ALPASLAN II
ENERJI URETIM VE
MADENCILIK SAN. TIC. A.S.

ALPASLAN II DAM AND HEPP PROJECT

(DAM, HEPP, MATERIAL BORROW AREAS, CRUSHING-SCREENING-WASHING FACILITY, CONCRETE PLANT, RELOCATION ROAD)

FINAL EIA REPORT (VOL.-1)

MUS PROVINCE,

MERKEZ AND VARTO DISTRICTS

☐ EIA REPORT ■ FINAL EIA REPORT

KALİTE YÖNETİM SİSTEMİ
ISO 9001

TÜRKAK
Kalite Yönetim Sistemi
TS EN 45012
AB-0001-KY

TÜRKAK
Test
TS EN ISO/IEC 17025
AB-0168-T

ENCON ENVIRONMENTAL
CONSULTANCY CO.

ANKARA, APRIL 2012

Name of Project Owner	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S.
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Name of Project	Alpaslan II Dam, Material Borrow Areas and HEPP Project
Project Cost	509.922.000 Euro
Mailing Address of the Selected Project Site (Province, District, Location)	Mus Province, Merkez and Varto Districts
Coordinates of Project Location Zone	Coordinates are given in Page 2
Project in EIA Regulation (Sector, Sub Sector)	Eıa Regulation Annex I List; 15- Su depolama tesisleri (Dams and Ponds that have Reservoir Capacity≥10 million m^3)
Name of Company/Working Group who Prepared the Report	ENCON Environmental Consultancy Co.
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Presentation Date of the Report	... / … / 20…

Corner Coordinates of Dam Axis, Material Field, Storage Areas, Crushing-Screening-Washing Facilities, Concrete Plants, Construction Sites

PROJECT UNITS	KOORDİNATLAR			
	ED50 UTM Zone 37		GEOGRAPHICAL WGS84	
	X	Y	X	Y
Dam Axis	717738	4323877	41,515400	39,035301
	718560	4323795	41,524799	39,034302
Construction Site Facilities - 1	718193	4327920	41,521900	39,071602
	718314	4328010	41,523300	39,072300
	718548	4327680	41,525902	39,069302
	718427	4327600	41,524502	39,068600
Construction Site Facilities - 2	717756	4324460	41,515800	39,040501
	717901	4324420	41,517399	39,040199
	717799	4324040	41,516102	39,036701
	717654	4324080	41,514400	39,037102
Construction Site Facilities - 3	718776	4321700	41,526600	39,015400
	718921	4321660	41,528301	39,014999
	718819	4321280	41,527000	39,011600
	718674	4321310	41,525299	39,012001
Concrete Plant - 1	718285	4324320	41,521801	39,039101
	718375	4324440	41,522900	39,040100
	718415	4324410	41,523300	39,039902
	718324	4324290	41,522301	39,038799
Concrete Plant - 2	718434	4324190	41,523499	39,037899
	718474	4324220	41,523998	39,038101
	718563	4324090	41,524899	39,036999
	718523	4324070	41,524502	39,036800
Concrete Plant - 3	718340	4323270	41,522099	39,029701
	718349	4323420	41,522301	39,030998
	718399	4323420	41,522800	39,030998
	718389	4323270	41,522701	39,029598
Crushing – Screening - Washing Facility	719910	4327110	41,541500	39,063900
	720006	4327080	41,542599	39,063599
	719904	4326750	41,541302	39,060600
	719808	4326780	41,540199	39,060902
A Impermeable Material Field	718333	4323210	41,521999	39,029099
	718238	4323610	41,521000	39,032700
	718119	4323700	41,519699	39,033600
	718126	4324090	41,519901	39,037102
	718479	4324030	41,523998	39,036400
	718636	4323250	41,525501	39,029400
	718747	4323200	41,526798	39,028900
	718806	4322890	41,527401	39,026100
	718594	4322650	41,524799	39,023998
	719060	4321780	41,529900	39,016102
	718862	4321710	41,527599	39,015499
	718619	4322040	41,524899	39,018501
	718241	4322890	41,520802	39,026199
	718218	4323100	41,520599	39,028198
B Impermeable Material Field	718313	4325160	41,522400	39,046600
	718674	4325320	41,526600	39,048000
	718788	4325110	41,527901	39,046101
	718603	4324790	41,525600	39,043301
	718310	4324760	41,522202	39,043098

PROJECT UNITS	KOORDİNATLAR			
	ED50 UTM Zone 37		GEOGRAPHICAL WGS84	
	X	Y	X	Y
C Impermeable Material Field	719542	4326690	41,537102	39,060200
	719821	4326650	41,540298	39,059700
	719667	4326250	41,538399	39,056198
	719507	4326030	41,536499	39,054199
	719157	4325600	41,532299	39,050400
	718999	4325670	41,530499	39,051102
	719273	4326080	41,533798	39,054798
	719367	4326130	41,534901	39,055199
D Impermeable Material Field	719121	4326690	41,532200	39,060299
	719395	4326600	41,535400	39,059299
	718657	4325430	41,526501	39,049000
	718483	4325510	41,524502	39,049801
E Permeable Material Field	719476	4327280	41,536499	39,065498
	720515	4327490	41,548599	39,067101
	721233	4327550	41,556900	39,067501
	721256	4327410	41,557098	39,066200
	719895	4327130	41,541302	39,063999
	719765	4326710	41,539700	39,060200
	719505	4326720	41,536701	39,060501
F Permeable Material Field	719323	4327610	41,534901	39,068501
	720305	4327990	41,546299	39,071701
	720519	4327750	41,548698	39,069500
	719955	4327420	41,542099	39,066700
	719449	4327330	41,536201	39,066002
	719421	4327130	41,535801	39,064098
	719388	4327120	41,535400	39,063999
	719273	4327470	41,534199	39,067200
G Permeable Material Field	718702	4327800	41,527699	39,070400
	719384	4328200	41,535801	39,073799
	719642	4327960	41,538601	39,071602
	719273	4327630	41,534302	39,068699
	719220	4327490	41,533600	39,067402
	719363	4327100	41,535099	39,063900
	719263	4327070	41,534000	39,063599
Stockpiling for Reuse Area	718630	4322660	41,525299	39,024101
	718765	4322790	41,526901	39,025200
	718995	4322530	41,529400	39,022900
	718997	4322180	41,529301	39,019699
	718874	4322230	41,527901	39,020100
K1 Rock Quarry	715911	4331817	41,496799	39,107201
	715631	4331822	41,493500	39,107300
	715562	4331972	41,492802	39,108700
	715651	4332067	41,493900	39,109501
	715941	4331856	41,497101	39,107601
K2 Rock Quarry	712633	4333246	41,459400	39,120899
	712908	4333325	41,462601	39,121498
	713065	4333119	41,464298	39,119598
	713214	4333109	41,466000	39,119499
	713312	4333176	41,467201	39,120098
	713591	4333123	41,470402	39,119499
	713519	4332788	41,469398	39,116501
	713066	4332768	41,464199	39,116501
	712643	4333158	41,459400	39,120098

PROJECT UNITS	**KOORDİNATLAR**			
	ED50 UTM Zone 37		**GEOGRAPHICAL WGS84**	
	X	**Y**	**X**	**Y**
K3A Rock Quarry	720950	4330300	41,554501	39,092300
	720525	4330325	41,549599	39,092602
	720525	4330366	41,549599	39,092999
	721859	4330745	41,565201	39,096100
	722123	4330393	41,568100	39,092800
	722116	4330300	41,568001	39,091999
K5 Rock Quarry	721058	4327285	41,554798	39,065102
	721269	4327382	41,557301	39,065899
	721621	4326963	41,561199	39,062099
	722409	4326688	41,570202	39,059399
	722391	4326119	41,569801	39,054298
	722177	4326133	41,567299	39,054501
	721875	4326564	41,563999	39,058399
	721247	4326809	41,556801	39,060799
K6A Rock Quarry	721974	4321430	41,563499	39,012100
	721373	4322150	41,556801	39,018799
	721583	4322330	41,559200	39,020401
	722565	4321920	41,570400	39,016399
	723363	4322000	41,579700	39,016899
	722892	4321390	41,574001	39,011600
K6B Rock Quarry	723789	4321110	41,584301	39,008801
	722892	4321390	41,574001	39,011600
	723363	4322000	41,579700	39,016899
	723513	4321890	41,581402	39,015900
	723469	4321500	41,580700	39,012501
	724369	4321150	41,591000	39,008999
	725061	4320360	41,598701	39,001701
	724673	4320180	41,594200	39,000198
D1 Storage Area	717613	4324970	41,514301	39,045200
	717868	4325000	41,517200	39,045300
	718091	4324940	41,519798	39,044800
	718022	4324580	41,518902	39,041599
	717961	4324470	41,518101	39,040600
	717662	4324520	41,514702	39,041000
	717719	4324760	41,515400	39,043201
	717684	4324830	41,514999	39,043800
	717557	4324970	41,513599	39,045101
D2 Storage Area	718008	4325530	41,519001	39,050098
	718241	4325500	41,521702	39,049801
	718287	4325590	41,522202	39,050499
	718315	4325700	41,522598	39,051498
	718345	4325740	41,522999	39,051899
	718586	4325800	41,525799	39,052399
	718408	4325620	41,523602	39,050800
	718418	4325490	41,523701	39,049702
	718191	4325280	41,521000	39,047798
	718099	4325170	41,519901	39,046799
	717904	4325280	41,517700	39,047798

PROJECT UNITS	**KOORDİNATLAR**			
	ED50 UTM Zone 37		**GEOGRAPHICAL WGS84**	
	X	**Y**	**X**	**Y**
D3 Storage Area	718834	4325030	41,528400	39,045399
	719647	4326170	41,538101	39,055401
	719860	4326120	41,540600	39,054901
	719714	4325700	41,538700	39,051102
	719958	4325650	41,541599	39,050701
	720265	4325460	41,544998	39,048901
	719723	4325270	41,538700	39,047298
	719527	4325050	41,536400	39,045399
	719074	4324850	41,531101	39,043701
	719038	4324940	41,530701	39,044601
D4 Storage Area	718207	4325560	41,521301	39,050301
	718028	4325690	41,519299	39,051498
	717980	4326040	41,518799	39,054699
	718355	4326040	41,523201	39,054501
	718769	4326600	41,528099	39,059502
	718984	4326520	41,530602	39,058701
	718657	4325870	41,526600	39,053001
	718319	4325780	41,522701	39,052200
D5 Storage Area	717463	4327390	41,513302	39,066898
	717828	4327800	41,517700	39,070599
	718241	4327490	41,522301	39,067600
	718047	4327250	41,520000	39,065498
D6 Storage Area	720870	4327030	41,552502	39,062901
	720466	4326940	41,547798	39,062199
	720377	4326880	41,546799	39,061600
	720363	4326930	41,546600	39,062099
	720331	4327200	41,546398	39,064602
	720663	4327260	41,550201	39,064999
	720771	4327100	41,551399	39,063599
Relocation Road	718290	4321743	41,521000	39,015900
	718252	4321877	41,520599	39,017101
	718208	4321977	41,520199	39,018101
	718139	4322062	41,519402	39,018799
	717754	4322418	41,515099	39,022099
	717693	4322496	41,514400	39,022900
	717661	4322589	41,514099	39,023701
	717614	4322872	41,513599	39,026299
	717579	4322965	41,513199	39,027100
	717511	4323036	41,512501	39,027802
	717448	4323081	41,511700	39,028198
	717384	4323126	41,511002	39,028599
	717336	4323170	41,510502	39,028999
	717301	4323225	41,510101	39,029499
	717175	4323496	41,508701	39,032001
	717148	4323642	41,508499	39,033298
	717194	4323782	41,508999	39,034599
	717235	4323849	41,509499	39,035099
	717269	4323887	41,509899	39,035500
	717312	4323914	41,510399	39,035702
	717349	4323930	41,510899	39,035900
	717386	4323946	41,511299	39,035999
	717471	4324032	41,512299	39,036701
	717472	4324152	41,512402	39,037800

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ABBREVATIONS

ABPRS		Address-Based Population Registration System
ALPII		Alpaslan II
ANFO	:	Amonyum Nitrat-Fuel Oil
BERN	:	Convention on the Conservation of European Wildlife and Natural Habitats
BOD		Biological Oxygen Demand
CANKAYA		Cankaya Environmental Measurement and Analysis Laboratory
CHC		Central Hunting Commission
CITES	:	Convention on International Trade in Endangered Species
COD		Chemical Oxygen Demand
EAFZ		East Anatolian Fault Zone
EIA	:	Environmental Impact Assessment
EIE	:	General Directorate of Electrical Works Survey Administration
ENCON	:	Encon Environmental Consultancy Co.
EMRA		Energy Market Regulatory Authority
FOS	:	River Observation Station
GAP		Southeastern Anatolia Project
GDH	:	General Directorate of Highways
HEPP		Hydroelectric Power Plant
HH		Households
ICOLD		International Commission on Large Dams
IUCN	:	International Union for Conservation of Nature
ISCST-3		Industrial Source Complex - Short Term 3
ISKUR		Turkish Employment Organization
KEP		Kilogram of Equivalent Petroleum
LTL	:	Long Term Limit
MCE		Maximum Earthquake Created Seismic Sources
MDE		Maximum Design Earthquake
METU	:	Middle East Technical University
MTEP		Million Tones of Equivalent Petroleum
NAFZ		North Anatolian Fault Zone
OBE		Operation Basis Earthquake
PM	:	Particulate Matter
RAMEN	:	Regulation on the Assessment and Management of Environmental Noise
RCAPSI	:	Regulation on the Control of Air Pollution Sourced from Industry
SHW	:	State Hydraulic Works
SOS		Sediment Observation Station
SPO	:	State Plaanning Organization
SS		Suspended Solid
STL	:	Short Term Limit

TRDB : Red Data Book of Turkish Plants
UCTEA Union of Chambers of Turkish Engineers and Architects
USD : United States Dollars
USEPA United States Environmental Protection Agency
TurkStat : Turkish Statistical Institute
WPCR : Water Pollution Control Regulation

CHAPTER I

DESCRIPTION AND PURPOSE OF THE PROJECT

CHAPTER 1: DESCRIPTION AND PURPOSE OF THE PROJECT

(Subject of the Project, time table for facility characteristic data, which will be constituted in the project, operation period, purpose of service, market/service areas and their economic and social importance and necessity in national, Regional and/or provincial scale)

Economic constriction, which began to show the impacts in the world since the second half of 2008 and continued in 2009, slowed energy sector growth down and then stopped. In 2010, as such in economy, recovery and growth has been observed in energy sector.

As stated in the 9th Development Plan (2007-2013), Annual Programme of 2011, which is prepared by State Planning Organization (SPO), is expected that primary total energy production in 2010 will show similar progress. In 2009, with showing a small increase (0.9%), primary power supply, which has 30.5 million tones of equivalent petroleum (MTEP), is expected to reach 30.8 MTEP, with 0.8% of growth rate in 2010. With the increase in primary energy supply in 2009, production-consumption coverage ratio is not observed. Production-consumption coverage ratio, which is 28.0% in 2008 and 29.5% in 2009, is projected to stay at 28.5% in 2010. These data show that energy external dependency is about 70% and security of energy supply is not provided sufficiently in Turkey. Since 2008, natural gas source has the largest share in primer energy consumption in our country.

Electricity consumption shows similar progress with general energy consumption. Electricity demand was 198.1 billion kWh in 2008. With the economic crisis in 2009, it decreased to the level of 194.1 billion kWh, which has been the lowest rate (2%) for last 30 years. In 2010, it is expected that growth rate of electricity demand will be 7.5% when it is compared to 2009 and reach to 208.7 billion kWh. Although all of the sectors make contributions to increase in demand, the biggest growth has been observed in industrial electricity.

In Turkey increase of primer electricity consumption in 2010 is expected to continue also in 2011. In this context, it is estimated that primer energy consumption will be 114.3 MTEP with an increase of 5.6% and energy consumption per capita will be 1,555 kg equivalent petroleum (KEP) with an increase of 4.5%. Electricity consumption is expected to be 210 billion kWh in 2010 and is estimated to be 222 billion kWh with an increase of 5.8% in 2011. Thus, electricity consumption per capita, which was estimated to be 2,871 kWh in 2010, is expected to raise to 3,010 kWh in 2011.

Total installed capacity of power plants is estimated to reach 48,781 MW with an increase of 5.8% in 2011. It is anticipated that the resource shares of the electricity production will be the same in a considerable extent. Power plants with natural gas (46.8%), hydraulic power plants (24.3%) and lignite power plant (18%) are expected to take the first place. The share of the wind and geothermal electricity production is anticipated to have an increase of 1.7%.

As explained in the development plans and programs prepared by the SPO, the energy policy of Turkey supply the energy needs of the country with affordable prices. Turkey attach particular importance to development of renewable energy resources. Preparing the programme to increase of production using renewable energy resources, is given in Short-term targets of European Union Accession Partnership. Hydropower is one of the most significant and valuable renewable energy resource as it mentioned above.

Build-operate-and transfer model that is developed within the framework of the law and legislations, is considered to overcome the problems in energy sector within the context of Electricity Market Law No. 4628 (2001), the Law No. 5346 on the Use of Renewable Energy Resources for Electricity Production Purposes No. 5346 (2005) involving private sector in energy investments. Since 1984, significant steps have been taken, a number of projects have been developed and some of those projects have been realized.

Energy requirement, which results of rapid population growth, urbanization and industrialization, is growing day by day. More than half of the generating energy is used in industry and dwelling. Therefore, it is understood that energy is one of the basic component of both human life continuity and economic development. In recent years, problems maintaining energy production-consumption balance were observed in Turkey as it is throughout the world. Petroleum and natural gas is imported to overcome these problems. However, importing a major portion of energy, which is extremely important for a country, is considered as a risk factor. For this reason, it is recommended that using national energy resources as sustainable way is the most rational solution.

Fossil fuel resources, which have economic and ecological drawbacks, are going to be exhausted in time. This points to the importance of other energy resources, especially renewable ones. Thus, in earlier 2007, new and ambitious targets, which integrated with the environment was specified in European Union's new energy policy that announced by the European Commission and it is foreseen that 20% of energy consumption could produce from renewable energy sources. In Turkey, which is in the harmonization period for European Union membership, 9.2% of total primer power supply is met from renewable energy sources.

Hydropower is a primary source of energy since it is;

- a renewable source of energy as a result of hydrological cycle rotated by one third of the solar energy that reaches the earth,
- a clean source of energy in terms of preventing environmental pollution,
- and a substantial source for Turkey with a special place in meeting the demand for electrical energy.

The primary investment costs of dam and hydroelectric plant is high, however; as the economic life of the project is long it is an economic advantage. Hydropower is ecologically sound, i.e. causing less environmental pollutions, when it is compared with the fossil fuel.

A comparison made at the Energy Report that was prepared by Union of Chambers of Turkish Engineers and Architects (UCTEA) in 2006, is given in Table I.1. As it can be seen from this table, solar energy, wind energy and hydraulic power have negligible or limited environmental effects when they are compared with the primary energy sources.

Table I.1. The Comparison of the Energy Production Systems in terms of Their Environmental Effects

	Climate Change	Acid Rain	Water Pollution	Soil Pollution	Noise	Radiation
Petroleum	√	√	√	√	√	-
Coal	√	√	√	√	√	√
Natural gas	√	√	√	-	√	-
Nuclear	-	-	√	√	-	√
Hydraulic	√	-	-	-	-	-
Wind	-	-	-	-	√	-
Solar	-	-	-	-	-	-
Geothermal	-	-	√	√	-	-

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Hydroelectric has been confirmed as renewable energy technology in World Summit on Sustainable Development-United Nations. As a result of this decision, hydroelectric energy and dams acquire much more important qualification.

Although possessing 1.5% of technically feasible hydroelectric potential in the world, Turkey is behind European countries like Norway, France, Sweden and Italy, in terms of energy generation. However, in terms of the economic potential, it holds the second place after Norway.

For today, 25% of total electrical energy is produced from hydropower plants in Turkey. This ratio was 40% in previous years. However, with a decline in dam and hydroelectric projects and prominence in natural gas fired power plants cause decrease in the share of hydropower among total energy production.

As of 2009, the average annual production capacity of Turkey is 47,871 GWh with 172 hydropower plants. Also 258 hydropower plants, which have 39,404 GWh average annual production capacities, are still under construction or have been scheduled to be constructed.

Alpaslan II Dam and HEPP Project which is the subject of this report and planned to be constructed by Alpaslan II Enerji Uretim Madencilik San. Tic. A.S., was designed on Murat River which is sub-basin of Firat River Basin in Mus, on the 1,265.00 m thalweg elevation of this river and approximately 34.00 km away to Mus city center. General Site Plan of Alpaslan II Dam and HEPP Project is given in App-1.

As a result of Alpaslan II Project studies, which was started in 1967 by "*General Directorate of the State Hydraulic Works Firat Planning Authority*" and revised according to the developing and changing conditions, *"Mus Alpaslan II Project Planning Report"* was prepared in September, 1994. Within scope of this report, the aim of the Project was proposed as "Irrigation, Power Generation and Flood Control and Prevention".

In planning report, within scope of the Alpaslan II Project; construction of Alpaslan II Dam, Arincik Regulator, Alpaslan II HEPP and Irrigation and Overflow Plant was proposed.

Downstream of Alpaslan II Dam is Mus Plain. Karasu River, after draining Murat River and Mus Plain, converges with Murat River at the downstream of the dam. In order to protect Mus Plain from Karasu River flooding, a flood control volume has been reserved at Alpaslan II Dam.

In line with the principles of planning report, Alpaslan II Dam and HEPP Project was prepared and it was approved by General Directorate of State Hydraulic Works (SHW).

However, with changing conditions and within the framework of research, inspection and evaluations about the project, it has been concluded that Alpaslan II Dam and energy facilities are required to be revised in terms of location and size. These studies have been carried out in order to realize the project under more appropriate conditions and improve its economic feasibility. As a result, the proposed location of the Alpaslan II dam axis in the Planning Report of September, 1994 has been decided to be located at the downstream. Also, it has been determined that it would be more favorable to increase the installed capacity of the project in terms of its feasibility.

The first researches about Alpaslan II Project was started in 1982 by General Directorate of the State Hydraulic Works (SHW) and three different axis which named Zorova, Arincik and Mercimekkale (respectively from upstream to downstream) was investigated for dam construction.

Mercimekkale axis was found infeasible due to the social reasons and length of the dam axis, while Zorova was found infeasible due to the landslip that has occurred at the right bank of the downstream. Detailed studies were also carried out at Arincik axis and Feasibility Report was prepared in September, 1994, Final Project was designed by Alpaslan II Consortium in 2004.

As a result of the geological surveys conducted in Alpaslan II Dam site since 1990, “Alpaslan II Dam and HEPP Project Geology and Equipment Report” was prepared. Those were emphasized on result section of this report:

- Impact of landslides to the project structures,
- Depth of strong base rock,
- Strength, swelling and stability properties of Yazla Formation, which is base rock
- Engineering properties of natural building materials and similar issues about groundwork and construction materials, which based on geological and geotechnical resources need to be taken into consideration

Drawbacks about geology of Arincik axis was expressed in Alpaslan II Dam and HEPP Project Geology and Equipment Report, which was prepared for Alpaslan II Dam location. For this reason, in April, 2009, a technical visit have been arranged to the current axis (which was investigated before by General Directorate of SHW) and to Zorova axis, which is located approximately 4.00 km away from current axis and the reports were revised accordingly.

As a result of field observations, it was concluded that geotechnical issues may be more critical than stated in the report, therefore this may increase the construction cost and construction time. In Zorova axis, it is reported that there is not a major problem except the spring landslide and a detailed geological survey would be appropriate in this axis, which is closer to material areas. Therefore, basic research and pre-project studies was started in October, 2009.

Within the scope of geological studies carried out in October 2009-February 2010 at Zorova axis, total of 19 boreholes with 1,116 m total depth were drilled and laboratory analysis were conducted on core samples which were taken from these holes. As a result of these studies, “Zorova Axis Location Geotechnical Survey Report” has been prepared, and the feasibility of the dam construction at this axis was proved technically.

In this respect, it was determined that Zorova axis is more appropriate for dam construction.

With the Revised Feasibility Report, which was prepared within the scope of this project, required application was made to the General Directorate of SHW and Revised Feasibility Report was approved by SHW (official letter dated May 24, 2011, No. 183825). The above-mentioned official letter is presented in App-2.

Alpaslan II HEPP, within the scope of Alpaslan II Dam and HEPP Project, will be established with the gross head of 98.00 m and with the project flow of 344.00 m^3/s. With a total capacity of 280.00 MW, for the current situation, annually 862.26 GWh will be generated as 606.35 GWh of it is firm. For the future situation, annually 733.80 GWh will be generated as 511.46 GWh of it is firm. At the same time, irrigation of Mus Plain will be provided with this project.

In Alpaslan II Dam and HEPP Project dam axis precipitation area of Murat River is 17,505.00 km^2. In this basin, a number of projects were planned to be realized by General Directorate of SHW. Some of these projects are in planning level or under construction and some are in operation. However, Alpaslan I Dam and HEPP Project, which is the largest one planned both for power generation and flood control, is located at the upstream of Alpaslan II Dam and HEPP Project and it is in operation.

Feasibility studies showed that Alpaslan II Dam thalweg elevation is 1272.00 m; crest elevation is 1371.00 m; water elevation of normal operation is 1368.00 m and water elevation of minimum operation is 1340.00 m. The water elevation of minimum and normal operation, the crest elevation of the dam are the same with the values given in the original planning report, thalweg elevation and minimum operation elevation had to be replaced due to the transfer of the dam axis to the upstream. In original planning report, it is projected that thalweg elevation is 1265.00 m and minimum water elevation is 1328.60 m. At this stage, thalweg elevation and minimum water elevations at Zorova flow increase, 4.00 m and 13.20 m, respectively, when compared to original axis.

