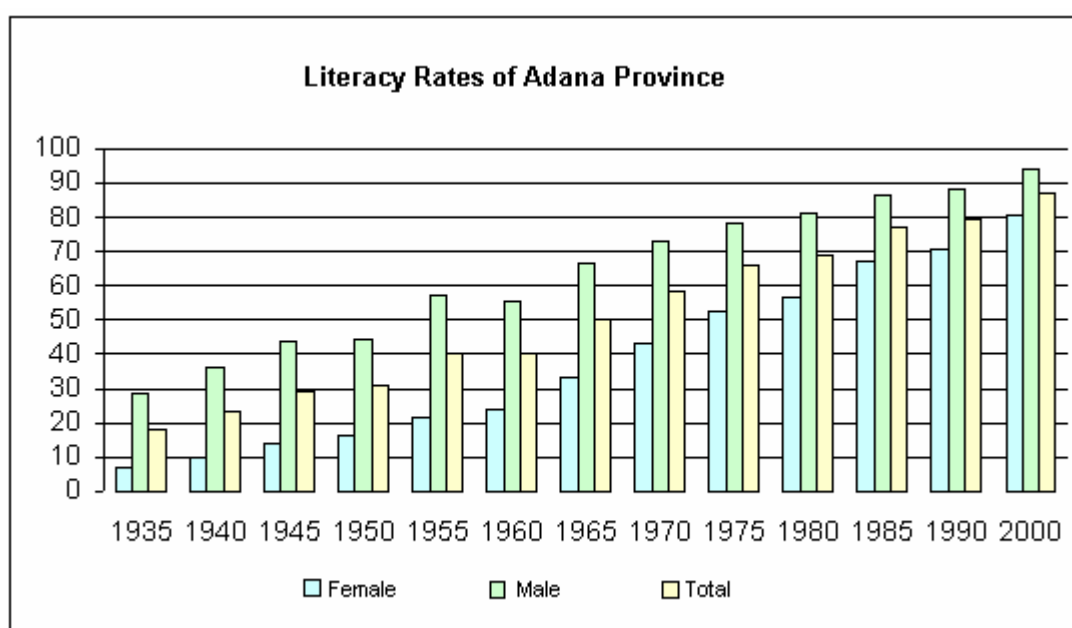


Figure IV-46 Literacy Rates in Adana

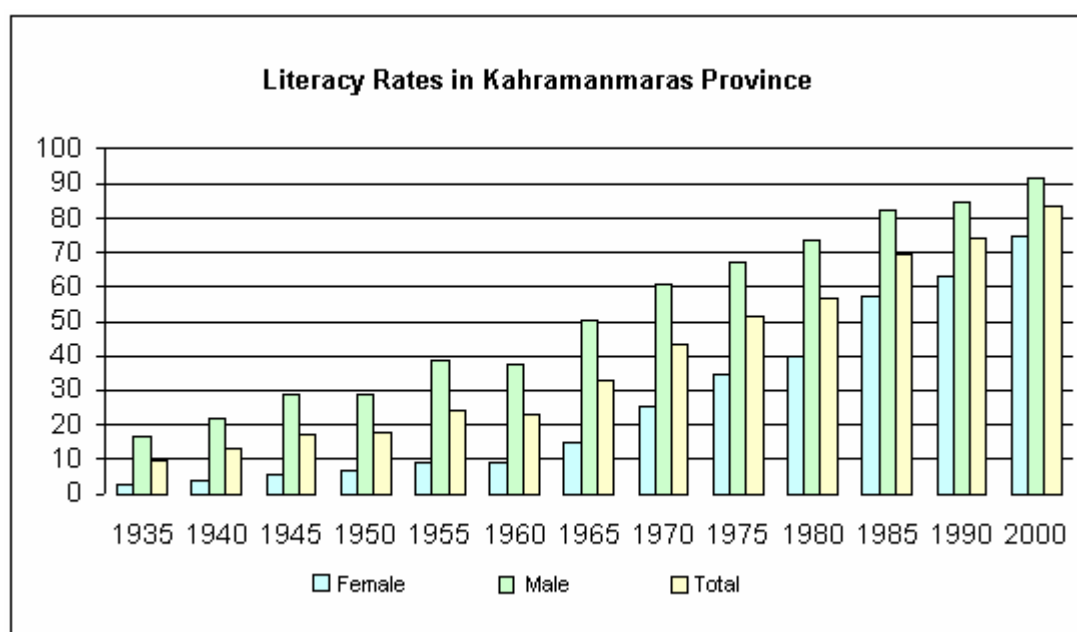


Figure IV-47 Literacy Rates in Kahramanmaraş Province

Table IV-45 Schooling in Adana Province

TYPE OF SCHOOL	Number of Schools	Number of Students	Number of Teachers	Number of Classes
Nursery School	411	14.533	590	808
Primary School	718	336.264	11.636	10.331
High School	112	77.318	3.034	2.113
Vocational High School	96	32.200	2.120	1.034
Total	1.337	460.315	17.380	14.286

Ref.: TURKSTAT, 2006

Table IV-46 Schooling Ratio in Kahramanmaraş Province

TYPE OF SCHOOL	Number of Schools	Number of Students	Number of Teachers	Number of Classes
Nursery School	315	10,071	280	506
Primary School	816	176,672	6,798	7,241
High School	48	28,944	1,418	890
Vocational High School	64	17,144	1,110	625
Total	1,243	232,831	9,606	9,262

Ref.: TURKSTAT, 2006

During the period 1975-2000, there has been an important increase in the proportion of the population receiving education after primary school in Adana province. While 13.4% of males completed their education after primary school in 1975, this ratio reached to 38.1% in 2000. Same developments were observed in females as well. 5.6% of females in 1975 and 22.3% in 2000 have completed at least one of the educational stages after primary school.

Same increase in the proportion of the population receiving education after primary school was seen in Kahramanmaraş. While 7.3% of males completed their education after primary school in 1975, this ratio reached to 32.2% in 2000. . Same developments were

observed in females as well. 1,8% of females in 1975 and 11,7% in 2000 have completed at least one of the educational stages after primary school.

The number of people who has received at least high school education has increased for both males and females significantly. While only 5.5% of the males and 3.1% of females were high school graduates in 1975, this ratio has increased to 17.1% for males and 11.1% for females by 2000. Tertiary education graduation rates have also increased in both sexes. While 2.9% of the males and 0.6% of the females were graduates of higher education institutions in 1975, these values have increased to 9.6% for males and 5.3% for females in 2000.

Same development is seen in Kahramanmaraş too. . While only 3,54% of the males and 0,9% of females were high school graduates in 1975, this ratio has increased to 13,6% for males and 5,3% for females by 2000. Tertiary education graduation rates have also increased in both sexes. While 1% of the males and 0.1% of the females were graduates of higher education institutions in 1975, these values have increased to 8% for males and 2,5% for females in 2000.

Population by educational attainment with respect to TUIK 2000 data in Adana and Kahramanmaraş Provinces and the districts of Saimbeyli and Goksun, are presented in Figures IV-48, 49, 50 and 51 respectively and the population by literacy and last school completed is shown in Table IV.47.

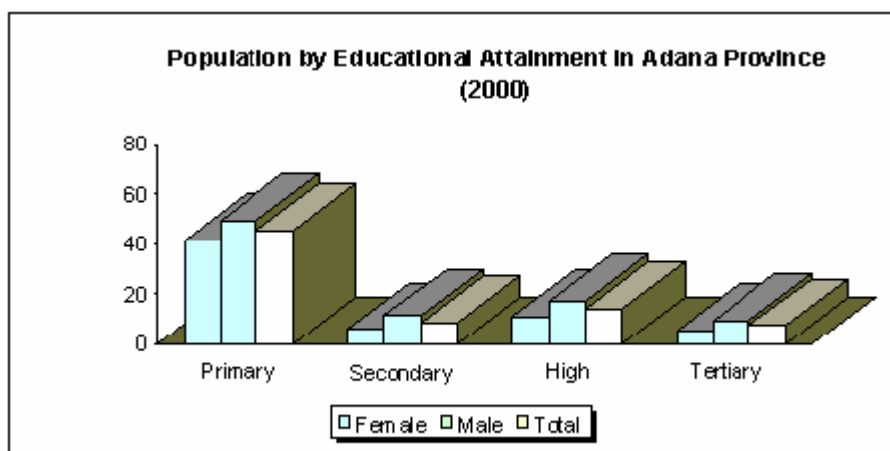


Figure IV-48 Population by Educational Attainment in Adana Province

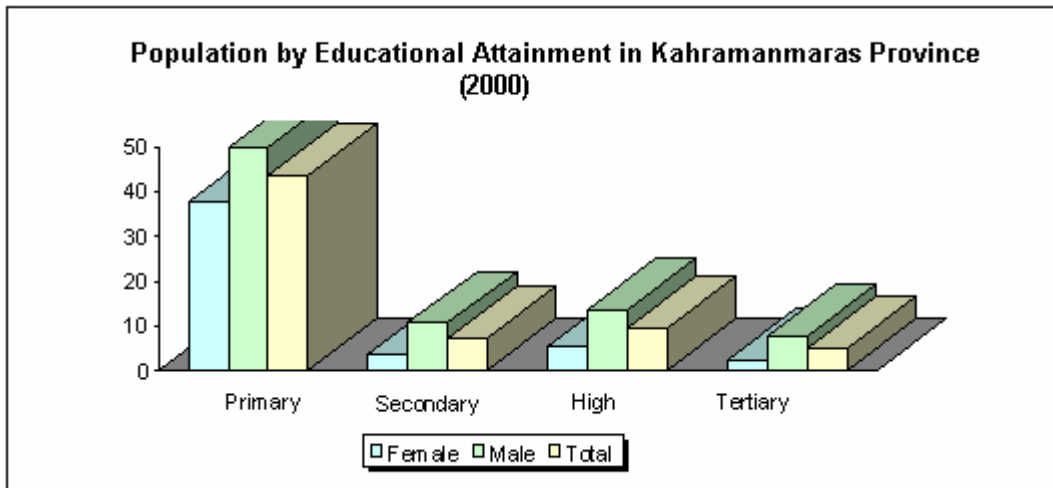


Figure IV-49 Population by Educational Attainment in Kahramanmaraş Province

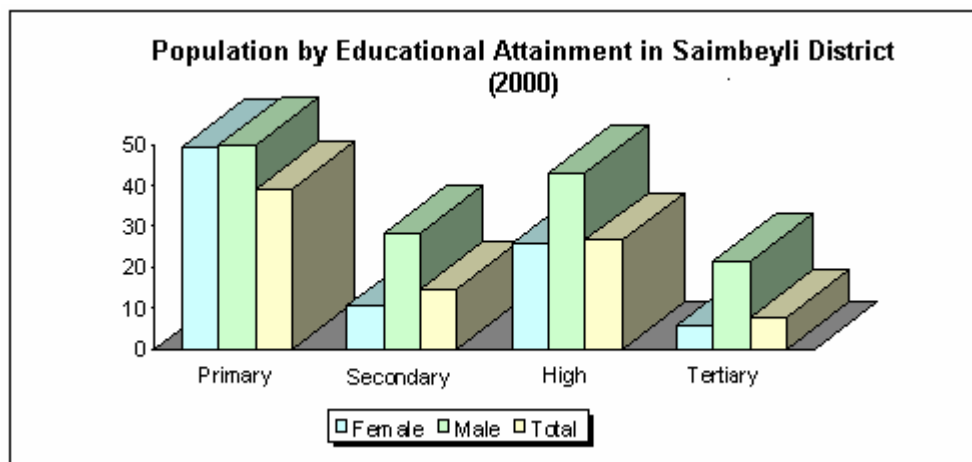


Figure IV-50 Population by Educational Attainment in Saimbeyli District

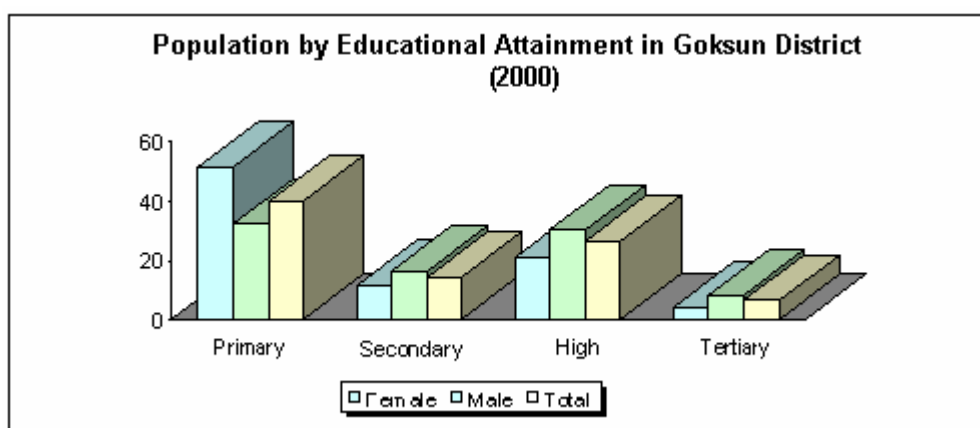


Figure IV-51 Population by Educational Attainment in Göksun District

There are primary schools in Yeniköy, Eyüplü and Aksaağaç (Saimbeyli) and in Kaleboynu (Göksun). Pupils in Aksaağaç and Eyüplü are provided with transportation to primary schools located in the district center.

Table IV-47 Population by Literacy and Last School Completed

Literacy Status	Adana Province	Kahramanmaraş Province	Saimbeyli District	Göksun District
Illiterate	212,623	141,845	497	3,117
Not graduated from any school	382,752	215,249	911	6,085
Graduated from first school	554,088	298,900	1,293	6,887
Graduated from secondary school	167,349	52,974	485	2,469
Graduated from High school and Vocational school	226,859	20,440	70	4,548
Graduated from senior high school and Faculty.	76,882	28,275	253	1,110

Ref.: TURKSTAT, 2000.

There is no educational institute in the vicinity of the Project Site to be affected by construction of the project site.

Health Services

According to 2000 World Health Organization (WHO) , While the number of patient per bed is 420 in Adana Province, the figure is 380 for Turkey.

Total number of patient beds is 5,019 in Adana Province. 1,291 medical experts, 1,496 medical practitioners, 2,122 nurses, 1,727 health officers and 1,325 midwives are working in health sector according to 2005 health data.

According to same years data, there are 1.579 patient beds, 318 medical experts, 527 medical practitioners, 876 nurses, 896 health officers and 669 midwives working in health sector of Kahramanmaraş province.

There are 143 health clinics in Adana Province three of which are in Saimbeyli . At Eyuplu, Yenikoy and Aksaagac which are villages closed to the project site there are not any health clinics or dispensaries.

In addition to 3 health clinics in Saimbeyli there are 6 dispensaries. Central health clinic serves the district centre and its villages with 3 doctors, 1 nurse and 1 midwife. The other 2 health clinics are in the villages of Saimbeyli.

For cure and control of workers during the construction period, requirements of the 180th item of the "Public Health Law In Turkey" with date 24.04.1930 and no. 1593 are going to be accomplished.

Transportation

Transportation is provided by road, airway, railroad, sea road in Adana province. There are 448 km state highway, 511 km province road, and 146,2 km divided road within the borders of Adana Province.

Adana airport came into service as a civil-military airport in 1937. It was started to be used as civil airport in 1956. It is 3,5 km away from the city center. The annual passenger capacity of 2.000.000 by 1997 reached to 5.000.000 passenger/year with the opening of International Lines terminal.

It is possible to travel to many cities by railroad transportation from Adana station which was connected to railroad network in 1860's. There is a total of 205 km long railroad within the borders of Adana Province, of which 156 km is main route, 23 km is double route (Yenice-Adana), 26 km is station route, and indirect routes. There are 11 stations in total.

Transportation is provided by road, airway, railroad, sea road in Kahramanmaras province. There are 397 km state highway, 533 km province road, and 128 km divided road within the borders of the province. there are 107,2 km railroad in the borders of the province 46,5 km and 60,7 km of which are electric and non-electric railroads respectively. Kahramanmaras Airport which is on the Gaziantep-Pazarcik beltway is 8 km away from the city centre. The annual passenger capacity is 400.000 for the airport.

Transportation to the project site is delivered by two state roads junction point of which is Pinarbasi District. First one is D-300 state road connecting Kayseri to Malatya. Second one is D-815 state road connecting Adana to Kayseri through Kozan-Feke-Saimbeyli-Tufanbeyli.

The project site is 215 km away from Adana by D-815 state road and 190 km away from Kayseri by D-300 state road. Yamanli is 67 km away from Saimbeyli. And the road connecting Tufanbeyli to Kayseri through Develi is 145 km long.

IV.3.6 Land Usage of Rural and Urban (The Distribution of Settlement Area, Present and Planned Usage Areas, in this Context, Industrial Regions, Houses, Tourism Areas etc.)

Present and Planned Usage Areas

The surface area of Adana is 1,403,000 ha of which 539,000 ha is cultivated agricultural land, 48,970 ha is meadow and pasture, 547,730 ha is forest-shrub and brush, 234,300 ha is mountainous and stony, 13,000 ha is residential area and 19,000 is water surfaces. The distribution of land assets of Adana Province is presented in Figure IV.52.

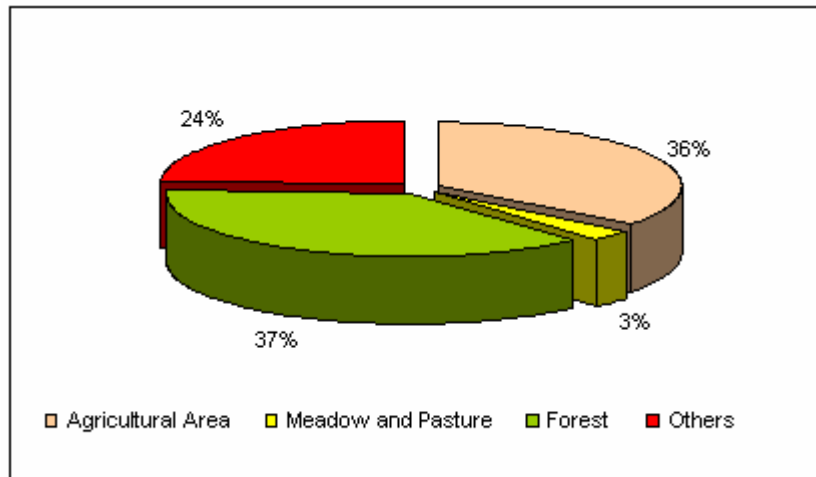


Figure IV-52 Adana Province by Land Assets

Among the agriculture-convenient lands, class I area is 198,000 ha, class II area is 85,000 ha, class III area is 117,000 ha and class IV area is 69.000 ha. Distribution of agricultural lands of Adana Province is given in Figure IV.53.

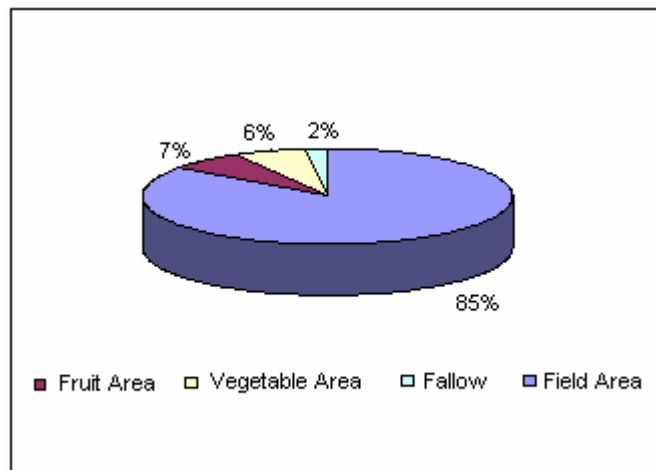


Figure IV-53 Agricultural Land Distribution of Adana Province

The surface area of Kahramanmaras is 1,434,600 ha of which 426,467 ha is cultivated agricultural land, 117,269 ha is meadow and pasture, 503,321 ha is forest-shrub and brush, 371,908 ha is non agricultural area and 15,635 ha is water surfaces. The distribution of land assets of Kahramanmaars Province is presented in Figure IV.54.

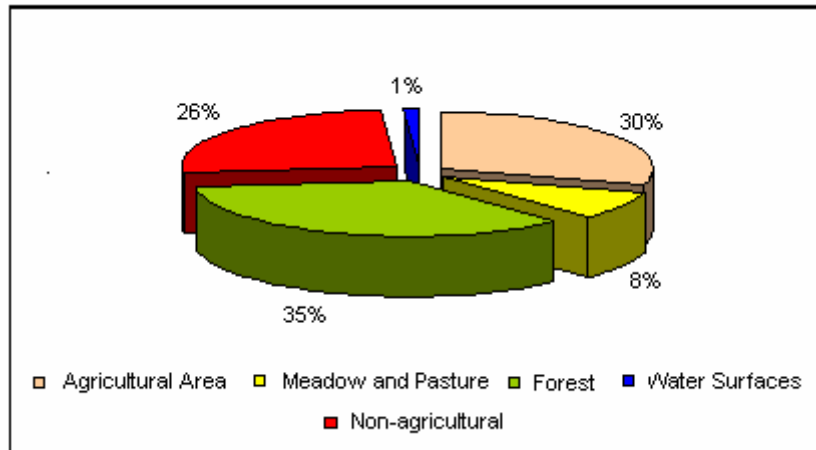


Figure IV-54 Kahramanmaraş Province by Land Assets

Among the agriculture-convenient lands, class I area is 123,965 ha, class II area is 103,481 ha, class III area is 78,467 ha and class IV area is 94,197 ha in Kahramanmaraş province. Distribution of agricultural lands of Kahramanmaraş Province is given in Figure IV.55.