In the upstream of the project area, some facilities are in operation phase while the others are in planning phase. Therefore, with the realization of the projects that are in planning phase, Alpaslan II Dam flows will be reduced a little amount. In this context, Alpaslan II Dam flows and energy production was calculated in two-stage. These stages were classified “Current Situation” and “Future Situation” including the upstream structures. These issues are taken into consideration and termed as follows;

- Current Situation is defined as the year 2017, in which Alpaslan II Dam will be taken into operation
- Future Situation at the end of the year 2025 that is regarded as the date that the facilities located at upstream are taken into operation

Also, both energy generation and economic and financial conditions were determined based on these scenarios.

Within this scope, in Alpaslan II HEPP installed capacity is projected to be 280.00 MWe as a result of the operation studies, which depends on the flood control volume in original axis,

- In the current situation annual average of energy generation will be 878.11 GWh, while 639.61 GWh of this energy is firm energy.

- In the future situation, annual average of energy generation will be 738.46 GWh, while 544.94 GWh of this energy is firm energy.

Mus Plain water requirement will be met by the water, which is regulated and turbined in dam.

As it stated in planning report prepared in September, 1994, it is confirmed that 78,210 ha agricultural area will be irrigated in Mus Plain. 10,150 ha of this field is being irrigated by Arincik Regulator and Irrigation, which is located at 5.00 km upstream of Alpaslan II Dam and constructed with the aim of irrigation in 1968 by the General Directorate of SHW. 4,800 ha of this field is located on the right bank of Murat River while 5,350 ha of are located on the left bank. In addition, it is envisaged that, 1,424 ha area will be irrigated by regulators, which constituted on Karasu; then, total irrigation area will be 11,574 ha. Including Karasu Irrigation, 68,060 ha area still needed to irrigate in Mus Plain. 12,847 ha of this area is located on the right bank while 55,213 ha are located on the left bank and it is proposed to irrigate the whole area by pumping.

Previously, irrigation of these areas, after supplying the capacity increase of both right and left channels of Arincik, were proposed to be realized by pumping. Within this scope;

- At the first level 9,617 ha and at the second level 3,230 ha will be irrigated by the use of P11 pump that is located on the right coast of Arincik. (total area to be irrigated is 12,847 ha)
- At the first level 46,700 ha and at the second level 8,513 ha will be irrigated by the use of P1 pump that is located on the left coast main channel of Arincik.

Total of 55,213 ha irrigation is envisaged.

Within the scope of Alpaslan II Dam and HEPP Project, construction of Alpaslan II Dam, spillway and derivation structures, energy tunnel, power conduit and Alpaslan II HEPP facilities were proposed. The outer derivation channel will be used as bottom outlet by the installation of a valve after the energy tunnel curve.

The reservoir, borrow sites, route of the relocation road and all other units of the proposed project are given in App-1.

Alpaslan II Dam Zorova axis is located on Murat River, approximately 34.00 km away to Mus city center, on route of Mus-Varto-Erzurum State Highway, which is used to reach the dam axis. The road is covered with asphalt and open to traffic every season.

The dam is designed as impermeable core rock fill type.

Mus-Varto State Highway and Mus-Varto junction Karaagil Provincial Road pass through the reservoir. With the realization of the project, these roads have to be relocated. In this context, as a result of these studies, permission about route and details have been received from General Directorate of Highways (GDH) regarding the 3.5 km of road. Works regarding the rest of the road are still on progress. The road, which will be relocated, will be with 4 lanes and 24 m width. 3.5 km section of the road which approved by GDH, will be evaluated in EIA Report with the aim of providing access from right bank to the dam axis. For the remaining roads, another EIA Report will be prepared after the GDH approval. Opinion article about subject from 11th District Office of Highways is given in App-2, road route, which is planned to be relocated, is given in App-1.

As it seen in Table I.2, reservoir, which will be formed at maximum water elevation, is 54.69 km^2. The Project area mainly consists of meadow and agricultural areas. Apart from these, small amount of forests and non-cultivated areas are also present.

Total of 225 households will be inundated by the reservoir; 25 households of Gocmenler (Muhacir Zorova) Quarter, which is located on the left shore of Murat River, 45 households of Tepekoy Village, 15 households of Dogdap Quarter, 50 households of Bagici (Carbuhur) Quarter, 50 households of Asagi Hinzir Quarter of Kayalidere Village, on the right shore 25 households of Sanlica Village and 15 households of Aligedik Village. In addition to these inundated households some structures belonging to these households will also be inundated; a barn for each, a shed for each and small mosque belonging to each village, 5 mosques and 4 primary schools with their public housings.

Switchyard will be built near dam axis, on the right coast and energy, which will be produced in Alpaslan II HEPP, will be given to transmission lines. This switchyard is planned to be 154 kV in 130.0 m x 160.0 m area. Energy produced in Alpaslan II HEPP, is connected to Alpaslan I HEPP at 26.00 km distance and alternatively transmitted to Mus Substation, which is at 28.00 km distance and then to the national network. Studies on energy transmission line will be planned later, and another EIA Report will be prepared.

Alpaslan II Dam and HEPP Project characteristics are given in Table I.2.

Table I.2. Characteristics of Alpaslan II Dam and HEPP Project

ALPASLAN DAM		
Drainage Area		17,505.00 km^2
Annual Average Flow	Natural Flow	4,297.17 hm^3 (136.26 m^3/sec)
	Current Situation	4,030.51 hm^3 (127.81 m^3/sec)
	Flow for the Future Situation	3,386.99 hm^3 (107.40 m^3/sec)
Crest Length		844.00 m (936,00 m., including spillway)
Crest Width		12.00 m
Type		Clay Core Rockfill
Thalweg Elevation		1,272.00 m
Crest Elevation		1,371.00 m
Height (from Thalweg)		99.00 m
Height (from foundation)		116.00 m
Maximum Water Elevation		1,368.00 m
Normal Water Elevation		1,368.00 m
Minimum Water Elevation		1,340 m
Reservoir at Min. Water Level		35.06 km^2
Reservoir at Max. Water Level		54.69 km^2
Volume at Normal Water Level		2,097.20 hm^3
Maximum Volume		997.77 hm^3
Active Volume		1,099.43 hm^3
Incline of Slope	Upstream	2.45 H / 1.0 V
	Downstream	2.25 H / 1.0 V
Fill Volume (Total)		12,446,062 hm^3
Regulation Ratio	Current Situation	92.99%
	For the Future Situation	94.42%
Water for the Energy Generation	Current Situation	3,747.88 hm^3
	For the Future Situation	3,198.12 hm^3
SPILLWAY		
Spillway Inlet Peak		7,542.00 m^3/sec
Q_{25}		1,874.00 m^3/sec
Q_{50}		2,078.00 m^3/sec

Type		Radial Gate
Number of Gates		6
Gate Width/Heigt		11.00 m width x 12.00 m height)
Total Gross Width of Spillway		86.00 m
Total Net Width of Spillway		66.00 m
Access Channel Elevation of Spillway		1,350.00 m
Threshold Elevation of Spillway		1,355.50 m
DERIVATION TUNNEL – UPSTREAM COFFERDAM		
Number of Derivation Tunnel		2
Length of Tunnel		T1 = 875.00 m; T2 = 950.00 m
Diameter		8.00 m
Inlet Base Elevation		1,274.00 m
Outlet Base Elevation		1,270.00 m
Slope of the 1st Tunnel		0.0046
Slope of the 2nd Tunnel		0.0042
Type of Coffer Dam		Clay Core Rock fill Adjacent to the Body
Crest Elevation of the Upstream Cofferdam		1,301.50 m
Height of the Upstream Cofferdam		31.50 m
Crest Elevation of Downstream Cofferdam		1,281.50 m
Diameter of the Spillway		2.50 m
ENERGY TUNNEL		
Number		2
Inner Diameter	Derivation Tunnel Part	8.00 m
	After the Diversion Tunnel (the inner side of both are steel-coated)	6.30 m
PENSTOCK		
Number of		4
Diameter	Within Small Units	2.40 m
	Within Large Units	4.50 m
Size		35.00 m each
ALPASLAN II HEPP		
Width of the Power Plant		33.00 m
Height of the Power Plant		89.00 m
Tailwater Elevation		1,270.00 m
Gross Head	Maximum	98.00 m
	Medium	93.51 m
	Minimum	84.58 m
Net Head	Maximum	97.87 m
	Medium	93.32 m
	Minimum	84.49 m
Type of the Power Plant		Exposed
Turbine Type		Francis-Vertical Axis
Number of Units		4
Project Capacity		344,00 m^3/s
Project Flow Rate		2 x 136.00 m^3/s;+2 x 36.00 m^3/s
Project Flow Rate of the Unit		2 x 110.00 MW + 2 x 30.00 MW
Power of the Unit		280.00 MW
Efficiency		0.94
Annual Energy Generation		
Current Situation	Firm Energy	606.35 GWh
	Secondary Energy	255.92 GWh
	Total Energy	862.27 GWh
Situation in Future	Firm Energy	511.46 GWh
	Secondary Energy	222.34 GWh
	Total Energy	733.80 GWh
GENERATOR		
Type		4-Phase synchronous generator

Quantity	2
Power	2 x 122,222 kVA; 2 x 33,333 kVA
Power Factor	0.90
Frequency	50 Hz
Number of Pole Pairs	24 pairs (48 pieces); 12 pairs (24 pieces)
Efficiency of the Generator	0.975
TRANSFORMERS	
Quantity	4
Type	External Type, 3-Phase, Oil-insulated
Continuous Power	2 x 125,000 kVA; 2 x40,000 kVA
Rated Voltage	11 /154 kV (+/-2x2.5%)
Frequency	50 Hz
Linkage Group	YNd 11
Cooling Type	ONAN
Efficiency	0.985

CHAPTER II

LOCATION OF THE SELECTED PROJECT AREA

CHAPTER II. LOCATION OF THE SELECTED PROJECT AREA

II.1. Project Location (Including reservoir volume, concrete plant and crushing-screening plant) (representation of The Project location that is approved by relevant Governorship or Municipal including legend and plan notes, which are approved by Environmental Plan or Development Plan, if the plans are absent, on the existing land map)

Alpaslan II Dam and HEPP Project, which is planned to be constructed by Alpaslan II Enerji Uretim Madencilik San. Tic. A.S., was designed on Murat River, which is sub-basin of Firat River Basin in Mus, on the 1,265.00 m thalweg elevation of this river and approximately 34.00 km away to Mus city center.

The project area is located within the boundaries of central district of Mus and Varto district. It is consist of rural areas, some places flat or hilly, pasture, agricultural and empty fields and some villages, which dispersedly located.

Project is located in J-47d4, J-47d3, J-47c4, J-46c3, J-46c2 (1/25,000 scale maps), the coordinates of the project units is given Table II.1, and in App-3 in the digital form.

Table II.1. Coordinates of Project Units

PROJECT UNITS	COORDINATES			
	ED50 UTM Zone 37		GEOGRAPHICAL WGS84	
	X	Y	X	Y
Dam Axis	717738	4323877	41,515400	39,035301
	718560	4323795	41,524799	39,034302
Construction Site Facilities - 1	718193	4327920	41,521900	39,071602
	718314	4328010	41,523300	39,072300
	718548	4327680	41,525902	39,069302
	718427	4327600	41,524502	39,068600
Construction Site Facilities - 2	717756	4324460	41,515800	39,040501
	717901	4324420	41,517399	39,040199
	717799	4324040	41,516102	39,036701
	717654	4324080	41,514400	39,037102
Construction Site Facilities - 3	718776	4321700	41,526600	39,015400
	718921	4321660	41,528301	39,014999
	718819	4321280	41,527000	39,011600
	718674	4321310	41,525299	39,012001
Concrete Plant - 1	718285	4324320	41,521801	39,039101
	718375	4324440	41,522900	39,040100
	718415	4324410	41,523300	39,039902
	718324	4324290	41,522301	39,038799
Concrete Plant - 2	718434	4324190	41,523499	39,037899
	718474	4324220	41,523998	39,038101
	718563	4324090	41,524899	39,036999
	718523	4324070	41,524502	39,036800
Concrete Plant - 3	718340	4323270	41,522099	39,029701
	718349	4323420	41,522301	39,030998
	718399	4323420	41,522800	39,030998
	718389	4323270	41,522701	39,029598
Crushing – Screening -Washing Facility	719910	4327110	41,541500	39,063900
	720006	4327080	41,542599	39,063599
	719904	4326750	41,541302	39,060600
	719808	4326780	41,540199	39,060902

PROJECT UNITS	COORDINATES			
	ED50 UTM Zone 37		GEOGRAPHICAL WGS84	
	X	Y	X	Y
A Impermeable Material Field	718333	4323210	41,521999	39,029099
	718238	4323610	41,521000	39,032700
	718119	4323700	41,519699	39,033600
	718126	4324090	41,519901	39,037102
	718479	4324030	41,523998	39,036400
	718636	4323250	41,525501	39,029400
	718747	4323200	41,526798	39,028900
	718806	4322890	41,527401	39,026100
	718594	4322650	41,524799	39,023998
	719060	4321780	41,529900	39,016102
	718862	4321710	41,527599	39,015499
	718619	4322040	41,524899	39,018501
	718241	4322890	41,520802	39,026199
	718218	4323100	41,520599	39,028198
B Impermeable Material Field	718313	4325160	41,522400	39,046600
	718674	4325320	41,526600	39,048000
	718788	4325110	41,527901	39,046101
	718603	4324790	41,525600	39,043301
	718310	4324760	41,522202	39,043098
C Impermeable Material Field	719542	4326690	41,537102	39,060200
	719821	4326650	41,540298	39,059700
	719667	4326250	41,538399	39,056198
	719507	4326030	41,536499	39,054199
	719157	4325600	41,532299	39,050400
	718999	4325670	41,530499	39,051102
	719273	4326080	41,533798	39,054798
	719367	4326130	41,534901	39,055199
D Impermeable Material Field	719121	4326690	41,532200	39,060299
	719395	4326600	41,535400	39,059299
	718657	4325430	41,526501	39,049000
	718483	4325510	41,524502	39,049801
E Permeable Material Field	719476	4327280	41,536499	39,065498
	720515	4327490	41,548599	39,067101
	721233	4327550	41,556900	39,067501
	721256	4327410	41,557098	39,066200
	719895	4327130	41,541302	39,063999
	719765	4326710	41,539700	39,060200
	719505	4326720	41,536701	39,060501
F Permeable Material Field	719323	4327610	41,534901	39,068501
	720305	4327990	41,546299	39,071701
	720519	4327750	41,548698	39,069500
	719955	4327420	41,542099	39,066700
	719449	4327330	41,536201	39,066002
	719421	4327130	41,535801	39,064098
	719388	4327120	41,535400	39,063999
	719273	4327470	41,534199	39,067200
G Permeable Material Field	718702	4327800	41,527699	39,070400
	719384	4328200	41,535801	39,073799
	719642	4327960	41,538601	39,071602
	719273	4327630	41,534302	39,068699
	719220	4327490	41,533600	39,067402
	719363	4327100	41,535099	39,063900
	719263	4327070	41,534000	39,063599

PROJECT UNITS	COORDINATES			
	ED50 UTM Zone 37		GEOGRAPHICAL WGS84	
	X	Y	X	Y
Stockpiling for Reuse Area	718630	4322660	41,525299	39,024101
	718765	4322790	41,526901	39,025200
	718995	4322530	41,529400	39,022900
	718997	4322180	41,529301	39,019699
	718874	4322230	41,527901	39,020100
K1 Rock Quarry	715911	4331817	41,496799	39,107201
	715631	4331822	41,493500	39,107300
	715562	4331972	41,492802	39,108700
	715651	4332067	41,493900	39,109501
	715941	4331856	41,497101	39,107601
K2 Rock Quarry	712633	4333246	41,459400	39,120899
	712908	4333325	41,462601	39,121498
	713065	4333119	41,464298	39,119598
	713214	4333109	41,466000	39,119499
	713312	4333176	41,467201	39,120098
	713591	4333123	41,470402	39,119499
	713519	4332788	41,469398	39,116501
	713066	4332768	41,464199	39,116501
	712643	4333158	41,459400	39,120098
K3A Rock Quarry	720950	4330300	41,554501	39,092300
	720525	4330325	41,549599	39,092602
	720525	4330366	41,549599	39,092999
	721859	4330745	41,565201	39,096100
	722123	4330393	41,568100	39,092800
	722116	4330300	41,568001	39,091999
K5 Rock Quarry	721058	4327285	41,554798	39,065102
	721269	4327382	41,557301	39,065899
	721621	4326963	41,561199	39,062099
	722409	4326688	41,570202	39,059399
	722391	4326119	41,569801	39,054298
	722177	4326133	41,567299	39,054501
	721875	4326564	41,563999	39,058399
	721247	4326809	41,556801	39,060799
K6A Rock Quarry	721974	4321430	41,563499	39,012100
	721373	4322150	41,556801	39,018799
	721583	4322330	41,559200	39,020401
	722565	4321920	41,570400	39,016399
	723363	4322000	41,579700	39,016899
	722892	4321390	41,574001	39,011600
K6B Rock Quarry	723789	4321110	41,584301	39,008801
	722892	4321390	41,574001	39,011600
	723363	4322000	41,579700	39,016899
	723513	4321890	41,581402	39,015900
	723469	4321500	41,580700	39,012501
	724369	4321150	41,591000	39,008999
	725061	4320360	41,598701	39,001701
	724673	4320180	41,594200	39,000198
D1 Storage Area	717613	4324970	41,514301	39,045200
	717868	4325000	41,517200	39,045300
	718091	4324940	41,519798	39,044800
	718022	4324580	41,518902	39,041599
	717961	4324470	41,518101	39,040600
	717662	4324520	41,514702	39,041000
	717719	4324760	41,515400	39,043201

PROJECT UNITS	COORDINATES			
	ED50 UTM Zone 37		GEOGRAPHICAL WGS84	
	X	Y	X	Y
	717684	4324830	41,514999	39,043800
	717557	4324970	41,513599	39,045101
D2 Storage Area	718008	4325530	41,519001	39,050098
	718241	4325500	41,521702	39,049801
	718287	4325590	41,522202	39,050499
	718315	4325700	41,522598	39,051498
	718345	4325740	41,522999	39,051899
	718586	4325800	41,525799	39,052399
	718408	4325620	41,523602	39,050800
	718418	4325490	41,523701	39,049702
	718191	4325280	41,521000	39,047798
	718099	4325170	41,519901	39,046799
	717904	4325280	41,517700	39,047798
D3 Storage Area	718834	4325030	41,528400	39,045399
	719647	4326170	41,538101	39,055401
	719860	4326120	41,540600	39,054901
	719714	4325700	41,538700	39,051102
	719958	4325650	41,541599	39,050701
	720265	4325460	41,544998	39,048901
	719723	4325270	41,538700	39,047298
	719527	4325050	41,536400	39,045399
	719074	4324850	41,531101	39,043701
	719038	4324940	41,530701	39,044601
D4 Storage Area	718207	4325560	41,521301	39,050301
	718028	4325690	41,519299	39,051498
	717980	4326040	41,518799	39,054699
	718355	4326040	41,523201	39,054501
	718769	4326600	41,528099	39,059502
	718984	4326520	41,530602	39,058701
	718657	4325870	41,526600	39,053001
	718319	4325780	41,522701	39,052200
D5 Storage Area	717463	4327390	41,513302	39,066898
	717828	4327800	41,517700	39,070599
	718241	4327490	41,522301	39,067600
	718047	4327250	41,520000	39,065498
D6 Storage Area	720870	4327030	41,552502	39,062901
	720466	4326940	41,547798	39,062199
	720377	4326880	41,546799	39,061600
	720363	4326930	41,546600	39,062099
	720331	4327200	41,546398	39,064602
	720663	4327260	41,550201	39,064999
	720771	4327100	41,551399	39,063599
Relocation Road	718290	4321743	41,521000	39,015900
	718252	4321877	41,520599	39,017101
	718208	4321977	41,520199	39,018101
	718139	4322062	41,519402	39,018799
	717754	4322418	41,515099	39,022099
	717693	4322496	41,514400	39,022900
	717661	4322589	41,514099	39,023701
	717614	4322872	41,513599	39,026299
	717579	4322965	41,513199	39,027100
	717511	4323036	41,512501	39,027802
	717448	4323081	41,511700	39,028198
	717384	4323126	41,511002	39,028599

PROJECT UNITS	COORDINATES			
	ED50 UTM Zone 37		GEOGRAPHICAL WGS84	
	X	Y	X	Y
	717336	4323170	41,510502	39,028999
	717301	4323225	41,510101	39,029499
	717175	4323496	41,508701	39,032001
	717148	4323642	41,508499	39,033298
	717194	4323782	41,508999	39,034599
	717235	4323849	41,509499	39,035099
	717269	4323887	41,509899	39,035500
	717312	4323914	41,510399	39,035702
	717349	4323930	41,510899	39,035900
	717386	4323946	41,511299	39,035999
	717471	4324032	41,512299	39,036701
	717472	4324152	41,512402	39,037800

Project area site location map is given in Figure II.1.

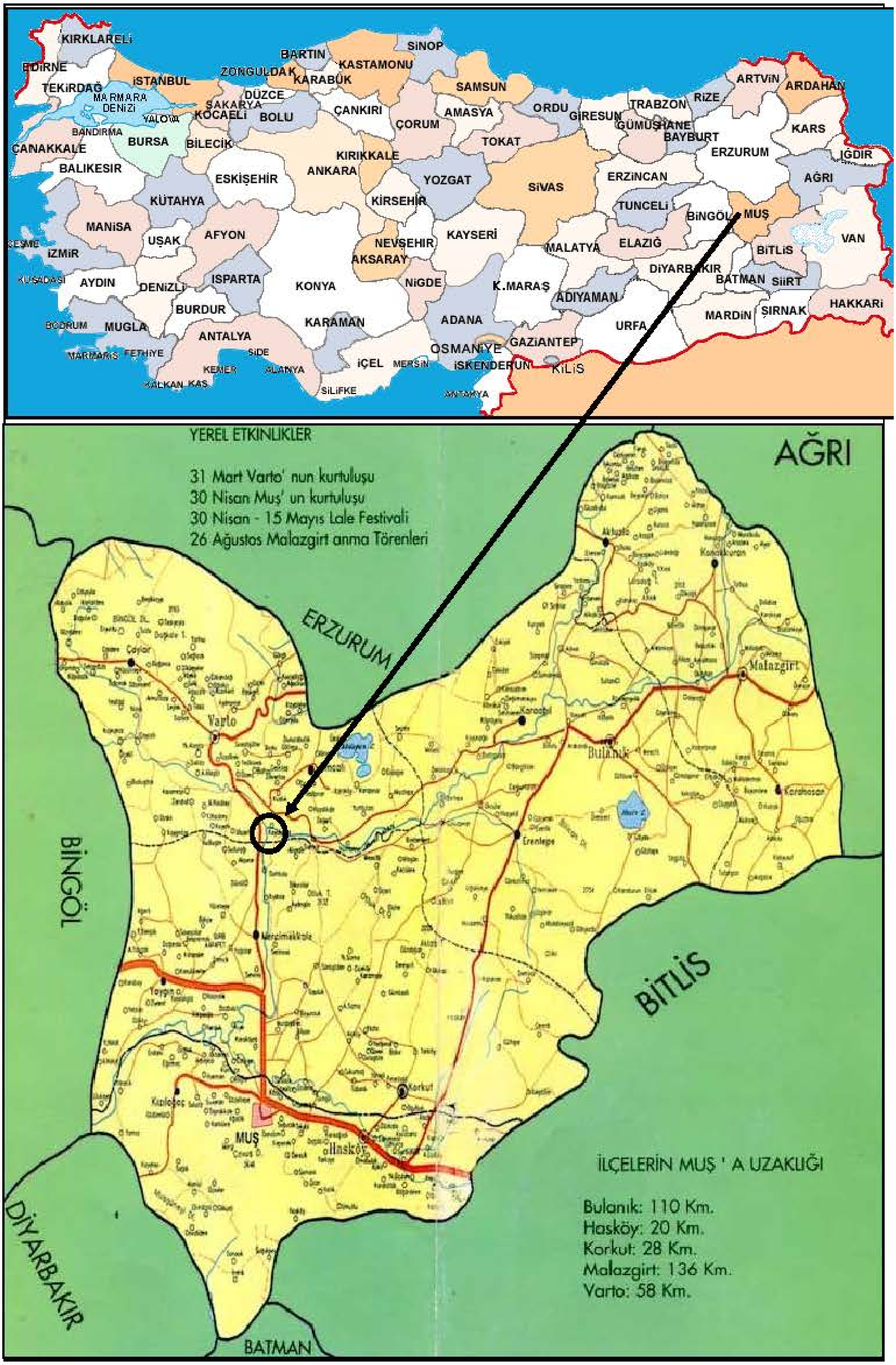


Figure II.1. Alpaslan II Project Site Location Map

Project area is located outside of the municipal adjacent area. The project area is considered within the scope of “1/100,000 scaled Environmental Master Plan of Mus-Bitlis-Van Planning Region”. It has been approved on 01.04.2011, in line with the Regulation on Environmental Master Plans (dated September 11, 2008, No: 27051), 2(h) and 10 (c) articles of Law numbered 4856 and 9(b) article of Law numbered 2872/5491. In accordance with the provisions of this plan, necessary procedures will be followed for Alpaslan II Dam and HEPP Project.

Alpaslan II Dam and HEPP Project, which is subject of EIA Report, is marked as the Dam and HEPP in 1/100,000 scaled Environmental Plan. The mentioned plan, plan legend, related plan provisions and current land use map are given in App-4 and App-5.

II.2. Location of Units (technical infrastructure units, social and administrative units, other units –if available-, indoor and outdoor area size for them, presentations of these units locations on layout plan or sketch, representation of representative pictures or impressions with other techniques) within the scope of the Project (including pond volume, concrete plant and crushing-screening plant)

1/25.000 scaled maps, which show Project area and its close vicinity, is presented in App-1. Material borrow areas, crushing-screening plants, concrete plants, storage areas and relocation road locations within the scope of the Project is showed in maps. Photographs of the project site are given in Figure II.2 – Figure II.19.

Alpaslan II Dam is located according to the dam axis which is described in the old formulation in the mentioned environmental master plan. As it is mentioned in previous chapters the new dam axis (Zorova axis) is located 4 km upstream according to the old axis. The location of the new dam axis is given in App-4.