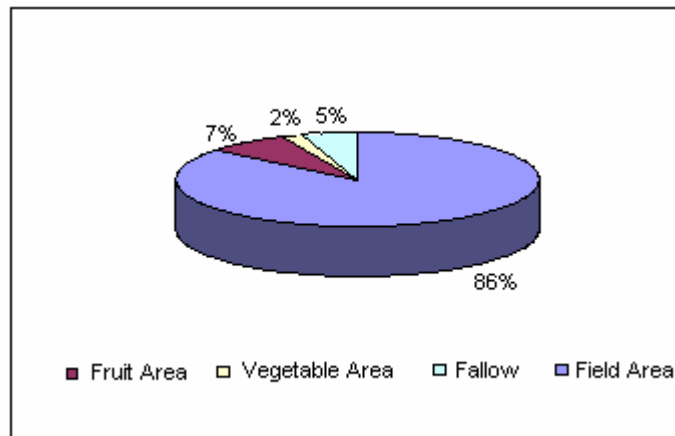


Figure IV-55 Agricultural Land Distribution of Kahramanmaraş Province

Present And Planned Usage Areas

All land assets of Saimbeyli and Goksun Districts are 113,200 ha and 74,998 ha, respectively. Land usage patterns of the subject districts are presented in Table IV.48.

Table IV-48 Land Usage Patterns of Saimbeyli and Kozan Districts

Land Usage Types	Saimbeyli		Göksun	
	AREA(HA)	RATE (%)	AREA (HA)	RATE (%)
Area	113.200	100	74.998	100
Total Agricultural Land	11.700	10,3	48.000	64
Meadow pasture Area	11.700	10,3	26.130	34,8
Forestry Area	69.547	61,4	-	0
Other Lands	20.253	18	868	1,2

Industrial Regions and Tourism Areas

Saimbeyli District

Saimbeyli, which is 157 km away from Adana has church and castle remains. Saimbeyli-Obruk Resting Place which is 5 km away from the district is a significant place with its cold spring water, beautiful landscape and plateau property.

Goksun District

Saimbeyli, which is 89 km away from Adana has a lot of castles, remains and mounds. Maltepe, Camiz, Cardak and Cataltepe Mounds and Bozhoyuk; Kizilkaya, Gerdek and Akcakalesi, Kaya Graves and Cakir Caves are the main cultural richness of the district.

Mazgac, Arpalik, Meryemcil, Tasoluk, Alocat, Catak, Ucpinar, Kozcakoz, kavsut and Binboga Plateaus are important richnesses of Goksun in terms of both animal husbandry and tourism.

IV.3.7 Other Aspects

There is not any other additional information to be given in this section.

V. IMPACTS OF THE PROJECT ON THE AREA DESCRIBED IN CHAPTER IV AND THE NECESSARY MEASURES TO BE TAKEN

V.1 Preparation of Area, Projects in Construction and Operational Phases, Impacts on Physical and Biological Environment and Necessary Measures to be Taken (Including Weir, HPP, Quarries)

In this section, possible bio-physical and socio economic impacts regarding construction and operation phases of the Project facilities are evaluated. The section comprises the measures to be taken against potential impacts at both the Project Site and on ecological and socio-economic environment at the downstream and upstream of the Project Site.

While the possible impacts of construction activities are explained in section V.1, the possible impacts during operation and pertinent mitigation measures are explained in Section V.2. Possible socio-economic effects in both construction and operation phases are evaluated in detail in Section V.3.

V.1.1 Within the Context of Works for Preparation of Land, Where and How Much Excavation will be Made, Amount of Excavation, Where Excavation Materials Like Soil, Stone, Soil etc. will be Transported, Where They will be Stored or Used for Which Purposes, the Materials to be Used During Excavation

During the construction of Weirs and HPP as well as other facilities within the context of the Project, there will be excavation due to digging, fill-in, leveling, unloading of material, road construction and rehabilitation processes and topographic structure of the present area will change. The excavation to be performed within the context of the Project will be as below.

The area to be excavated and excavation amount

Digging and leveling works in the construction of the Project will be carried out for the facilities stated below. In this context, amount of total digging within the context of the Project is approximately 1.162.757 m³, and the distribution of the total excavation material by project units is given at Table V.1.

Table V-1 Excavation amount

Unit	Excavation Amount		
	Mechanical Digging Amount (m ³)	Digging made with explosive material (m ³)	Total (m ³)
Yamanlı II Stage I			
Yamanlı II Stage I Weir Access Tunnel		26,793	26,793
Yamanlı II Stage I Weir and gravel pass	10,610	33,250	43,860
Yamanlı II Stage I Weir Intake Structure	2,560	20,160	22,720
Yamanlı II Stage I Energy Tunnel	142,585		142,585
Surge tank	6,626	4,200	10,826
Penstock and Valve Chamber	2,920	15,880	18,800
Yamanlı II Stage I HPP Building	11,200	108,600	119,800
Yamanlı II Stage II			
Yamanlı II Stage II Weir and Gravel Pass	6.440	19.200	25.640
Yamanlı II Stage II Weir and Intake Structure	1.880	12.880	14.760
Yamanlı II Stage II Supply Canal	240.119	160.079	400.198
Yamanlı II Stage II Supply Tunnel		17.283	17.283
Hocabey Weir and Gravel Pass	1.735	8.860	10.595
Hocabey Weir and Intake Structure	1.120	8.600	9.720
Hocabey Weir Supply Canal	57.387	86.080	143.467
Yamanlı II Stage II HPP Forebay and Valve Chamber	11.900	2.250	14.150
Penstock	450	2.430	2.880
Yamanlı II Stage II HPP Building	11.780	126.900	138.680
Total	366.727	796.030	1.162.757

Ref.: Yamanlı II Weir and HPP Feasibility Report April 2005

Amount of digging materials derived from Yamanlı Project is significant as seen above. Therefore, usage of digging materials on convenient zones in accordance with digging material characteristics is important for the project economy. Within the context of project 17,160 m³ back wall fill-in will be used.

- Total Concrete Amount 137,166
- Total Concrete Aggregate Need (x1.2) 165,000

Elimination of waste material

The part of mentioned excavation materials remaining from fill-in and construction will be stored in storage sites. Within the context of project 7 deposit sites will be used and the areas of sites and distances to nearest living locations are given at Table V.2.

Table V-2 The Areas of Sites and Distances to Nearest Living Locations

Deposit Sites	Area (ha)	The Nearest Living Location	Distance (m)
P1	9,0	Hocabey Houses	1.200
P2	0,9	Hocabey Houses	200
P3	8,9	Hocabey Houses	200
P4	5,4	Hocabey Houses	900
P5	101,5	Aksaağaç	500
P6	3,0	Kaleboynu	200
P7	5,3	Aybaşı Mahallesi	400

The coordinates of storage sites are given at Table V.3.

Table V-3 The Coordinates of Storage Sites

Storage Site	Point	Coordinates	
		Easting	Northing
P 1	1	250 326.33	4 196 999.10
	2	250 598.06	4 196 870.79
	3	251 093.89	4 196 826.53
	4	251 168.86	4 196 713.66
	5	250 987.10	4 196 592.03
	6	250 509.57	4 196 579.01
P 2	1	251 749.02	4 197 186.65
	2	251 940.53	4 197 233.53
	3	252 092.96	4 197 378.09
	4	252 374.37	4 196 811.57
	5	252 326.55	4 196 489.41
	6	251 963.98	4 196 631.85
P 3	1	252 573.78	4 197 356.34
	2	252 862.95	4 197 351.97
	3	253 090.77	4 197 255.61
	4	253 244.12	4 197 106.70
	5	253 366.80	4 197 071.66
	6	253 467.57	4 196 712.52
	7	252 998.77	4 196 585.51
	8	252 841.04	4 196 642.45
	9	252 595.68	4 196 629.31
	10	252 380.99	4 196 975.31
P 4	1	253 139.11	4 197 731.55
	2	253 292.05	4 197 641.62
	3	253 480.99	4 197 722.56

Storage Site	Coordinates		
	Point	Easting	Northing
	4	253 418.78	4 197 565.40
	5	253.332.54	4 197 475.24
	6	253 067.13	4 197 596 .65
P 5	1	254 464.83	4 201 414.15
	2	254 467.90	4 200 607.34
	3	254 470.87	4 199 825.53
	4	253 883.29	4 200 019.01
	5	253 461.62	4 200 654.75
	6	253 605.06	4 200 902.36
P 6	1	255 651.01	4 203 954.06
	2	255 867.48	4 203 496.44
	3	255 764.57	4 203 390.02
	4	255 316.12	4 203 549.11
	5	255 239.36	4 203 904.39
P 7	1	260 281.00	4 213 866.50
	2	260 301.50	4 213 724.50
	3	260 218.63	4 213 608.28
	4	259 613.50	4 213 866.50
	5	259 828.00	4 214 069.00
	6	259 973.50	4 213 963.00

The map showing area information, coordinates and transportation routes of storage sites are given at Appendix-C.

All excavation and storing processes within the context of the Project will be carried out in compliance with the Regulation on Control of Excavation, Construction and Demolition Wastes, effective since publication in Official Gazette dated 18.03.2004 date and numbered 25406. Excavation material will not be stored in unsuitable places in the Project Site. Vegetative soil extracted during excavation will be stored with its surface covered, and it will be used as vegetal top layer during landscape works.

Machine and Equipment Using for Construction Process

The equipment which is within the context of construction works during the main process like digging, fill, open tunnel, grazing, concrete works, transportation will be used as bellow.

- Road cylinder
- Cylinder with vibration
- Bulldozers
- Excavators
- Loaders with tire wheel
- Dump Trucks

- Compressors
- Tunnel Jumbo Drillers
- Open Excavation Rock Drillers
- Portable Compressor
- Generators
- Crushers
- Washing and sifting machines
- Concrete Pump
- Concrete Mixing Unit
- Crusher
- Injection Machine
- Drilling Machine
- Loaders as Backhoe Type
- Tunneling Machine

The number of equipment, which will be used, can change depending on construction stage.

V.1.2 Transportation, Storage and Utilization of the Flammable, Explosive, Dangerous, Toxic and Chemical Material which will be Used During Preparation of Land and Construction of Units

Due to the geological structure of the construction site, it is planned to use explosive materials. Necessary permissions will be obtained from the Governorship of Adana, and after being supplied by the producer, the explosive material will be conveyed to the Project Site according to the pertinent regulations. For conveying explosives, escort and 10-ton trucks and for conveying diesel and oil, 10-ton tankers and straight chassis trucks will be used.

Transportation, storage and usage of flammable and explosive materials (dynamite, capsule, benzene, diesel etc.) will be carried out according to the provisions of the bylaw on "Taking Measures on work place and works worked with Explosive, Flammable, dangerous, and noxious substance" (Official Gazette dated 24 December 1973 and numbered 14752) and the provisions of the bylaw on "Production, import, transportation, keeping, storing, selling, using, destruction, control of the explosive, hunting equipment and etc. substances excluded from monopoly of procedures and basis" (Official Gazette dated 29 September 1987 and numbered 19589).

Diesel and benzene will be conveyed to construction site by tanker and stored in buried tanks and it will be distributed by pump according to the pertinent regulations. Motor oil will be provided with barrels and conveyed to construction site with trucks and used within the area where is connected to drainage oil holder, thereby leakage will prevented

Oil waste from construction equipment will be annihilated according to regulation on “Control of Waste Oil” (Official Gazette dated 21 April 1987 and numbered 25353).

V.1.3 Flood Prevention and Drainage

Yamanlı II stage I and II weirs and Hocabey Weir will function as a spillway. This spillway of Yamanlı II Stage I and II will be outer-receptor with no gates and its width will be 60 m. The spillway of Hocabey will be also be outer-receptor with no gates and its width will be 20 m.

At the location of Yamanlı II Stage I Weir, 100 years recursive flood flow rate (Q_{100}) of Goksu River 591 m³/s. The spillway at 1,170 m crest level, with a 2.73 m water head can carry this flood flow rate safely. Weir landscaping level, to provide safety at 500 year repetitive flood flow rate, calculated as 1.173 m.

At the location of Yamanlı II Stage II Weir, 100 years recursive flood flow rate (Q_{100}) of Goksu River 679 m³/s. The spillway at 858 m crest level, with a 3.00 m water head can carry this flood flow rate safely. Weir landscaping level, to provide safety at 500 year repetitive flood flow rate, calculated as 861.50 m.

At shaft location of Hocabey Weir, 100 years recursive flood flow rate (Q_{100}) of Goksu River 180 m³/s. The spillway at 850 m crest level, with a 3.58 m water head can carry this flood flow rate safely. Weir landscaping level, to provide safety at 500 year repetitive flood flow rate, calculated as 853.40 m.

Since flow diverting structures of Project will be weir, there is not need to any special waste outlet. With intake structures the required water will be taken to transmission systems and the residual water will be delivered to waterbed.

V.1.4 Amount of stone, soil, gravel will be taken out by reason of digging, dredging etc., Locations into which They will be Transferred or Utilization Purposes

During construction of the Project, excavations performed at wet lands are the ones to be made for weir intake structures at weir areas. Excavation amounts of the intake structures of Yamanlı II Stage I and II Weirs and Hocabey Weir which are given at Table V.1 is 47,200 m³.

Impermeable materials obtained after excavations, suitable part for construction will be used residual part will be stored at storage sites. Storage sites are shown at “Project Components and Storage Sites” map.

Water accumulated due to excavations will be removed by drainage system.

V.1.5 The Number of Quarries like Stone Quarry, Soil Quarry, Clay Quarry etc., Size of Quarries, Size of Operating Area and its Coordinates, Amounts of Production Plan, Production Techniques that will be Applied, Blasting Bench Height, Width, Slope Angle, Number of Benches, Marking The Beginning and Final Situations of Quarries on Production Map

Within the context of the Project the required material will primarily be obtained from excavation of tunnel with an 8,212 m of length between Yamanlı II Stage I Weir and surge tank. M1 and M2 quarries will be opened if required. The coordinates and reserve information about the quarries is given in Table V-4.

Table V-4 M1 and M2 Quarries

Quarry M1				Quarry M2			
Main Step	Year	Coordinates	Amount of Materials to be Utilized (m ³)	Main Step	Year	Coordinates	Amount of Materials to be Utilized (m ³)
1	2009	4 197 438,98 K 253 740,60 D	4,500	1	2009	4 203 172,50 K 255 189,50 D	7,160
2	2009	4 197 298,14 K 253 639,87 D	64,000	2	2009	4 203 086,11 K 255 212,13 D	26,300
3	2010	4 197 394,06 K 253 440,84 D	133,400	3	2010	4 203 086,50 K 255 059,50 D	42,110
4	2011	4 197 557,98 K 253 462,69 D	203,100	4	2010	4 203 196,13 K 255 079,09 D	~24,430
Toplam : 405,000				Toplam : 100,000			

At both quarries production is planned as four benches. At quarry M1 production in the first two steps will be made in 2009, production in other two benches will be made in 2010 and 2011. The sizes of quarries M1 and M2 are 4.2 ha and 1.3 ha respectively.

Both quarries will consist of four benches. At quarry M1 first bench is 10 m high and each of other steps is divided into two equal 10-m high stages. Therefore each of other three steps are 20-m high. At quarry M2 height of each step is 10 m.

The maps showing the quarries and the production maps are given in Appendix-C and Appendix-L respectively.

Quarry M1 is at the upstream of Hocabey Weir, on the east of Hocabey Houses in Adana. The distance between M1 and Hocabey Weir is 3 km. The nearest residential area to M1 is Hocabey Houses and is 1,000 m distant to M1. The nearest house is 200 m away from quarry M1. M2 is on the south of Kaleboynu Village in Kahramanmaraş. The nearest residential area to quarry M2 is Kaleboynu Village and is 1,100 m away from M2. The nearest house is 1,000 m away from quarry M2. Both quarries will be located in forestland and “open-pit mining” will be applied in quarries. At quarry M1, production activities will be carried out for 2.5 year and at quarry M2, production activities will be carried out for two years. Total production at quarries M1 and M2 will be 405,000 and 100,000 m³ respectively.

After EIA positive decision is given for the quarries opened within the context of Project, an application will be made to the “Mining Facilities General Management” and production will be started after license is taken according to Mining Law numbered 3213. Also before the operations in quarries and crushers begin, permissions for opening and operating the work place from related locations will be taken.

An application will be made for obtaining permission Appendix II to Adana Province Directorate of Environment and Forestry according to regulation of “Protection of water land” for the quarries which will be opened within the context of the Project. Works will not be started until the necessary permissions are obtained.

Within the context of the Project because quarries are placed in forest lands, according to the Regulation on Reclamation of Lands Disrupted by Mining Facilities to Nature (Official Gazette dated 14 December 2007 and numbered 26730), “The Plan of Reclamation to Nature” must be prepared.

V.1.6 Blasting in Quarries, Blasting Pattern, Amount of Blasting Materials to be Used for Each Turn, Transportation, Storage and Utilization of Blasting Materials, Calculation of Air Shocks and Flying-off of Rocks

During construction, stone excavations in quarries will be carried out by the method of bench blasting. Prior to blasting in the construction site, hole pattern, method and amount of explosive which will be used will be made in a plan by taking all necessary measures.

“The Work Flow Chart” related to production in quarries is given Figure V-1.

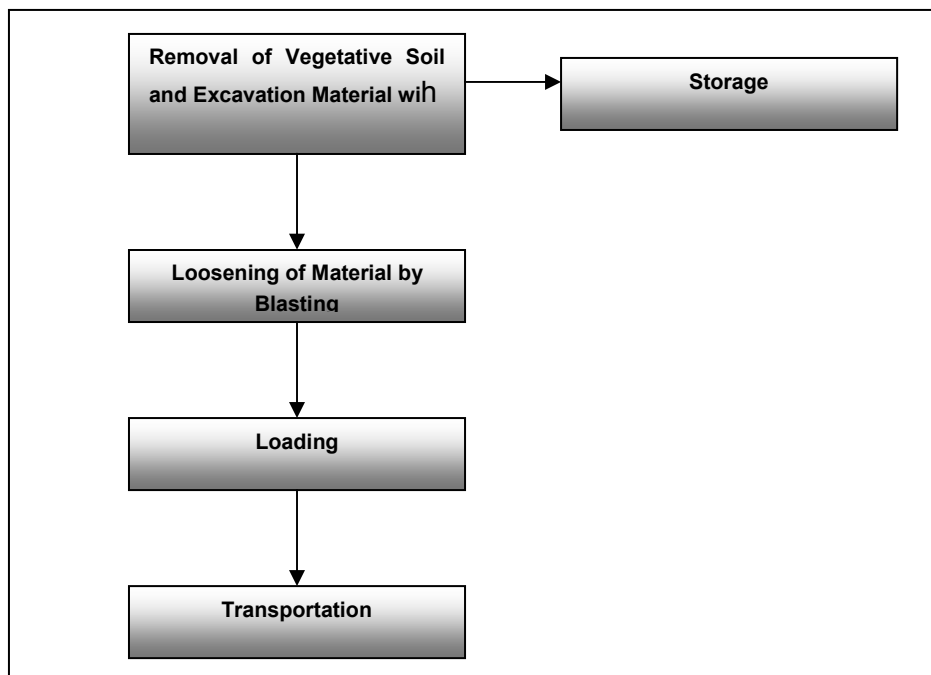


Figure V-1 Quarry Work Flow Diagram

Method of Blasting

To minimize failures on vegetative structure and animal nests the method of bench blasting was adopted. On the bench blasting method, amount of explosive material and number of holes can be determined in site conditions by blasting engineers. Because, the amount of blasting materials that will be used in holes can be determined through evaluating some criteria together like; geological structure of quarry (hardness of stone, strata planes, splits, jointed and faults etc.) hole diameter, hole length, hole number, hole inclination, bench height, piece thickness, environmental interaction and economical operation of quarry. These criteria are different for each quarry so the most economic and secure application can be optimized as a result of trials that will be made on area one to one. Operation plan of stone quarries will be prepared collectively with one mining and one geological engineers. A secure operation of quarries in harmony with the environment, within the scope of the related regulations will be carried out under control of a mining engineer.

Considering slope stability of quarries and impact of the topography of the quarry on production, bench blasting parameters may vary as follows. Step designs on stone quarries are given in Figure V.2.

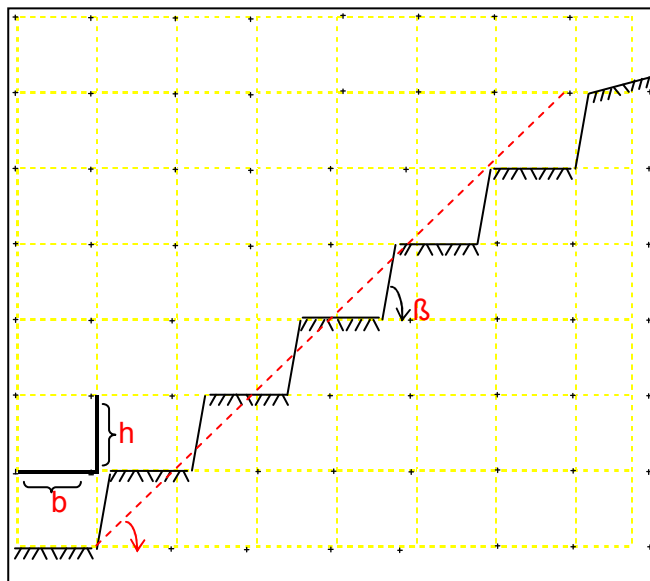


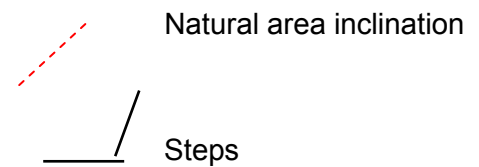
Figure V-2 Schematic View of Quarries

h (step height) = 20 m

b (step size) = 10 m-25 m

β (angel of repose) = $35^\circ - 80^\circ$

α (general angel of repose) = $20^\circ - 45^\circ$



The design of explosions specific to quarries is given in Figure V.3 and Figure V.4.

Production in quarries will be carried out for 12 months a year, 25 days a month and two eight-hour shifts (total 16 hours) a day. The construction period has been planned as 30 months (2.5 years). The density of stone was taken as 2.70 ton/m^3 . The production plan is given in Table V.3.

Quarry M1**Blasting Data**

Total amount of excavation material: 162,000 m³/year

Total amount of excavation material : 437,400 ton/year

Total amount of excavation material : 36,450 ton/month

Hole depth : 11.0 m

Hole diameter : 89 mm (3.5 inch)

Load per hole : 4.0 m

Distance between two

successive holes : 3.0 m

Charge : 35.0 kg AN-FO + 1.0 kg Dynamite+Electric Capsule

Charge per hole : 7.0 m Blasting Material + 4.0 m Stemming Material

Amount of material obtained per hole: 120.0 m³

: 324,0 ton

Number of holes : 1,350 holes/year

: 113 holes/month

If one explosion is planned every week the number of holes to be drilled will be 29 (113 / 4 = 28.25 ~ 29). The blasting pattern is given in Figure V.3.

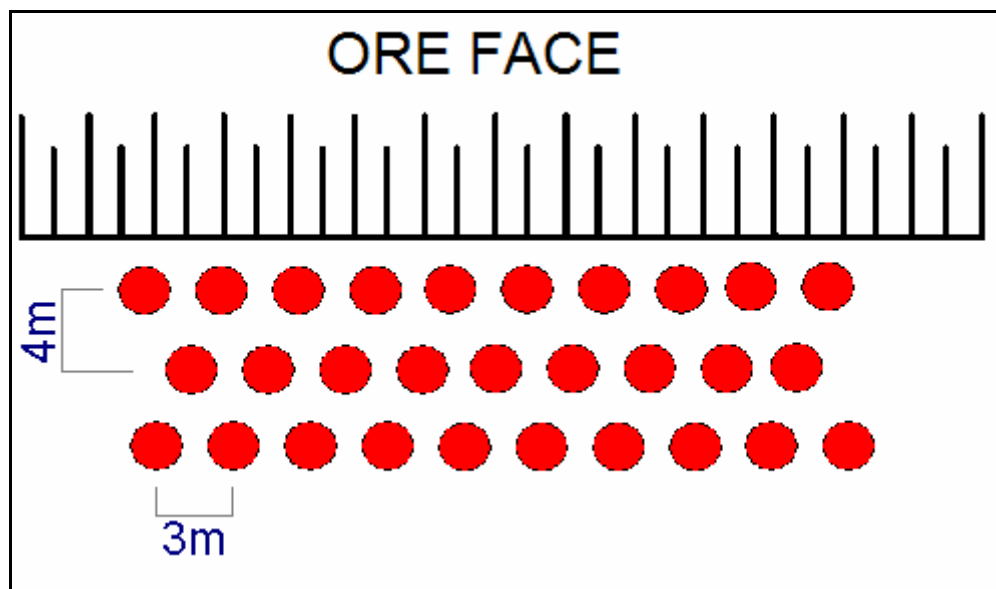


Figure V-3 Blasting Pattern for Quarry M1

Blasting will be made in three rows. A total number of 29 holes are distributed in order to have ten 10 holes in two rows and nine holes in one. Blasting material charge will be 360 kg for rows with 10 holes (36 kgx10) and 324 kg for the nine-hole row (36 kgx9). separated by a row with five holes and a row with four holes. Electric capsule will be chosen in a way that there will be 30 ms of blasting delay between rows.

Vibration Calculation

At quarry M1, during material production stage, vibrations will result from use of blasting materials.

Depending on the amount of blasting materials used for one blasting, the vibration will be calculated with the formula given below. (Olofsson, 1991):

$$V = K \times (Q / R^{3/2})^{1/2} \quad [5-1]$$

V : Vibration speed (mm/s) (value to be calculated)

Q : Amount of blasting material (kg) (360 kg)

R : Distance from blasting area (m) (varying between 0-1000 m)

K : Transmission coefficient (≤ 400) (K=400 for the worst-case)

The vibration speed that is calculated by using the parameters given above and the proposed limit values for vibration speed that does not damage the surrounding buildings are presented in Table V-5. The table given below summarizes potential level of damages for different geological structures and vibration speeds.

Table V-5 Damages in Structures Caused by Surface Blasting Works

	Sand, Clay and Groundwater	Soft Limestone	Granite, Hard Limestone, Quartz	Potential Damages in Structures
Vibration Speed (mm/s)	18	35	70	No damage
	30	55	100	Minor cracks
	40	80	150	Apparent cracks
	60	115	225	Serious deformation

Ref. : (Olofsson, 1991).

Considering that 360 kg blasting materials will be used for each blasting (the worst-case scenario) at M1 quarry, the vibration speeds that will occur with respect to distances are given in Figure V-4. In order to stay on the safe side, transmission coefficient (K) was taken as 400.

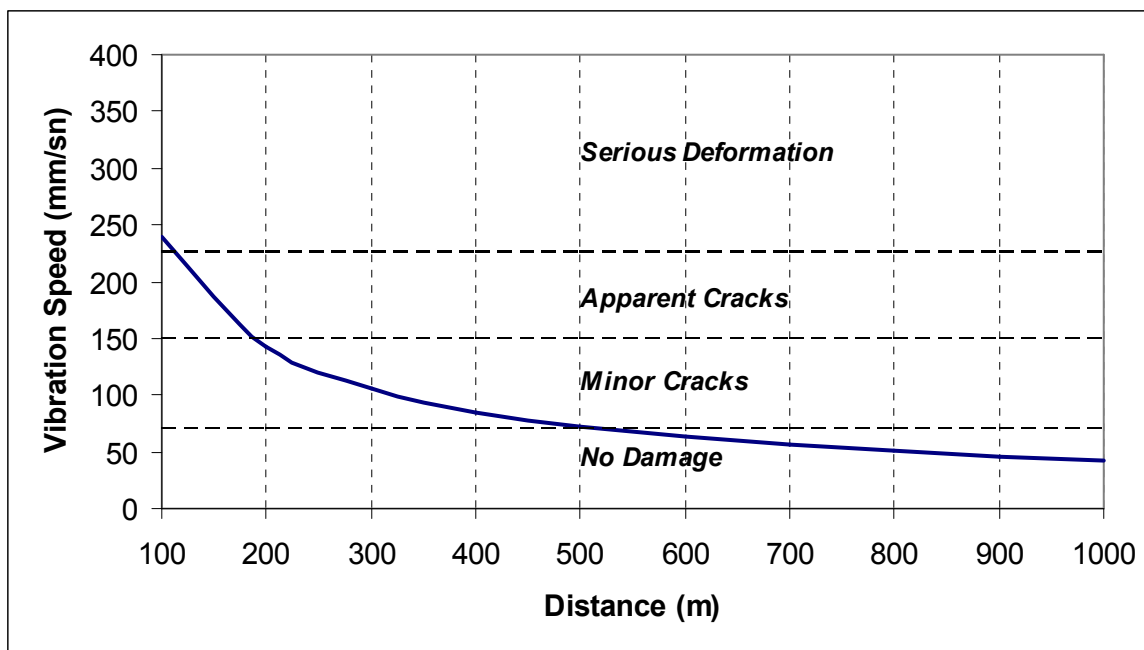


Figure V-4 Variation of Vibration Speed with respect to Distance

As seen on the Table V.4, the value of vibration speed that will not cause any harm in blasting carried out on hard and strong surfaces is 70 mm/s. In this case, as seen on the figure, any effect of blasting is not in question after 600 m. So there is no negative effect of blasting to Hocabey Houses, which is 1,000 m away from quarry M1.

Quarry M2

Blasting Data

Total amount of excavation material: 50,000 m³/year

Total amount of excavation material : 135,000 ton/year

Total amount of excavation material : 11,250 ton/month

Hole depth : 11.0 m

Hole diameter : 89 mm (3.5 inch)

Load per hole : 4.0 m

Distance between two

successive holes : 3.0 m

Charge : 35.0 kg AN-FO + 1.0 kg Dynamite+Electric Capsule

Charge per hole : 7.0 m Blasting Material + 4.0 m Stemming Material

Amount of material obtained per hole: 120.0 m³

: 324.0 ton

Number of holes

: 417 holes/year

: 35 holes/month

If one explosion is planned every week the number of holes have to be drilled will be nine ($35 / 4 = 9$). Therefore the pattern of explosion will be like given at Figure V-5.

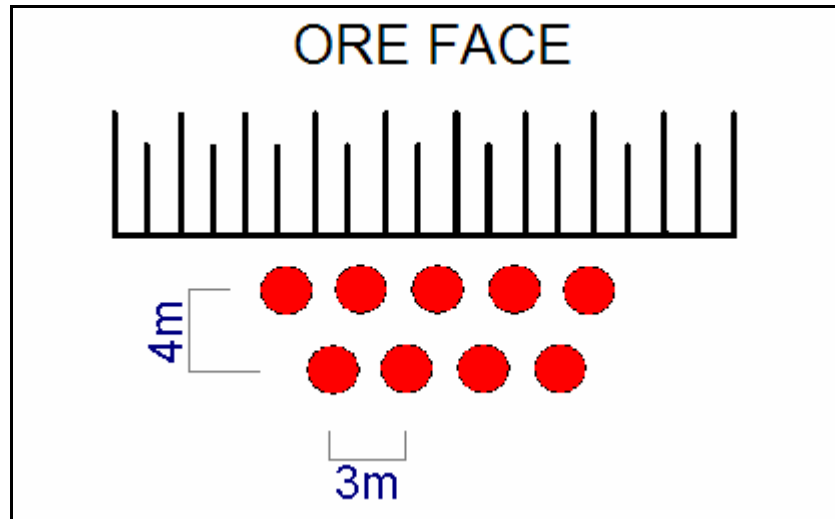


Figure V-5 Blasting Pattern for Quarry M2

Blasting will be made in nine holes, separated by a row with five hole and a row with four hole. Blasting material charge will be 180 kg ($36 \text{ kg} \times 5$) for row with five holes and 144 kg ($36 \text{ kg} \times 4$) for row with four holes. Electric capsule will be chose in a way that the blasting delay between two successive rows is 30 ms.

Vibration Calculation

The vibrations occurred as a consequence of blasting in quarry M2 if maximum explosive material is calculated as 180 kg [5-1] and the graphic given at Figure V-6 will be obtained.

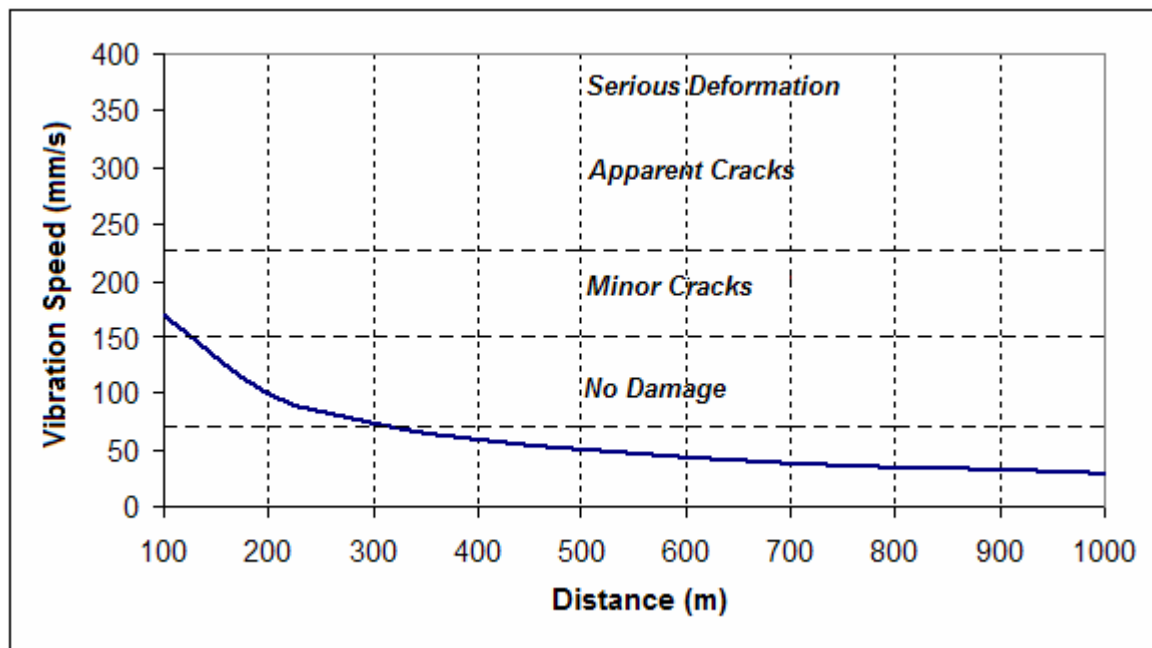


Figure V-6 Variation of Vibration Speed with respect to Distance

As seen from the graph, the value of vibration speed drops below the limit value of 70 mm/s beyond a distance of 350 m. Therefore, there will be no negative impacts of blasting on Kaleboynu Village, the closest residential area to quarry M2 with a distance of 1,100 m.

Assesments of Effects and Precautions to be Taken

Stones flying after explosions are directly connected with drilling, stuffing and firing system. Thus, planning of drilling frame, calculating of stuffing according to geological conditions and using sequential and sufficient capsules at firing system are necessary for the control of flying stones. Selecting of explosion hole locations, ranges and complying with calculations at dynamite backfill operations is very important for the possible effects to environment. Providing these conditions is possible by working of experienced people at explosion works.

The distance of M1 and M2 quarries, at which explosions are made, to the nearest stream bed are 2300 and 700 m, respectively. So there will not be seen any adverse effects on stream beds due to explosions.

To minimize the amount of explosive materials to be used and spreading of particulates during blasting, cracking will be made prior to blasting.

To minimize the vibration due to explosions lagged firing system will be used. The operation plan will be prepared in a such a way that all the blasting and drilling works will start and end within day shift.

The transportation, storage and usage of flammable and explosive materials as secure way will be under responsibility contractor firm.

During the carrying, storing and using of explosive materials as stated above it will be conformed to rudiments stated in statue “Taking Measures on work place and works worked with Explosive, Flammable, dangerous, and noxious substance” of ministry of labour and social security, statue “Workers health and work security” of ministry of labour and social security and statue “Production, import, carrying, hiding, storing, selling, using, annihilating, checking of the explosive, hunting equipment and etc.substances excluded from monopoly of procedures and basis”.

In addition to these, exciter sheets and signs will be placed surrounding of quarries.

V.1.7 Amount of Production in Quarries and Work Program as day, month and year, Transportation Routes, Transportation Infrastructure Plan, Works Related to Construction of Transportation Infrastructure and Machinery and Equipment to be Utilized

The detailed information about the amount of material to be obtained annually from each bench in quarries M1 and M2 is given in Table V-4. Information about machinery and equipment to be utilized in quarries is given in Table V-6.

Table V-6 Quarries

Quarry	Location	Area (ha)	Machinery	
			Type	No.
M1	Kaleboynu Village	4.2	Truck	5
			Loader	1
			Driller	1
			Dozer	1
			Water Tanker	1
M2	Sülmen Settlement	1.3	Truck	2
			Loader	1
			Driller	1
			Dozer	1
			Water Tanker	1

The total amount of production in quarry M1 within 30 months of construction period is 1,093,500 ton. In this respect, considering a 12-month production a year, monthly production amount will be 36,450 and weekly (per blasting) amount is 9,112.5 ton.

The total amount of material to be produced in quarry M2 during the same period is 270,000 ton with a monthly production of 9,000 ton and a weekly (per blasting) production of 2,250 ton.

Transportation between M1 and Hocabey Weir will be provided by means of a road to be constructed. Another road will be constructed for transportation between Hocabey Weir and Yamanlı II Stage II HPP. Besides, two new tracks will be constructed for transportation from quarry M2 to surge tank and Yamanlı II Stage I and Stage II weirs. These roads are shown in the map given in App.-C.

The existing village roads will also be used for transportation from quarries to construction sites. Transportation will be more faster by rehabilitation of the existing roads and construction of the service roads.

An application for permit for using quarries will be made to the General Directorate of Nature Protection and National Parks in compliance with the Wetlands Regulation.

The materials extracted from the quarries M1 and M2 will be prepared for utilization as construction material in the crusher facilities K1 and K2.

K1 : 4 197 211.60 N, 253 598 E

K2 : 4 203 616.70 N, 254 985 E

The installed capacity of K1 and K2 is 50 m³/day. Amount of material produced is 11.1 m³/day (30 ton/day) and 37.0 m³/day (ton/day), respectively. K1 is about 200 m away from M1 whereas K2 is 400 m away from M2. The closest residential area to K1 is 400 m (Hocabey Evleri) and the closest residential area to K2 is 500 m (Kaleboynu Village). The locations of crushers, K1 and K2 are shown in App.-C.

A crusher facility comprises of a bunker feeding materials to the crusher, a jaw breaker with a 90 mm spacing, sieve system and a system of conveyor belts with various lengths that transports materials between successive units of the facility.

Crushers will be located outside both quarries. The concrete to be used in construction of Project units will be prepared in concrete plants B1 and B2. Each of them will be located very close to the pertinent crusher facility.

V.1.8 Dust Emitting Processes (e.g. crushing, grinding, transportation and storage) in the Construction Phase and Cumulative Values

Quarries, storage sites and crushers will be used during the construction phase and there will be dust emission during extraction, loading, transportation, unloading, crushing and storing of material. M1 will be used throughout the construction phase whereas M2 will not be used in the last year of the construction. A part of the materials produced in both quarries will be prepared in K1 and K2 to be used for construction.

Dust depression system will be in use in order to control dust emission from the crushers. The pressure in the spraying head of the dust depression system will be 0.5-4 bar and water consumption will be varying according to demand between 1 and 120 L/h. With this system, two liters of water will be adequate to depress one ton of material. Considering that production in K1 and K2 is 30 and 100 ton/day, respectively, the water consumption will be 60 and 200 L, respectively for each crusher facility. Water will be supplied from the nearby fresh water resources or from municipalities.

The emission factors given in Table V-7 will be used to calculate dust emission to be resulting from the quarries.

Table V-7 Dust Emission Factors

Activity	Unit	Emission Factor
Blasting	kg/ton	0.08
Extraction	kg/ton	0.025
Loading	kg/ton	0.01
Transportation	kg/km-vehicle	0.7
Unloading	kg/ton	0.01
Storing	kg/ha-day	5.8
Crushing	kg/ton	0.243 (Uncontrolled) 0.0243 (Controlled)

Ref.: www.cedgm.gov.tr

Quarry M1

The amount of material to be extracted from M1 is 405,000 m³. The most amount of production will take place in the last year of the construction phase, and it will be 203,100 m³. Materials will be extracted from a 4.2-ha area. A vegetative top soil layer of 0.3 m will be removed from surface of quarry.

Extraction, blasting, loading and transportation will take place in M1. Dust emission from these activities is calculated below. Dust emission due to blasting will be calculated later.

Dust Emission due to Removal of Vegetative Top Soil:

Depth = 0.30 m

Density of material = 1.6 ton/m³

Total amount of excavation material = 42,000 m² x 0.30 m x 1.6 ton/m³
= 20,160 ton

Amount of excavation material = 20,160 ton / (12 month x 25 day x 16 hour)
= 4.2 ton/hour

Dust emission = 4.2 ton/hour x 0.025 kg/ton = 0.09 kg/hour

Dust Emission due to Loading:

Amount of material extracted = 114.2 ton/hour (203,100 m³/year)

Dust emission = 114.2 ton/hour x 0.01 kg/ton = 1.142 kg/hour

Dust Emission due to Transportation:

A number of five 40-ton trucks will be used for transportation of extracted materials.