Figure II.2. Alpaslan II Dam Axis

Figure II.3. General View of the Project Area - I

Figure II.4. General View of the Project Area (Woodlands)

Figure II.5. The Intersection of Murat River and Bingol Stream, E, F, G Permeable Material Borrow Area

Figure II.6. General View of the Impermeable Material Borrow Area

Figure II.7. B General View of the Impermeable Material Borrow Area – B

Figure II.8. General View of the Storage Areas (D1, D2 and D4)

Figure II.9. Rock Quarry - K1

Figure II.10. Rock Quarry – K2

Figure II.11. Rock Quarry - K3A and Kusluk Village

Figure II.12. Tepekoy Village

Figure II.13. Bagici Village

Figure II.14. Kayalidere Village

Figure II.15. Sanlica Village

Figure II.16. Bagici Village

Figure II.17. Dogdap Arable Field Hamlet

Figure II.18. Kusluk Village (New)

Figure II.19. Gocmenler Quarter

CHAPTER III

ECONOMICAL AND SOCIAL ASPECTS OF THE PROJECT

CHAPTER III. ECONOMICAL AND SOCIAL ASPECTS OF THE PROJECT

III.1. Investment Program and Financial Sources Related to Realization of the Project

Studies for Alpaslan II Project started in 1967 by General Directorate of State Hydraulic Works (SHW) and revised according to the developing and changing conditions. Finally with the Revised Feasibility Report which was prepared by Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S necessary applications were made to General Directorate of SHW. Revised Feasibility Report presented with the official letter of No. 183825 on May 24, 2005 General Directorate of SHW was endorsed.

The Project, after taking Production License from Energy Market Regulatory Authority (EMRA), preparation of the final project and tender documents will be initiated. It is envisaged that construction and installation works about facilities within the scope of the Project, will be completed and operated within four years after preparation period. Project investment program is given in Table III.1.

Alpaslan II Dam and HEPP Project total investment value is about 509,922,000 Euro. It is envisaged that project will be realized with shareholder’s equity.

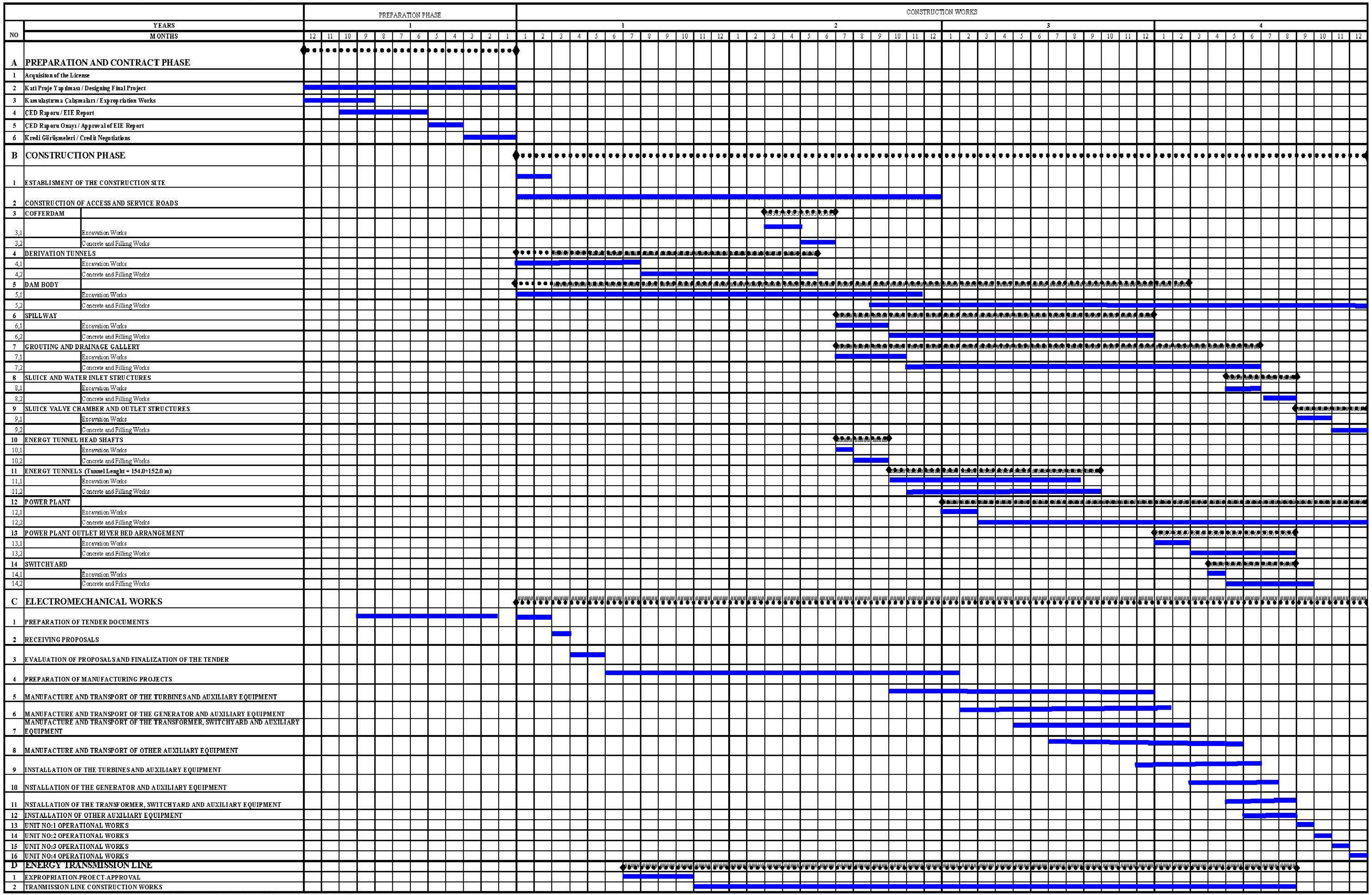
III.2. Flow Chart or Timing Schedule Related to Realization of the Project

After given Production License by EMRA, 5 years application plan was considered for Alpaslan II Dam and HEPP. In the first year of this period was planned for additional studies, drilling, mapping and preparation of the final project. Following four years was considered for construction works and procurement and installation of the electromechanical equipment.

As it mentioned above, 12 months of these 5 years was separated for preparatory works such as 1/1.000 scaled maps of dam, valve chamber, penstock and plant location, drilling and geological studies, preparing final Project.

Nine months before construction starting date and five months after this date, total of 14 months was considered for preparing tender document for procurement and assembly of the electromechanical equipments and finalization of the tender process. For this reason, in the beginning of the construction works, a major part of electromechanical equipment tender process will have to be completed. After finalization of the tender process, 36 months was envisaged for the project preparation, equipment fabrication and shipping. Electromechanical equipment assembly activities will be finished after 3 months from fabrication. After the assembly, commissioning and test production will be done and 4 years after the construction, units will start the commercial undertake. Alpaslan II Dam and HEPP working schedule is given in Table III.1.

Table III.1. Time Schedule for Alpaslan II Dam and HEPP



*** Delays due to Expropriation Works (A-3), EIA Report Approval (A-5), Expropriation Project Approval (D-1), will be added to the time table.

III.3. Cost-Benefit Analyses for the Project

In this section, contribution of Alpaslan II Dam and HEPP Project Facilities the national economy were evaluated. For that purpose, the project life is taken as 50 years and within the framework of these following criteria, per-annum rate for firm and secondary energy benefits, investment and 50 years operating period, is taken as 9.5%. In the amount of investment account, studying economic analysis due to the country's economy, Insurance, Independent Consultant, Operational Capital and Value-Addax-Tax (VAT) are not included to total. Besides, Construction Period Interests has been considered as 9.5% in the re-created Table of Investment Distribution by Years.

The unit prices for energy that are determined by the General Directorate of State Hydraulic Works are used. Those unit prices are:

Firm Energy	: 6.00 cent/kWh
Secondary Energy	: 3.30 cent/kWh
Peak Power	: 85.00 $/kW

The unit prices for energy that are determined by the General Directorate of Electrical Power Resources Survey and Development Administration are used. Those unit prices are:

Firm Energy	: 4.50 cent/kWh
Secondary Energy	: 3.50 cent/kWh
Peak Power	: 240.00 $/kW

Furthermore, as the benefits of market power, firm and secondary energy calculated as 9.00 cent/kW, peak power benefit considered in this benefit.

Because of many facilities are exist in project area spring, Alpaslan II Dam and HEPP Project energy production amounts was examined as "current situation" for 2014, and "future situation" for 2025.

Within this scope, energy production and benefits in current and future situations for various alternatives are given in Table III.2.

Table III.2. Energy Production and Benefits

	Installed Power	**Energy Production**		
		Firm	**Secondary**	**Total**
	(MW)	**(GWh)**		
Current Situation	280,000	606,350	255,920	862,270
Future Situation		511,460	222,340	733,800
BENEFITS (United States Dollars)				
Annual Benefits according to SHW Energy Unit Prices				
	Firm	**Secondary**	**Peak Power**	**Total**
Current Situation	36,381,000	8,445,360	15,628,440	60,454,800
Future Situation	30,687,600	7 337 220	16,907,265	54,932,047
Annual Benefits according to General Directorate of EPRSDA Energy Unit Prices				
Current Situation	27,285,750	8,957,200	50,340,480	86,583,340
Future Situation	23,015,700	7,781,900	42,462,480	73,260,033
Annual Benefits according to Market Energy Unit Prices				
Current Situation	54,571,500	23,032,800		77,604,300
Future Situation	46,031,400	20,010,600		66,042,000

Annual costs are composed of “Interest + Amortization + Replacement Costs” and “Management + Maintenance Costs”. The overall annual cost of Alpaslan II Dam and HEPP Project Facilities is 80,357,994 USD.

Income-cost rates are calculated by dividing the annual incomes to annual costs. Another way to determine these rates for 50 years period is transfer the income and cost cash flows to first year with discount rate (9.5% for this project) and then calculating these proportions. Income/cost rate for Alpaslan II Dam and HEPP Project Facilities was calculated with these two methods, considering 50-year period.

Alpaslan II Dam and HEPP Project facilities Internal Rate of Return calculations which is the discount rate that equalize operation + maintenance cost and the values of annual energy income moved to first year, were made on the cost of the project. These values are calculated as 7.48% with construction unit prices of General Directorate of SHW and energy benefits, 10.63% with construction unit prices of General Directorate of SHW and energy benefits of General Directorate of Renewable Energy, 11.49% with market construction prices and energy benefits.

Table III.3. Economic Parameters of the Project

	SHW	General Directorate of EPRSDA	Market
Project Cost	622,615,879	622,615,879	512,669,751
Investment Value	790,803,144	790,803,144	653,074,583
Annual Income	60,454,786	86,583,340	77,604,300
Annual Cost	80,357,994	80,357,994	66,505,847
Rantability (B/C)	0.792	1.123	1.224
Internal Rate of Return (IRR)	7.48	10.63	11.49

Beside the energy benefits of General Directorate Expenses of SHW, SHW and General Directorate of Renewable Energy Administration, it is accepted that construction works will be conducted with 25% discount, considering SHW unit prices of construction works in the market. With this respect, an alternative assessment has been implemented. In this consideration, firm and secondary energy unit prices are taken as 9.00 cent/kWh.

Within this assessment, Income / Cost rate is defined as 1.224 and internal rate of return as 11.49% these are calculated by transferring income/cost rates of the project to the first year with 9.5% of discount rate.

As a result of these evaluations, it is determined that Alpaslan II Dam and HEPP Project is evaluated realizable in terms of economic conditions.

III.4. Other Economic, Social and Infrastructure Projects which is not Included the Scope of the Project but Depending on Project Realization, Planned to Realized by Project Owner or Other Investors

In the construction and operation phases of the Project local people will be able to find opportunity to work. Within this scope, necessary staff needs of the project will be primarily provided from the locality. Also, social needs of the personnel will be provided from nearby settlements and these activities will create additional income sources for local people.

Mus-Varto main road passes through the dam reservoir. With the realization of the project, this road needs to be relocated. Relocated part of Mus-Varto road is 23,199 m and relocated part for transportation from Varto road junction to Alpaslan II Dam is 24,350 m. Overall length of the road which has to be relocated is 47,549 m. Total road lengths along with rural roads will be 58,000 km. In this context, as a result of the studies, necessary approvals for 3.5 km part of the road and its route and details are received from General Directorate for Highways (GDH), studies on remaining part still continues. For the purpose of providing access to the dam center line from right coast, this 3.5 km part which is approved by GDH will be evaluated in EIA Report. For the remaining parts, another EIA Report will be prepared after being approved by GDH.

Also, it is expected that employment opportunities will be generated for 1,126 person. Unqualified personnel will be provided mainly from local. When it is considered that local people will be employed in the project, local income would increase.

III.5. Other Economic, Social and Infrastructure Projects which is not Within the Scope of the Project but Necessary to be Realized the Project and Planned to Realized by the Project Owner or Other Investors

Within the Alpaslan II Project, to provide the access between the units, some rural roads will be improved and renewed. These improved and renewed roads will meet transportation needs of the surrounding villages at later stages.

A transmission line which is the subject of another EIA Report, has to be built to distribute the produced energy. This line will connect Alpaslan II Project to national integrated transmission line system.

III.6. Expropriation and/or Methods for Resettlement

III.6.1. Expropriation

Among the areas that will be needed for construction of the dam axis, project facilities and the area to be inundated by the reservoir, private lands will be purchased from the owners. In case of a dispute or need for expropriation for other areas, expropriation process will be realized in accordance with the Expropriation Law No: 2942 and its amendment, Expropriation Law No: 4650, which came into force upon its publication in the Official Gazette dated May 5, 2001.

Based on the cadastral information, it is determined that 5,009.32 ha will be inundated by reservoir and 335.40 ha will be inundated by material borrow areas. Land asset table is given in Section IV.2.7.2. Private land within Project area is subject to expropriation.

For the lands to be expropriated, according to the Electricity Market Law No. 4628 Article 15/c (Amended: Law No. 5784 Article 5), expropriation procedures will be carried out by EMRA; the expropriation decision to be given as such will be deemed as a public interest decision, and the expropriated immovable assets will be registered to the title deeds register in the name of the Treasury. The procedures to be followed by EMRA during the expropriation process are given in Figure III.1.

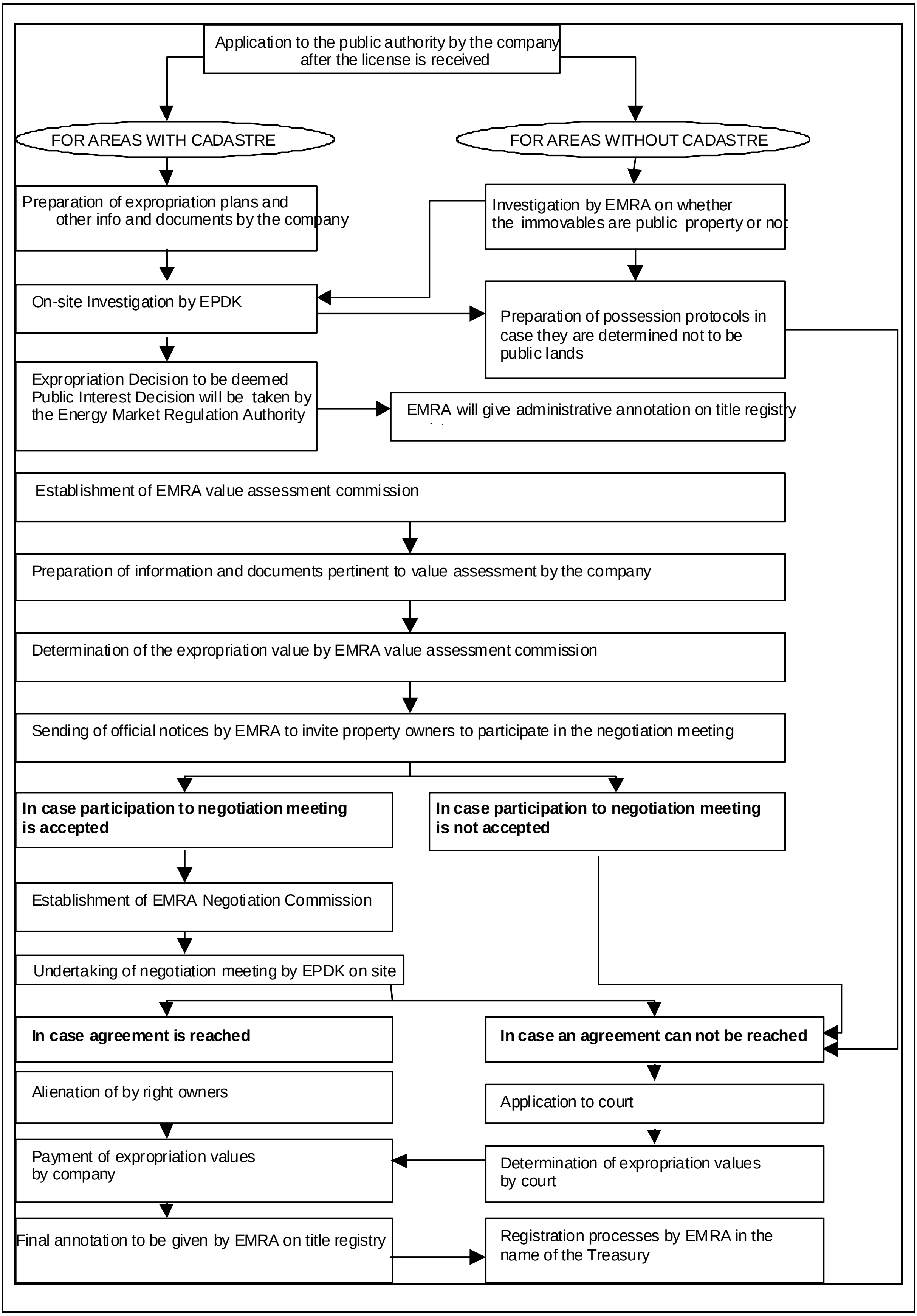


Figure III.1. Flow Chart of Expropriation Procedures

Necessary mitigation measures for protection of the immovable assets that are expropriated during construction and operation phases from rising of water level or landslides will be taken.

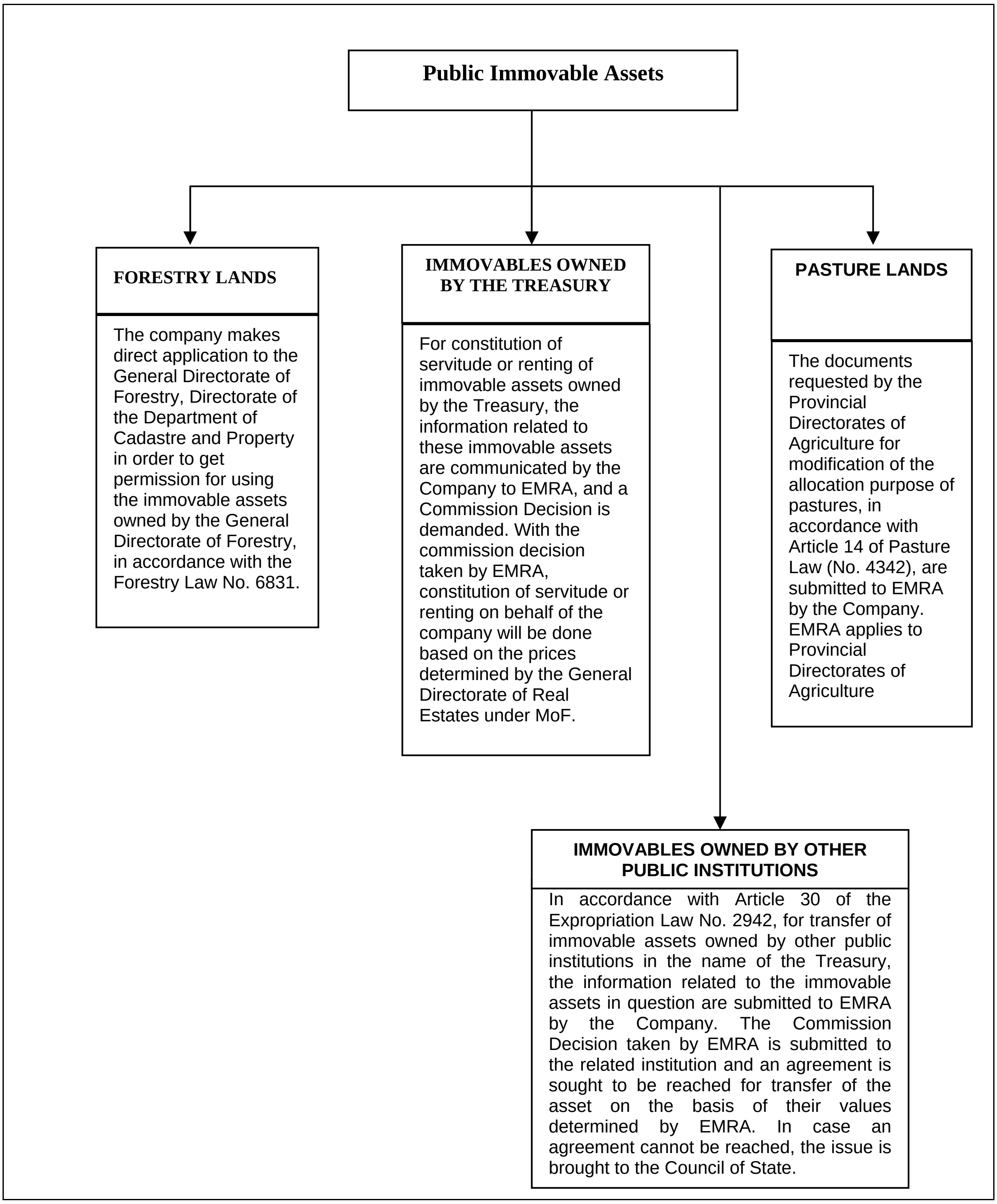
For expropriation of public immovable assets (land, building etc.) owned by public institutions, the project owner makes written application to the concerned administration also stating the amount payable. Procedures related to the expropriation of public immovable assets are given as a flow chart in Figure II.3.

III.6.2. Legal Framework Related to Resettlement

Within the framework of Settlement Law (Official Gazette on September 26, 2006, No. 26301) resettlements of people living in residential areas likely to be affected within the Alpaslan II Dam and HEPP Project will be provided in order to their requests.

There is no article in the Constitution anticipating the resettlement of affected households. However 44th and 45th articles of the Constitution are indirectly related to resettlement. In the 44th article addressing land ownership, the state’s duty to protect landless farmers or farmers with insufficient lands is addressed, while in the 45th article its duties related to the protection of agriculture and animal husbandry, and those working in these areas are addressed. In addition in the 56th article of the Constitution, it is stated that every individual has the right to live in a healthy environment. In Turkey issues related to resettlement are regulated with the Settlement Law. Settlement Law (Law no: 5543) and Settlement Law Implementation Regulation mainly determine duties, responsibilities and authorities related to settlement issues, conditions of right ownership, financial issues, and issues related to the establishment of settlement commission. The Settlement Law covers both agricultural and non-agricultural settlements.

According to the Law, the settlement activities are carried out by the Ministry of Public Works and Settlement (MPWS) in cooperation with other relevant ministries (Ministry of National Education, Ministry of Environment and Urbanization etc.). Decree Law Concerning the Organization and Duties of the Ministry of Environment and Urbanization came into force by its publication in the Official Gazette No. 27984 on July 4, 2011. The duties and powers within the settlement law is given to Ministry Environment and Urbanization with in question decree (Article 2 tasks g) carry out strategy development and programming works and procedures related residential sector, take mitigation measures to provide development of building cooperatives and do ministry’s duty in accordance with the Settlement Law No. 5543).



Public Immovable Assets

FORESTRY LANDS

The company makes direct application to the General Directorate of Forestry, Directorate of the Department of Cadastre and Property in order to get permission for using the immovable assets owned by the General Directorate of Forestry, in accordance with the Forestry Law No. 6831.

IMMOVABLES OWNED BY THE TREASURY

For constitution of servitude or renting of immovable assets owned by the Treasury, the information related to these immovable assets are communicated by the Company to EMRA, and a Commission Decision is demanded. With the commission decision taken by EMRA, constitution of servitude or renting on behalf of the company will be done based on the prices determined by the General Directorate of Real Estates under MoF.

PASTURE LANDS

The documents requested by the Provincial Directorates of Agriculture for modification of the allocation purpose of pastures, in accordance with Article 14 of Pasture Law (No. 4342), are submitted to EMRA by the Company. EMRA applies to Provincial Directorates of Agriculture

IMMOVABLES OWNED BY OTHER PUBLIC INSTITUTIONS

In accordance with Article 30 of the Expropriation Law No. 2942, for transfer of immovable assets owned by other public institutions in the name of the Treasury, the information related to the immovable assets in question are submitted to EMRA by the Company. The Commission Decision taken by EMRA is submitted to the related institution and an agreement is sought to be reached for transfer of the asset on the basis of their values determined by EMRA. In case an agreement cannot be reached, the issue is brought to the Council of State.

Figure III.2. Flow Chart of Expropriation Procedures for Publicly Owned Immovable Assets

III.6.2.1. Basic Steps in Resettlement Process

Resettlement implementations are performed with a high level of coordination and under the framework of a plan. The basic steps forming the plan and coordination within the resettlement implementations are explained below.

Settlement Announcement – Under the framework of the Law, the manner and the conditions of settlement is notified in writing by the governorate to the legal persons, and in nomads to the person capable of representing the nomad group. In addition, it is announced via posting the announcement in visible places such as the municipality, school and headman's office for thirty days. Posting and removing the announcement text are documented with minutes to be prepared jointly by the representatives of the legal person, or in nomads representatives of the nomad group, and the personnel to be charged by the governorate.