Number of rounds = 114.2 ton/hour x 16 hour/day / 40 ton/round / 5 truck
= 9 round/day

Total distance covered = 9 round/day x 0.2 km/round = 1.8 km/day
 Dust emission = 1.8 km/day x 0.7 kg toz/km-vehicle x 1 days/16 hour
 = 0.08 kg/hour

Total dust emission = 0.09 + 1.142 + 0.08 = 1.312 kg/hour

Quarry M2

The amount of material to be extracted from M2 is 100,000 m³. The most amount of production will be made in the third year of the construction with a 42,110 m³ of material. Material will be extracted from a 1.3-ha area and the thickness of the vegetative top soil to be removed is 0.3 m.

Extraction, blasting, loading and transportation will take place in M2. Dust emission from these activities is calculated below. Dust emission due to blasting will be calculated later.

Dust Emission due to Removal of Vegetative Top Soil:

Depth = 0.30 m
 Density of material = 1.6 ton/m³
 Total amount of excavated material = 13,000 m² x 0.30 m x 1.6 ton/m³
 = 6,240 ton
 Amount of excavated material = 6,240 ton / (12 month x 25 day x 16 hour)
 = 1.3 ton/saat
 Dust emission = 1.3 ton/saat x 0.025 kg/ton = 0.03 kg/saat

Dust Emission due to Loading:

Amount of material extracted = 23.7 ton/hour
 Dust emission = 23.7 ton/hour x 0.01 kg/ton = 0.237 kg/hour

Dust Emission due to Transportation:

A number of two 40-ton trucks will be used for transportation of extracted materials.

Number of rounds = 23.7 ton/hour x 16 hour/day / 40 ton/round / 2 truck
 = 5 round/day
 Total distance covered = 5 round/day x 0.4 km/round. = 2.0 km/day
 Dust emission = 2.0 km/day x 0.7 kg toz/km-vehicle x 1 days/16 hour
 = 0.09 kg/hour

Total dust emission = 0.03 + 0.225 + 0.09 = 0.345 kg/hour

Crushers

Crusher K1

K1 has a 30 ton/day capacity. Unloading, crushing and loading will be made in K1, and the dust emission from this facility is calculated as follows.

Dust Emission due to Unloading

$$30 \text{ ton / hour} \times 0.01 \text{ kg / ton} = 0.300 \text{ kg / hour}$$

Dust Emission due to Crushing

$$30 \text{ ton / hour} \times 0.243 \text{ kg / ton} = 7.290 \text{ kg / hour (Uncontrolled)}$$

$$30 \text{ ton / hour} \times 0.0243 \text{ kg / ton} = 0.729 \text{ kg / hour (Controlled)}$$

Dust Emission due to Loading

$$30 \text{ ton / hour} \times 0.01 \text{ kg / ton} = 0.300 \text{ kg / hour}$$

$$\begin{aligned} \text{Total dust emission} &= 0.300 + 7.290 + 0.300 \\ &= 7.890 \text{ kg / hour (Uncontrolled)} \end{aligned}$$

$$\begin{aligned} \text{Total dust emission} &= 0.300 + 0.729 + 0.300 \\ &= 1.329 \text{ kg / hour (Controlled)} \end{aligned}$$

Crusher K2

Capacity of K2 is planned as 100 ton/day. There is also unloading, crushing and loading of material in this facility. Dust emission due to these activities is calculated as follows.

Dust Emission due to Unloading

$$100 \text{ ton / hour} \times 0.01 \text{ kg / ton} = 1.000 \text{ kg / hour}$$

Dust Emission due to Crushing

$$100 \text{ ton / hour} \times 0.243 \text{ kg / ton} = 24.300 \text{ kg / hour (Uncontrolled)}$$

$$100 \text{ ton / hour} \times 0.0243 \text{ kg / ton} = 2.430 \text{ kg / hour (Controlled)}$$

Dust Emission due to Loading

$$100 \text{ ton / hour} \times 0.01 \text{ kg / ton} = 1.000 \text{ kg / saat}$$

$$\begin{aligned}\text{Total dust emission} &= 1.000 + 24.300 + 1.000 \\ &= 26.300 \text{ kg / hour (Uncontrolled)} \\ \text{Total dust emission} &= 1.000 + 2.430 + 1.000 \\ &= 4.430 \text{ kg / hour (Controlled)}\end{aligned}$$

The criteria regarding emissions –except from stack- in terms of mass flow rate from newly established facilities are given in Table 2.1 in App.-2 of the Regulation on Control of Air Pollution from Industrial Establishments (RACPOIE), numbered 26236 and dated 22 July 2006. In this respect, emission from these facilities will be determined using emission factors and the values found will be compared to the ones given in Table 2.1. In case the emission value is higher than the one given in Table 2.1, a dust modeling study will be necessary to determine the value for contribution to air pollution.

The limit value for dust emission is 1.5 kg/hour (Table 2.1, App.-2 of RACPOIE). Hence, the calculated dust emission values were compared to this value and those resulting from M1 and M2 (1.3121 and 0.345 kg/hour, respectively) were decided to be below this limit value. The dust emission values for K1 and K2 are above the limit value stipulated in the RACPOIE (7.890 and 26.300 kg/hour, respectively for the uncontrolled case and 1.329 and 4.430 kg/hour, respectively for the controlled case). Therefore, a modeling study was performed to determine dust emissions from K1 and K2.

Methods and Values Used in Modeling Study

Modeling study was conducted for two scenarios as controlled and uncontrolled for K1. Data recorded at Tufanbeyli Meteorological Station, the closest station to the Project Site, was benefited. The dispersion classes according to directions are B and C/1, and cloudiness was taken as 4.1. Table V-8 contains meteorological model inputs.

Table V-8 Dispersion Classes According to Directions, Wind Speed and UH Values

Direction	Dispersion	UA (m/s)	UR (m/s)	UH (m/s)
N	B	2.7	3	3.0
NE	C/1	3.7	3	3.0
E	B	2	2	2.0
SE	B	2.4	3	3.0
S	B	2.5	3	3.0
SW	B	2.9	3	3.0
W	B	2.5	3	3.0
NW	C/1	3.3	3	3.0

Uh value is calculated by using the formula, $U_h = U_R (h/Z_a)^M$.

*M can take the following values:

Dispersion Class	M
A(very unstable)	0.09
*B(unstable)	0.20

*C/I(neutral)	0.22
C/II(neutral)	0.28
D(stable)	0.37
E(very stable)	0.42

$Z_a=10$ m is the elevation of anemometer from the ground and $h=10$ m is the maximum height dust can ascend (according to observations).

- Formula II of the Environmental Legislation was used for dust dispersion modeling.

$$C_i(x, y, z) = \frac{10^6}{3600 \times 2 \times \pi} \times \frac{Q_i}{U_h \times \sigma_y \times \sigma_z} \times \exp\left[-\frac{y^2}{2 \times \sigma_y^2}\right] \times \left[\exp\left[\frac{-(z-h)^2}{2 \times \sigma_z^2}\right] + \exp\left[\frac{-(z+h)^2}{2 \times \sigma_z^2}\right]\right] \times \exp\left[-\sqrt{\frac{2}{\pi}} \times \frac{V_{di}}{U_h} \times \int_0^x \frac{1}{\sigma_z(\xi)} \times \exp\left[\frac{-h^2}{2 \sigma_z^2(\xi)}\right] d\xi\right]$$

- Formula III of the same legislation was used to determine the amount of settleable dust.

$$d(x, y) = 86400 \sum_{i=1}^4 V_{di} \times C_i(x, y, 0)$$

Limit Values for Ambient Air Quality

Concentrations of pollutants shall not exceed the limit values given in Table V-7 in compliance with the Air Quality Protection Regulation (AQPR).

Long Term-Limit Value (LLV): the value which is the arithmetic mean of all measurement results and cannot be exceeded.

Short Term-Limit Value (SLV): the values which cannot exceed 95% of the measurement results as all the measurement results or maximum daily average values are ordered according to their magnitudes.

Table V-9 LLVs and SLVs

Pollutants	LLV	SLV
PM($\mu\text{g}/\text{m}^3$)	150	300
Settleable Dust (mg/m^2 . gün)	350	650

Results of Modeling Study

Crusher K1

Uncontrolled Case

Dust emission from K1 in the uncontrolled case is 7.890 kg/hour.

For Suspended Particulate Matter, $C(x, y, z)$ (%20);

$Q = 1.58$ kg/hour (particle diameter less than $10\mu\text{m}$)

$H = 10$ m (by experience)

$Z = 2$ m, $V_{di} = 0.01$ m/hour.

Using values and formulas given above, the below dust dispersion tables are prepared.

Table V-10 Dispersion of Suspended Particulate Matter with respect to Distance ($\mu\text{g}/\text{m}^3$) (Uncontrolled Case)

Air	UH	Dir.*	100 m	200 m	300 m	400 m	500 m	600 m	700 m	800 m	900 m	1000 m
B	3.0	N	51.0	14.7	6.8	3.9	2.6	1.8	1.3	1.0	0.8	0.7
C/1	3.0	NE	87.2	28.9	14.3	8.6	5.8	4.2	3.2	2.5	2.0	1.7
B	2.0	E	76.5	22.0	10.2	5.9	3.8	2.7	2.0	1.6	1.2	1.0
B	3.0	SE	51.0	14.7	6.8	3.9	2.6	1.8	1.3	1.0	0.8	0.7
B	3.0	S	51.0	14.7	6.8	3.9	2.6	1.8	1.3	1.0	0.8	0.7
B	3.0	SW	51.0	14.7	6.8	3.9	2.6	1.8	1.3	1.0	0.8	0.7
B	3.0	W	51.0	14.7	6.8	3.9	2.6	1.8	1.3	1.0	0.8	0.7
C/1	3.0	NW	87.2	28.9	14.3	8.6	5.8	4.2	3.2	2.5	2.0	1.7

* Dir.: Direction

For Settleable Dust (d_i); (%80)

$Q = 6.310$ kg/hour (for the particles with diameter greater than $10\mu\text{m}$)

$H = 10$ m

$Z = 0$

$V_{di} = 0.05$ m/s

Table V-11 Dispersion of Settleable Particulate Matter with respect to Distance ($\text{mg}/\text{m}^2\text{-day}$) (Uncontrolled Case)

Uh	Air	Dir.*	100 m	200 m	300 m	400 m	500 m	600 m	700 m	800 m	900 m
3.00	B	N	589.1	169.2	78.5	45.3	29.5	20.8	15.4	11.9	9.5
3.00	C/1	NE	1007.8	333.3	164.8	99.0	66.5	48.0	36.4	28.6	23.2
2.00	B	E	882.7	253.6	117.7	67.9	44.2	31.1	23.1	17.9	14.2
3.00	B	SE	589.1	169.2	78.5	45.3	29.5	20.8	15.4	11.9	9.5
3.00	B	S	589.1	169.2	78.5	45.3	29.5	20.8	15.4	11.9	9.5
3.00	B	SW	589.1	169.2	78.5	45.3	29.5	20.8	15.4	11.9	9.5
3.00	B	W	589.1	169.2	78.5	45.3	29.5	20.8	15.4	11.9	9.5
3.00	C/1	NW	1007.8	333.3	164.8	99.0	66.5	48.0	36.4	28.6	23.2

* Dir.: Direction

According to Tables V-10 and V-11, the LLV and SLV stipulated in the AQPR are complied with beyond a distance of 100 m. Considering the dispersion of settleable particulate matters, the values stipulated in the AQPR are complied with at a distance farther than 100 m. The closest house to the crusher is at a distance of 400 m, and the residential areas are not likely to be adversely impacted from the dust generated.

Controlled Case

Dust emission from the crusher, $Q = 1.329$ kg/hour

For Suspended Particulate Matter $C(x,y,z)$ (%20);

$Q = 0.27$ kg/hour (for the particles with diameter less than $10\mu\text{m}$)

$H = 10$ m (by experience)

$Z = 2$ m, $V_{di} = 0.01$ m/hour.

Using values and formulas given above, the below dust dispersion tables are prepared.

Table V-12 Dispersion of Suspended Particulate Matter ($\mu\text{g}/\text{m}^3$) (Controlled Case)

Air	UH	Dir.*	100 m	200 m	300 m	400 m	500 m	600 m	700 m	800 m	900 m	1000 m
B	3.00	N	8.6	2.5	1.1	0.7	0.4	0.3	0.2	0.2	0.1	0.1
C/1	3.00	NE	14.7	4.9	2.4	1.4	1.0	0.7	0.5	0.4	0.3	0.3
B	2.00	E	12.9	3.7	1.7	1.0	0.6	0.5	0.3	0.3	0.2	0.2
B	3.00	SE	8.6	2.5	1.1	0.7	0.4	0.3	0.2	0.2	0.1	0.1
B	3.00	S	8.6	2.5	1.1	0.7	0.4	0.3	0.2	0.2	0.1	0.1
B	3.00	SW	8.6	2.5	1.1	0.7	0.4	0.3	0.2	0.2	0.1	0.1
B	3.00	W	8.6	2.5	1.1	0.7	0.4	0.3	0.2	0.2	0.1	0.1
C/1	3.00	NW	14.7	4.9	2.4	1.4	1.0	0.7	0.5	0.4	0.3	0.3

* Dir.: Direction

For Settleable Dust (d_i);(%80)

$Q = 1.06$ kg/hour (for the particles with diameter greater than $10\mu\text{m}$)

$H = 10$ m

$Z = 0$

$V_{di} = 0.05$ m/s

Table V-13 Dispersion of Settleable Particulate Matter with respect to Distance ($\text{mg}/\text{m}^2\text{-day}$) (Controlled Case)

Uh	Dir.*	Air	100 m	200 m	300 m	400 m	500 m	600m	700 m	800 m	900 m	1000 m
3.00	B	N	99.2	28.5	13.2	7.6	5.0	3.5	2.6	2.0	1.6	1.3
3.00	C/1	NE	169.8	56.1	27.8	16.7	11.2	8.1	6.1	4.8	3.9	3.2
2.00	B	E	148.7	42.7	19.8	11.4	7.4	5.2	3.9	3.0	2.4	2.0
3.00	B	SE	99.2	28.5	13.2	7.6	5.0	3.5	2.6	2.0	1.6	1.3
3.00	B	S	99.2	28.5	13.2	7.6	5.0	3.5	2.6	2.0	1.6	1.3
3.00	B	SW	99.2	28.5	13.2	7.6	5.0	3.5	2.6	2.0	1.6	1.3
3.00	B	W	99.2	28.5	13.2	7.6	5.0	3.5	2.6	2.0	1.6	1.3
3.00	C/1	NW	169.8	56.1	27.8	16.7	11.2	8.1	6.1	4.8	3.9	3.2

* Dir.: Direction

According to the values given in Tables V-12 and V-13, both suspended particulate matters and settleable dust levels are below the limit values at a distance farther than 100 m. Hence, the crusher is not expected to have any adverse impacts on the nearest house.

Crusher K2**Uncontrolled Case**

Dust emission is 26.300 kg/hour for the uncontrolled case.

For Suspended Particulate Matter C(x,y,z) (%20);

Q = 5.26 kg/h (for the particles with diameter less than 10 μ m)

H = 10 m (by experience)

Z = 2 m, $V_{di} = 0.01$ m/h.

Using values and formulas given above, the below dust dispersion tables are prepared.

Table V-14 Dispersion of Suspended Particulate Matter with respect to Distance ($\mu\text{g}/\text{m}^3$) (Uncontrolled Case)

Air	UH	Dir.*	100 m	200 m	300 m	400 m	500 m	600 m	700 m	800 m	900 m	1000 m
B	3.00	N	170.1	49.0	22.7	13.1	8.5	6.0	4.5	3.5	2.7	2.2
C/1	3.00	NE	290.6	96.4	47.7	28.7	19.3	13.9	10.5	8.3	6.7	5.6
B	2.00	E	255.2	73.4	34.1	19.6	12.8	9.0	6.7	5.2	4.1	3.4
B	3.00	SE	170.1	49.0	22.7	13.1	8.5	6.0	4.5	3.5	2.7	2.2
B	3.00	S	170.1	49.0	22.7	13.1	8.5	6.0	4.5	3.5	2.7	2.2
B	3.00	SW	170.1	49.0	22.7	13.1	8.5	6.0	4.5	3.5	2.7	2.2
B	3.00	W	170.1	49.0	22.7	13.1	8.5	6.0	4.5	3.5	2.7	2.2
C/1	3.00	NW	290.6	96.4	47.7	28.7	19.3	13.9	10.5	8.3	6.7	5.6

* Dir.: Direction

For Settleable Dust (di);(%80)

Q = 21.040 kg/h (for the particles with diameter greater than 10 μ m)

H = 10 m

Z = 0

$V_{di} = 0.05$ m/s

Table V-15 Dispersion of Settleable Particulate Matter with respect to Distance ($\text{mg}/\text{m}^2\text{-day}$) (Uncontrolled Case)

Uh	Air	Dir.*	100 m	200 m	300 m	400 m	500 m	600 m	700 m	800 m	900 m
3.00	B	N	1963.7	563.9	261.6	150.9	98.3	69.2	51.4	39.7	31.7
3.00	C/1	NE	3359.4	1110.9	549.3	330.1	221.8	160.0	121.4	95.5	77.3
2.00	B	E	2942.4	845.3	392.3	226.2	147.3	103.7	77.1	59.6	47.5
3.00	B	SE	1963.7	563.9	261.6	150.9	98.3	69.2	51.4	39.7	31.7
3.00	B	S	1963.7	563.9	261.6	150.9	98.3	69.2	51.4	39.7	31.7
3.00	B	SW	1963.7	563.9	261.6	150.9	98.3	69.2	51.4	39.7	31.7
3.00	B	W	1963.7	563.9	261.6	150.9	98.3	69.2	51.4	39.7	31.7
3.00	C/1	NW	3359.4	1110.9	549.3	330.1	221.8	160.0	121.4	95.5	77.3

* Dir.: Direction

According to the values given in Table V-14 and V-15, the LLV and SLV for the suspended particulate matter concentration are complied with at a distance farther than 200 m and 100 m, respectively from the crusher. Considering the dispersion of settleable particulate matter, the LLV and SLV are complied with at a distance of 400 m and 300 m, respectively from the crusher. The nearest house is 500 m away from the crusher and thus, it is not likely to be adversely affected by the activities to be taking place in the crusher.

Controlled Case

Dust emission from the crusher, $Q = 4.430$ kg/h

For Suspended Particulate Matter $C(x,y,z)$ (%20);

$Q = 0.890$ kg/h (for the particles with diameter less than $10\ \mu\text{m}$)

$H = 10$ m (by experience)

$Z = 2$ m, $V_{di} = 0.01$ m/h.

Using values and formulas given above, the below dust dispersion tables are prepared.

Table V-16 Dispersion of Suspended Particulate Matter with respect to Distance ($\mu\text{g}/\text{m}^3$) (Controlled Case)

Air	UH	Dir.*	100 m	200 m	300 m	400 m	500 m	600 m	700 m	800 m	900 m	1000 m
B	3.00	N	28.7	8.2	3.8	2.2	1.4	1.0	0.8	0.6	0.5	0.4
C/1	3.00	NE	49.0	16.2	8.0	4.8	3.2	2.3	1.8	1.4	1.1	0.9
B	2.00	E	43.0	12.4	5.7	3.3	2.2	1.5	1.1	0.9	0.7	0.6
B	3.00	SE	28.7	8.2	3.8	2.2	1.4	1.0	0.8	0.6	0.5	0.4
B	3.00	S	28.7	8.2	3.8	2.2	1.4	1.0	0.8	0.6	0.5	0.4
B	3.00	SW	28.7	8.2	3.8	2.2	1.4	1.0	0.8	0.6	0.5	0.4
B	3.00	W	28.7	8.2	3.8	2.2	1.4	1.0	0.8	0.6	0.5	0.4
C/1	3.00	NW	49.0	16.2	8.0	4.8	3.2	2.3	1.8	1.4	1.1	0.9

* Dir.: Direction

For Settleable Dust (d_i);(%80)

$Q = 3.54$ kg/h (for the particles with diameter greater than $10\ \mu\text{m}$)

$H = 10$ m

$Z = 0$.