For those making a settlement demand, it is obligatory that the household representative applies with a petition to the district governorate or the governorate with family's identity registry copy within the announcement period or ninety days, and for the nomads hundred and eighty days, following the expiry of the announcement. However, in case of situations like long-term medical treatment, imprisonment and similar compelling situations, which are certifiable, these periods will commence as of the date such situations cease to exist

Formation of the Settlement Commission – In case it is considered necessary by the Ministry of Public Works and Settlement, a Central Settlement Commission is established under the chairmanship of the Minister or the undersecretary or the vice undersecretary to be charged by the Minister in order to ensure the implementation of the project, determination of the measures to be taken, and the coordination between the relevant institutions and establishments. This commission includes the General Director of the relate Directorate under the Ministry, the Deputy General Director and Chairman of the Department performing settlement services, and representatives from the Ministry of Internal Affairs and other relevant institutions. The commission meets at a place determined by the Chairman of the Commission and takes decisions unanimously.

The Local Settlement Commission will be formed with the participation of the authorities specified in the Law with the approval of the directorate and the governorate for the purpose of settling those under the scope of the Settlement Law and determining the right owners during physical arrangement procedures of the settlements. Then this Local Settlement Commission holds a meeting under the chairmanship of the top civilian authority in the locality or the person charged by that top civilian authority. Whether the families are right owners or not are decided or right ownership is cancelled unanimously based on the information obtained by the directorate via surveys and researches and according to information of the Commission members of work field of their institutions.

Site Selection – For selection of the settlement site, MPWS and the Governorate research whether there is an appropriate treasury land area in the vicinity of the project area. In case there is no treasury land, resettlement site(s) can also be acquired via purchase or expropriation. The principles for the process of selection of resettlement site(s) are not specified in Laws of Turkey, only some criteria related to the quality and ownership status of the land are defined. According to the Settlement Law, in case an area is not suitable for agriculture, this area can be used for resettlement only if rehabilitation/improvement works are conducted. Though not specified in the laws, it is considered to be an important factor for selection of the resettlement site to have the new settlement in an area close the previous settlement with similar environmental conditions, since livelihoods of many local people are directly related to natural resources. This is useful in preserving the social relations as well.

After the MPWS and the Governorate completes their works on resettlement sites, the Governorate to which the resettlement site to be newly established is affiliated for approval. In case the resettlement site to be newly established is a district centre, the selection is submitted to the National Assembly for approval and the selected site is declared by law. Since the period of this procedure is not specified with the Law, this period lasts for years in some cases.

- ***Preparation of the Settlement Project*** – The MPWS and the Governorate prepares the settlement project according to the population to be settled and their needs taking into consideration the needs such as housing, school, mosque, village house, police station, cemetery, pasture areas, wells, infrastructure, irrigation channels etc. Although such projects are not specified clearly in the Law, the MPWS and the Governorate consults the project affected people (PAP).
- ***Preparation of the Settlement Site*** – Settlement projects (land rehabilitation/improvement works for agriculture purposes, construction of houses and public buildings, infrastructural construction etc.) are tendered by the MPWS and the Governorate. In case the project affected are displaced before the preparation of the settlement site, MPWS and the Governorate are obliged to provide temporary settlement for PAP. In case a family, which has demanded settlement, abandons this right due to reasons such as delays in preparation of the settlement site, the MPWS and the Governorate provided land and housing credits.

III.6.2.2. Right Ownership for Settlement

In the Settlement Law, right ownership is recognized for the below categories of residents:

In accordance with the 12th Article of the Settlement Law, families that had to leave their places due to partial or total expropriation of their immovable assets and families that do not have immovable assets but have settled the area of expropriation at least three years before the beginning of the calendar year, in which the settlement survey studies have commenced, are recognized to be right owners. However the following categories cannot be right owners;

a) In accordance with the 4th paragraph of the 12th article of the Settlement Law, the family members who demand settlement by the state, but do not bank in the Account of the Central Accountancy Unit of the Ministry the amount within the total expropriation value they have received or will receive including cost increases, corresponding to the thirty-day gross value of the minimum wage in force for workers above the age sixteen on January of the year settlement announcement was made, multiplied by hundred and twenty months, or all the expropriation value in case the expropriation value is less than this gross minimum wage multiplied by hundred and twenty months, and those who do not undertake to bank or transfer the values they will receive in the future;

b) Those who are not certified to live in the settlement unit within the expropriation area, even if they have immovable assets to be expropriated;

c) For those without immovable assets, those who are not certified to be settled by residence in the expropriation area at least three years prior to the beginning of the calendar year of the earliest of the following dates: starting date of the settlement planning surveys, date of public interest decision for expropriation of immovable assets or the date of work contract;

d) Among those working subject to any social security institution or those employed in works, which require being subject to a social security institution but are not registered to any or those who receive an income or a salary from social security institutions in return for the premiums or cuts they have paid, those having a total annual income exceeding the eighteen times of the gross amount of thirty-day minimum wage in force for workers above the age sixteen on the date of determination;

e) The families who have sold their immovable assets and have not bought others with values equivalent to or more than the values of those they had sold within three years before the beginning of the calendar year of the date on which settlement planning surveys started, even though they have not left their places unless they can prove the following compulsory cases via the following documents:

1. Disposal of the immovable assets as a result of the liquidation of an inheritance with a court decision via writ and land registry documents,
2. Transfer of shares in immovable assets via granting or selling to other heirs due to the fact that they are not sufficient to make a living or to settle via land registry records or minutes kept by the board of aldermen and the authorities from the related Directorate,
3. Disposal of the immovable assets for the purpose of medical treatment of himself/herself, his/her spouse, children, mother and father via documents to be taken from the health institution in which treatment is carried out,
4. Disposal of the immovable assets due to debts belonging to their deceased, due to joint and several surety to agricultural, commercial, industrial credits of others via documents to be taken from the relevant authorities,
5. Disposal of the immovable assets due to disasters such as fire, flood, landslide, earthquake via documents to be taken from the relevant authorities or the board of aldermen.

Principles of Resettlement by the State

The families to have rights can be settled both for agricultural and non-agricultural purposes according to the Settlement Law and other related legislation. The principles for settlement are as follows:

- For the determination of the level of living of those who lose their livelihood means in the old settlement or those to be settled for agricultural and non-agricultural purposes, the gross amount of the thirty-day minimum wage in force for workers above the age sixteen at the date of determination, multiplied by eighteen is taken as basis.

- For accepting that the related parties are obliged to leave their places upon the expropriation of their immovable assets, it is required that the settlement unit is completely expropriated or that the residence of the family is expropriated in cases where the settlement unit is partly expropriated. However, the situation will be examined by a technical committee of at least three people, agricultural engineer expert on the issue and if necessary map engineer, construction engineer, economist, and whether the related parties lose their means of livelihood or not will reported unanimously and the procedure will be carried out, by taking into consideration the level of living of those immovable assets of whom are partly expropriated and those who do not have immovable assets and the general condition of the settlement unit and the condition of the expropriated lands.

- Among those whose immovable properties were expropriated, for the sheltering of those who had to vacate the old settlement place, firstly migrant admitting centres or the buildings of public institutions, establishments and administrations to be determined by the related governorate will be used. In case sheltering need cannot be met by this way, free-of-charge rental assistance can be made for temporary settlements on the amount to be determined per family with the approval of the Minister up to the thirty per cent of the gross amount of the thirty-day minimum wage in force for workers above the age sixteen in order to provide contribution to the rental expenditures until the permanent settlements of the families are provided.

- Sheltering, food, fuel and treatment assistances foreseen in the third paragraph of the 9th article of the Settlement Law are met by the state in buildings and facilities belonging to public institutions, establishments and administrations with the coordination of the Central Settlement Commission as of the date those immovable assets of whom are expropriated are taken to temporary settlement. In case such assistance cannot be met in public buildings, free-of-charge monthly assistance is made to the families on the amount to be determined with the approval of the Minister up to the thirty per cent of the gross amount of the thirty-day minimum wage in force for workers above the age sixteen until after twenty months following the date of definite settlement in order to support the families in passing to a situation in which they are producers, the starting date being the date on which those whose immovable assets are expropriated are taken to temporary settlement.

Costs of transfer of the families to be settled from the old settlement places to temporary and definite settlement places are met by the State under the framework of the transfer projects to be prepared. For food expenditures among the transfer costs, payment per person is made on the amount to be found by multiplying the three hundred indicator figure with the civil servant coefficient.

Settlement through one’s Own Means

Another choice for the PAPs, is settlement through their own means. If a PAP prefers settlement through his/her own means or does not meet the criteria for settlement by the State, he/she can receive the expropriation amount and settle on his/her own. In this case, those settling through their own means cannot make use of state assistance or credit rights. Consultancy services will be given by the State for the PAPs preferring such settlement choice.

III.7. Other Agreements

There are no other agreements to be issued about this topic.

CHAPTER IV

DETERMINING THE AREA THAT ARE LIKELY TO BE AFFECTED BY THE DAM, HEPP, MATERIAL BORROW AREAS, CONCRETE PLANT AND CRUSHING-SCREENING FACILITIES AND STONE CRUSHER FACILITIES WITHIN THE SCOPE OF THE PROJECT AND EXPLAINING CURRENT ENVIRONMENTAL CONDITIONS WITHIN THIS AREA

CHAPTER IV. DETERMINING THE AREA THAT ARE LIKELY TO BE AFFECTED BY THE DAM, HEPP, MATERIAL BORROW AREAS, CONCRETE PLANT AND CRUSHING-SCREENING FACILITIES AND STONE CRUSHER FACILITIES WITHIN THE SCOPE OF THE PROJECT AND EXPLAINING CURRENT ENVIRONMENTAL CONDITIONS WITHIN THIS AREA

IV.1. Determining the Impact Area of the Project (how and according to what impacted area was determined will be explained and impact area will be shown on the map)

Impact area of Alpaslan II Dam and HEPP Project is determined by taking into consideration the environmental, economic and social impacts, which are probable to occur in residential areas near construction sites and areas inundated by the reservoir or catchment area both in construction and operation phases. Settlements located near construction areas will be affected from the dust or noise generated by construction activities, however; these adverse impacts are only limited to construction activities.

Another criteria that is taken into consideration during determining the impact area are concrete plant and screening plant and their impacts to the environment. As a result of these activities in these plants noise and dust will occur and they will have some impacts on cultivated and settlement areas near these facilities.

In accordance with above-mentioned parameters, study area is shown on the map at App-1. This area covers the reservoir, material borrow areas, crushing-screening and washing plant, concrete plant and other related facilities. Distances of material borrow area, concrete plants and crushing-screening-washing plants to the nearest settlement are given in Table IV.1.

Table IV.1. Distances of Material Borrow Areas, Concrete Plants and Crushing-Screening-Washing Plants to the Nearest Settlement

Project Area	Nearest Residential Area	Distance (m)
K2 Rock Material Borrow Area	Dogdap	1,470
K1 Rock Material Borrow Area	Dogdap	770
K5 Rock Material Borrow Area	Kayalidere	520
E Permeable Material Borrow Area	Kayalidere	1,450
G Permeable Material Borrow	Kayalidere	2,860
F Permeable Material Borrow Area	Kayalidere	1,980
C Impermeable Material Borrow	Akkonak	1,900
D Impermeable Material Borrow	Akkonak	2,390
B Impermeable Material Borrow	Akpinar	1,860
A Impermeable Material Borrow	Dumlusu	620
K6 Rock Material Borrow Area	Dumlusu	1,260
K3 Rock Material Borrow Area	Kusluk	700
Crushing-Screening-Washing Facilities	Akkonak	2,025
Concrete Plant 1	Akpinar	1,650
Concrete Plant 2	Akpinar	1,560
Concrete Plant 3	Akpinar	1,150

Impact of the reservoir will be limited to the boundaries of the reservoir only and impacts of other project units (dam, material borrow areas, crushing plant, etc.) will be mainly limited to 500 m. Map of impact area where dam reservoir will be limited with lake area is given in App-1.

IV.2. Characteristics of Physical and Biologic Environment Within Impact Area and Use of Natural Resources

In this Section, meteorological, geological and hydrogeological conditions around the project impact area and natural resources and their characteristics are assessed under related topics.

IV.2.1. Meteorological and Climatic Characteristics

Mus is located in East Anatolian Region in Turkey. The province is under the effect of continental climate. Winters are characterized cold and snowy; summers are characterized short and cool. Because of quickly transitions between these two seasons, autumn and spring take a short time.

While evaluating meteorological and climatic conditions Varto Meteorological Station data (1976-2010), which is the closest meteorological station to project area, were used. Mentioned data are presented in App-6. Varto Meteorological Station is located 1,650 m above sea level, 38.1 latitude and 41.28 longitude.

Temperature Distribution

According to Varto Meteorological Station records, annual mean temperature is 7.6°C. The highest temperature is recorded as 40.5 ºC in July, 2000 and the lowest one as -33.4°C in February, 1985. The graphical representation of the average temperature records is given in Figure IV.1 and given in tabular form in Table IV.2.

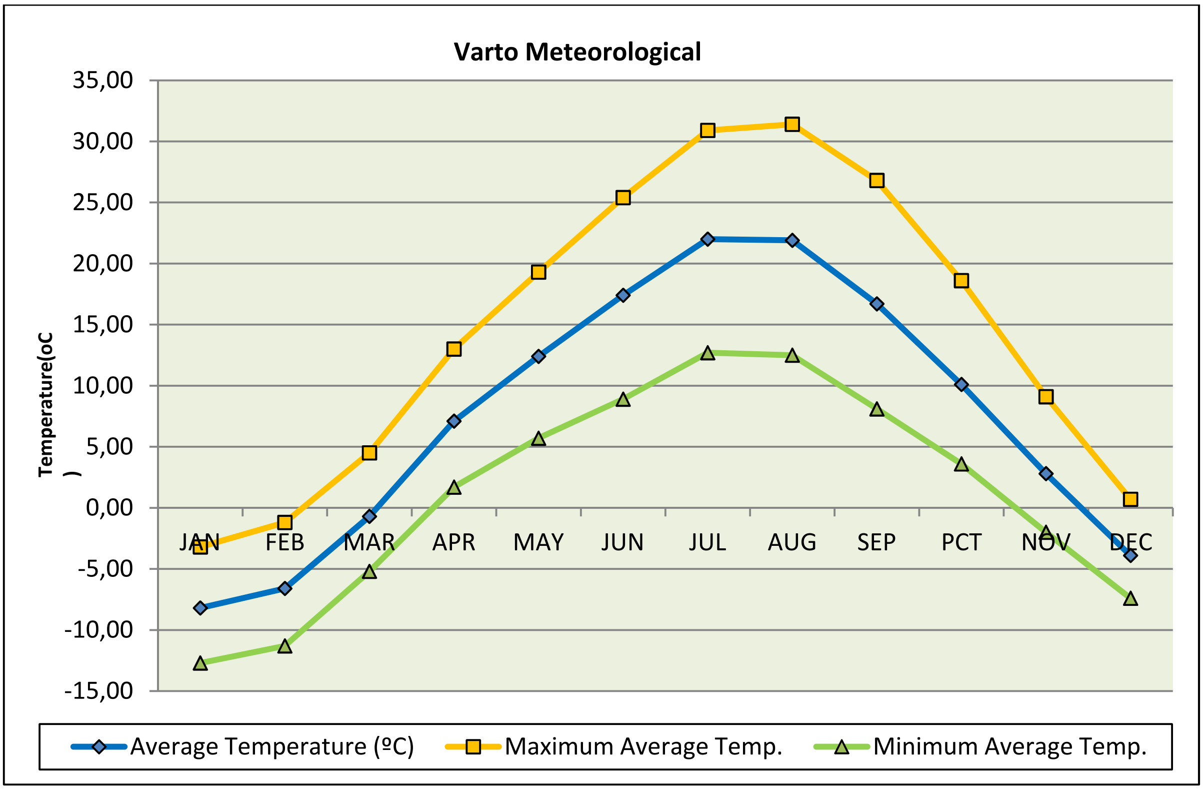


Figure IV.1. Average Temperature, Maximum Average Temperature and Minimum Average Temperature

Table IV.2. Temperature Values

Months	Average Temperature (^{o}C)	Average Maximum Temperatures (^{o}C)	Average Minimum Temperatures (^{o}C)	Maximum Temperature (^{o}C)	Minimum Temperature (^{o}C)
January	-8.2	-3.2	-12.7	8.6	-31.1
February	-6.6	-1.2	-11.3	11.4	-33.4
March	-0.7	4,5	-5.2	21.4	-31.3
April	7.1	13.0	1.7	27.0	-11.3
May	12.4	19.3	5.7	29.4	-3.3
June	17.4	25.4	8.9	35.0	1.0
July	22.0	30.9	12.7	40.5	4.5
August	21.9	31.4	12.5	38.5	4.7
September	16.7	26.8	8.1	36.9	-1.0
October	10.1	18.6	3.6	29.0	-7.5
November	2.8	9.1	-2.0	20.4	-21.4
December	-3.9	0.7	-7.7	17.7	-31.0
Annual	**7.6**	**14.6**	**1.2**	**40.5**	**-33.4**

Pressure

Annual mean local pressure measured in Varto Meteorology Station is 852.4 hPa. Maximum and minimum pressures within a year are observed in March. These values are 867.7 hPa and 832.9 hPa, respectively. Local pressure distributions are given in Table IV.3 and graphical illustration of this distribution is presented in Figure IV.2.

Table IV.3. Average, Maximum and Minimum Pressure Values

Months	Average Pressure (hPa)	Maximum Pressure (hPa)	Minimum Pressure (hPa)
January	855.0	867.4	838.6
February	853.4	867.2	834.5
March	851.5	867.7	832.9
April	851.6	864.4	837.3
May	851.8	861.7	840.1
June	849.6	859.6	840.2
July	847.8	857.2	838.7
August	849.1	857.7	841.4
September	852.2	861.2	844.1
October	855.5	864.8	844.2
November	856.0	867.6	839.2
December	855.5	866.9	834.7
Annual	**852.4**	**863.6**	**838.8**

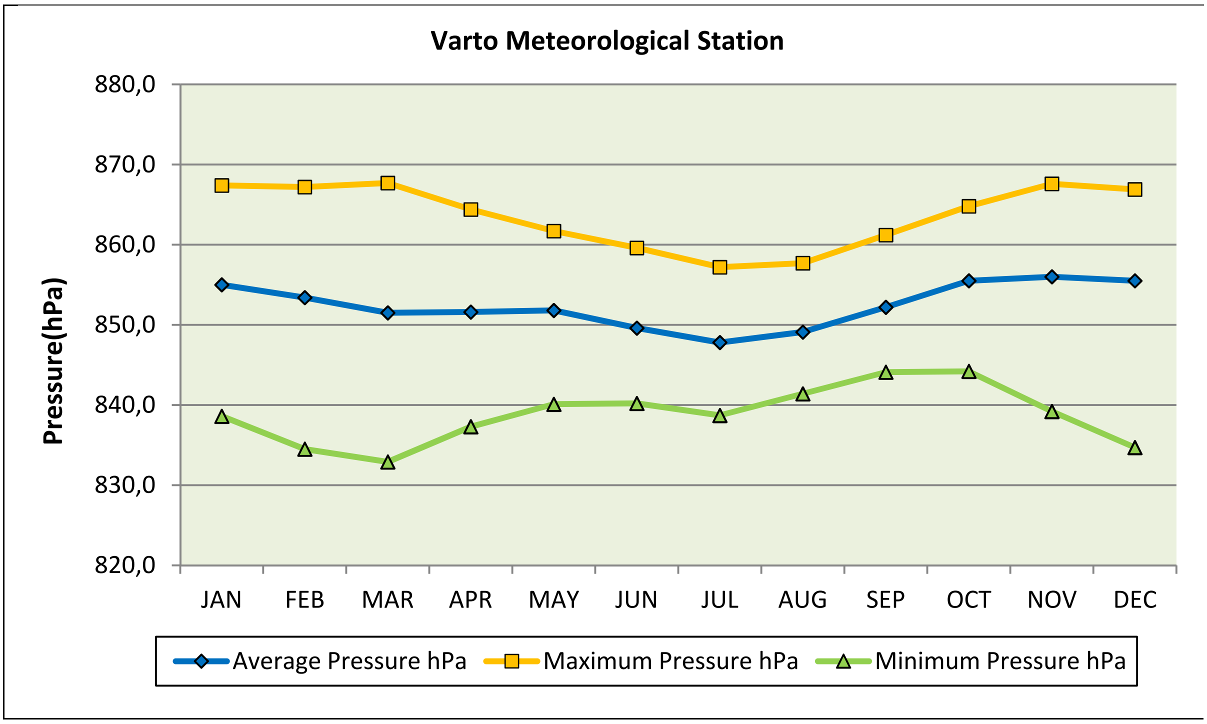


Figure IV.2. Average, Maximum and Minimum Pressure Values

Precipitation

Average annual total precipitation in Varto Meteorology Station is 49.6 mm. Average total precipitation is maximum in April with 87.3 mm, and minimum in August with 7.7 mm. Maximum precipitation was observed in October as 93.0 mm. Observed average monthly precipitation is given graphically in Figure IV.3 and tabulated in Table IV.4.

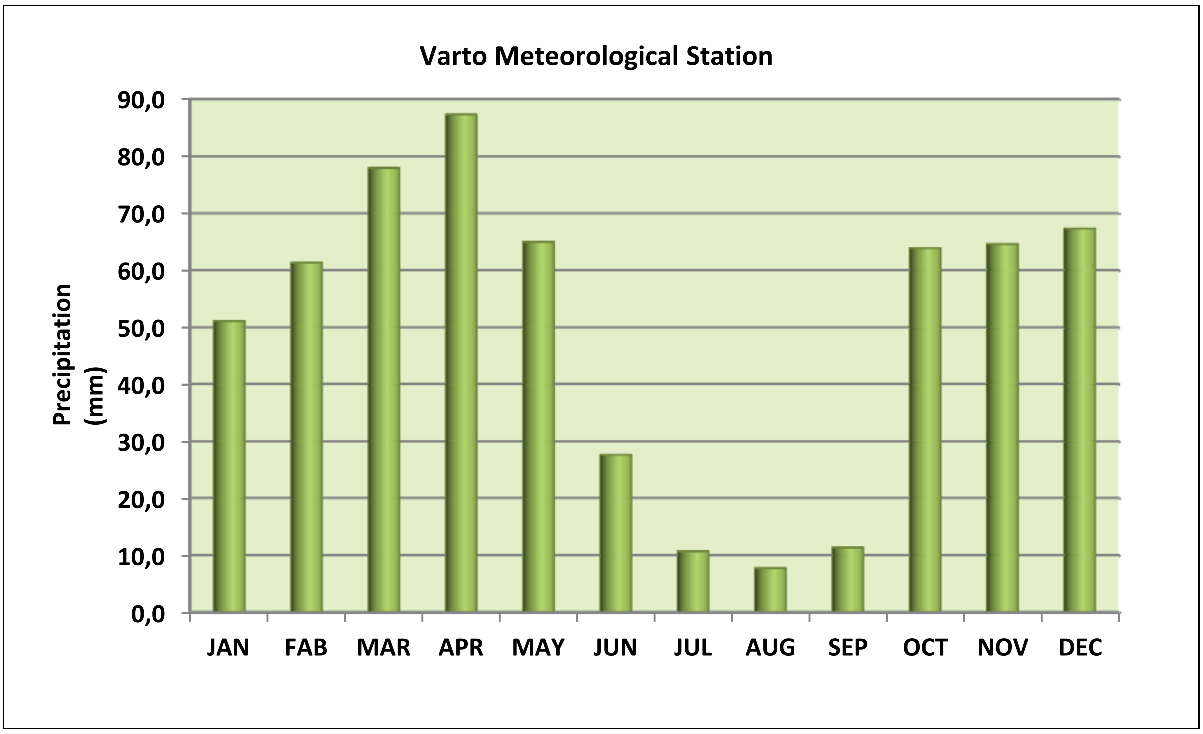


Figure IV.3. Average Monthly Precipitation
Table IV.4. Monthly and Annual Precipitation Amounts

Months	Average Precipitation Amount (mm)	Maximum Precipitation Amount (mm)
January	51.1	32.8
February	61.3	35.0
March	77.9	57.0
April	87.3	46.7
May	65.0	58.2
June	27.6	33.0
July	10.7	26.2
August	7.7	44.4
September	11.3	22.1
October	63.9	93.0
November	64.6	59.6
December	67.3	30.8
Annual	**49.6**	**93.0**

Humidity

The average annual humidity for Varto Meteorological Station is recorded as 63.1%. Minimum monthly humidity is recorded in July (47.7%) and maximum monthly humidity is recorded in December (75.8%). According to the monthly average relative humidity records of the station, the monthly variations of relative humidity are given in Figure IV.4 and in Table IV.5.

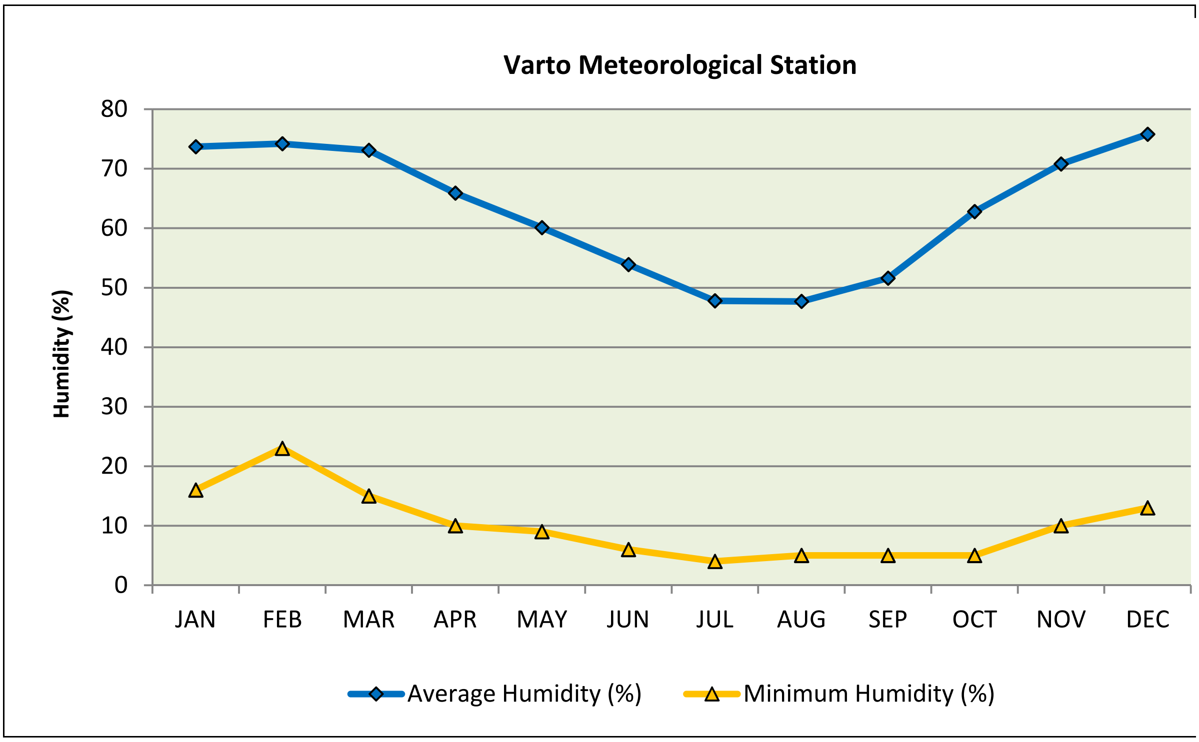


Figure IV.4. Average and Minimum Humidity

Table IV.5. Average and Minimum Humidity Averages

Months	Average Humidity (%)	Minimum Humidity (%)
January	73.7	16
February	74.2	23
March	73.1	15
April	65.9	10
May	60.1	9
June	53.9	6
July	47.8	4
August	47.7	5
September	51.6	5
October	62.8	5
November	70.8	10
December	75.8	13
Annual	**63.1**	**4**

Foggy and Snowy Days Distribution

According to the data of Varto Meteorology Station, the number of annual average snowy days is 39.4, the number of days with snow blanket in a year is 83, depth of snow cover is 10.6 cm. Monthly distribution of average foggy, snowy and snow-covered days and depth of snow cover are given in Table IV.6, Figure IV.5 and Figure IV.6.

Table IV.6. Foggy and Snowy Days Distribution (Average Foggy Days, Snowy Days, Snow-covered Days and Maximum Snow Depth)

Months	Average Number of Foggy Days	Average Number of Snowy Days	Number of Snow-covered Days	Maximum Snow Depth (cm)
January	3.1	9.1	21.8	78
February	2.3	9.0	21.6	112
March	1.3	8.1	17.0	100
April	0.2	2.1	3.3	88
May		0.1	0.1	9
June				
July				
August				
September				
October	0.1	0.3	0.2	14
November	1.4	2.4	3.1	38
December	2.2	8.3	15.9	60
Annual	**10.6**	**39.4**	**83.0**	**112**

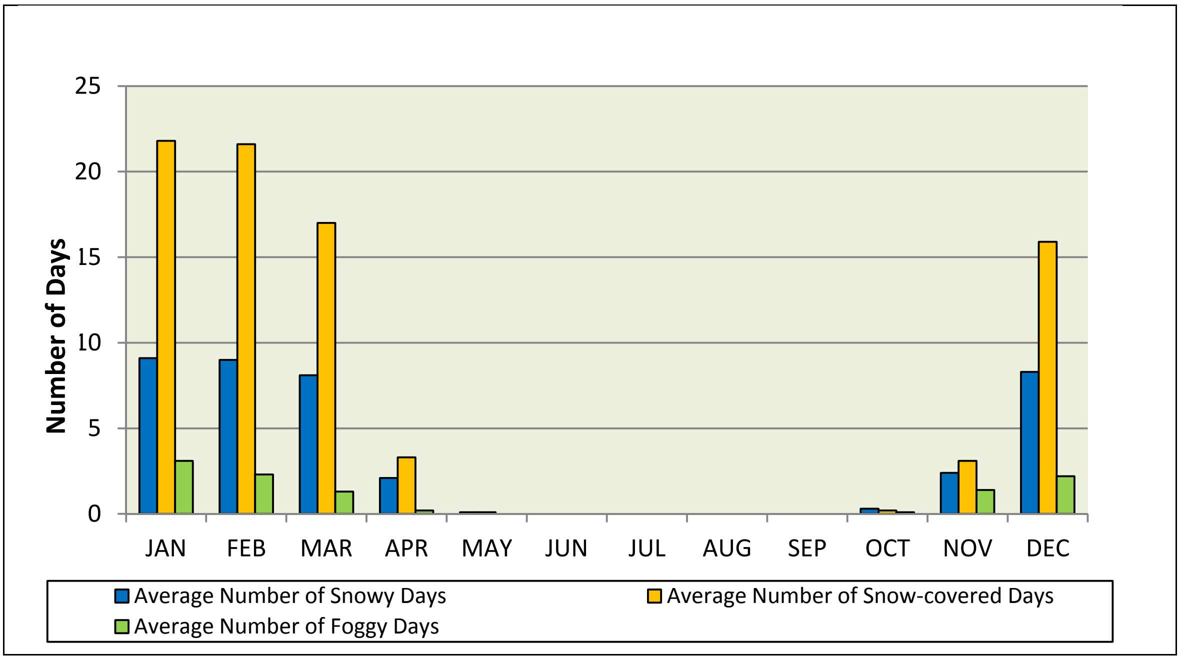


Figure IV.5. Average Number of Snowy, Snow-covered and Foggy Days

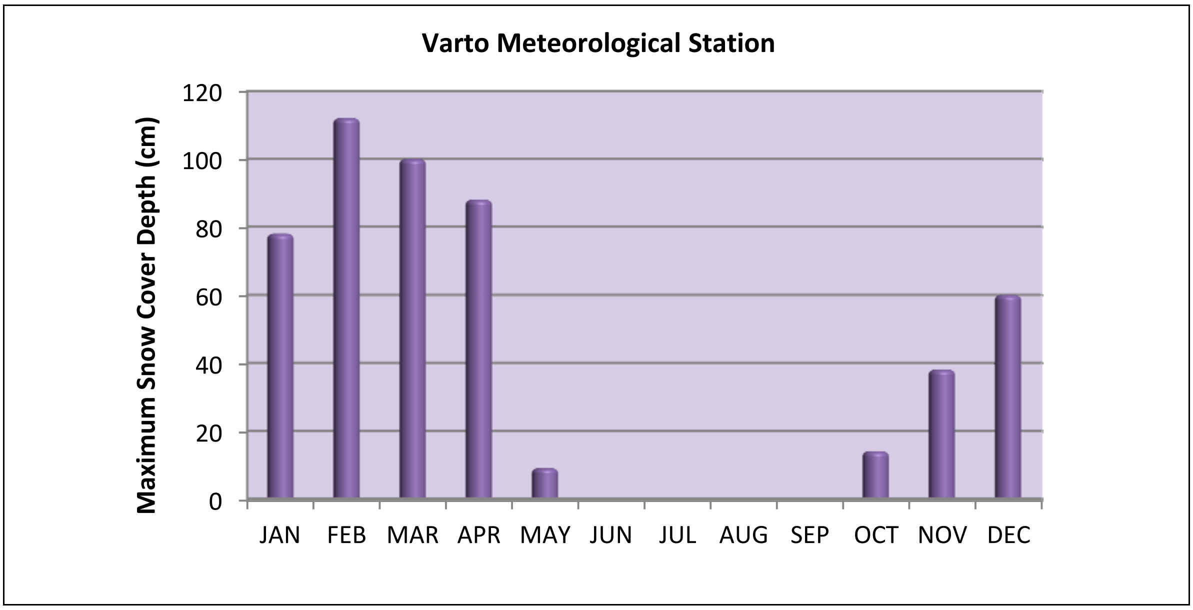


Figure IV.6. Maximum Snow Cover Depth

Wind Distribution

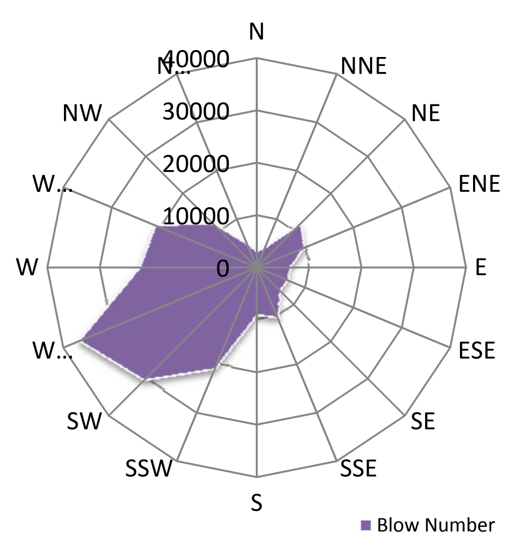
The monthly, yearly and seasonally wind blow numbers and wind speeds recorded in Varto Meteorological Station are given in Table IV.7, Table IV.8 and Table IV.9, graphics are given in Figure IV.7 and Figure IV.8. According to Varto Meteorological Station records, 1st dominant wind direction is west southwest (WSW), 2nd dominant wind direction is southwest (SW) and 3rd dominant wind direction is west (W).

Table IV.7. Distribution of Monthly and Yearly Wind Blow Numbers According to Directions

Months	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
January	179	152	422	365	258	249	290	322	487	1,155	2,580	4,322	2,587	1,725	778	289
February	142	113	375	401	236	296	228	282	396	985	2,551	4,119	2,226	1,567	891	199
March	231	190	543	552	313	395	284	433	411	1,282	2,244	3,666	2,830	2,175	1,029	278
April	286	351	740	706	434	592	590	891	680	1,895	2,362	2,913	1,952	2,123	1,059	349
May	218	284	953	836	586	681	606	1,211	976	2,313	2,462	2,807	1,659	1,988	1,141	423
June	240	433	1,168	894	579	595	598	1,266	853	2,182	2,447	2,397	1,284	1,616	1,003	469
July	293	835	1,729	1,230	832	677	749	1,495	1,083	1,780	2,171	1,744	1,075	1,400	954	516
August	310	745	1,976	1,426	830	723	934	1,320	1,163	1,998	2,087	1,637	967	1,386	1,095	592
September	282	386	1,425	1,227	758	622	608	1,163	1,047	2,260	2,250	2,246	1,164	1,579	1,135	562
October	276	344	1,274	1,027	698	553	593	1,073	706	2,043	2,670	2,878	1,554	1,925	1,037	473
November	255	215	649	667	428	494	449	663	787	1,657	3,067	3,522	2,191	1,646	808	300
December	274	125	485	409	314	429	301	363	557	1,527	3,702	4,504	2,856	1,844	906	239
Annual	2,986	4,173	11,739	9,740	6,266	6,306	6,230	10,482	9,146	21,077	30,593	36,755	22,345	20,974	11,836	4,689

Table IV.8. Distribution of Monthly and Yearly Average Wind Speeds According to Directions (m/sec)

Months	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
January	2.0	2.1	1.7	1.8	1.9	1.6	1.4	1.4	0.9	1.0	0.9	0.9	1.0	1.4	1.5	1.7
February	2.1	2.0	1.6	1.7	1.9	1.7	1.4	1.4	1.1	1.1	0.9	1.0	1.1	1.4	1.7	2.2
March	2.2	2.2	1.9	1.9	2.1	1.8	1.6	1.8	1.5	1.3	1.1	1.3	1.2	1.6	1.7	2.0
April	2.2	1.9	1.9	1.8	1.9	2.0	2.0	2.1	2.3	1.8	1.8	1.7	1.6	2.0	1.9	2.0
May	2.1	2.0	1.9	1.7	2.0	1.8	1.9	2.2	2.3	1.8	1.7	1.6	1.5	1.9	1.9	2.1
June	1.9	2.3	1.9	1.8	1.9	1.8	1.8	2.0	2.0	1.6	1.4	1.4	1.3	1.5	1.5	1.9
July	2.0	2.6	2.0	1.9	1.8	1.7	1.6	1.8	1.7	1.5	1.2	1.3	1.1	1.3	1.3	1.6
August	1.6	2.2	1.8	1.6	1.6	1.6	1.6	1.8	1.9	1.5	1.4	1.3	1.1	1.2	1.2	1.4
September	1.7	1.5	1.4	1.4	1.4	1.5	1.4	1.7	1.9	1.5	1.4	1.5	1.3	1.2	1.2	1.2
October	1.7	1.6	1.3	1.4	1.6	1.4	1.4	1.5	1.7	1.2	1.2	1.1	1.0	1.2	1.3	1.3
November	1.7	1.8	1.3	1.4	1.6	1.4	1.2	1.4	1.1	1.1	1.1	1.2	1.1	1.3	1.5	1.4
December	1.6	1.8	1.4	1.4	1.5	1.4	1.3	1.4	1.1	1.0	0.8	0.9	1.0	1.3	1.4	1.4



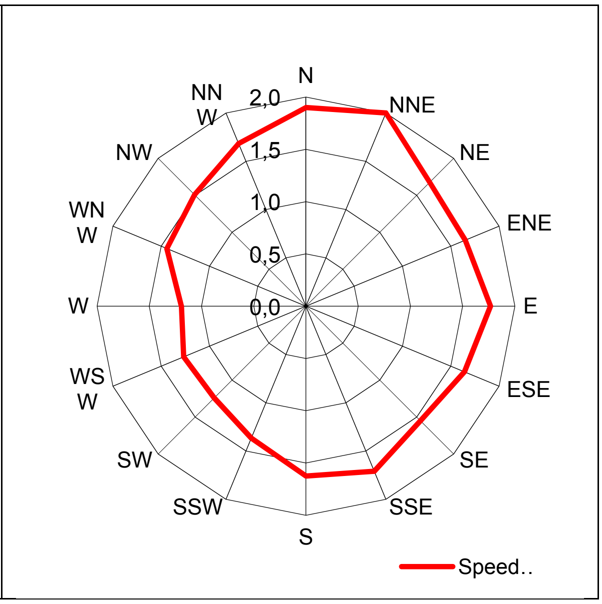


Figure IV.7. Annual Wind Diagram According to Wind Blow Numbers and Average Wind Speeds

Table IV.9. Distribution of Seasonally Wind Blow Numbers According to Directions

Months	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Winter	595	390	1,282	1,175	808	974	819	967	1,440	3,667	8,833	12,945	7,669	5,136	2,698	727
Spring	735	825	2,236	2,094	1,333	1,668	1,480	2,535	2,067	5,490	7,068	9,386	6,441	6,286	3,229	1,050
Summer	843	2,013	4,873	3,550	2,241	1,995	2,281	4,081	3,099	5,960	6,705	5,778	3,326	4,402	3,052	1,577
Autumn	813	945	3,348	2,921	1,884	1,669	1,650	2,899	2,540	5,960	7,987	8,646	4,909	5,150	2,980	1,335

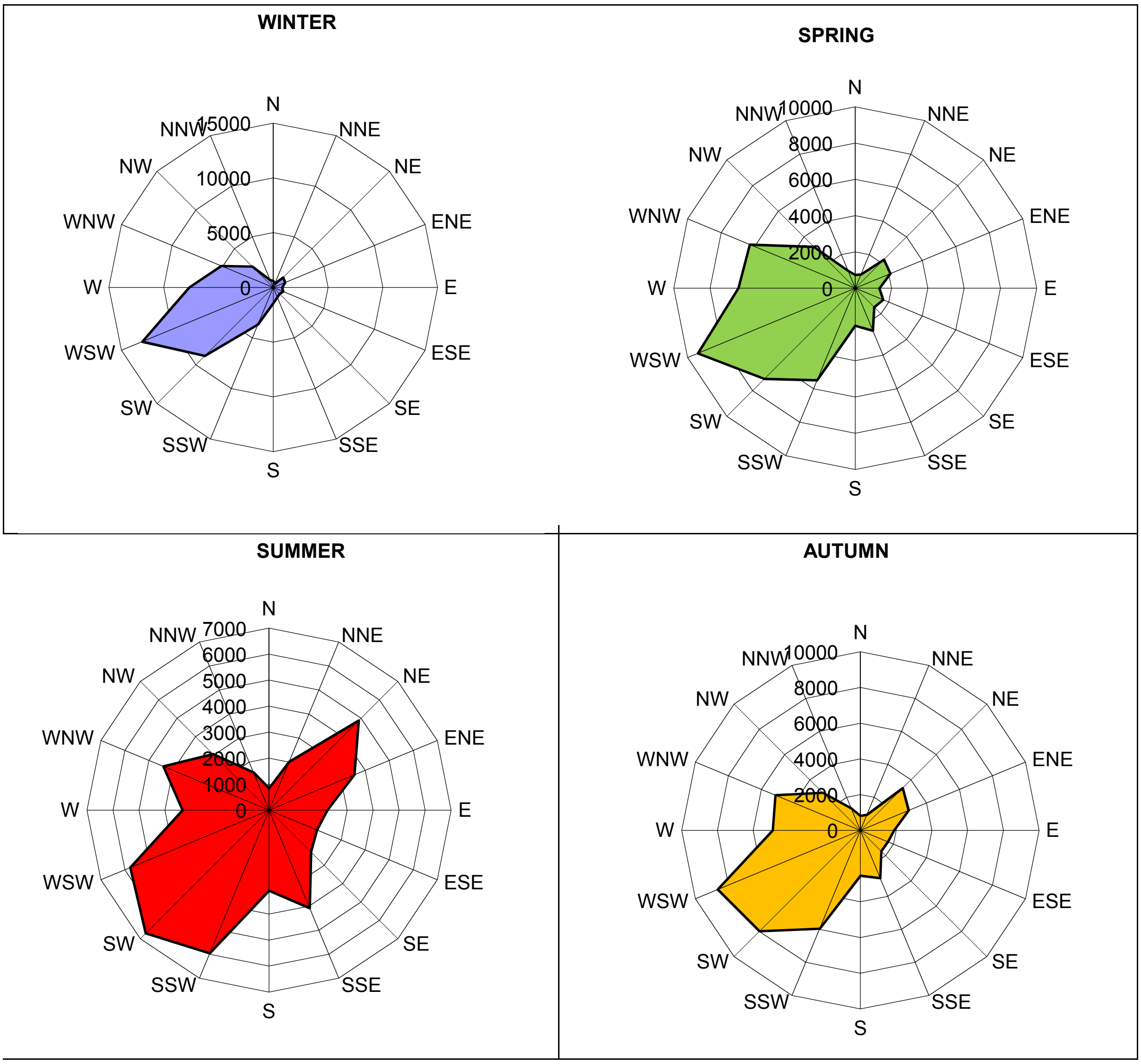
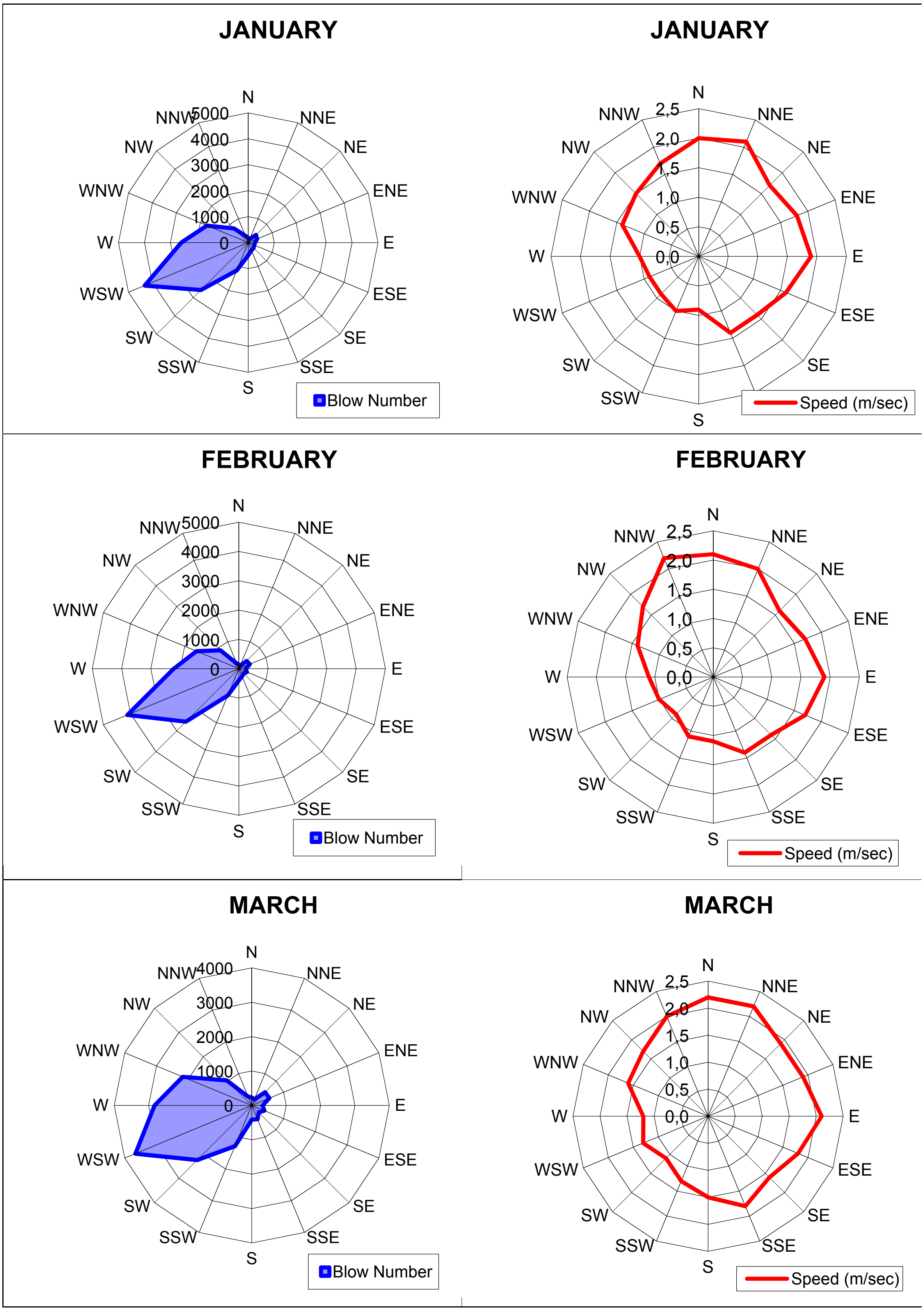


Figure IV.8. Seasonally Wind Diagrams According to Wind Blow Numbers

Monthly Wind Diagrams according to wind blow numbers and average wind speeds are given in Figure IV.9.



JANUARY

JANUARY

FEBRUARY

FEBRUARY

MARCH

MARCH

Figure IV.9 Monthly Wind Diagrams According to Wind Blow Numbers and Average Wind Speeds

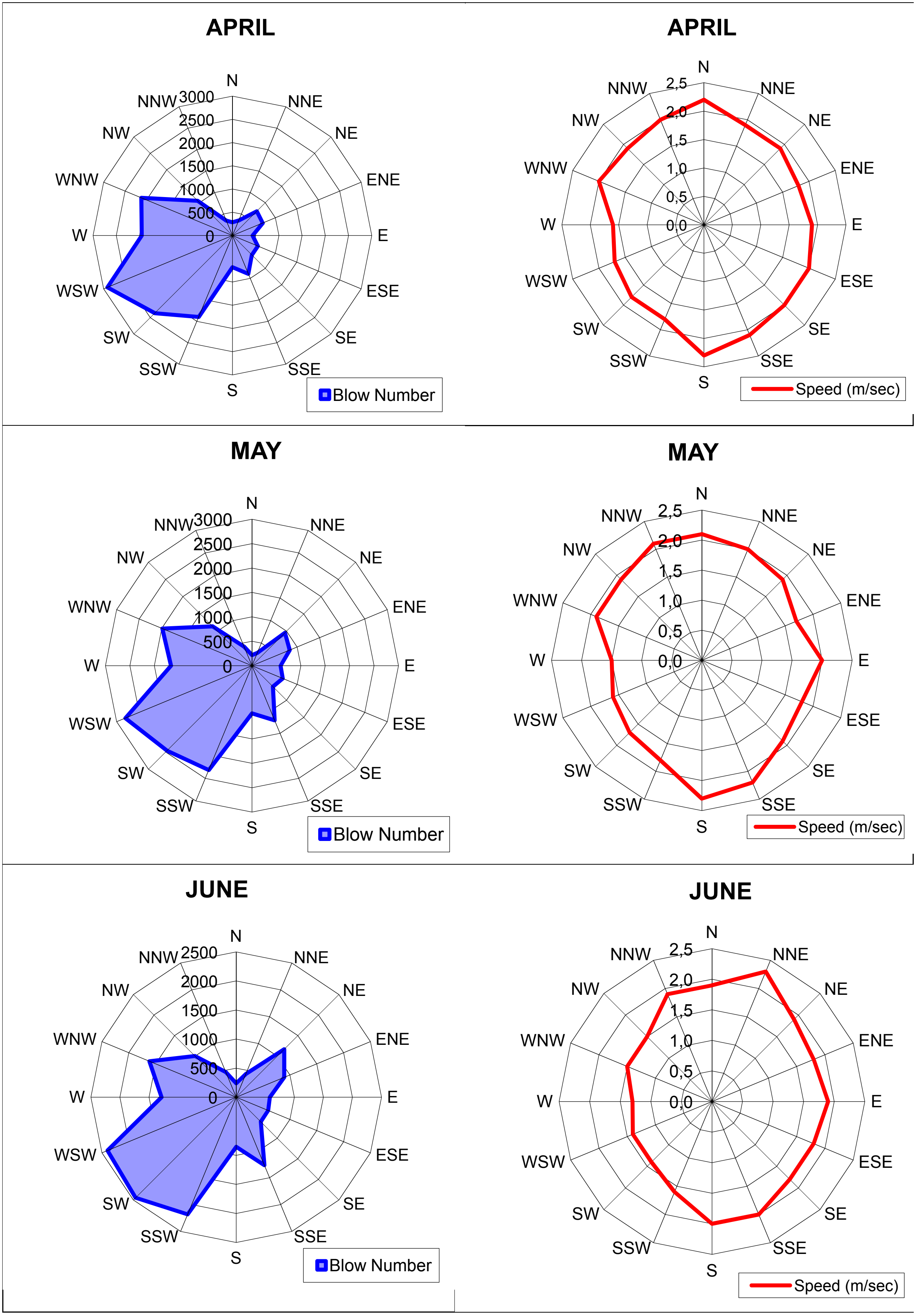


Figure IV.9 Monthly Wind Diagrams According to Wind Blow Numbers and Average Wind Speeds (Cont.)