$V_{di} = 0.05$ m/s

Table V-17 Dispersion of Settleable Particulate Matter with respect to Distance (mg/m². gün) (Controlled Case)

Uh	Air	Dir.*	100 m	200 m	300 m	400 m	500 m	600m	700 m	800 m	900 m	1000 m
3.00	B	N	330.8	95.0	44.1	25.4	16.6	11.7	8.7	6.7	5.3	4.4
3.00	C/1	NE	565.9	187.1	92.5	55.6	37.4	27.0	20.4	16.1	13.0	10.8
2.00	B	E	495.6	142.4	66.1	38.1	24.8	17.5	13.0	10.0	8.0	6.5
3.00	B	SE	330.8	95.0	44.1	25.4	16.6	11.7	8.7	6.7	5.3	4.4
3.00	B	S	330.8	95.0	44.1	25.4	16.6	11.7	8.7	6.7	5.3	4.4
3.00	B	SW	330.8	95.0	44.1	25.4	16.6	11.7	8.7	6.7	5.3	4.4
3.00	B	W	330.8	95.0	44.1	25.4	16.6	11.7	8.7	6.7	5.3	4.4
3.00	C/1	NW	565.9	187.1	92.5	55.6	37.4	27.0	20.4	16.1	13.0	10.8

* Dir.: Direction

According to the values given in Tables V-16 and V-17, the concentration of suspended particulate matter is below the LLV and SLV at a distance of 100 m. The LLV and SLV are complied with for the settleable dust concentration at a distance of 100 m and 200 m, respectively. Since the nearest house is 500 m away from the crusher, the dust emitted from the crusher is not expected to pose any negative impacts on the residential areas.

V.1.9 Ground Safety and Applications for Preventing Water Leaks

Minor joints and cracks in limestone and marl rocks were observed during site surveys. There were no geological structures that might create stability and leakage problems.

Ground safety and the details of the applications to be made for preventing water leaks will be clear after the permeabilities of the structures in the river bed are determined. These applications include removing and/or rehabilitating material inappropriate for ground stability, constructing an impermeability curtain down to a sufficient depth in order to ensure impermeability.

V.1.10 Tree Species and Number of Trees to be Cut for the Preparation of Land for Construction, Effects of Trees on the Regional Forest Ecosystem, Natural Plant Species to be Removed and Demand for Land for These Activities and Impacts on the Fauna

The “Examination and Evaluation Form” prepared by the Regional Forest Directorate of Kahramanmaraş Province is presented in App.-E. According to this form, the Project Site lies within the boundaries of Göksun and Yağbasan forest management directorates.

There are trees of type Turkish Pine and juniper in the Project Site. Since there is a wide area in the Project Site with forest cover, determining the number of trees is impossible in this stage. A 1/1,000 scaled plans of the forest area will be prepared prior to construction and the exact number and types of trees will be determined.

There will not be a significant number of trees to be flooded in reservoirs of weirs. Hence, removing forest cover will not pose a significant impact on the regional forest ecosystem. The surrounding forest lands have the same characteristics as the Project Site. Besides, the faunal species in the Project Site will emigrate to areas with similar environmental conditions. Afforestation works will minimize the impacts of the removal of forest. Necessary afforestation works will be carried out in the areas where construction materials will be extracted.

MoEF is responsible for all the trees in the Project Site. Therefore, in order to minimize the number of trees to be removed during construction phase, recommendations of MoEF will be taken into account. Compensation of tree cutting is possible both in the Project Site and the entire country.

V.1.11 Size of Agricultural Lands Allocated for the Project, Land Use Capabilities and Crops

Adana Provincial Directorate of Agriculture is responsible for the 1,418-ha area to be used in the scope of the Project. Residential areas and dry marginal agricultural lands constitute 20 ha and 130 ha of the Project Site. The remaining part of the area is constituted by forests. Dry marginal agricultural lands in the Project Site can be utilized for non-agricultural purposes according to the second clause of Article 13 of the Soil Protection and Land Utilization Law numbered 5403. The official letter from Adana Provincial Directorate of Agriculture, numbered B12.4.İLM.0.01.00.01-4533-611 and dated 15 January 2008 is given in App.-E.

The forest area and private property land, 58.2 ha, in the Project Site are under responsibility of Kahramanmaraş Provincial Directorate of Agriculture, and character of this land is dry marginal agricultural land according to the Criteria of Standards for Agricultural Lands, and it is permitted to be utilized for energy generation purposes in compliance with the second clause of Article 13 of the Soil Protection and Land Utilization Law numbered 5403. The official letter from Kahramanmaraş Provincial Directorate of Agriculture numbered B.12.4.İLM.0.46.00.01/275-780 and dated 6 February 2008.

The necessary measures will be taken in order to eliminate impacts of weirs and pertinent structures, water transmission channels, storage site, construction site, new roads and quarries for extraction of stuffing material in compliance with the Soil Protection and Land Utilization Law numbered 5403 and the Regulation on Protection and Utilization of Agricultural Lands. These measures are explained in the “Soil Protection Project”.

According to this project, a minor part of the Project Area is marginal dry agricultural land, some part is flood bed due to material transported by Göksu River through time and the major part of the Project Site is classified as the land type “other”. Dry marginal agricultural lands constitute 20 ha of the Project Site.

Agricultural yield is much lower than the province average due to topographical conditions. The land is not suitable for conventional irrigation and there are no public investments for irrigation projects.

Furthermore, the Project Site lies outside the areas defined in the Law on Rehabilitation of Olive Gradening and Vaccination of Wild Animals and the Grasslands Law. Hence, it is insuitable for agriculture except for compulsory conditions.

The Soil Protection Project is presented in App.-M.

V.1.12 Types and Properties of Fuel to be Used and Emissions during Land Preparation

Diesel will be used as fuel on the various heavy construction equipments such as grader, excavator, bulldozer, mixer, compressor, mobile lifter, tower lifter and welding machine that they will be used for construction works of Kavsakbendi Dam, HPP and Quarries project facilities. The chemical aspects of diesel are given in Table V-18. No other types of fuel except diesel will be used in other activities.

Table V-18 Chemical Properties of Diesel

Parameter	Unit	Value
Intensity (at 15°C)	kg/L	0.820-0.860
Flame point	°C	55 (minimum)
Cool filter blocking point – winter	°C	-10 (maximum)
Cool filter blocking point – summer	°C	5 (maximum)
Distillation – at 250°C recovered	% (Volume)	65 (maximum)
Distillation – at 350°C recovered	% (Volume)	85 (minimum)
Distillation – at 370°C recovered	% (Volume)	95 (minimum)
Sulphur	% (weight)	0.70 (maximum)
Carbon remnant (Over 10% remnant)	% (weight)	0.30 (maximum)
Fluidity (at 40°C)	cSt	2.0-4.5
Ash	% (weight)	0,01 (maximum)
Setan index	-	46 (minimum)
Water	mg/kg	200 (maximum)
Particulate matter	mg/kg	25 (maximum)
Oxidation Stability	g/m ³	25 (maximum)

Source: www.tupras.com.tr

Diesel motors work more different principles than benzine motors and although their carbonmonoxide (CO), hydrocarbhone (HC) emission is lower, nitrogen oxide (NO_x) and their particule substance (PM) emissions is higher. Generally in diesel motors air pollution in diesel motors occurs from exhaust emissions and carter leaks. These evaporation loses can be decreased by used closed circuit injection systems and less volatile diesel. According to the United States Environmental Protection Agency (USEPA), emission factors are 8.61 g/min for CO, 6.27 g/min for HC and NO_x, while speed 0-30 km/hr of a heavy construction machines maintained regularly.

Except construction equipment running on electricity, it was calculated daily pollutant emissions resulting from dozer, loader, grader, cylinder, beko, truck, compressor and generator. On a specific location, daily CO, HC and NO_x emissions grown out construction equipments were calculated with USEPA emission factors by considered that there is only one for each machine and it is worked 8 hours in a day continuously. These emission values are given in Table V-19.

Table V-19 Expected Emissions from Construction Equipment

Pollutant	Emission Factor (g/minute)	Time (Hour)	Daily Emission (kg/day)
CO	8.61	8	33.0
HC	1.38	8	5.3
NO _x	6.27	8	24.0

The emission from working of construction equipments is temporary. In addition to this, the expected emissions do not have impotent effect on air quality. It is anticipated that air pollutants (CO, HC ve NO_x and PM) will be very low value in the Project Site. Besides, the air pollution from traffic during construction will be also insignificant levels.

All vehicle exhaust emission will be measured by authorized foundations regularly and it will be documented that they provide determined limit values for exhaust emission.

V.1.13 Amount of Water to be Taken from the Water Resources and Characteristics and Amount of Wastewater to be Generated and Water Body for Wastewater Discharge

The maximum number of workers will be 200 for the construction phase. According to the data obtained from TURKSTAT the water consumption is 178 L/cap-day in Adana in 2004. Considering the worst-case scenario, the water consumption value may be taken as 200 L/cap-day and the total water consumption of workers is calculated as 40 m³/day (200 L/cap-day x 200 workers). Potable water demand in the construction phase will be met by the resources in the vicinity. Water will be supplied by means of tanker trucks.

Wastewater will be generated due to the following basic operations:

- Domestic wastewater generated by workers,
- Wastewater from concrete and material preparation and storage site,
- Wastewater from drainage system in the construction site.

According to data obtained from TURKSTAT wastewater generation is 178 L/cap-day in Adana in 2004 whereas it is 131 L/cap-day in Kahramanmaraş. Considering the worst-case scenario the wastewater generation value for Adana is taken into account and the total wastewater generation is calculated as 35.6 m³/day. There will be only domestic wastewater generation and it will be treated in the package treatment plant before being

stored in unleaking septic tanks. Wastewater stored will be drawn by the sewage trucks and be disposed of in the wastewater treatment plant of Kozan Municipality.

Assuming that the BOD₅ load in the wastewater is 60 g/cap-day, the total BOD₅ load will be 12 kg/day.

Wastewater treatment procedure for the package wastewater treatment plant is given as follows.

Biological treatment system will consist of aeration, sedimentation and disinfection units. Biological treatment removes organic compounds that cannot be treated by physical and chemical means. Organic matter in the aerated wastewater is utilized as food by microorganisms, and CO₂ and water is produced upon degradation of organic matter.

Air is supplied by means of a blower placed in the surge chamber. Air supplied to wastewater forms bubbles to ensure a uniform treatment. The blower supplying air to the system is controlled with a timer in the control panel. Aerated wastewater flows into the sedimentation tank by gravity.

Water flow rate is decreased in the sedimentation tank in order to allow suspended particles to settle down. Sedimentation tank is equipped with a lamella type separator, separate weirs and “air lift” pumps. Supernatant in the sedimentation tank is the treated effluent which flows out of the tanks through weirs. Settled sludge (activated sludge) is pumped back to the aeration tank.

There is a chlorination tank at the outlet of the sedimentation tank. chlorine dosage into treated wastewater is made in this unit. Hence, wastewater is disinfected. A liquid level sensor is used to control the dosage pump in order to ensure that the dosage pump will only work as the effluent leaves the system. This decreases operational costs.

Surge chamber contains a blower, a chlorine dosage pump, a chlorine tank and a control panel. Blower was chosen in such a way that the lowest noise level could be achieved.

V.1.14 Amount of Solid Waste Generated from the Preparation of Land for Construction until Commissioning and Disposal of Solid Wastes

Waste excavated material will be generated in excavation sites and aquatic medium during preparation of land for construction. As it is mentioned in Section V.1.1, a part of this waste material will be used in stuffing and concrete production. The remaining waste material will be stored in storage sites which are shown in the “Project Components and Storage Sites” map presented in App.-C.

There will be also solid wastes such as iron and sheet metal pieces and packaging materials and similar wastes. Recyclable wastes will be collected separately and will be sold as salvage. Unrecyclable wastes will be disposed of in places determined by Saimbeyli and Göksun municipalities. The construction phase of the Project is planned to last for 30 months. It is expected that a maximum number of 200 people will be working during construction (see Section V.1.16).

According to the data obtained from TURKSTAT, the average domestic solid waste generation in Adana is 1.3 kg/cap-day whereas it is 1 kg/cap-day in Kahramanmaraş. Considering the worst-case scenario the total domestic solid waste generation by 200 people will be 260 kg/day.

Domestic solid waste will be stored in containers in the Project Site and disposed of by Saimbeyli and Göksun municipalities with expenses covered by the Project's owner. These municipalities do not have landfills. However, Göksun Municipality is planning to construct a landfill. In case this facility is not commissioned during the construction phase of the Project, the solid wastes collected will be disposed of in a landfill in compliance with the Solid Waste Control Regulation numbered 20814 and dated 14 March 1991.

Waste oil from construction machines will be disposed of in compliance with the Waste Oil Control Regulation numbered 25353 and dated 21 April 2004.

V.1.15 Sources and Levels of Vibration and Noise, Cumulative Noise and Vibration Values from the Preparation of Land for Construction and Commissioning and Preparation of the Acoustic Report

The Acoustic Report, prepared in compliance with the Regulation on Assessment and Management of Environmental Noise (RAMEN) and presented in App.-N, contains information about sources and levels of vibration and noise resulting from Project's activities.

Acoustic calculations were performed separately for the construction and the operational phases. Sound pressure level with respect to distance for every machine was calculated in terms of dBA (A-weighted decibel) and the graphs showing sound pressure levels vs. distance were obtained. These graphs were utilized to determine the sound pressure levels at the closest "sensitive receptor" to the location of machinery equipment. These values were evaluated according to the RAMEN.

V.1.16 Accommodation of Personnel and Provision of Other Technical and Social Utilities

The construction sites for the following units will be established during the construction phase :

- The field offices of the contractor the authorized personnel
- Equipment and spare part warehouses

- The parking fields for the service depot and machines
- Stonecrusher facilities
- Facilities for concrete preparation
- Pressurized Air and Water Obtainment Systems
- Cafeteria
- Health Center

The works on the project field are going to be delegated to different contractors specializing on construction, hydromechanics and electromechanics and each contractor will work with his own workers.

All of the construction sites will be built near the construction places. The number of people working during the construction phase is expected to be 200 at the peak period (see Table V-20) and these people will have their daily meals on the prefabricated restaurants built on the construction site. It is also planned that the majority of the working personnel will be obtained from the districts that are near the construction site. Because of that reason, it is expected that there will be no accommodation for these people and servis buses are planned to be utilized for the transportation of them to the project field. The other workers will be recruited from outside of the district and they will stay in the prefabric construction buildings. Moreover, for the works in the construction places, restaurant, canteen, warehouse building, dormitory are going to be built.

Table V-20 Number of Construction Workers

Project's Unit	Number of Workers Assigned
Weir	40
Tunnel	25
Surge Tank	10
Penstock	10
Channel	35
Forebay	10
Power Plant	30
Switchyard	10
Transportation Road	30
Total (Maximum)	200

For the workers staying in the construction site to enjoy their free times; prefabricated sport fields, reading rooms, TV rooms and telephone booths will be built. The environment and the field will be arranged accordingly.

The temperature in Adana is relatively high according to the information taken from Tufanbeyli Meteorological Station. Fuel is needed between the months of November and March to heat up. During the activities, the kind of the fuel to be utilized in the social facilities is distilled fuel oil and it will be used only for the heating activities. This kind of fuel is fluid and volatile and it does not contain a significant amount of nitrogen(N) compared to the other fuel-oil kinds.

When we consider that a large proportion of the workers will be hired from the district, we can say that service and food industries will benefit from this situation a lot.

In the field, there will also be a health center and personnel as required by the relevant health laws and regulations. The treatment for the less significant wounds and injuries will be treated at the health center. For the more crucial incidents, the personnel will be taken to one of the health units in Adana, Kahramanmaraş and Saimbeyli and Göksun.

V.1.17 Risky and Dangerous Activities for Human Health and the Environment from Land Preparation until Commissioning

It is not expected that the execution of the project will cause a problem for the human health and for the environment. The traffic jam and the traffic accidents arising out of the construction material and worker transportation are planned to be prevented if not at least minimized by training the personnel, putting the relevant traffic signs, speed limitation and through periodic maintenance and control of the vehicles. The use of heavy construction machines for tunnel and powerhouse construction activities is also planned. In the works related to the electricity, electric shocks and in the service studies, penstocks could be risky and dangerous for the human health. To prevent the accidents here, qualified personnel will be recruited and they will be trained on the topic of job security.

In all of the construction works, there is always a risk getting hurt and wounded. The other dangers awaiting the workers are traffic accidents, falling from a high place and some materials falling on top of the workers. Speed limitations, showing maximum care while going backwards, using a cage and a ladder with security handfold, utilizing safety belt and webs could be some precautions for minimizing the accidents and dangers. Also for the contractors, a workplace safety scheme and an accident prevention plan in accordance with the relevant laws will be prepared and put into practice. The personnel and the workers will be equipped with the relevant work security equipment depending upon the nature of the work and it will be ensured that they work under the conditions dictated by the health and job security laws.

To minimize the risks and dangers on the subject of worker security; number 1475 work law, number 7/7583 worker health and security legislation of the ministry of work and social safety, number 7/5734 legislation about the worker health and job security, the regulation about the working conditions of the workplace doctors and their duties, obligations and number 2872 environment law and other laws and regulations about collective agreements will be taken into consideration.

The most serious health threat for the workers is the infectious diseases. To minimize this problem, workers will have periodic check-ups on the health center that will be constructed in the field. In the case of more serious diseases, they will be taken to one of the hospitals in either Saimbeyli District of Adana or in Göksun District of Kahramanmaraş will be utilized.

V.1.18 Land Utilization for Landscape Elements Created in the Project Site (land allocation for afforestation and/or Greenland etc.) and Tree Species to be Selected

To minimize the erosion potential in Goksu River that causes high turbidity level, special care will be taken in to consideration and waste disposal areas and stabilizing of these areas will be provided. Before the process of waste storage begins, the plants and the top soil will be removed from the waste field. After the waste fields are prepared, the surface soil will be stored on a separate place to be utilized on the landscape business. To protect its characteristics until its use for the landscape goals, the soil will be taken off as late as possible and used in the nearest time. As long as the soil is stored, its surface is going to be sporuted. Also, plant wastes and plant roots will not be allowed to be thrown into the river.

The contractors will cover all of the waste and construction fields with herbal soil, before they leave the construction site and they will recreate the field with the appropriate tree kinds and bushes within the initiative of MoEF. The choice of the tree kinds that will be used for the rehabilitation purposes contains the kinds stated in the report. Beyond these kinds, some kinds that make up a nice view may also be asked to be planted. Similarly, the opinions and views of MoEF will be taken into consideration.

V.1.19 Assessment of Potential Impacts on Cultural and Natural Assets (traditional urban texture) in the Project Site including Quarries

As it is explained in detail in Section IV.2.9 the Project has no adverse impacts on the cultural and natural assets and archaeological remains in the Project Site.

V.1.20 Other Aspects

There are no other activities to be carried out in the Project Site.