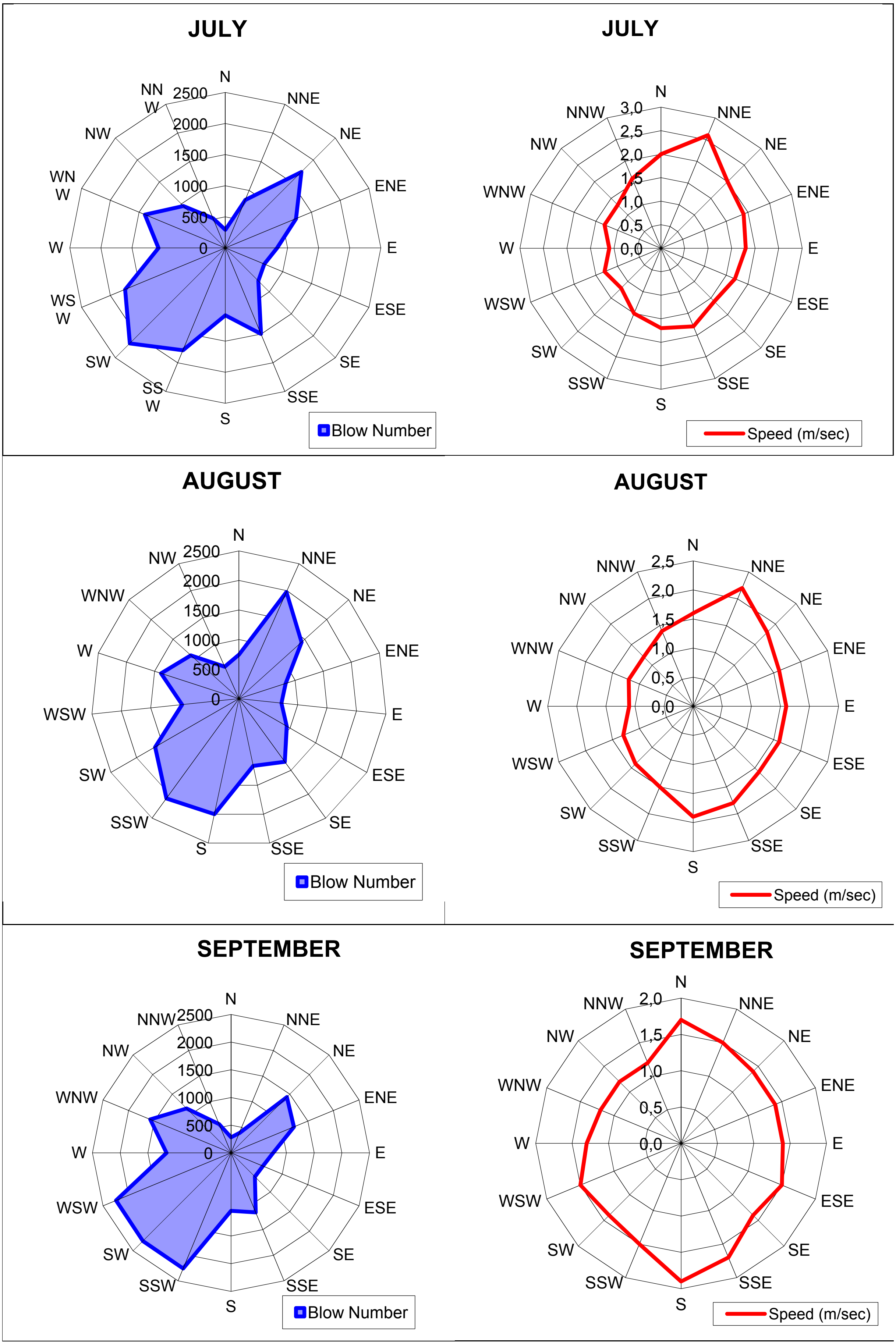


Figure IV.9 Monthly Wind Diagrams According to Wind Blow Numbers and Average Wind Speeds (Cont.)

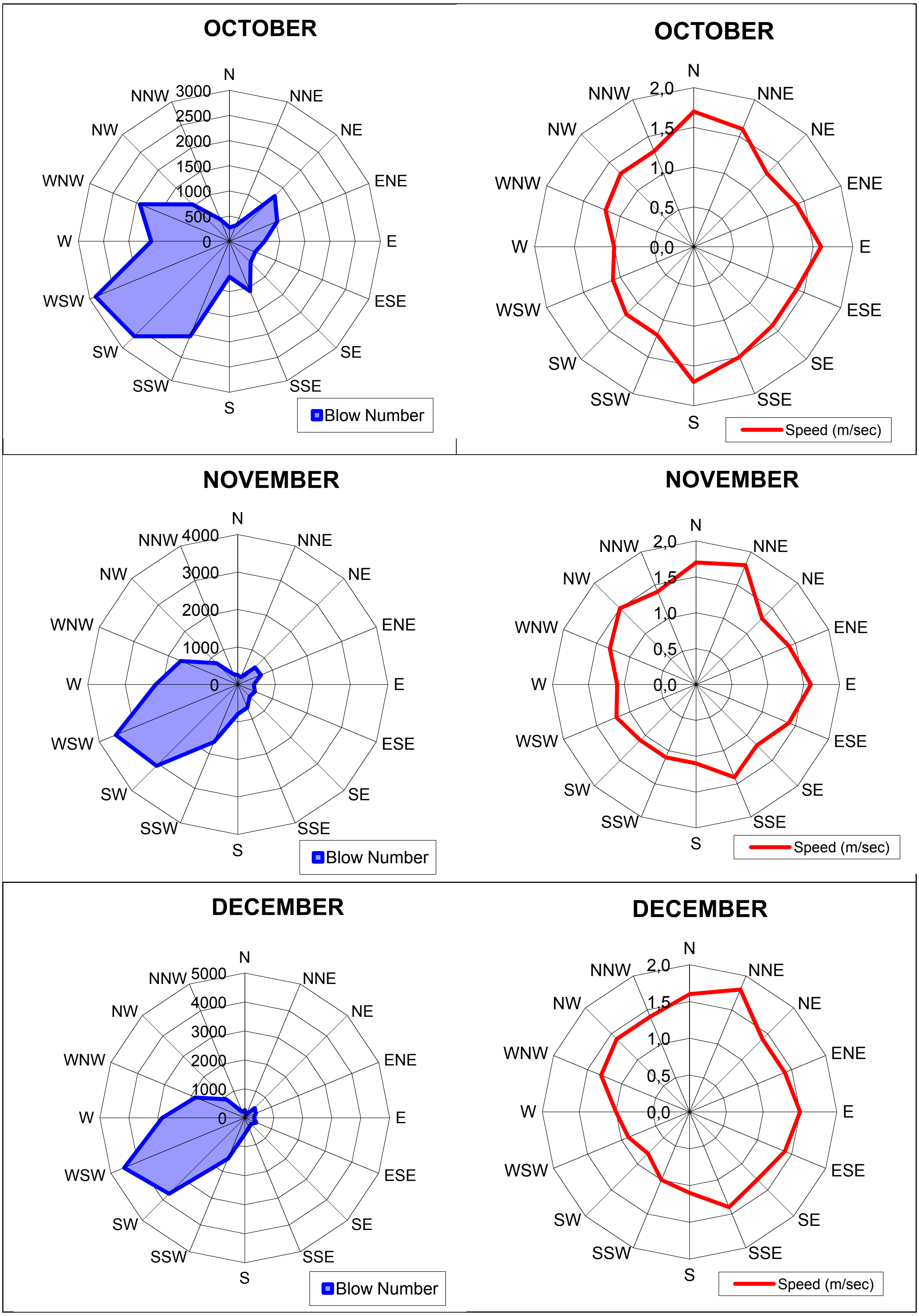


Figure IV.9 Monthly Wind Diagrams According to Wind Blow Numbers and Average Wind Speeds (Cont.)

According to data from Varto Meteorology Station, annual average wind speed is 1.26 m/sec. Monthly average wind speeds are given numerically in Table IV.10 and graphically in Figure IV.10.

Table IV.10. Monthly Average Wind Speed

Months	January	February	March	April	May	June	July	August	September	October	November	December	Average
Average Wind Speeds (m/sec)	0.90	0.90	1.20	1.70	1.70	1.40	1.40	1.40	1.40	1.20	1.10	0.80	1.26

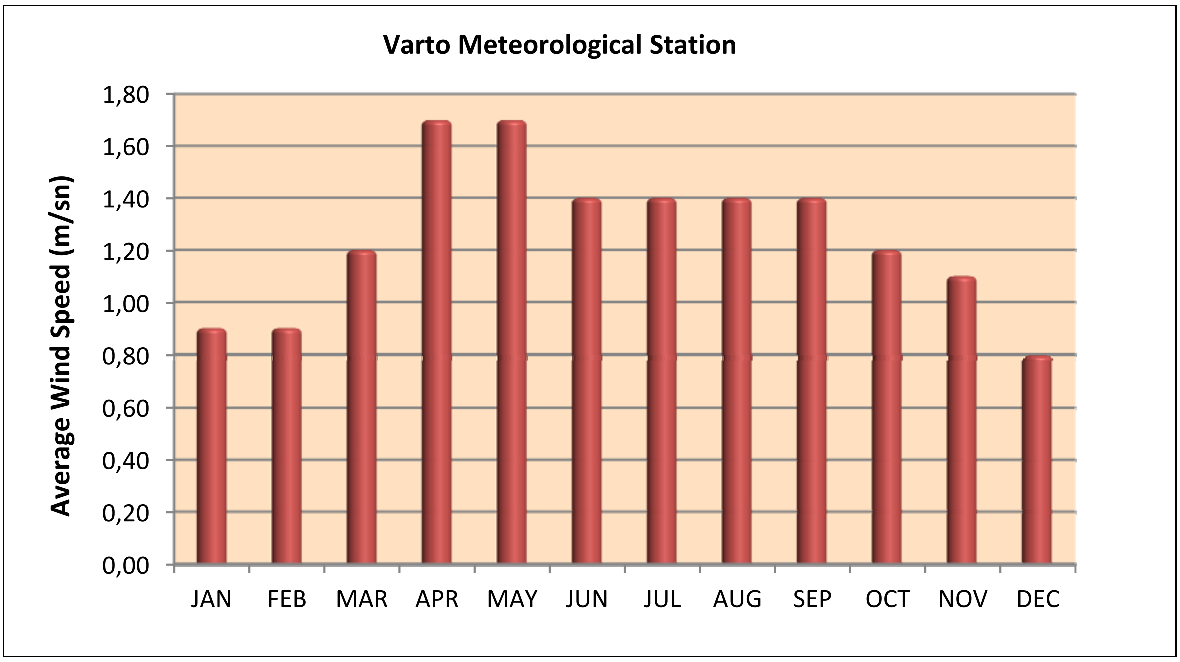


Figure IV. 10. Monthly Average Wind Speeds

The wind speed data of the Varto Meteorological Station indicate that the highest speed was recorded as 28.5 m/sec in the direction of Southwest (SW).

During this observation period, numbers of annual average stormy days are 4 days and number of annual average strong windy days is 28.5 days. Maximum wind speed and directions and average stormy and strong windy day numbers are given in Table IV.11.

Table IV.11. Monthly and Annual Wind Distributions

Months	Maximum Wind Directions	Maximum Wind Speed (m/sec)	Number of Average Stormy Days	Number of Average Strong Windy Days
January	WSW	23.4	0.2	0.7
February	NW	25.0	0.2	0.7
March	SW	28.5	0.2	1.3
April	NNE	28.1	0.4	3.4
May	WNW	25.4	0.9	4.7
June	WSW	25.2	0.4	3.0
July	NNE	24.6	0.4	2.9
August	NNE	20.1	0.3	3.8
September	NW	22.3	0.4	3.3
October	WNW	21.4	0.2	2.7
November			0.2	1.4
December			0.2	0.6
Annual	**SW**	**28.5**	**4.0**	**28.5**

IV.2.2. Geological Characteristics (Physico-chemical characteristics of project area and material borrow areas geological structure, tectonic movements and seismicity, stratigraphic columnar section, borehole logs, mineral sources, landslip, unique formations, snowslip, flood, rock fall, 1/100,000, 1/25,000 and/or 1/5,000 scaled geological map and geotechnical survey if it has legend, and information, figures and maps)

In this section, landslide, flood and geological characteristics and seismicity of the Project area and its vicinity were examined. “Alpaslan II Dam and HEPP Project, Final Project Stage, Geotechnical Survey Report” is presented in App-7.

General geology map of the project area is given in App-8, detailed geological plan and sections of project units are presented in “Alpaslan II Dam and HEPP Project, Final Project Stage, Geotechnical Survey Report” that is provided in App-7.

IV.2.2.1. General Geology

IV.2.2.1.1.Stratigraphical Geology

In the dam and reservoir area and their vicinity, volcanic rocks that are active in the same period of the Tertiary aged sedimentary rocks and volcanosedimentary units crop out. In the order from oldest to youngest, these rock units are Oligocene aged Yazla, Upper Oligocene-Lower Miocene aged Adilcevaz, Upper Miocene-Pliocene agec Zirnak and Pliocene aged Solhan formations. In broader sense, formation names that are used by previous researchers who carried out geological studies are used. Stratigraphic sections of Alpaslan II Dam and its vicinity is given in Figure IV.11.

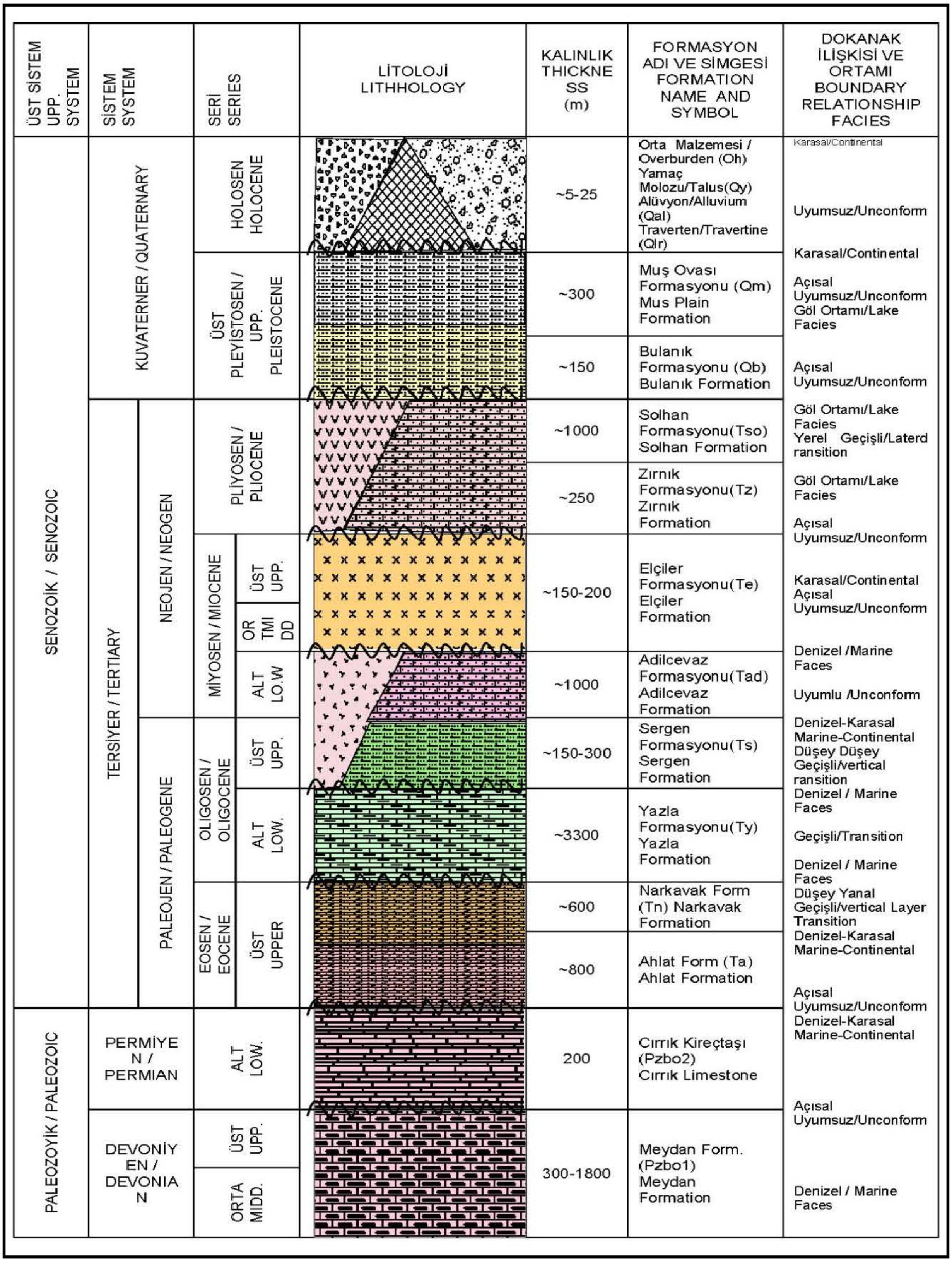


Figure IV.11. The Generalized Stratigraphic Section of Alpaslan II Dam Site and its Surroundings

Sedimentary Rocks

Yazla Formation

Yazla formation is not observed in dam site and reservoir, but can be seen near the project area. This formation is widely distributed in Mus Tertiary Basin and on the South of dam site. Formation lithology is formed of sandstone-claystone at bottom and sandstone-limestone-siltstone at top level. The thickness of the formation, which is composed of medium-thin and lamina levels, is measured as 3,289 m. The age of the Yazla formation is stated as Oligocene and Adilcevaz formation is on the Yazla formation with conformity.

Adilcevaz Formasyonu

Adilcevaz formation is situated in the upper levels of the upstream and the right and left bank of the dam in project area. It continues in the upper levels from the right bank of the dam to the west. The stratigraphic thickness of the formation is 690 m. It is composed of sandstone - siltstone – claystone with conglomerate intercalated. The lower units of the formation are thick-very thick and the upper units of the formation are thin and laminate. The age of the Adilcevaz formation is stated as Upper Oligocene and Lower Miocene. Zirnak Formation is on the Adilcevaz Formation with an angular unconformity.

Zırnak Formasyonu

The stratigraphic thickness of Zirnak Formation, which is observed in the reservoir and its vicinity along the Murat River, is 250 m in study field and 500-600 m in general. The sedimentary unit on terrestrial facies is formed of recurring of various lithological units in complex and chaotic form. The thin-thick unit is composed of conglomerate – sandstone and claystone in lower levels and it shows a chaotic structure in upper levels with the composition of claystone – siltstone – sandstone – marn - limestone and basalt irregularly (bimrock, Block-In-Matrix). This formation is on the Yazla and Adilcevaz formation with an angular unconformity. In upper levels, it is gradually transitional laterally and alternate vertically with volcanic rocks of Solhan Formations and pyroclastics. The age of this formation is stated as Pliocene (Figure IV.12).

Figure IV.12. Close up Appearance of Zirnak Formation in and around the Dam Site

Solhan Formation

Solhan Formation outcrops in and around the research area and consists of interfingering volcanoclastic and lava laterally and alternation vertically. Lithology of Pyroclastic sedimentary is defined as agglomerate, volcanic breccias, tuffite, lava, basalt and andesite. Lava that are compatible with the pyroclastic stratification, which is thin – medium laminated, horizontal and low-inclined, is represented mostly by basalt. It is on the Adilcevaz Formation with an angular unconformity. It is laterally transitive with Zirnak Formation. Quaternary alluvial rocks are on this formation incongruously.

The stratigraphic thickness of the formation is 1,000 m mostly, and 100-150 m generally in the study area and it vicinity. The age of this formation is stated as Pliocene and Lower-Pliocene.

Alluvion-Slope Debris and Residual Ground Cover Material

Quaternary alluvion is represented in the junction point of Bingol Stream and Murat River and valley bed of Bingol River with the maximum width of 2 km. The stratigraphic thickness of the formation is about 2-4 m according to drilling data. Alluvion distribution, which is composed of gravel and thin-thick sand with silt and clay, continues 4 km upstream along the Bingol Stream. Except for these junction points, it has been determined that width is ranging from 50-500 m in the vicinity of both of these river beds. Alluvial material thickness is minimum 5.0-7.5 m in the alluvial deposit at the junction of both of these two river and located upstream of the Dam.

Slope debris with the thickness of 2-25 m and weathering zone of base rock are covering the base rock. The thickness of slope debris, which is composed of polyangular half cornered gravel and less sandy and mainly clay and small quantities of silt, has a range of 2-10 m. The thickness of weathered rock, which is more clayey and developed due to weathering depending on lithological structure, rises up to 20-25 m on the base rock. It is observed that this material was exposed to movement due to inclined slope (see Figure IV.13).

Figure IV.13. Picture of Alluvium Stored Along the River Bad

Magmatic Rocks

This unit is differentiated as Solhan formation from the volcanic rocks that constitute Varto group in the southern of Bingol volcano. It is composed of basalt, andesit and observed in large areas within the study area. Detailed description of the formation is presented in the section “Solhan Formation”.

IV.2.2.1.2.Structural Geology

Tectonic movements were slowed down after paroxysmal stage, which has been ended in Late Cretaceous. The formations that are deposed on sedimentary basins, which are rather independent of each other, are seen on old massives due to vertical movements based on rising and falling of sea levels on the shoreline. The low sloped layers are generally aligned at NW-SE and inclined at 15º-30º to the northeast. Folding has not been detected. Occasional monocline structures have been observed. It has been determined that the Faults detected with discontinuities are low dip-slip normal fault, with NE-SW and NW-SE alignment and a slope of 45º-75º.

Yazla formation, which is the oldest unit in the vicinity of the research area has concordant transition, contact with Eocene-Olygocene aged formations is beneath and Adilcevaz formation on top. Adilcevaz and Zirnak formations have concordant transition contact with each other with an angular discordance. Zirnak and Solhan formations are lateral and vertical transitive and provide harmonic contact. Quaternary sediments have discordance with formations mentioned above.

IV.2.2.1.3 Seismicity

The Project area is located within the “First Degree Earthquake Zone” according to Turkey Earthquake Zones Map prepared by the Ministry of Environment and Urbanization (see Figure IV.14).

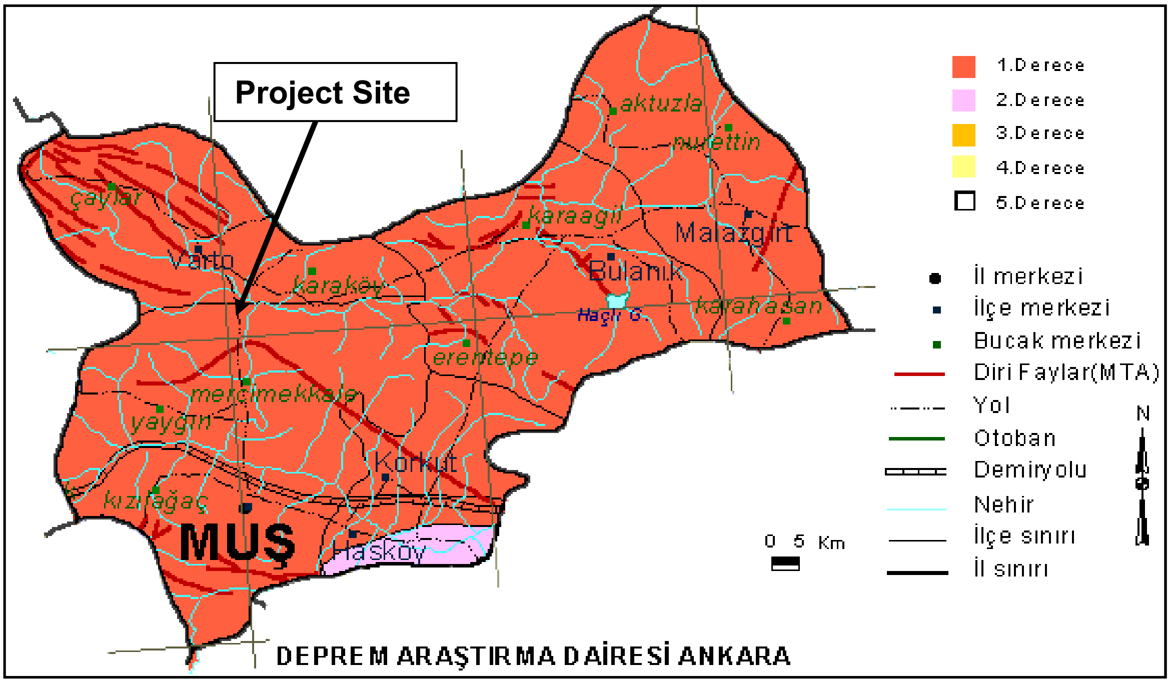


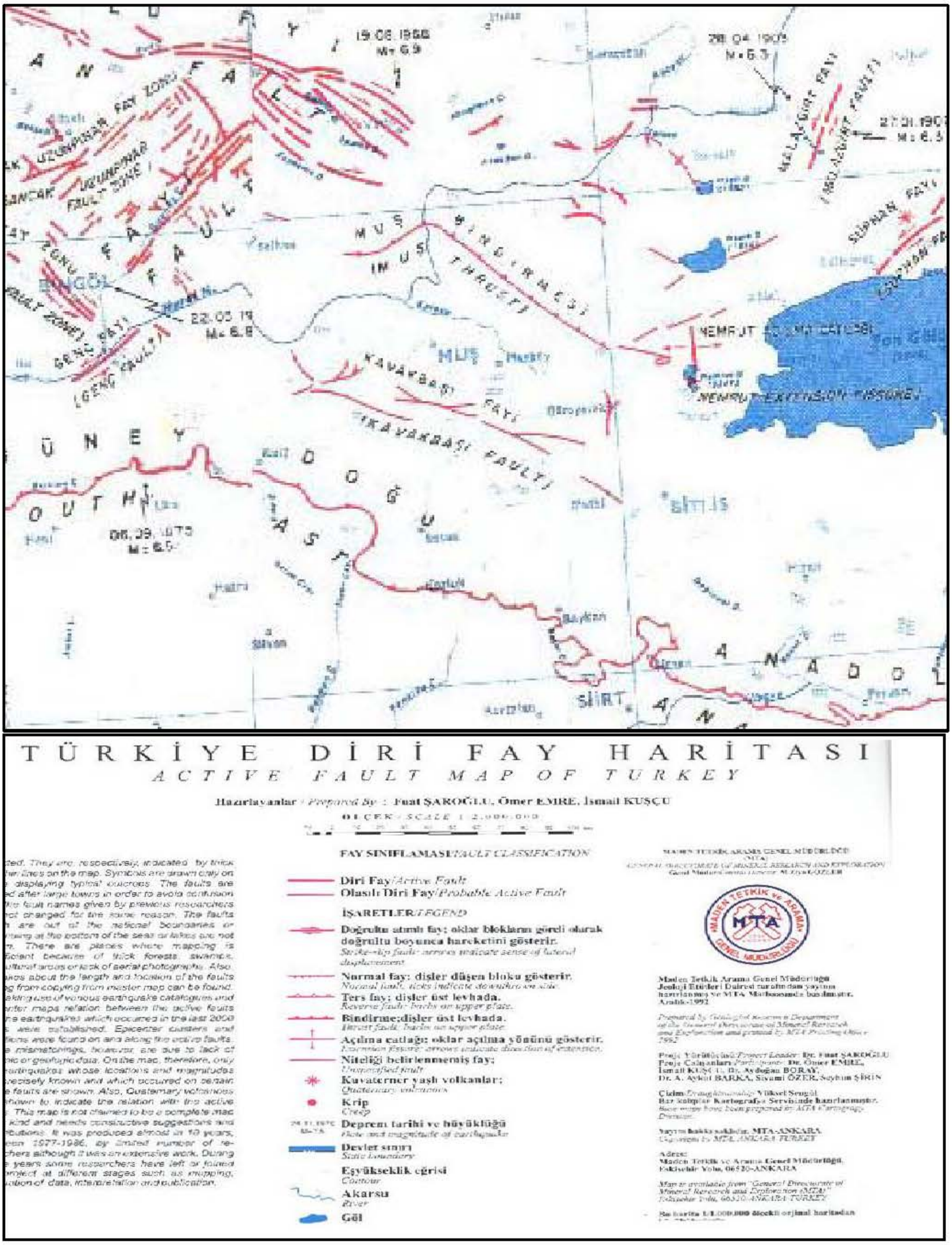
Figure IV.14. Map of Seismic Zones in Mus Province

Alpaslan II Dam site is located near the vicinity of East Anatolian Fault Zone (EAFZ) on the southwest and North Anatolian Fault Zone (NAFZ) on the northwest. These fault zones, which are the biggest fault zones of Anatolia, are known as active fault systems. Dam site is located 50 km away from Karliova, which is junction point of these two fault zones (EAFZ and NAFZ).

East Anatolian Fault is left sided strike slip fault in the direction of NE-SW extending between Antakya and Karliova. Vertical slip of East Anatolian Fault is 400 m and total slip is 22 km. Fault Zone was formed with collision of Arabian and Anatolian plate in late Miocene. North Anatolian Fault is right sided strike slip fault extending 1,500 km from East Anatolia to Greece. The width of the zone is between 100 m and 40 km.

Except for East Anatolian Fault Zone and North Anatolian Fault Zone, there is another fault in Mus province and its vicinity that is called Mus overlap.

Active fault map of Project site and its immediate vicinity is given in Figure IV.15



Figurel IV.15. Active Fault Map for the Study Area

“Assessment of Eartquake Hazard for Alpaslan II Dam Location” was prepared by Bogazici University Kandilli Observatory and Earthquake Research Institute for the determination of earthquake risk of the area. Mentioned report is presented in App-9.

Within the scope of “Active Fault Survey”, which is prepared for the Project area and its vicinity, active faults around the Project area and ground acceleration rates from their dislocation were identified. Within the scope of this study, geological units in the field have been distinguished, location of active faults, their lengthening and activity and possible impacts of eathquakes on dam was studied.

The oldest unit of studied area is Adilcevaz formation. The formation continues from Dumlusu Village located east of the Murat River to the west of the Murat River without interruption. During and after sedimentation, probably in Middle-Late Miocene, both sides of Murat River had been raised with the normal faulting, thus, Pliocene aged Zirnak Formation continued along the Murat River till Akpınar.

Within the study area, Adilcevaz, Zirnak ve Solhan formations and Quaternary aged rocks that affected from active faults were observed. Active faults of study area are Caycati, Leylekdag and Varto segments, which are located on North part of study area in the direction of NW-SE. The other active faults of the area are Goynuk segment between Bingol and Karliova and Mus fault on their south. Details of the analysis is given in “Alpaslan II Dam and HEPP Project Zorova Axis and its Vicinity Active Fault Survey Report” in “Second Stage Geological and Geotechnical Research Information and Geotechnical Summary Report”, which is prepared by Hidro Dizayn Muh. Mus. Ins. ve Tic. A.S. and Insitu Jeoloji Jeoteknik Sondajcilik Ltd. Sti. in October, 2010 (see App-10).

Seismic Hazard Analysis study was carried out based on probability calculus of design spectrum (see App-11). In this study, 3 linear and 1 areal earthquake sources were identified for seismic hazard study based on calculus of probabilities (see Figure IV.16 and Figure IV.17). Seismic hazard analysis based on probabilistic methods for Mus Alpaslan II Dam and HEPP site, which is located within the 1st degree earthquake zone, was carried out consistently with the ICOLD Bulletin No. 72.

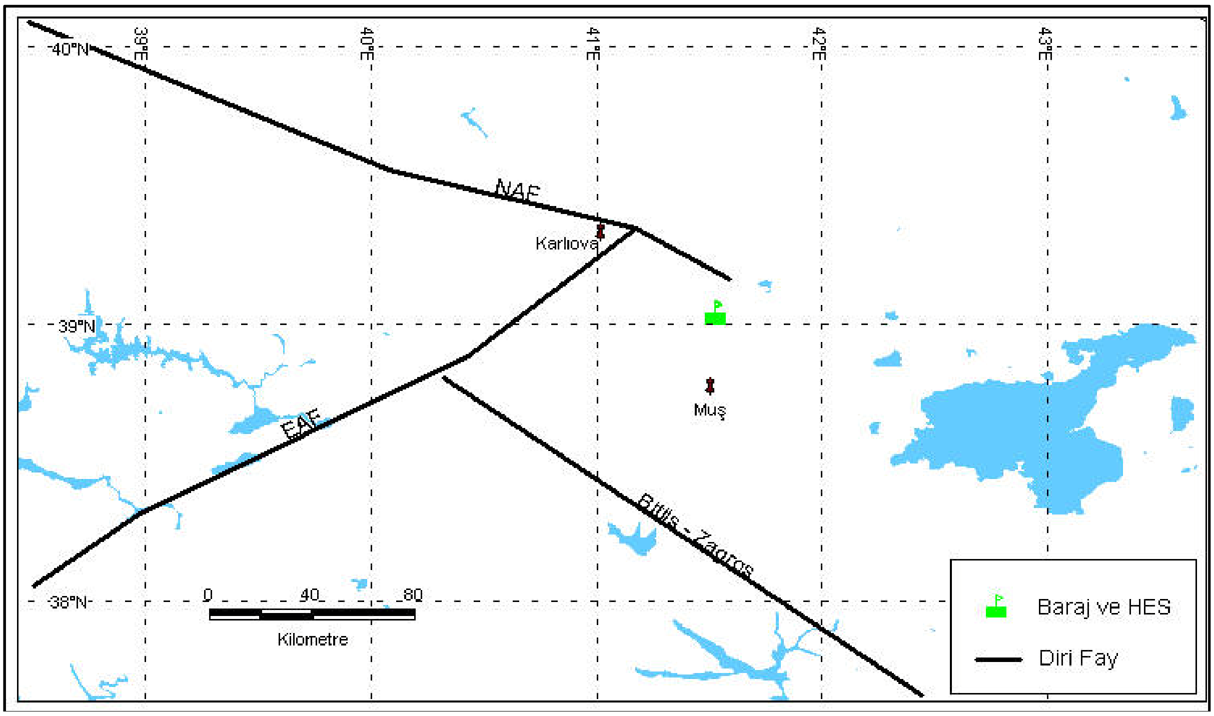


Figure IV.16. (a) Linear Earthquake Sources, which are Determined for Seismic Hazard Analysis Based on Probability Calculus for Working Site

In this study, Spectral values that represent danger levels of Operation Basis Earthquake (OBE), the Maximum Design Earthquake (MDE) and the Maximum Earthquake Created Seismic Sources (MCE) were determined. As compared with the comparable spectral values defined by Earthquake Regulations (2007), lower values were determined in the area. As well as the Earthquake Regulations FEMA-P750 (Earthquake Risk Analysis, October, 2010), which is used for seismic designs in United States of America, were used in order to evaluate the design spectrum and overhaul the rack spectrum due to different types of soil. Detailed information about seismic hazard analysis for the dam site is given in App-11.

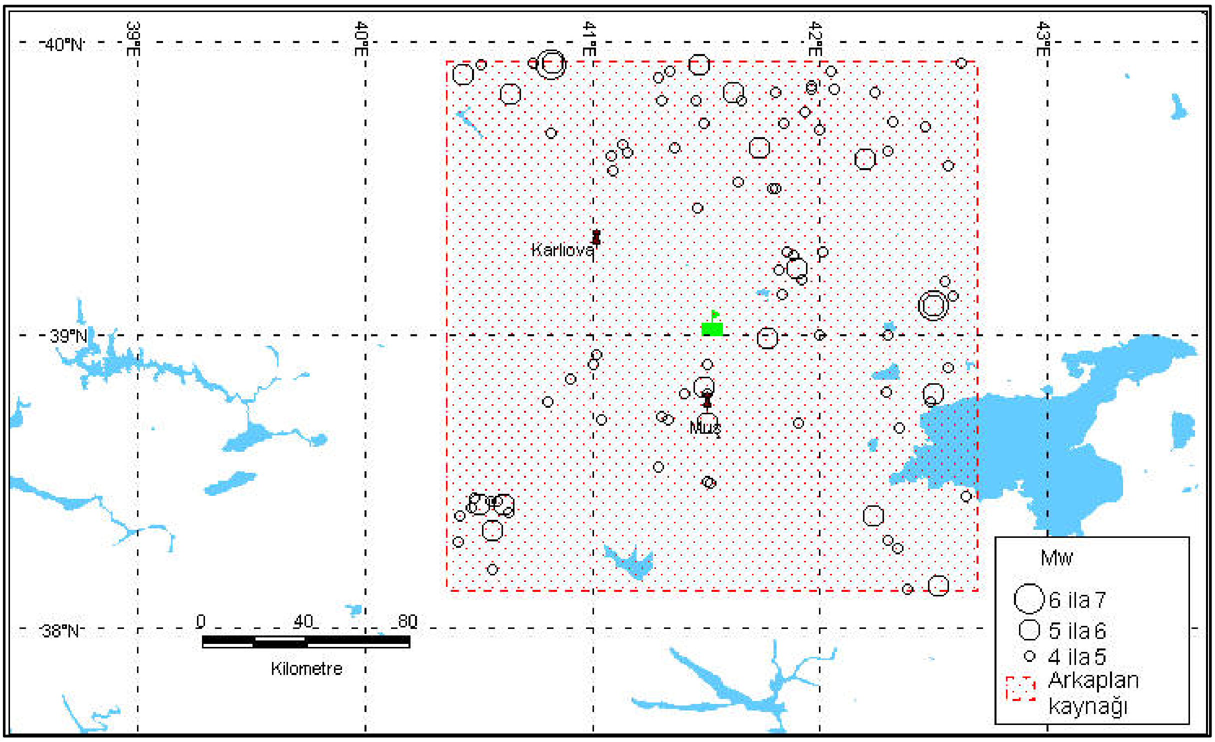


Figure IV.17. (a) Linear and (b) Areal Earthquake Sources, Which are determined for Seismic Hazard Analysis based on Probability Calculus for Working Site

Within the scope of the project, earthquake-resistant design and construction of all buildings and structures will be done considering Regulations for Buildings in Disaster Areas (2007) and the relevant provisions and standards will be implemented during the design and construction phase imn order to comply with the those regulations.

IV.2.2.1.4. Geology of Dam Site and Related Structures

During the geological studies carried out within the Project, a total of 2,798 m at 41 boreholes were drilled in the dam site and its vicinity. In the boreholes, pressiometer tests, hydraulic pressure tests, and standard penetration tests were done and some laboratory analyses were carried out on bores and core samples. Also, test pits and drains were dig and material investigations were done.

Dam Axis Location

Two base rocks in Alpaslan II Project Zorova axis are Adilcevaz and Zirnak Formations. Dam body is located on Adilcevaz Formation on the left bank of the spillway, and Zirnak Formation on the right bank, thalweg and a part of left bank.

On the left bank, lithology of Adilcevaz Formation is defined as sandstone, conglomerate, limestone, claystone and mudstone from the upper grade of the slope up to the approximately 1,250 grade. Under this grade, this lithological structure changes to fine-grained sandstone and sandstone. Under the dam body, Adilcevaz Formation is composed of greenish-grey claystone and sandstone. In dam axis, Zirnak Formation is composed of different size of basalt, limestone, sandstone, siltstone and marl blocks in sandstone, claystone, siltstone, tuff, tuffit matrix. The sandstones, claystones and siltstones are loose in various locations with little hold on each other. These lithological units show a heterogenous and anisotropic structure vertically and horizontally.

Spillway

Base rock type near the spillway, which is planned to be constructed on the left bank, is Adilcevaz Formation. According to data belonging to drilling works along the spillway, Quaternary aged cover material, which is composed of fine-gravelled and silty clay and between 8-22 m of thickness, is located on the base rock. The thickness of the cover material is 8 m between the spillway sill structure and water stilling device and 22 m in the vicinity of water stilling device. The carrying capacity of the Adilcevaz formation is sufficient for the spillway if the cover material is all excavated and the spillway is based directly on this formation.

Energy and Derivation Tunnel

Derivation/energy tunnels were planned to project on the left bank with 8 m diameter. The length of T-1 tunnel is 875 m and T-2 tunnel is 950 m. Base rocks in both tunnels are Zirnak and Adilcevaz Formations. According to data belonging to drilling works along the spillway, tunnels will be located on Zirnak Formation at about 190 m from the entrance and the remaining part will be located on Adilcevaz formation.

Power Plant Site

Base rock in plant site is Adilcevaz Formation. In boreholes, after 11-12 m thick layer of clayed cover material, Adilcevaz Formation was observed. Pressiometer tests were carried out in holes with 2 m intervals. According to test results, safe bearing capacity (q_{safe}) is defined as 18 kg/cm^2.

Reservoir

Due to lithological characteristics and hydrogeological conditions of the formations in the reservoir area, the area is impermeable and any water leakage is not expected from the reservoir. Formations located in reservoir are covered with material with a thickness of 1-20 m. Some part of cover material was either exposed to or have a potential to be exposed to slope instability. Some of these areas would be inundated by the reservoir, while some would be left on the banks. However, volumes of these areas that can slide into the reservoir are rather small when compared to water volume so no significant impact is expected. Impermeability and slope stability of reservoir is given in detail in the above-mentioned geotechnical report.

IV.2.2.1.5. Natural Disaster Status

Landslides

Landslides are seen within the studied area. The obvious landslides occur at Talanyaylasi Hill and Kas Hill that are located 1 km northeastern side of Dumlusu and occur towards southwest (see Figure IV.18). In this site, landslides are caused by the gradient of the slope and lithology of hypotonic loamystone, sandstone, which form the lower part of Adilcevaz Formation.

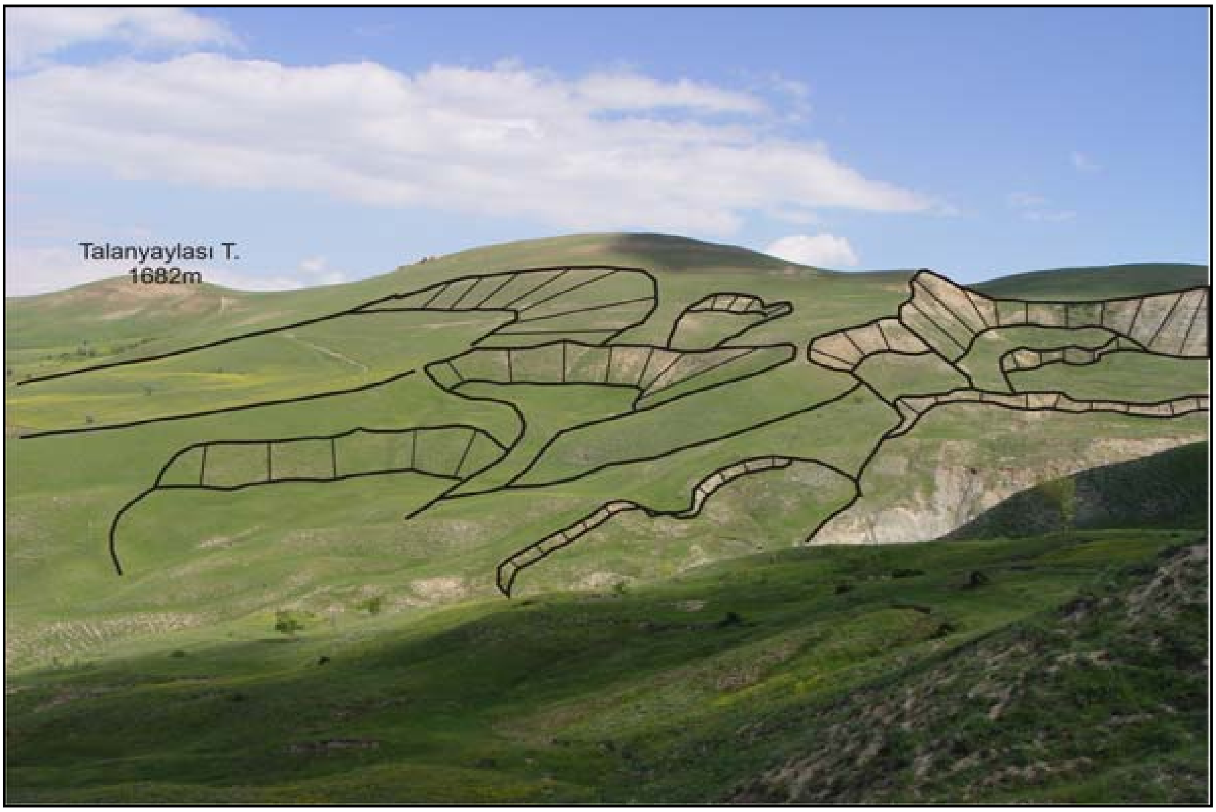


Figure IV.18. Landslides at 1 km Northeast of Dumlusu to the Soutwest

Another landslide can be observed in Gocmenler District residential area. Landslides on Adilcevaz Formation could affect Zirnak Formations (see Figure IV.19). This landslide is originated from high slope gradient of Adilcevaz Formation on the side of Murat River. Landslide on west of Murat River took place at 1 km northeast of Akpinar. Zirnak Formation, which covers basalt block, is also affected from landslides on Adilcevaz Formation (see Figure IV.20).

As a result of the studies and drilling activities, landslide supply thickness on rigth bank is identified as 22 m and on left bank as 15 m. Landslides have the characteristics of fossil landslides. As it can be seen from penetration tests, which are carried out in wells that were opened in the Project area, landslide supply is named as “solid-very solid” between 0.00-10.00 m and “very solid-extremely solid” between 10.00-20.00 m.

No problems with respect to carrying capacity and stability of the Zirnak and Adilcevaz formations are expected at Zorova dam axis, once the cover material and dissociation zones are stripped with surface excavation. It is expected that a 5 m excavation would be necessary on the right bank and the river bed and a 10 m excavation is necessary on the left bank at the dam axis site.

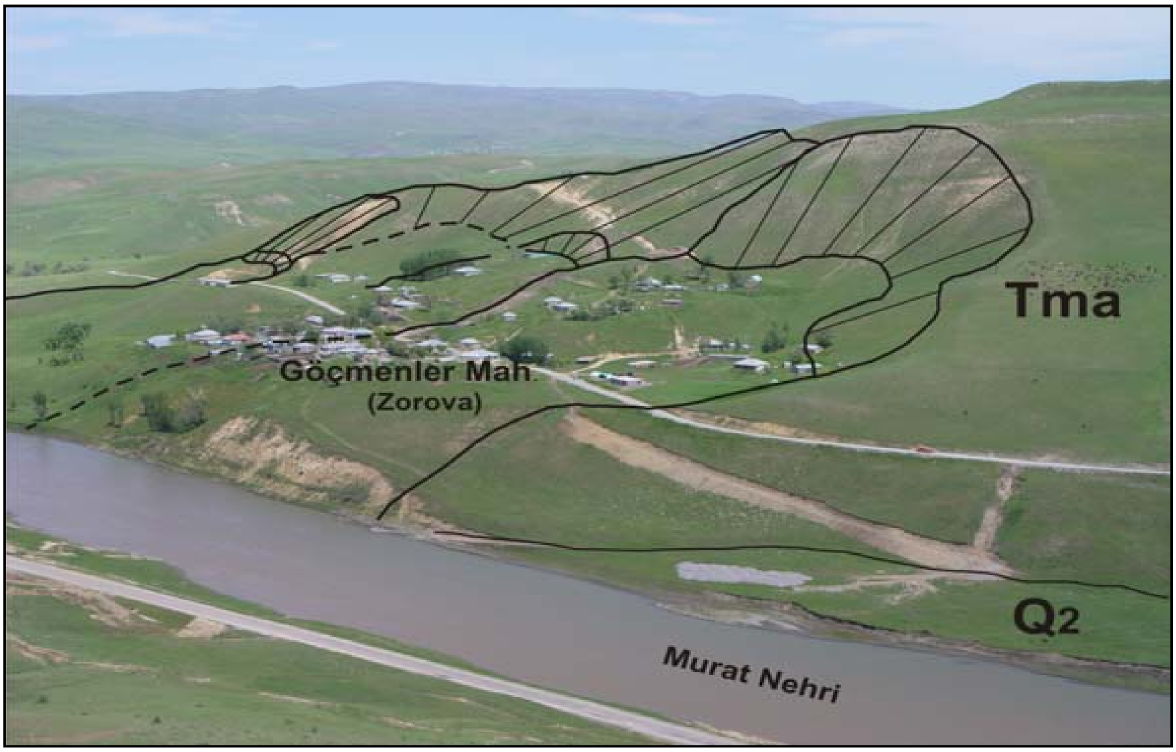


Figure IV.19. Landslides formed by Adilcevaz Formation from Higher Elevations in the East to West in the vicinity of Gocmenler District

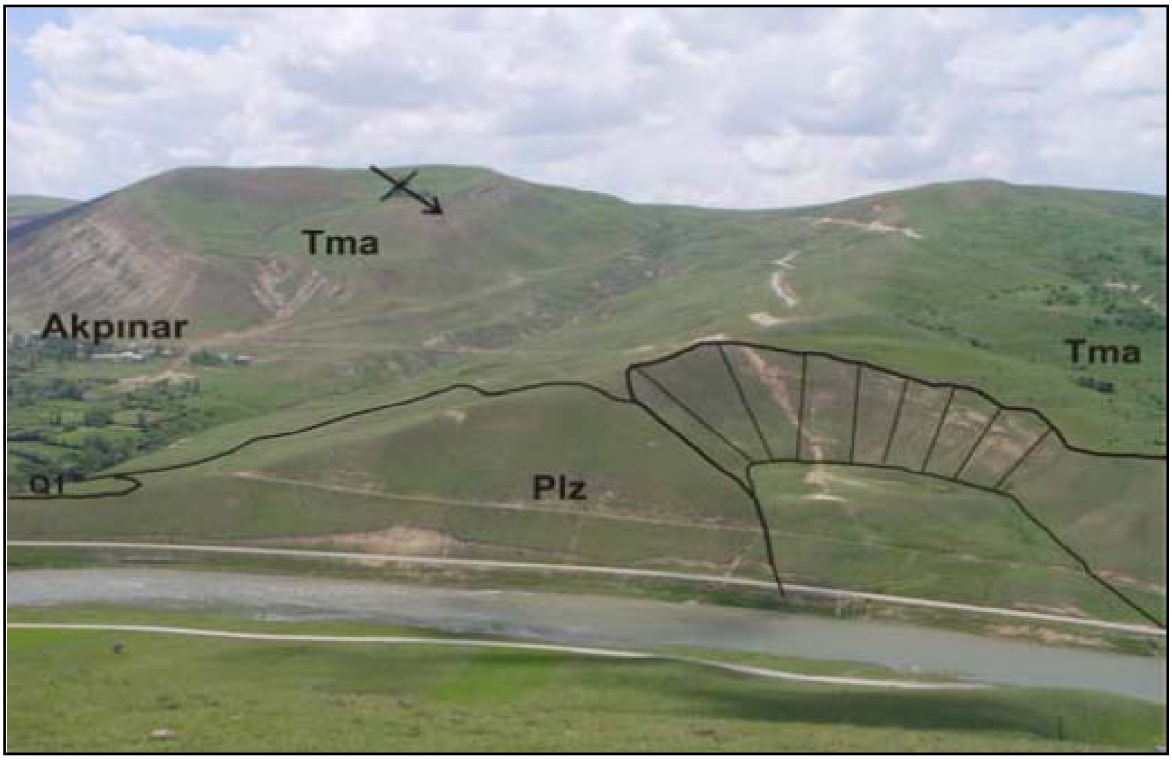


Figure IV.20. General View of the Landslide towdrs Murat River at 1,250 m NE of Akpinar

Where landslide risks are identified in the nearby settlements during construction and impounding due to the project, soil investigations would be conducted in order to prevent any landslide events. Necessary precautions will be taken according to the results of these investigations in order to reduce landslide risks.