V.2 Impacts of the Project on Physical and Biological Environment During Operational Phase of the Project and Measures to be Taken

V.2.1 Characteristics of the Project Units, Capacities of the Project Units, Products or Services Supplied through the Project Units

Period before the construction is decided to be 14 months and construction period is decided to be 30 months. And the project is expected to be finished in 4 years. The characteristics of the project is given in Table V.4 and in table V.5

Table V-21 Characteristics of the First Stage of the Project

Structure	Characteristics	Unit	Amount
YAMANLI-II STAGE I WEIR	Drainage Area	km ²	1.696
	Yearly avr. Flow (Full Development situation, 1974-2003)	m ³	318.27x10 ⁶
	Crest length	m	60.00
	Type	-	Outer Receptor
	Thalweg Elevation	m	1153.50
	Crest Elevation	m	1170.00
	Elevation	m	21.30
	Elevation from Thalweg	m	16.50
Water Intake Structure	Type	-	Outer Receptor
	Cover	-	2 gates, h=2.50 m, b=5.00 m
Sedimentation Tank	Length	m	60.00
	Width	m	10.00
	Compartment Number	-	2
	Settling Particle Diameter	mm	0.50
DERIVATION TUNNEL	Diameter	m	3.50
	Length	m	8,212
	Type	-	Horseshoe
	Derivation Flow Rate	m/s	1.83
	Tunnel Water Height	m	3.50
Surge Tank	Type	-	Simple, Circular

Structure	Characteristics	Unit	Amount
	Diameter	m	12.00
PENSTOCK	Length (Plan-Inclined)	m	378.00 – 479.14
	Internal Diameter	m	2.30 (Steel Covered)
	Wall Thickness	mm	20-33
YAMANLI-II STAGE I HPP	Elevation of Water Intake Structure	m	1170.00
	Net Fall	m	299,25 (Q=20 m ³ /s)
	Thalweg Elevation at HPP Location	m	858.00
	Type of HPP	-	On-ground
	Type of Turbine	-	Vertical-axis Francis
	Installed Capacity	MW	49.70 (2x20 MW + 1x9.70 MW)
	Firm Energy	GWh	55.26
	Secondary Energy	GWh	137.04
	Total Energy	GWh	192.30
	Design Flow Rate	m ³ /s	20
Generator	Type	-	3 phase, secondary
	Count	-	3
	Power	kVA	22,300 (Major Units) 10,800 (Minor Units)

Ref.: Yamanlı II Regülatörü ve HES Fizibilite Raporu, April 2005

Table V-22 Characteristics of the Second Stage of the Project

Structure	Characteristics	Unit	Amount
YAMANLI II STAGE II WEIR	Drainage Area	km ²	2,031
	Average Annual Amount of Water (for the full development of upstream projects)	m ³	568.51x10 ⁶
	Crest Length	m	60.00
	Type	-	Outer Receptor
	Thalweg Elevation	m	841.50
	Crest Elevation	m	858.00
	Body Elevation (from foundation)	m	16.50
	Threshold Elevation (from thalweg)	m	21.30
Water Inlet Structure	Type	-	Outer Receptor
	Number and Dimensions of Gates	-	3 gates, h=2.50 m, b=5.00 m
Sedimentation Tank	Length	m	60.00
	Width	m	15.00
	Number of Divisions	#	3
	Diameter of Settling Particles	mm	0.50
TRANSMISSION CHANNEL	Dimensions	m	4.00x2.80
	Length	m	4,180
	Type	-	Trapezoid
	Inclination	-	0.0005

Structure	Characteristics	Unit	Amount
	Water Depth	m	2.60
TRANSMISSION TUNNEL	Diameter	m	3.50
	Length	m	1.000
	Type	-	Horseshoe-Free Flow
	Flow Rate	m/s	3.67
	Water Depth	m	2.80
HOCABEY WEIR	Drainage Area	km ²	70.1
	Average Annual Amount of Water (full development of upstream projects)	m ³	38.99x10 ⁶
	Crest Length	m	20.00
	Type	-	Outer Receptor
	Thalweg Elevation	m	844.00
	Crest Elevation	m	850.00
	Body Elevation (from foundation)	m	10.00
	Threshold Elevation (from thalweg)	m	6.00
Water Inlet Structure	Type	-	Outer Receptor
	Number and Dimension of Gates	-	1 gate, h=1.50 m, b=4.00 m
Sedimentation Tank	Length	m	20.00
	Width	m	4.00
	Number of Divisions	#	1
	Diameter of Settling Particles	mm	0.50
TRANSMISSION CHANNEL (HOCABEY WEIR TO FOREBAY)	Dimensions	m	4.00x2.80
	Length	m	1,900
	Type	-	Trapezoid
	Inclination	-	0.0005
	Water Depth	m	2.70
FOREBAY	Type	-	Valve room included
	Width	m	10.00
	Length	m	50.00
	Height	m	4.20-14.65
	Active Volume	m ³	825
PENSTOCK	Length (Plan-Inclined)	m	80.99-123.31
	Inner Diameter	m	3.10
	Wall Thickness	mm	14
YAMANLI II STAGE II HPP	Elevation of Water Inlet Structure	m	849.25
	Net Fall	m	88.55 (Q=38 m ³ /s)
	Thalweg Elevation of HPP Location	m	758.00
	Type of HPP	-	On-ground
	Type of Turbine	-	Vertical-axis Francis
	Installed Capacity	MW	27.96 (3x9.32)
	Firm Energy	GWh	41.76
	Secondary Energy	GWh	67.55

Structure	Characteristics	Unit	Amount
	Total Energy	GWh	109.31
	Design Flow Rate	m ³ /s	38
GENERATOR	Type	-	3 phase, synchronous
	Count	#	3
	Power	kVA	10,360

Ref.: Yamanlı II Regülatörü ve HES Fizibilite Raporu, April 2005

The units of the Project are given below.

- Yamanlı II Stage I Weir
- Transmission Tunnel (between Yamanlı II Stage I Weir and Penstock)
- Surge Tank and Valve Room
- Penstock (between Transmission Tunnel and Yamanlı II Stage I HPP)
- Yamanlı II Stage I HPP
- Yamanlı II Stage II Weir
- Transmission Channel (between Yamanlı II Stage II Weir and Transmission Tunnel)
- Transmission Tunnel
- Hocabey Weir
- Transmission Channel (between Hocabey Weir and Forebay)
- Forebay and Valve Room
- Penstock (between Valve Room and Yamanlı II Stage II HPP)
- Yamanlı II Stage II HPP
- Switchyard

Yamanlı II Stage I Weir

Weirs will be used to divert water flow. Considering the shape of the valley, design and flood flow rate and topographical characteristics weirs were designed as outer receptor and free-flow type.

Thalweg and crest elevation of the weir is 1,153.00 m and 1,170 m, respectively. Crest width is 60.00 m. Height of the weir body is 16.50 m. The design flow rate is 20 m³/s, and elevation of the water inlet structure is 1,167.00 m. There are curtains extending to the elevation of 1,169.50 m. Dimensions of the screens are 2.50 m by 5.00 m. Inner diameter of the water inlet structure is 11.00 m and the length of the sedimentation tank is 60.00 m.

Transmission Tunnel (between Yamanlı II Stage I Weir and Penstock)

Water taken to the tunnel in the left hand side by means of the water inlet structure will flow into the surge tank and valve room. Beginning and end points of the pressurized transmission tunnel are at 1,163.00 m and 1,134.90 m of elevation, and its bottom

inclination is 0.0034. Length, diameter and wall thickness of the tunnel are 8,212 m, 3.50 m and 35 cm, respectively from the beginning to the valve room. Velocity in the tunnel is 1.83 m/s at design flow rate. Horseshoe-shaped tunnel will be constructed with steel-coated in inner walls. Steel coating will be applied to the section after the surge tank km 8+168.

Surge Tank and Valve Room

Surge tank will function to balance pressure variations in the penstock when turbines are closed and opened. Diameter of the surge tank is 12.00. the maximum and minimum levels are 1,170 m and 1,145 m, respectively. The upper elevation of the surge tank is 1,175 m.

Valve room is located at km:9+270. Water will be taken into the penstock from the valve room.

Penstock (between Transmission Tunnel and Yamanlı II Stage I HPP)

Diameter of the penstock was determined as 2.30 m as a result of optimization of installed capacity. Length of the penstock is 479 m. Penstock was designed to be two-section. The first section extending up to the elevation of 950 m has 20 mm of wall thickness. Wall thickness of the section extending from this point to the elevation of 860.00 m is 33 mm.

Penstock will be separated into three branches at the water inlet structure of the HPP in order to supply water for the three units. Water velocity stays constant in each unit, and the flow rate is 8 m³/h in large units and 4 m³/s in the smaller unit.

Yamanlı II Stage I HPP

Turbine type was selected as vertical-axis Francis. There are three units in the HPP and one of them is smaller as compared to other two. The smaller unit has a capacity of 4 m³/s and one large unit has a capacity of 8 m³/s. The installed capacity of the HPP is 49.7 MW. Installed capacity of the small unit is 9.7 MW and that of one large unit is 20 MW.

There will be three three-phase generators installed in each unit. Generators of the large units will be 22,300 kVA and that of the small unit is 10,800 kVA. Large generators have a rotation frequency of 500 rpm and that of small one is 750 rpm. Generators have a frequency of 50 Hz.

Yamanlı II Stage II Weir

Yamanlı II Stage II Weir is located in the downstream of the Yamanlı II Stage I Weir. It is at a thalweg elevation of 841.5 m and its crest elevation is 858 m. The crest length is 60 m and the body height is 16.5 m.

Elevation of the water inlet structure of Yamanlı II Stage II Weir is 854.25 m. Screen dimension is 2.5 m by 5.0 m. Inner width of the water inlet structure is 17.00 m and the sedimentation tank, located at the downstream of the water structure, is designed to be 60.00-m long.

Transmission Channel and Transmission Tunnel (between Yamanlı II Stage II Weir and Hocabey Weir)

Water will flow into the transmission tunnel from the transmission tunnel through a transition structure at the left shore of Yamanlı II Stage II Weir and it then water is transmitted to the forebay and valve room. The beginning and end of the transmission tunnel are at an elevation of 854.25 m and 852.16 m. The bottom inclination is 0.0005. Length of the channel is 4,180 m. Channel width and height is 4.00 m and 2.80 m, respectively. Water depth in the channel is 2.60 and the freeboard is 20 cm.

Transmission tunnel is 1,000 m long and its inner diameter is 3.50 m. Bottom inclination and the design flow rate is 0.0036 and 38 m³/s, respectively. Water velocity in the tunnel is 3.67 m/s. Elevation of the beginning of the horseshoe-shaped tunnel is 852.16 m, and the elevation of the tunnel end is 848.56 m.

Transmission tunnel will be connected to the outlet of the water inlet structure-sedimentation tank of Hocabey Weir through a steel syphon at an elevation of 847.50 m.

Hocabey Weir

Thalweg and crest elevation of Hocabey Weir is 844 m and 850 m, respectively. Crest width is 20 m and height of the weir is 6.00 m.

Elevation of the threshold of the water inlet structure is 847.50 m. Water inlet structure has one opening and 4.00-m wide. Screen dimension is 4.00 m by 1.50 m. The sedimentation tank located at the downstream of the water inlet structure is 20.00-m long.

Transmission Channel (between Hocabey Weir and Forebay)

Water flowing into the transmission channel through the water inlet structure of Hocabey Weir and the flow from the steel syphon is transmitted to the forebay through a 1,900-m long transmission channel.

Elevation of the beginning of the channel is 847.50 m and the bottom inclination is 0.0005. Bottom elevation at the end of the channel is 846.55 m. Bottom width and height of the channel is 4.00 m and 2.80 m. Water depth in the channel is 2.70 m. The design flow rate is 38.00 m³/s.

Forebay and Valve Room

Transmission channel is located between km: 1+900 and the forebay at an elevation of 846.55 m. Normal water level in the forebay is 849.25 calculated according to the water depth of 2.70 at design flow rate. The maximum water level in the forebay is 849.75 m. Width of the forebay is 10.00 m and its length is 50.00 m.

The minimum water level in the forebay is 848.10 m and the elevation of the upper section of the water inlet structure of the penstock was designed as 841.00 m in order to prevent vortex.

There will be a valve with a diameter of 3.10 m and it will be used to evacuate the penstock for maintenance.

Penstock (between Valve Room and – Yamanlı II Stage II HPP)

Diameter of the penstock is 3.10 m. Looking from the plan view the length of the penstock is 80.99 m and its exact length is 123.31 m. Wall thickness of the penstock was determined as 14 mm considering diameter, flow rate, length and water hammer. There are three branches with equal capacity to supply water to the three units. Each of the branches have a diameter of 1.80 m.

Yamanlı II Stage II HPP

Type of the turbine was chosen as vertical-axis Francis as a result of the optimization of installed capacity. Design flow rate is 38.00 m³/s and the capacity of each unit is 12.67 m³/s. Diameter of the penstock is 3.10 m. Each unit has a 9.33 MW of installed capacity and the total installed capacity is 28.00 MW.

Generators to be installed in the HPP will be three-phase and synchronous with a power of 10,360 kVA and 375 rpm. Their frequencies will be 50 Hz.

Switchyard

Switchyard will be located by the HPP since the topography is suitable. Switchyard will be 40 m by 50 m.

Energy Transmission

Turkish Electricity Transmission Inc. (TEIAS) is the authority to determine the connection of the electricity generated by the Project to the national grid. There are two alternatives for connection to the national grid. The first one involves in making the connection to Feke Transformer Center by a 7-km transmission line of 2 x 1C 954 MCM with Cardinal conductor. In the second alternative, a private direct transmission line is proposed to be used for connection to the Tufanbeyli Power Plant. Evaluation of the alternatives and determination of the way to connect to the national grid will be decided by Ser Energy Generation and Trading Inc. The official letter from TEIAS numbered 213 and dated 25 January 2007 is presented in App.-E.

Energy transmission line and switchyard will be evaluated according to the Environmental Impact Assessment Regulation, effective since publication in Official Gazette numbered 25318 and dated 16 December 2003.

V.2.2 Impacts on the Water Quality and Aquatic Life, Amount of Environmental Flow and Details of Calculation of Amount of Environmental Flow

Article 22 of the Fishery Law numbered 1380, effective since publication in Official Gazette numbered 13789 and dated 22 March 1971:

“It is compulsory that fish passages and escalators are built so as to allow passage of fishery products in facilities like dam and weir constructed on streams and they are in operation all the time.”

Fish passage will be built and be kept in operation all the time.

Provisions of Article 8 of the Regulation on Fishery Products will be obeyed and a suitable screen or cage will be installed at the inlet of any channel and water path. The minimum water depth should be 15-20 cm in order to allow a mature salmon trout to move to the upstream easily. Environmental flow rate was calculated accordingly and the calculations are summarized below.

According to the feasibility report of the Project (Dogru Muhendislik, 2005) the environmental flow for Yamanlı II Stage I and Stage II weirs is 400 L/s.

These values were determined according to the flow diagram prepared for the flow measurement station numbered 1824 that is respected to represent this section of the river bed best. This environmental flow will ensure a water depth of 18 cm. The flow diagram prepared for the 1824 is given in Figure V-7.

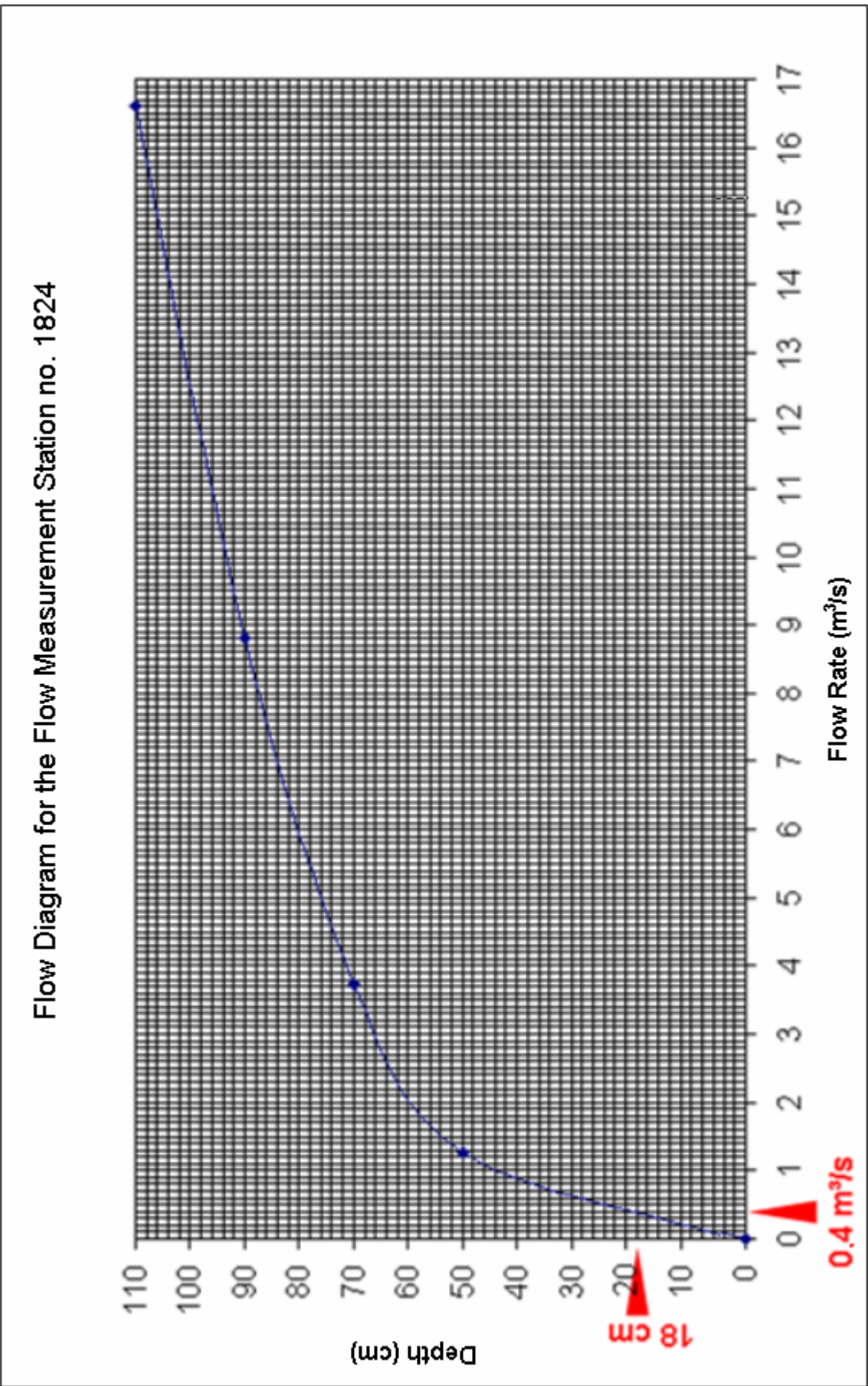


Figure V-7 Key Flow Curve for the FMS no. 1824

These values were also compared to the 10% of the average of minimum monthly flow rate accepted by MoEF for the Kavşakbendi Dam, HPP and Quarries Project located in the downstream of the Project. Making this comparison, the average monthly flow data recorded at weir locations between 1979 and 2003 for the full development of the upstream projects were used. These data are presented in App.-O.

The minimum values of flow rate obtained from the above mentioned data are tabulated below.

Table V-23 Calculation of Environmental Flow to be Released from Yamanlı II Stage I and II Weirs

Year	Minimum Flow at Yamanlı II Stage I Weir (m ³ /s)	Minimum Flow at Yamanlı II Stage II Weir (m ³ /s)
1979	2.335	6.644
1980	4.815	8.534
1981	4.309	7.96
1982	3.531	8.083
1983	2.518	5.813
1984	1.962	6.231
1985	1.247	4.75
1986	0.729	3.819
1987	2.725	6.512
1988	4.898	9.295
1989	0.623	3.919
1990	2.504	6.843
1991	2.579	6.655
1992	3.654	7.807
1993	3.653	7.962
1994	1.854	4.844
1995	3.126	6.099
1996	4.348	8.791
1997	3.39	8.038
1998	3.184	7.703
1999	3.07	7.58
2000	3.416	7.093
2001	1.64	5.164
2002	3.065	6.518
2003	2.934	7.345
Average	2.884	6.800

As seen from Table V-23, the environmental flow determined to be released from Yamanlı II Stage I Weir, 0.400 m³/s, is well over the calculated flow rate of 0.288 m³/s. Therefore, there will be no impacts due to release of the determined environmental flow. The environmental flow to be released from Yamanlı II Stage II Weir was determined to be 0.680 m³/s given in Table V-23.

The environmental flow to be released from Hocabey Weir is given as 20 L/s in the feasibility report. Since Hocabey Weir is located in a narrow section of the valley, the water depth will be fairly good to sustain the aquatic life.

There will be no adverse impacts of the water flowing from the by-pass line that will be built for the construction of weirs since there will be no physical or chemical alterations in water. Moreover, the necessary measures stated in the Fishery Law will be taken.

Measures to be Taken in Dams and Artificial Reservoirs

Article 8 – for the determination of necessary measures to be taken with regards to fishery products before releasing water into dam reservoirs and other artificial reservoirs, an application shall be made to the Ministry of Agriculture and Rural Affairs and the measures to be determined by the ministry shall be taken.

Measures for the Protection of Fishery Products

Article 9 – It is compulsory that the necessary measures for prevention of fishery products from any losses when inland waters are used for irrigation and energy generation purposes. These measures are determined by the Ministry of Agriculture and Rural Affairs.

V.2.3 Impacts on Areas Protected by National and International Legislation

Yamanlı II Stage I Weir and the transmission tunnel connecting this weir to Yamanlı II Stage I HPP are located in Hançerderesi Wild Life Development Area (WLDA), determined as the protection area for the wild goat. The management plan prepared for this area was approved by the MoEF (the official letter numbered B.18.DMP.03.04.480.02 00-224 and dated 29 July 2008).

The General Directorate of Nature Protection and National Parks lists the requirements to be fulfilled within the scope of the Project with the official letter numbered B.18.0.DMP.03.04.480.00-19 and dated 7 January 2009 (see App.-E). These requirements are given below.

- A full-time forest engineer or a wild life technician who lives nearby (in Saimbeyli or Goksun) will be employed for continuous monitoring of impacts due to construction works and other works that take place prior to construction on the target species and other biodiversity elements present in the area.
- Technical employee will work on the issues determined by the Adana Provincial Directorate of Environment and Forestry.
- Technical employee will be equipped with a four-wheel drive (4x4) car, binocle, global positioning system (GPS) device and camera.
- A report will be submitted to Adana Provincial Directorate of Environment and Forestry and the General Directorate of Nature Protection and National Parks

about the area, the impacts of the Project on the area and population, once every four months or more frequently.

- Poster and brochure will be published in order to inform local people about that the Project is not harmful to ecosystem.
- Five phototaps, two camera traps and five radio-wave leash with technical features specified by the General Directorate of Nature Protection and National Parks for monitoring of impacts of Project activities on the other features in the area will be supplied and installed in the area by the technical employee with the supervision of the General Directorate of Nature Protection and National Parks and Adana Provincial Directorate of Environment and Forestry.
- A monitoring booth will be designed and located (on map) by Adana Provincial Directorate of Environment and Forestry, and will be constructed at the area. Equipments such as telescope will be installed in the booth.
- It is anticipated that the Project might cause emigration of partridge, a local species, a number of 1,000 partridges will be released to the area with the supervision of Adana Provincial Directorate of Environment and Forestry.

V.2.4 The Possible Changes In The Downstream That will Take Place as a Result of Utilization of The Resources to Obtain Water (Erosion, River Hydrology, Sediment Transport, Etc.)

Aquatic Ecosystem

Since weirs will be constructed as the water diverting structure in the scope of the Project, there will not be any alterations on the river habitat. Environmental flow will be released from weirs so as to eliminate adverse effects on the aquatic media. Hence the river ecosystem in the impact area of the Project will be protected and alteration of composition of species and immigration activities of aquatic life components is out of question.

Sedimentation

In Seyhan River reservoir, sedimentation measurements are made in 1801 Goksu River-Himmetli, 1826 Zamanti River-Ergenusagi, 1818 Seyhan River-Uctepe AGI, 1820 Korkun S.- Hacili Bridge AGIs. The most appropriate station to calculate the efficiency and the amount of sediment in Seyhan River is 1818 AGI station which is on the downstream of Yamanlı II Stage II HPP (see Figure V.2).

According to sediment measurements of 1801 AGI since 1966 the average suspended sediment efficiency is 58 ton/year/ km² (EIE-2000). The drainage area of station is 2596.8 km², the drainage area of Yamanlı II Stage I Weir is 1,696 km², the drainage area of Yamanlı II Stage II Weir is 2,031 km². The sediment measurements on the weirs are calculated by using ratio of AGI and area and by assuming sediment

efficiency and station efficiency of weir basins are equal. Because of the steep slope of basin bed materials is also considered in sediment content so sediment content increased by 25%.

$$A_{\text{Yamanlı II I. Stage}} = 1696 \text{ km}^2 \quad Q_{s(\text{Yamanlı II I. Stage})} = 1696 \times 58 \text{ ton/year/km}^2 \times 1,25 \\ = 123,000 \text{ ton/year}$$

$$A_{\text{Yamanlı II II. Stage}} = 2031 \text{ km}^2 \quad Q_{s(\text{Yamanlı II II. Stage})} = 2031 \times 58 \text{ ton/year/km}^2 \times 1,25 \\ = 147,300 \text{ ton/year}$$

$$Q_{s(\text{Yamanlı II I. Stage})} = 123.000 \text{ ton/year} = 123,000 / 1,165 = 105,600 \text{ m}^3/\text{year}$$

$$Q_{s(\text{Yamanlı II II. Stage})} = 147.300 \text{ ton/year} = 147,300 / 1,165 = 126,500 \text{ m}^3/\text{year}$$

These rates do not imply any problem for the design of the Project; sediment can be transferred to the downstream through gravel passage.

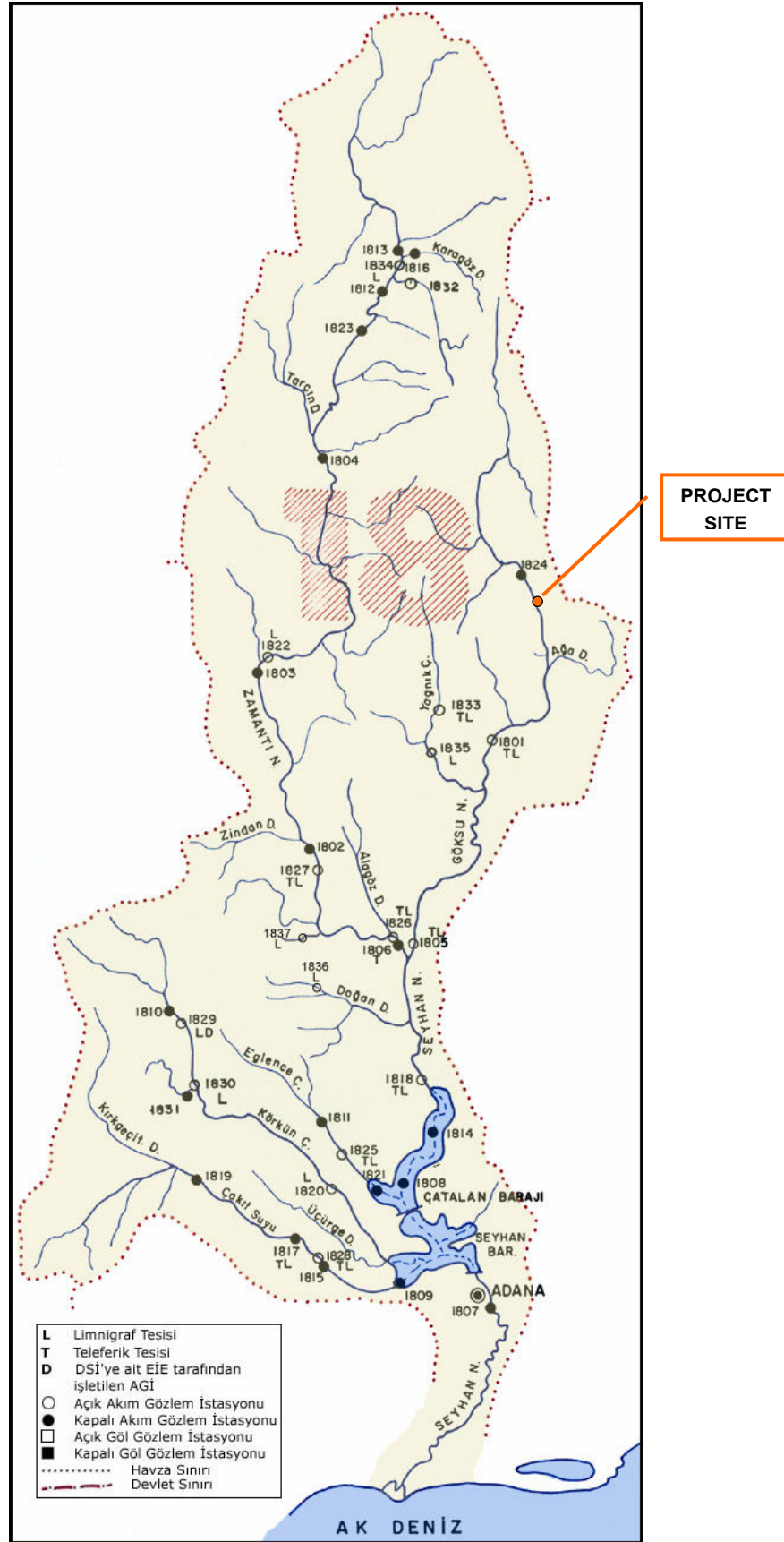


Figure V-8 Flow Observation Stations (AGI) on Seyhan River

Erosion

Causing significant damages especially in our country, water erosion is the most significant erosion type when we consider all types of erosion. There is the 2nd degree erosion risk where Yamanlı II Stage II and Hocabey weirs will be located, and there is 3rd degree erosion risk where Yamanlı II Stage I Weir will be located.

The soil eroded is carried to the streams and then to the dams. The soil carried to the dams accumulates at dams and soon causes the dam lake to be filled. Once the dams are filled up, soil is held instead of water. As the time passes, the dam gets filled a lot and it may not be benefited from. This means a huge loss of money. In our country, the lifetime of the power plant dams are very short due to high erosion.

In order to prevent the water erosion and make the Project's lifespan increase, some precautions that could be taken are listed below.

1) *Administrative precautions*

The necessary administrative precautions will be taken about the law numbered 4856 about the Responsibilities and Organization of the Ministry of Environment and Forestry duties according to the article 11 of the law.

2) *Cultural precautions*

The aim of the cultural precautions is to stop the erosion by planting or developing the existing flora. Forestation, flora development, grassing activities, breeding the appropriate plant types can be classified as cultural precautions that to be taken in to consideration.

3) *Mechanical precautions*

a) Measures that will be implemented in the hillsides (Terracing, diversion ditch, barrier, etc.)

b) Measures that will be taken against the carve erosion (Soil barriers, riprap, etc.).

Landslides

When the geological and geomorphological structure of the project field is examined limestone is seen throughout the project field. So the risk of landslide is low at this field. At project field due to bare rocks and rubbles from place to places landslides can be seen. For this situation some administrative and mechanical precautions are taken.

1) *Administrative precautions*

The goal of these measures is to keep the people away from the negative effects of the landslides and to warn them against them.

- *Technical precautions*

The precautions will be taken to remove the landslide causes or at least to stop them in a way that they will not be harmful.

V.2.5 Other Types of Utilization of the Resource and Pertinent Impacts

Except from the project talked about usage patterns belonging to resources are given in Section IV.2.5. Except from these there is no other usage belonging to the resources.

V.2.6 The Impacts on the Underground and Surface Water Resources

The surface water resources in the Project Site are Goksu River and Hocabey Creek. As mentioned in Section V.2.2 the environmental flow released to river bed from weirs will contribute to the hydraulic regime of the river.

V.2.7 Accommodation and other social, technical infrastructure services for the personnel

The duties and the number of the people that will work on maintenance, security, control and on other works during the operation phase of the project are shown in Table V.22. Total number of administrative and technical person will be 40. The required workers will be provided from the local people. The accommodation facilities for the personnel will be built in the nearest district. For this reason, an administrative building which includes a manager room, a deputy manager room, a mechanist room, a drivers room, an assembly room, a tea shop, a central, a security room, etc. The personnel that will work in shifts will be obtained from the nearest districts and in the shift changes they will be carried to their houses by service buses. Also these personnel can use temporary buildings which will be used during construction.

Domestic waste water generated from the Project units and social facilities will be collected in a unleaking septic tank. This waste water will be drawn away by the vacuum trucks and disposed to the Kozan Municipality waste water treatment plant.

In winter time, distilled fuel-oil is used for heating buildings like energy unit, administrative and social facilities and guard house. This type of fuel is fluid and volatile

and it contains a smaller amount of clay and nitrogen(N). Sulphur content of the proposed fuel is 1.5%.

Table V-24 Number and Duties of Personnel to be Employed in the Operational Phase of the Project

Duty	Number
General Manager	1
General Manager Assistant	1
Electricity Head Engineer	1
Machine Head Engineer	1
HSE Engineer	1
Shift Technical Personnel	5
Mechanical Atelier Expert and His Assistant	2
Electric Atelier Expert and His Assistant	2
IT-computer and Program Technician	1
Warehouse responsible and the Assistant	2
The manager for the Social and Administrative Affairs	1
Human Resources Manager	1
Accountant	1
Purchaser	1
Security Chief	1
Security Personnel	15
Power Plant Responsible	1
Driver	2
TOTAL	40

Under these circumstances the Project does not have any negative effect on the social and technical infrastructure of the region.

V.2.8 The characteristics of the treatment facility for the waste water that emerges after the utilization of the water for drinking and usage purposes in the administrative and social unities, the details of the process and the receiving body and amount of the treated wastewater to be discharged

In the operation phase, there will be 40 people will be working in shifts. The domestic waste water arising out of them will be collected by tight septic tanks then will be pulled by vacuum trunks and disposed of in the wastewater treatment plant of Kozan Municipality. The septic holes will be drilled and approved according to the regulations published in the 13/03/1971 dated and 13783-numbered Official newspaper which are about Septic Constructed at Places where there is not any Sewage Channels. Septic type projects are in App.-D.

V.2.9 The amount and characteristics of solid wastes that will be emerges from house, social and administrative facilities, where and how these waste will be carried or for which purposes and how they will be evaluated

It is predicted that approximately 52 kg of solid waste (40 cap x 1.3 kg/cap.day) will be formed in the operating phase of the project. The solid wastes formed in the operating phase of the proposed project will be accumulated, collected periodically and sent to Saimbeyli and Goksun municipalities treatment plant facilities.

All activities concerning the solid wastes will be executed in line with the Solid Wastes Control Rregulation.

V.2.10 The sources of the noise that will be generated during the operation of the project units and the precautions that will be taken for the control of it

The most crucial source of noise during the operation of the facility is the mechanical noise that arises from the turbine mile turning around the axis. Noise is also expected to arise from air conditioning of the building besides the discontinuous noises from diesel generators and the noises from miscellaneous pumps.

To minimize the effect of the noise, vibration and land plates that have a sound absorbing character will be used. Also, the personnel will be provided with safety equipment and it will be made sure that they use these equipments. The activities will be executed in line with the "Worker Health and Labor Security Legislation" (12.09.1974 dated and 15004 numbered Official Newspaper).

V.2.11 Possible effects on forests and the definition of the precautions that will be taken against these effects

The only effect on the forests during the operation phase of the project could only be fire. Therefore, during the operations within the scope of the project, uncontrolled incineration of any material will not be allowed. There will always be mobile equipment to extinguish fire. These equipment will be obtained in accordance with the relevant articles of 11.01.1974 dated and 14765 numbered the Bylaw on Occupational Health and Safety (Official Gazette no. 14765 on 11 January 1974) and they will be controlled periodically. Also, the personnel will be trained about this issue. In case of a fire incidence in spite of all of these measures taken, necessary reaction will be taken against fire and the nearest fire department will be called. Besides fire, there are no other negative impacts of the Project on forests.

The Precautions for Possible Forest Fires

Sufficient number of fire extinguishers (diggings, shovels, axes, fire extinguishers, etc.) will be had present for a possible fire at the field of activity. The regulations of

11.01.1974 dated and 14765 numbered "Worker Health and Internal Security Legislation" 5th Chapter 1st Part "Security Measures Taken for Fires at Working Places" will be obeyed. If a fire happens, the personnel will be trained about the possible effects and tasks. In case of fire risk other nearest companies will be announced. After realizing of a fire and giving an alarm fire fighting sources will be utilized and fire will be disposed immediately. Following actions will be taken.

- When fire is realized primarily nearest people, people worked at building and after those concerned will be announced.
- The nearest security and fire departments will be informed.
- The security of surroundings will be carried by emergency response team.
- Fire extinction team will extinguish the fire immediately.
- In case of fires caused by fluid gas and electricity the flammable materials nearest at fire will be insulated.
- To rescue a life will be first activity at a fire. In case of like this situation, people will be prevented about risking their life and other's life unnecessarily.
- Fire will be extinguished by the nearest extinguishing equipments.
- Against undesired effects of smoke people shall take necessary precautions (closing mouths and noses etc.with wet cloth).
- While fire is extinguishing unnecessary destructions, crushing will be prevented.
- Sufficient staffs and extinguishing equipments will be kept available. Fire truck will be earthed which can conduct static electricity.
- The rapid response team employed for extinguishing fire will be contacted with local fire department.
- Ambulances will be present at all fireplaces.

In case of possible fires some fire extinguishing equipments will be present and usable.

- Gas tubes (extinguishing gases used by spraying)
- Smoke detector (when smoke is appears it can transmit to control panel automatically).
- Flame detector (In case of flames it can transmit to control panel automatically).
- Gas detector (At first it can give an alarm in case of a leakage and excessive gas concentration and then to secure system it can decrease gas concentration by make fans run automatically).

V.2.12 Other Aspects

There are no other activities on the Project Site.

V.3 The Impacts of the Project on the Socio-Economic Environment

V.3.1 The expected increases in the income levels; Employment Opportunities created, population movements, migrations, education, health, culture, other social and technical, infrastructure services and changes in these services, etc.

The recommended Project will create a potential economic growth for the local and regional society. However, it will also cause some kind commitment on the societal services and on the infrastructure. The effects of the on the local and regional economies and on the societal services and infrastructure are explained in the parts below.

The reservoir that will be formed within the context of the Project will be very small. Yamanlı II Stage I and II weirs that will be constructed within the context of Project will be the highest weirs with an height of 16.50 m. For this reason, there are no residential areas, agricultural land and social facility areas to be flooded.

Employment Opportunities Created and Income Increases

Increase in the employment level in a particular region is considered as a positive development. Expenses that will rise in parallel with the salaries will create new local job opportunities. Consequently, proposed Project will provide economic benefits to the region both directly and indirectly.

The construction phase has been predicted as approximately 30 months. During this period an average of 200 people will work and they will be obtained from the district. In addition to the worker salaries; contractor services, building and equipment rental are other sources of income. Also, the fuel for the trucks and other construction machines will be obtained from the gasoline stations in the region. Moreover, food and drink needs will be supplied from the district, and the local economy will improved.

In the operation phase, 40 people will be employed continually. In the construction phase all of the needs of the construction site will be met by the local opportunities and this will make the general economic life especially food, textile, local transportation industries much more profitable.

During the 49 years life of operation, a large amount of the needs for the operation and maintenance will be met from the region. There is not a certain number on the amount of the expenses for the operation and maintenance activities but a large amount of these expenses will be met from the region. In addition, it is not foreseen that forestation, stockbreeding and agricultural activities will be effected negatively from the project.

Population movements and Migrations

In the scope of the Project, there will be no resettlement as there are no residential areas to be flooded. Therefore, problems like finding new income resources and getting adapted to a new life will not be faced.

Education, health, culture, other social and technical, infrastructure services and changes in the ways of benefiting from these services, etc.

Development projects may usually create negative consequences on the societal services and infrastructure by creating a demand that is beyond the current service capacity. However, these kinds of projects may create positive effects by providing additional funds that could be utilized in increasing the service capacity. In the scope Project, the workers coming from outside of the region are expected to leave after the completion of the construction works. Also, through providing some needs of the workers(first aid, canteen, communication facilities,etc.) from the construction site and camps, their contact with the local people will be maintained at the maximum level.

The project will not create any negative effect on the educational, cultural activities, health services and on communication, irrigation facilities as well.

V.3.2 Environmental Cost-Benefit Analysis

The aim of the Project as formulated in the “Lower Seyhan Basin Master Plan Report” published in 1980 on Goksu River, a tributary of Seyhan River is energy generation.

The Environmental Benefits of the Project;

- Beyond the contributions to the Turkish economy and the energy market, the contribution to the amount of “Green Energy” that Turkey produces.
- Prevention of the Floods
- Benefiting from the dam lake that will be formed in fishing and recreation activities
- Prevention of erosion through the forestation activities and environmental regulations
- Construction of transportation roads
- Personnel who will work in the construction and operation phase of the project will be selected from the local people

Costs;

- Project Costs (Costs related to weirs, transmission structures, plant buildings and other technical equipment)
- Costs related to the construction of the transportation roads
- The costs of the working personnel and the work machines
- The costs related to the environmental regulation and security measures that will be taken
- Infrastructural Costs

The installed power of Project is 77,66 MW, the annual energy production is 300,25 GWh and its internal profitability rate is %12,65.

The economic lifetime of the Project is foreseen as 50 years and it may raise to 100 years if in every 35 years the electro-mechanical equipment is renewed and rehabilitation activities are conducted.

VI. POTENTIAL IMPACTS AFTER DECOMMISSIONING AND RELEVANT MITIGATION MEASURES

In this section, the environmental impacts after operational phase of the plant was investigated. Generally, in most countries, the hydroelectrical power plant projects are designed as they are continuously operating. Duration of the licence is 49 years. However, the hydrolic structures are durable for longer time. Electromechanical equipment (turbines, generator, unit control systems and switchyard equipment) generally have 35 years life time. For a long life time durability, the maintenance and repairment of these equipments is definitely crucial. In case of the closure of the plant, the possible environmental impacts are discussed below.

VI.1 Site Remediation

The lifetime of the concrete structures limits the economic lifetime of the hydroelectrical power plants. By renovation and systematic maintenance of the concrete structures and depending on hydraulic conditions, operational phase of the power plant might be longer. Renovation of the electromechanical equipment results in long-lasting structure and highly efficient electricity generation. Grading and smoothing of the floor and rehabilitation of the area are included in land restoration.

Furthermore, drainage channels and trenches are built in order to prevent accumulation of surface run-off produced by rainfalls and to control the surface drainage.

VI.2 Site Remediation and Reclamation Works to be carried out in the Project Site and Quarries

Although the licence period is 49 years, the lifetime of the plant is much more longer provided that proper renovation and maintenance of the mechanical equipment is made. However, after 49 years, the removal of the weir may be necessary. In this case, necessary site remediation works will be performed before the site is abandoned.

After operation, the quarries will be arranged convenient to topography and will be rehabilitated by using their natural vegetation cover which was taken from the upper layer in the construction phase and afforestation will be achieved. Arrangements for runoff flow will be made in quarries.

VI.3 Impacts on the Water Resources

After completion of the Project and decommissioning period, any negative impacts on water quality are not expected.

VII. ALTERNATIVES OF THE PROJECT

Alternative Technologies for Electricity Generation

When compared to natural gas, nuclear and coal-fired power plants, hydroelectric power plants have significant advantages like consuming renewable sources and operating with maximum performance. As they can be activated rapidly in the peak hours and deactivated instantly in case of a decrease in demand, hydroelectric power plants are the most convenient power plants to meet “Peak Demand”. In order to determine the economic feasibility of hydroelectric power plants, resources that might produce the same amount of energy are explored in interconnected systems, hydroelectric power plant project is compared with the cheapest energy source in terms of economical aspects and proposed only if it is evaluated as more economical.

Alternatives of the Project

The project was proposed in the “Lower Seyhan Basin Master Plan Report” prepared in 1980 by the SHW placed onto the Göksu River, upstream of the Menge Dam. Yamanlı II system is planned with an installed capacity of 65.30 MW and total energy production of 254.06 GWh. On the contrary, at the proposed alternative, shorter transmission tunnel and a system with two power plants was formulated. Therefore, the cost of the proposed alternative is lower and the amount of energy produced is higher. In this regard, a system including a tunnel with a length of 8,212 m and two weirs was planned, instead of another system with a 16,090-m long tunnel, construction of which will be very demanding. Total installed capacity is 77.66 MW and total energy production for the full development situation is 300.25 GWh. The internal rate of return of the Project was estimated as 12.45%.

Economical life time of the project is expected as 50 years. The life time of the project may be 100 years if electromechanical equipment and the hydrolic structures are renewed every 35 years.

The Project can be justified when we consider that the electricity generated in other regions of Turkey is utilized in the region while it will be just the opposite in case of implementation of the Project. The aim of the Project in this respect is to contribute to regional and national economy.

No Action Alternative

Any investment might have a number of alternatives in terms of site selection and the technology to be used. All of these alternatives are the various investment choices developed for the implementation of the project. Furthermore, “no action” might be an alternative as well. This alternative aims at reviewing the cost and benefits at the present stage as if the Project is not to be implemented. As quantitative assessments are not quite

convenient in such cases, rather, alternative scenerios are presented to the decision-maker explaining the expected situations if the Project is implemented and those vice versa.

The no action alternative would bring about an annual electiricity loss of 300.25 GWh and economic burden of this are discussed. Besides, in case where the project is not implemented, no contribution would be made regarding the electrical energy production based completely on the national resources. Considering the current situation of the country and the demand for energy, it is clear that no action alternative regarding the proposed project is not a rational choice.

VIII. MONITORING PROGRAM

The monitoring studies will be implemented in line with the EIA Report and monitoring reports will be written and submitted to the MoEF.

Ser Energy Generation and Trading Inc. has planned the Project and taken the production licence from the Energy Market Regulatory Authority with the decision of that authority. An agreement will be signed with the SHW for the right of water usage and operating. According to the production license Ser Energy Generation and Trading Inc. is authorized to make the necessary monitoring and audits. In line with the agreement signed with the SHW, the activities will also be audited by that authority on the relevant issues.

VIII.1 The Monitoring Program Proposed for the Construction, Operational and Post-operational Phases and Emergency Action Plan

The Monitoring Program Proposed for the Construction Phase

The issues below should be considered during the construction phase

- The construction must be executed according to the plan and the regulations
- The quality of the construction must be inspected and every record about the Construction must be documented regularly.
- In the implementation phase, the construction must be executed in line with the prepared project documents and drawings
- The relevant actions for the work and worker security must be taken according to the regulations

Monitoring Program Proposed for the Construction Phase

The issues below should be paid attention during the construction phase:

- The construction must be executed according to the plan and the regulations
- The quality of the construction must be inspected and every record about the Construction must be documented regularly.
- In the implementation phase, the construction must be executed in line with the prepared project documents and drawings
- The relevant actions for the occupational health and safety must be taken according to the regulations

Apart from these, in order to lessen the effects of the construction on the environmental monitoring must be made during the time of the construction in line with the

regulations in force. The rehabilitation areas are the contractor site and material areas, Göksu river environment and the construction environment.

Monitoring program will cover the topics below:

- Assessment of erosion and sediment transport to the downstream.
- Disposal of municipal solid waste
- Rehabilitation of landscape damaged during construction
- Seasonal monitoring of water in the downstream in terms of turbidity, electrical conductivity, pH and suspended solids
- Seasonal control of dust and noise that may result from construction activities.

Article 12 of the Agreement on Water Utilization Rights and Operational Principles states that “During construction and operational phase of hydroelectric power facilities, necessary measures will be taken by the project’s owner in order not to affect the environment and the facilities of the SHW, which can either be in operation or in construction. There shall be no disruption of release of water.” Therefore, it is the responsibility of the Project’s owner to properly conduct construction works.

Monitoring Program Proposed for the Operational Phase

Protection and safety services for energy generation facilities will be provided in compliance with the pertinent legislation.

Seasonal measurement of dissolved oxygen, temperature, pH, suspended solids and sediment in Göksu River will be sufficient.

Collection of solid wastes and disposal in the solid waste disposal site of the municipality is also one of the issues that should be taken into consideration.

All the monitoring works will be conducted with the equipment to be used, calibrated and maintained in compliance with the standard methods recommended by MoEF. A copy of the results of monitoring studies will be sent to the Adana Provincial Directorate of Agriculture.

Monitoring in the Post-Operational Phase

Hydropower projects in all countries are generally designed as permanent facilities. License period of the Project is 49 years. However, lifetime of hydraulic structures are much longer. Lifetime of electromechanical equipment such as turbines, generators, control systems, switchyard equipment, etc. is designed as 35 years.

Lifetime of these facilities will be much longer provided that maintenance of the electromechanical equipment is periodically made.

The issues below will be taken into consideration when the decommissioning of the facility is in question at the end of the 49-year period.

- Land adjustment, if necessary area design and terracing will be made
- Because of the dense rains, the flora of the region has the capacity quickly renewing itself. So the green field will quickly rehabilitate itself after the land adjustment.
- The surface drainage will be checked by opening drainage channels and ditches so that the accumulation of the surface flow in the project field will be prevented.

Emergency Action Plan

An emergency intervention plan having information about the organizations to be informed in emergencies, the places of the safety equipment and the escape routes will be prepared and utilized when necessary during the construction phase. The most important aim of these plans is to define what must be done in emergencies. The accidents, natural disasters, mistakes within the project or sudden flows are defined as “emergencies”. Apart from that, there will be some adjusting interventions on the issues such as vibration and noise. Emergency Intervention Plans will be prepared for the issues below.

- The equipment for the emergency intervention will be determined and kept in a separate place. These kinds of equipment will include picks and paddles, face masks, protecting glass, gloves, pipes, electrical motors that do not explode, etc.
- The contribution of the heavy work machines to the emergency interventions will be determined and their parking spaces will be chosen accordingly.
- Emergency Intervention Plans will include the lists of the emergency teams, the places of the safety vehicles, their escape routes and procedures.
- Emergency Intervention Plans will be checked regularly and the periodical maintenance of the related equipment will be executed regularly. The personnel will also be trained about this issue.

VIII.2 Program Related to the Realization of the Issues Stated in the Second Paragraph Under the Title “Liabilities of the Institutions/Establishments Acquiring Proficiency Certificate” in the Proficiency Communication where the EIA Positive Certificate is Acquired

In the second paragraph of Article 9 of the Proficiency Communication published in Official Gazette numbered 25383 and dated 24 February 2004 that institutions and establishment acquiring EIA positive certificate shall fill out the Monitoring Form of the

Final EIA Report, in App.-4, in order to provide information about whether they comply with their obligations for the pre-construction and construction phases of the investment.

In this respect, upon acquiring the EIA positive certificate for the Project, monitoring program given in the Final EIA Report will be implemented accordingly and Monitoring Reports Form will be prepared and submitted to MoEF every six months.

IX. PUBLIC PARTICIPATION

MoEF decided holding the "Meeting on Public Participation to the EIA Process" as a requirement of Article 9 of the EIA Regulation for hearing public opinion about the Project. There were two meetings held in Kahramanmaraş on 21 February 2007 and in Adana on 22.02.2007, respectively. Both meetings were organized in coordination with the provincial directorates of Kahramanmaraş and Adana.

As a requirement of Article 9 of the EIA Regulation, advertisements for time, location and subject of the meeting were published in two newspapers, one local and one national (Zirve Gazetesi and Vatan Gazetesi, respectively). These advertisements are presented in Figure IX.1.

As can be seen from the following advertisements, the meetings, chaired by the provincial directors, were held on 21 and 22 February 2007 at 14:00 (see Figure IX.2)

DUYURU Adana ili, Saimbeyli İlçesi ve Kahramanmaraş İli Göksun İlçesi, Seyhan nehri'nin Göksu ana kolu üzerinde, Ser Enerji Üretim ve Ticaret A.Ş tarafından; "Yamanlı II Regülatörü ve Hidroelektrik Santrali Projesi" yapılması planlanmaktadır. Söz konusu faaliyet ile ilgili olarak, 16.12.2003 tarih ve 25318 sayılı Resmi Gazete'de yayımlanarak yürürlüğe giren Çevresel Etki Değerlendirmesi Yönetmeliği gereğince, aşağıda belirtilen yer, gün ve saate "ÇED Sürecini Halkın Katılım Toplantısı" düzenlenecektir. Yer : Halk Eğitim Kültür Merkezi Adres : Saimbeyli İlçesi Cumhuriyet Caddesi ADANA Tarih : 22.02.2007 Saat : 14.00 İlgili yönetmeliğin 9. maddesi gereğince HALKIMIZA DUYURULUR SER ENERJİ ÜRETİM VE TİCARET A.Ş	DUYURU ADANA İli Saimbeyli İlçesi ve Kahramanmaraş İli, Göksun İlçesi sınırları içerisinde, Seyhan Nehri'nin Göksu Ana Kolu Üzerinde, Ser Enerji Üretim ve Ticaret A.Ş. tarafından, "Yamanlı II Regülatörü ve Hidroelektrik Santrali Projesi"nin yapılması planlanmaktadır. Söz konusu faaliyet ile ilgili olarak, 16.12.2003 tarih ve 25318 sayılı Resmi Gazete'de yayımlanarak yürürlüğe giren Çevresel Etki Değerlendirmesi Yönetmeliği gereğince, aşağıda belirtilen yer, gün ve saatte "ÇED Sürecine Halkın Katılımı Toplantıları" düzenlenecektir. Yer : Göksun Oman İşletme Müdürlüğü Lokali Adres : Göksun İlçesi, KAHRAMANMARAŞ Tarih : 21.02.2007 Saat : 10:00 Yer : Halk Eğitim Kültür Merkezi Adres : Cumhuriyet Caddesi, Saimbeyli, ADANA Tarih : 22.02.2007 Saat : 14:00 İlgili yönetmeliğin 9. Maddesi gereğince HALKIMIZA DUYURULUR. SER ENERJİ ÜRETİM VE TİCARET A.Ş.
a. Zirve Gazetesi 16.02.2007	b. Vatan Gazetesi 16.02.2007

Figure IX-1 Advertisements for the Public Participation Meetings



Figure IX-2 Pictures from the Public Participation Meetings

The Public Participation Meeting Held in Saimbeyli

The meeting was opened with a keynote speech delivered by Nebi Erol Metin, Adana provincial director of environment and Forestry, explaining the EIA procedure and the purpose of the meeting.

DOKAY-EIA Environmental Engineering briefly explained the Project and pertinent activities and the meeting continued with questions and recommendations.

İsa Kuruoğlu, a member of the provincial council, asked whether it is possible or not to supply electricity and irrigation water for villagers free of charge.

The representative of Ser Energy Generation and Trading Inc. (the Project owner) stated that they were concerned about drawing water from the river would be disadvantageous for them, and that they had not considered supplying electricity free of charge yet. He also stated that the electricity generated would be supplied to Turkish Electricity Distribution Inc (TEDAS). He added that they would supply free electricity if TEDAS would supply too.

Another representative of the Project owner stated that the purpose of the Project is to generate electricity not to serve for irrigation purposes.

A representative from MoEF gave information about water use and added that the environmental flow would only be utilized for sustaining aquatic life that is calculations should be reviewed in case there would be water use for irrigation purposes.

The village head of Karakuyu Village, Turan Cengiz, asked whether the Project would harm their gardens and farmlands.

The provincial director responded that necessary payments would be made for damages.

The representative from the Project owner stated that water and energy were the two highly important issues and that everyone should do their best to overcome problems arising pertaining to these.

The Public Participation Meeting Held in Göksun:

Hüseyin Çanak, the provincial director, gave brief information about the EIA Directive and gave the floor to the representative of DOKAY-EIA Environmental Engineering Ltd. for giving a brief information

The representative of DOKAY-EIA Environmental Engineering Ltd. gave detailed information about the Project.

Ahmet Yener from Kazandere Village asked about whether there would be a quarry and if so where it would be located and he stated that local people should be primarily chosen when the Project staff was hired.

The representative of the Project's owner stated that environmental flow would be released from weirs in order to sustain the aquatic life and its amount would be given in the EIA Report. He also stated that surveys for determination of quarry locations were still in progress and excavation material from tunnels would be used in construction provided that it was suitable for construction. He stated that it would be beneficial for them to hire local people.

Ahmet Kurnaz from Kaleboynu Village stated that the Project had no adverse impacts on them provided that local people were hired for the Project and expropriation costs were paid.

The director stated that all the necessary measures for erosion risk would be taken and this issue would be evaluated by the commission, a member of which would be from the General Directorate of Forestry.

X. CONCLUSION

- Yamanlı II HPP and Quarries Project will be located on Göksu River, main tributary of Seyhan River, in the Lower Seyhan Basin and energy will be generated by means of the Project. The Project Site is within the boundaries of Saimbeyli (Adana) and Göksun (Kahramanmaraş) districts. Yamanlı II Stage I HPP will be located in the southern skirts of Kalebaşı Hill near Adaköprüsü. It will be located 1.5 km to the northeast of Kaleboynu Village (Göksun, Kahramanmaraş), 4.5 km to the west of Eyüplü Village (Saimbeyli, Adana) and 4 km to the southeast of Aksaağaç Village (Saimbeyli, Adana).
- Total installed capacity of the Project is 77.66 MW. Annual energy generation for the full development of the upstream projects is 330.25 GWh. The internal rate of return of the Project is 12.65%. The Project's lifetime is 50 years, and this will be as long as 100 years provided that electromechanical equipment is renewed every 35 years and regular maintenance is made.
- Permits for quarries will be acquired in compliance with the Mining Law numbered 3213, and an application will be made to the General Directorate of Mining Affairs. Besides, operation license, workplace opening certificate and working lincense will be acquired before activities in the quarries begin.
- There are no National Parks, Nature Protection Zones, Special Environmental Protection Zones, Wetlands, Biogenetic Reserve Areas, Bipsphere Reserves and registered grasslands. Besides, there are no cultural and touristic protection and development areas and touristic centers. However, a part of the Project Site overlaps Hançerderesi Wild Life Development Area, which was registered as the wild goat protection area. A management plan has been prepared for this wild life development area and the issues to be considered and necessary measures to be taken in this area were specified by the General Directorate of Nature Protection and National Parks, and they are given in Appendix-E.
- Excavated material will be utilized for construction. Any residual material will be stored in suitable places. This will be achieved in compliance with the Regulation on control of excavated material and construction and demolition wastes. There will be no improper disposal or storage of excavated material in the Project Site. The vegetative earth from the excavations will be stored in the site with a top cover. It will be utilized for landscaping.
- Transportation and storage of blasting materials to be used during excavation works will be made in compliance with the related regulations in effect in order not to pose any adverse impacts on human health and the environment. Necessary measures will be taken to prevent misuse of blasting materials. Storage places will

be locked and necessary heat insulation, air conditioning and fire protection will be ensured.

- Water will be needed during construction activities for preparation of concrete, dust control and cleaning. Besides, there will be drinking and potable water demand for the personnel. This demand will be met from the surrounding fresh water resources. Moreover, water demand for preparation of concrete, dust control and cleaning will be supplied from the surface water resources in the region.
- Dust emissions during land preparation and construction may result due to utilization of construction machines and blasting materials, extraction and transportation of materials to the Project Site and crushing the material. Speed limit will be 30 km/s in places where dust formation is high. Moreover, trucks will not be allowed to transport mud to highways with their tyres. These mitigating measures will be implemented in compliance with the AQPR and the RCAPOIE. This will ensure that dust emission resulting from construction activities will be kept at tolerable levels.
- Domestic wastewater will be generated during the construction phase and it will be treated in package treatment plants and stored in unleaking septic tanks before discharging in compliance with the WPCR. Septic tanks will be constructed in compliance with the Regulation on tanks constructed in places where construction of sewer system is inapplicable, numbered 13783 and dated 13 March 1971.
- Solid waste management will be carried out in compliance with the Solid Waste Control Regulation, numbered 20814 and dated 14 March 1991.
- The Project Site lies within the earthquake region degree three in the earthquake map of Turkey prepared by the General Directorate of Disaster Affairs. Implementation of the Project will be in compliance with the Regulation on structures to be constructed in disaster regions.
- Provisions of RAMEN will be complied with during construction and operational phase of the Project.
- Landscaping and afforestation will be made in order to reinstate quarries. Tree species suitable for the local environmental conditions will be chosen.
- Potential environmental impacts of the Project will be determined by using worldwide-accepted mathematical models. The worst-case scenario will be considered in order to be at the safe side. As a result of these assessments potential impacts and necessary mitigating measures will be determined.

Final Evaluation

The Project will make a significant contribution to Turkey's overall energy generation. It will not bring about an additional burden to public budget. Project's positive impacts include increase in energy generation, increase in employment rate and recreation.

Considering that Turkey is using 35% of its potential for energy generation and it is 80% in developed countries, it is obvious that Turkey should increase the number of HPPs. In this context, other alternatives to the hydropower may bring about serious environmental risks. This Project will also contribute to Turkey's efforts for being independent in energy generation.

A successful implementation of the Project from the environmental point of view and keeping environmental impacts at tolerable levels highly depends on the realization of measures recommended as a result of the EIA study. These measures can be taken without a significant alteration of the expected energy generation and cash flow. Hence, protection of environment and recreation will also be achieved by the Project besides energy generation. Turkey need such integrated development projects.

The Project will also contribute to local economy. Besides this, it will contribute to Turkey's "green energy" generation and improve energy export to the European countries in which green energy consumption will be 22% of the total consumption as a requirement of the Kyoto Protocol. Moreover, implementation of the Project with local resources will make utilization of governmental resources more efficient and will decrease the demand for imported energy.

The legislation to be complied with during the construction and operational phase of the Project is given as follows.

- Fishery Law numbered 1380 and related regulations
- Law on Protection of Cultural and Natural Assets numbered 2863 (amended by the law numbered 5226) and related regulations
- Environmental Law numbered 2872 and related regulations
- Labor Law numbered 4857 and related regulations
- Pasture Law no 5178 and related regulations
- Forestry Law no. 6831 and Law Amending the Forestry Law numbered 5192 and related regulations
- Regulation on tanks to be constructed in places where construction of sewer system is inapplicable (effective since publication in Official Gazette numbered 13783 and dated 13 March 1971)
- Air Quality Protection Regulation (effective since publication in Official Gazette numbered 19269 and dated 2 November 1986)

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- Guideline on production, import, transportation, preservation, storage, sale, use, disposal, control of the materials that are out of monopoly and hunting materials (effective since publication in Official Gazette numbered 19589 and dated 29 September 1986)
 - Noise Control Regulation (effective since publication in Official Gazette numbered 19308 and dated 11 December 1986)
 - Solid Waste Control Regulation (effective since publication in Official Gazette numbered 20814 and dated 14 March 1991)
 - Hazardous Chemicals Regulation (effective since publication in Official Gazette numbered 21634 and dated 11 July 1993)
 - Regulation on Fishery Products (effective since publication in Official Gazette numbered 22223 and dated 10 March 1995)
 - Regulation on structures to be constructed in disaster regions (effective since publication in Official Gazette numbered 23098 and dated 2 September 1997)
 - Environmental Audit Regulation (effective since publication in Official Gazette numbered 24825 and dated 24 July 2002)
 - Occupational Health and Safety Regulation (effective since publication in Official Gazette numbered 25311 and dated 9 December 2003)
 - Environmental Impact Assessment Regulation (effective since publication in Official Gazette numbered 25318 and dated 16 December 2003)
 - Regulation on Health and Safety on Constructive Works (effective since publication in Official Gazette numbered 25325 and dated 23 December 2003)
 - Waste Oil Control Regulation (effective since publication in Official Gazette numbered 25353 and dated 21 January 2004)
 - Regulation on control of excavated material and construction and demolition wastes (effective since publication in Official Gazette numbered 25406 and dated 18 March 2004)
 - Regulation on occupational health and safety in temporary jobs (effective since publication in Official Gazette numbered 25463 and dated 15 May 2004)
 - Regulation on Control of Waste Batteries and Accumulators (effective since publication in Official Gazette numbered 25569 and dated 31 August 2004)
 - Regulation on Control of Air Pollution Originating from Industrial Establishments (effective since publication in Official Gazette numbered 26236 and dated 22 July 2006)
 - Water Pollution Control Regulation (effective since publication in Official Gazette numbered 25687 and dated 31 December 2004)
 - Hazardous Waste Control Regulation (effective since publication in Official Gazette numbered 25755 and dated 14 March 2005)

- Regulation on Protection and Utilization of Agricultural Fields (effective since publication in Official Gazette numbered 25766 and dated 25 March 2005)
- Regulation on Control of Waste Vegetal Oil (effective since publication in Official Gazette numbered 25791 and dated 29 April 2005)
- Soil Pollution Control Regulation (effective since publication in Official Gazette numbered 25831 and dated 31 May 2005)
- Regulation on Assessment and Management of Environmental Noise (effective since publication in Official Gazette numbered 25862 and dated 1 July 2005)
- Medical Waste Control Regulation (effective since publication in Official Gazette numbered 25883 and dated 22 July 2005)
- Regulation on Protection of Wetlands (effective since publication in Official Gazette numbered 25818 and dated 17 May 2005)
- Regulation on reinstatement of fields disturbed as a result of mining activities (effective since publication in Official Gazette numbered 26730 and dated 14 December 2007)

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