Flood

Within the boundaries of Mus province, floods are seen from time to time. Merkez Dere, Murat Pasa, Kale Quarters, Sungu, Kırkoy, Karaagacli Subdistrict ve Kiyik, Ucdere, Suboyu, Yazla, Kumluca, Egirmenci Villages, Bulanik District, Yazbasi, Sultanli, Dokuzpinar Villages and Rustemgedik Town in Mus province have sensitivity in terms of flood. No flood was recorded in 2009. Settlements which are or might be affected from flood incidents in Mus province, are given in Table IV.12. As it stated in previous sections, one of the most important advantage of the project is preventing the risk of flooding that may occur on Murat River.

Table IV.12. List of Settlements where Flood Incidents Occurred or have Probability to Occur

District	Settlement	River from which it is/might be affected from
Merkez	Muratpasa Quarter	Sogurman Stream
Merkez	Suboyu Village	Murat River
Merkez	Sungu Subdistrict	Karasu River
Merkez	Yazla Village	Abdulbahar Stream
Merkez	Ucdere Village	Karasu River - Carcay Stream
Merkez	Kumluca Village	Karasu River
Merkez	Kiyik Village	Karasu River
Merkez	Kirkoy Subdistrict	Abdulbahar Stream
Haskoy	Duzkisla Subdistrict	Karasu River
Malazgirt	Aynalihoca Village	Murat River
Bulanik	Sultanli Village	Murat River
Bulanik	Yazbasi Village	Hinis Creek
Bulanik	Rustemgedik Subdistrict	Murat River
Bulanik	Yoncali Subdistrict	Korsu Creek

** Reference; Mus Province Environment Situation Report, 2009*

IV.2.3. Hydrogeological Characteristics (ground water level, currently available wells, deep and artesian well, distance of these resources to the project area, safe drainage value, physical, chemical, bacteriological characteristics of water, resources flow rates, current and planned uses of groundwater resources)

In dam and reservoir area and their vicinity, volcanic rocks that are active in the same period of the Tertiary aged sedimentary rocks and volcanosedimentary units crop out. In the order from oldest to youngest, rock units are Oligocene aged Yazla, Upper Oligocene-Lower Miocene aged Adilcevaz, Upper Miocene-Pliocene aged Zirnak and Pliocene aged Solhan formations. These formations are covered by Quaternary aged slope wash and alluvium in Murat River and Bingol Creek bed.

Adilcevaz Formation is composed of sandstone, claystone and upper grade of this formation is composed of lime stone and conglomerate. Zirnak formation is composed of sandstone, claystone, siltstone, marn and irregular type of basalt. Solhan Formation is composed of volcanoclastics and lava laterally and vertically.

According to lithological and structural characteristics, Adilcevaz and Zirnak Formations have impermeable characteristics but they do not show ground water aquifer characteristics. There are small seasonal infiltrations in the upper layers of Adilcevaz Formation. Within the scope of the studies in the dam site, hydraulic pressure tests were carried out in boreholes in order to evaluate the permeability values of Adilcevaz and Zirnak Formations. According to results of hydraulic pressure tests, 1-5 lugeon permeability values, which represent the impermeable and low-permeable category, were acquired in Adilcevaz and Zirnak Formations.

In dam site and its vicinity, alluvium thickness in Murat River bed is 2-5 m and it does not show a significant deposit.

In the upper elevations of the reservoir area Solhan formation is surfaced. In the basalt and andesite parts of this formation limited groundwater storage is seen due to faults and cracks. This groundwater are surfaced as small springs (1-3 L/sec) at various elevations depending on the impermeable layers in the formation. Where the impermeable layers in Solhan Formation reach the river bed, the stored groundwater discharges into the river, but the discharge points cannot be clearly observed.

Ground water flow direction in the Project area and its surroundings are from the hills to Murat River and Bingol Creek. Groundwater levels and elevations measured in the boreholes in the study area are given in Table IV.13.

Table IV.13. Ground Water Levels and GW Elevations Measured in Boreholes in Study Area

DATE	Well No. and Groundwater Levels (m)																	
	WW-2		WW-4		WW-7		WW-10		WW-11		WW-15		WW-16		WW-17		WW-18	
	Static Lv. (m)	GW Elevation (m)	Static Lv (m)	GW Elevation (m)	Static Lv (m)	GW Elevation (m)	Static Lv (m)	GW Elevation (m)	Static Lv (m)	GW Elevation (m)	Static Lv (m)	GW Elevation (m)	Static Lv (m)	GW Elevation (m)	Static Lv (m)	GW Elevation m)	Static Lv (m)	GW Elevation (m)
17.12.2009			14.0	1293.0														
14.02.2010	19.0	1330.0	13.1	1293.9	57.0	1321.0	6.5	1309.5										
14.06.2010	18.9	1330.1	12.9	1294.1	52.9	1325.1	2.8	1313.2									29.3	1348.7
21.07.2010	18.8	1330.2	12.3	1294.7	51.1	1326.9	2.6	1313.4							27.6	1295.4	29.0	1349.0
26.08.2010	18.6	1330.4	12.2	1294.8	50.1	1327.9	2.6	1313.4			2.9	1267.1	15.5	1278.5	11.0	1312.0	29.0	1349.1
01.09.2010	18.3	1330.8	12.2	1294.8	48.8	1329.2	2.5	1313.5			2.9	1267.1	24.9	1269.1	11.0	1312.0	29.0	1349.0
15.09.2010	18.1	1330.9	11.9	1295.1	48.3	1329.8	2.3	1313.7			2.9	1267.1	24.9	1269.1	11.0	1312.0	29.0	1349.1
01.10.2010	18.0	1331.0	11.8	1295.2	48.2	1329.8	2.0	1314.0			2.8	1267.2	25.0	1269.1	11.0	1312.0	28.9	1349.1
16.10.2010	18.0	1331.0	11.8	1295.2	47.9	1330.1	1.3	1314.7			2.8	1267.2	25.0	1269.0	11.0	1312.1	28.9	1349.1
02.11.2010	17.6	1331.4	11.7	1295.3	47.8	1330.2	1.3	1314.8			2.8	1267.2	25.1	1268.9	10.9	1312.1	28.9	1349.2
15.11.2010	17.6	1331.4	11.6	1295.4	47.4	1330.6	1.2	1314.8			2.7	1267.3	25.2	1268.9	10.9	1312.1	28.8	1349.2
01.12.2010	17.6	1331.5	11.4	1295.6	47.2	1330.8	1.2	1314.8			2.6	1267.4	25.3	1268.8	10.9	1312.1	28.3	1349.7
17.12.2010	17.5	1331.5	11.4	1295.7	47.2	1330.9	1.2	1314.8			2.6	1267.4	25.3	1268.7	10.9	1312.2	28.3	1349.7
03.01.2011	17.5	1331.5	11.3	1295.7	47.1	1330.9	1.2	1314.8			2.6	1267.5	25.3	1268.7	10.8	1312.2	28.2	1349.8
18.01.2011	17.5	1331.5	11.4	1295.7	47.1	1330.9	1.2	1314.8			2.6	1267.5	25.3	1268.7	10.9	1312.2	28.3	1349.8
01.02.2011	15.8	1333.3	10.6	1296.5	45.4	1332.7	1.0	1315.0			2.0	1268.0	24.8	1269.3	10.0	1313.1	26.8	1351.3
01.04.2011	15.5	1333.5	10.5	1296.5	44.3	1333.7	1.0	1315.0			1.8	1268.3	24.7	1269.3	9.9	1313.1	26.7	1351.3
15.04.2011	15.3	1333.8	10.5	1296.5	44.3	1333.8	1.0	1315.0			1.8	1268.3	24.6	1269.4	9.9	1313.1	26.8	1351.3
01.05.2011	15.2	1333.8	10.5	1296.6	44.0	1334.0	1.0	1315.1	61.5	1318.85	1.8	1268.3	24.6	1269.4	9.9	1313.2	26.8	1351.3

Not: River bed elevation at Dam site is about 1,270 m

There are hydrogeological impermeable units within the Project site and its vicinity. Therefore, there is no deep ground water well or sping discharge. Drinking and irrigation water requirements of villages in the Project area and its vicinity are met from springs at higher elevations, which show limited discharge (from andesitic and basaltic lava of Solhan Formation). Gardens near river bed are irrigated from Murat River and Bingol Creek.

In order to determine the ground water potential of Mus Plain, ground water resources were investigated by SHW in 1976. However, this study did not include the Project area.

There are no ground water management operations in the Project area or its surroundings.

IV.2.4. Hydrologic Characteristics (physical, chemical, bacteriological and ecological characteristics of surface water resources –lake, river and other wetlands-, flow rates of rivers, seasonal variations, floodings, drainage basin, sedimantation drainage, use of shorelines of surface waters, ecological characteristics, long years flow values for the water resource on which the project would be developed (m^3/sec), long years flowrates representing the water flow gauges and regulator locations that has to be obtained from relevant competent authority with its approval)

Alpaslan II Dam and HEPP proposed within the scope of Mus Alpaslan II Project Planning Report is located on Murat River. It originates at Aladag Mountain near Diyadin district in Agri province then flows to the east direction and passes through Agrı Province and it merges with another tributaries coming from North. Towards the end up Agri Plain, it merges with Seryan Creek from west. Then it flows to the South direction and enters a narrow valley, which has length of about 70.00 km, then passes Malazgirt and Bulanik Plains. It merges with Nadirseyh and Hinis from North and Patnos from South and reaches Alpaslan I Dam site. It flows in the direction of East-West and merges with Bingol Creek, which is the most important tributary on the North and it turns its direction to the North-South. Then it reaches to Alpaslan II Dam site. After Alpaslan II Dam site it passes through Mus Plain.

Within the scope of Alpaslan II Dam and HEPP Project, several flow observation stations were used to identify the flows that come to dam site and upstream facilities. These stations are operated by SHW and General Directorate of Electric Power Resources Survey and Development Administration (EIE). These stations are EIE-2102- Murat River - Palu, EIE- No. 2122 Murat River – Tutak, No. 2152 Murat River – Mus, EIE No. 2158 Bingol Creek - Abdurrahmanpasa Bridge, EIE No. 2174 Murat River – Akkonak ve No. 21-034 Murat Bridge, which belongs to SHW. Also, flow observation stations of SHW are used. These can be listed as; 21-34 Murat Bridge, 21-35 Bingol Suyu-Abdurrahman Pasa Bridge, 21-142 Devi Deresi-Karatoklu, 21-104 Yazici Suyu-Altıncayir, 21-218 Cuma Creek-Kayacik Güven, 21-84 Cuma Creek-Cuma, 21-216 Hanoba Creek-Donerdere, 21-204, 21-04 Murat River-Diyadin, 21-201 Seryan Creek-Karabacak, 21-87 Karahalit Creek- Karahalit, 21-213 Adadere-Agacli ve 21-220 Solhan Stream-Goksu.

Project area is located within the boundaries of Middle Firat Basin. Basin characteristics were presented for dam area using topography data with ArcHydro programme attachment. Location of Alpaslan II Dam in the basin is given in Figure IV.21. The map also includes locations for the stations of EIE and SHW in Middle Firat Basin.

Within the scope of Alpaslan II Dam and HEPP Project upstream facilities water consumption and flows were determined for identifying flows of Alpaslan II Dam site. In this regard missing flow values of the flow gauges were estimated for the upstream facilities and Alpaslan II Dam site using correlations. In these correlations, catchment areas were calculated and the ratios of these areas were used.

Approved monthly mean flow values, which were recorded in flow observation station (No. 2174) of EIE representing the dam site, are given in App-20. Alpaslan II Dam site average flow values were calculated using these values (see Table IV.14). This table and values were confirmed by SHW.

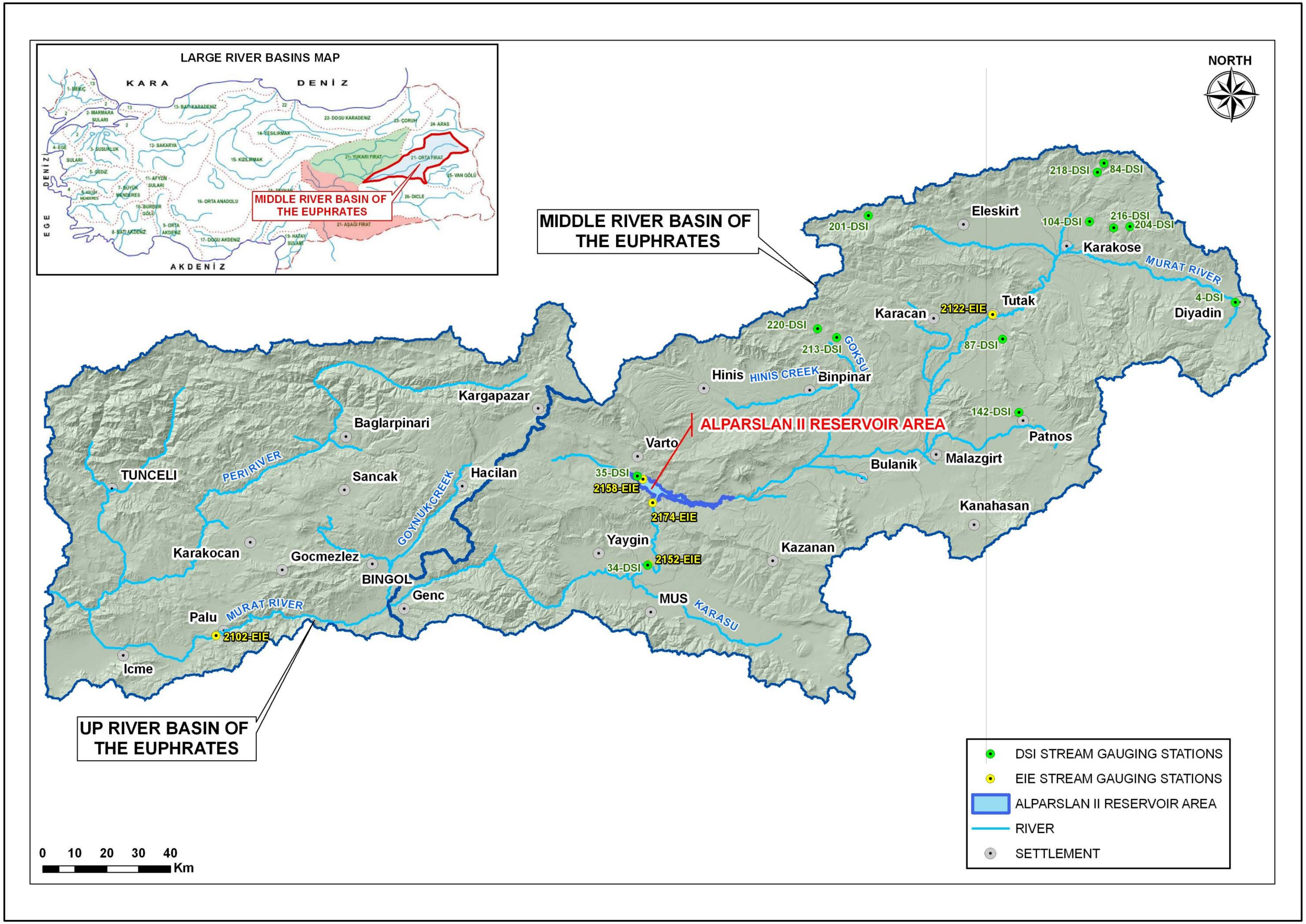


Figure IV.21. Location of Alpaslan II Dam in Middle Firat Basin

Table IV.14. Alpaslan II Monthly Average Flow Values (hm^3)

WATER YEAR	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	Ann.Total
1970	56,830	60,970	62,130	62,640	76,300	189,400	428,600	199,125	53,693	32,574	29,845	29,651	1,281,759
1971	152,213	158,034	166,409	167,775	184,585	507,289	1,110,931	533,337	139,174	87,246	79,937	76,856	3,363,786
1972	107,391	121,046	118,385	79,816	81,043	423,187	660,960	662,286	218,595	74,748	67,273	58,687	2,673,418
1973	99,034	111,586	128,536	97,413	92,482	233,048	1,451,779	1,141,184	524,969	166,135	105,199	83,519	4,234,884
1974	118,158	180,559	122,376	80,272	120,404	278,821	1,294,445	898,521	282,877	119,745	66,657	63,716	3,626,549
1975	106,072	126,982	92,994	93,155	141,862	695,045	1,006,992	870,125	280,081	98,244	102,784	119,635	3,733,970
1976	88,582	114,592	118,010	91,146	64,568	169,141	1,263,082	1,070,469	316,887	105,636	68,607	71,838	3,542,560
1977	107,565	110,627	99,128	119,858	148,358	268,911	1,955,664	1,698,361	704,835	223,195	106,459	91,193	5,634,154
1978	161,481	170,813	157,731	122,992	159,764	492,826	1,372,205	1,157,057	463,520	142,843	90,094	80,618	4,571,943
1979	104,137	111,534	136,652	303,195	195,399	376,315	1,592,006	1,327,671	602,710	210,687	101,772	87,772	5,149,849
1980	114,984	124,209	130,626	145,785	179,166	328,640	829,440	722,888	470,000	165,288	75,657	57,238	3,343,921
1981	142,572	252,927	200,666	120,099	91,956	411,938	1,572,566	987,782	280,265	120,425	99,817	82,821	4,363,834
1982	110,967	139,761	121,867	85,736	130,080	442,740	900,461	851,183	492,032	252,176	89,371	75,097	3,691,469
1983	123,153	185,743	156,901	171,444	157,248	241,163	1,953,331	1,495,606	584,307	168,931	116,182	93,422	5,447,431
1984	114,609	118,299	78,370	67,174	70,858	229,753	740,016	978,943	367,875	131,005	87,255	83,028	3,067,186
1985	106,065	241,989	178,971	126,260	118,866	632,638	956,448	1,030,100	451,337	184,064	94,460	84,013	4,205,211
1986	97,709	122,083	105,743	113,698	95,123	209,076	1,696,464	725,566	168,887	87,267	73,033	63,018	3,557,666
1987	94,173	105,157	116,028	119,912	133,491	278,286	989,626	662,356	403,644	126,318	69,363	67,010	3,165,365
1988	130,144	174,675	120,367	119,135	161,820	168,927	1,969,142	2,210,739	628,371	179,404	112,084	92,204	6,067,012
1989	116,538	213,762	268,644	165,418	215,056	514,521	2,685,312	2,788,202	1,028,057	392,872	240,433	180,617	8,809,431
1990	198,678	263,285	266,546	131,829	113,011	534,032	467,631	179,153	65,609	48,464	42,794	45,919	2,356,954
1991	168,839	367,889	507,999	159,369	225,176	748,539	1,114,849	862,712	337,726	109,711	57,531	49,617	4,709,958
1992	80,692	182,254	176,115	93,449	130,709	818,569	1,341,736	734,830	236,069	93,725	59,815	50,943	3,998,907
1993	102,310	171,941	148,712	117,960	109,847	224,832	1,465,492	1,313,343	682,477	183,091	84,021	65,529	4,669,555
1994	102,010	144,685	201,996	149,169	146,797	360,326	2,131,421	2,053,390	665,204	189,160	107,343	81,820	6,333,322
1995	99,118	170,468	157,847	194,384	167,423	648,060	1,378,568	798,931	196,697	107,407	71,262	61,931	4,052,095
1996	112,020	180,662	193,380	249,359	198,616	396,403	2,164,320	1,711,766	637,121	235,883	127,026	1,16,200	6,322,758
1997	178,444	226,282	173,828	153,740	181,907	374,976	1,233,792	1,221,619	287,201	125,533	81,493	86,911	4,325,725
1998	145,232	155,520	232,753	182,399	111,283	162,579	1,205,280	1,237,689	318,305	135,175	83,100	80,172	4,049,487
1999	144,696	130,118	111,154	113,832	112,735	401,760	1,404,864	953,779	409,025	127,676	86,850	74,210	4,070,699
2000	89,253	110,160	185,345	122,135	127,734	297,302	1,171,584	661,833	207,109	116,426	70,512	64,879	3,224,272
2001	87,378	97,459	102,851	99,101	81,933	144,634	1,023,840	541,305	132,459	69,822	45,924	37,663	2,464,369
2002	69,433	82,944	94,280	81,959	84,188	409,795	648,000	586,838	176,264	78,661	54,441	39,477	2,406,280
2003	67,826	78,019	129,099	120,796	108,864	632,102	1,684,800	1,245,724	507,521	222,491	110,152	78,616	4,986,012
2004	122,198	134,525	113,296	147,044	126,766	196,327	2,135,808	1,235,011	471,233	157,942	100,510	96,242	5,036,901
2005	158,598	401,000	222,000	160,000	183,000	1,219,000	1,036,000	1,578,304	708,041	226,307	125,568	100,169	6,117,988
2006	124,598	151,000	138,000	160,000	154,000	407,000	1,334,000	974,304	379,041	145,307	107,368	99,069	4,173,688
2007	128,598	133,000	151,000	128,000	166,000	591,000	1,891,000	1,180,304	221,041	157,307	88,368	77,269	4,912,888
2008	140,598	199,000	104,000	101,000	91,200	357,000	908,000	1,921,304	391,041	160,307	125,568	88,769	4,587,788
Mean	117,254	162,194	156,173	131,242	134,349	410,664	1,337,704	1,102,657	397,213	147,672	89,896	77,881	4,264,899
Standard Deviation	30,777	70,651	75,298	47,495	42,051	220,060	509,804	535,232	210,717	66,505	34,109	26,185	1,370,957
Median	112,020	144,685	136,652	120,796	130,080	376,315	1,294,445	987,782	379,041	135,175	87,255	78,616	4,173,688
Minimum	56,830	60,970	62,130	62,640	64,568	144,634	428,600	179,153	53,693	32,574	29,845	29,651	1,281,759
Maximum	198,678	401,000	507,999	303,195	225,176	1,219,000	2,685,312	2,788,202	1,028,057	392,872	240,433	180,617	8,809,431

There are existing projects in Murat River basin implemented for the purpose of irrigation, energy generation and utilization of drinking-potable water at the upstream and downstream of Alpaslan II Dam. The most important one of these is Alpaslan I Dam, which construction is in completion phase. Alpaslan I Dam located at the upstream of Alpaslan II Dam serves for the purpose of energy production and flood prevention. For the purpose of utilizing the water potential of the basin, Patnos Dam, Sekerova Dam, Yazici Dam, Nadirseyh Dam, Murat Dam, Aydintepe Dam, Karahalit Dam, Baskoy Dam, Agacli Dam and Sancaktar Dam was planned to be constructed at the upstream of the Project. Patnos Dam and Yazici Dam were taken into operation, and others are under planning and design phases.

Detailed information about wetland areas in the surroundings of the Project is given in Section IV 2.11.

For the Project, sedimantation information is given in Section V.2.5, flood information is given in Section V.1.2 and water quality information of rivers within the Project area is given in Section IV.2.18

IV.2.5. Current and Planned Uses of Surface Water Resources (drinking, potable, irrigation water, water products income, transportation, tourism, power generation, other usages and locations and distances of this resources to the Project area)

Alpaslan II Dam was projected at the upstream of Alpaslan I Dam 1,365.00 m thalweg elevation, and its precipitation area is about 15,460 km^2. Alpaslan I Dam was constructed for the purpose of energy production and flood control. Alpaslan II Dam was implemented for the purpose of irrigation, energy production and flood control and its precipitation area is about 17,505 km^2.

Several plants were planned to be constructed for the purpose of irrigation and drinking-potable water at the upstream of the Project. Some of these plants are in planning phase, some in construction phase and the remaining part is in operation phase. Current and planned projects on Murat River and at the upstream of Alpaslan II Dam are given in Map of Alpaslan Dam Upstream Project Development Situations in Figure IV.22.

For the purpose of evaluating the water potential of basin, Patnos Dam, Sekerova Dam, Yazici Dam, Nadirseyh Dam, Murat Dam, Aydintepe Dam, Karahalit Dam, Baskoy Dam, Agacli Dam and Sancaktar Dam was planned to be constructed at the upstream of the Project. Patnos Dam and Yazici Dam were taken into operation, and others are under planning and project phases. Except for that, there are Eleskirt, Gulluova, Bulanik, Mus, Adalar, Hinis, Karahasan, Karakaya regulator irrigations and Kadir lake irrigations in the area.

It is accepted in the study that, all plants which are planned at the upstream of Alpaslan I Dam will be taken into operation by the end of the 2025. Therefore, all the dams in the upstream were assumed to be in operation and drinking water portion of the Yazici Dam was calculated. Also, converted waters from regulator area to irrigation were calculated. Upstream irrigation characteristics of Alpaslan I Dam Project are given in Table IV.15 and irrigation water requirements are given in Table IV.16. Energy production in Alpaslan II Dam will be dependent on the water regime in the river basin. Therefore, amount of water in Alpaslan II Dam was calculated taking into consideration both the current situation and future situation, in which all the projects in the upstream are taken into operation.

Feasibility studies show that 15% of irrigation waters and 80% of drinking-potable water after usage returns back to the river bed. Within the operation studies, it is observed that waters regulated in dam have the potential of meet the Mus Plain water requirements.

Within the studies carried out for the planning report (September, 1994), it is determined that agricultural land of 78,210 ha will be irrigated in Mus Plain.10,150 ha of this land is being irrigated by Arincik Regulator and Irrigation, which is located at 5.00 km upstream of Alpaslan II Dam and constructed with the aim of irrigation in 1968 by the General Directorate of DSI. 4,800 ha of this land are located on the right bank of Murat River while 5,350 ha are located on the left bank. Besides, by the use of the regulator constructed on Karasu it is proposed to irrigate 1,424 ha land. In this case, the total irrigation area is 11,574 ha. In case Karasu irrigation is included, the area that requires irrigation within Mus Plain is 68,060 ha. 12,847 ha of this area are located on the right bank while 55,213 ha are located on the left bank and it is proposed to irrigate the whole area by pumping.

Alpaslan II HEPP, within the scope of Alpaslan II Dam and HEPP Project, will be established with the gross head of 98.00 m and with the project flow of 344.00 m^3/sec. With a total capacity of 280.00 MW, for the current situation, annually 862.26 GWh will be generated as 606.35 GWh of it is firm. For the future situation, annually 733.80 GWh will be generated as 511.46 GWh of it is firm.

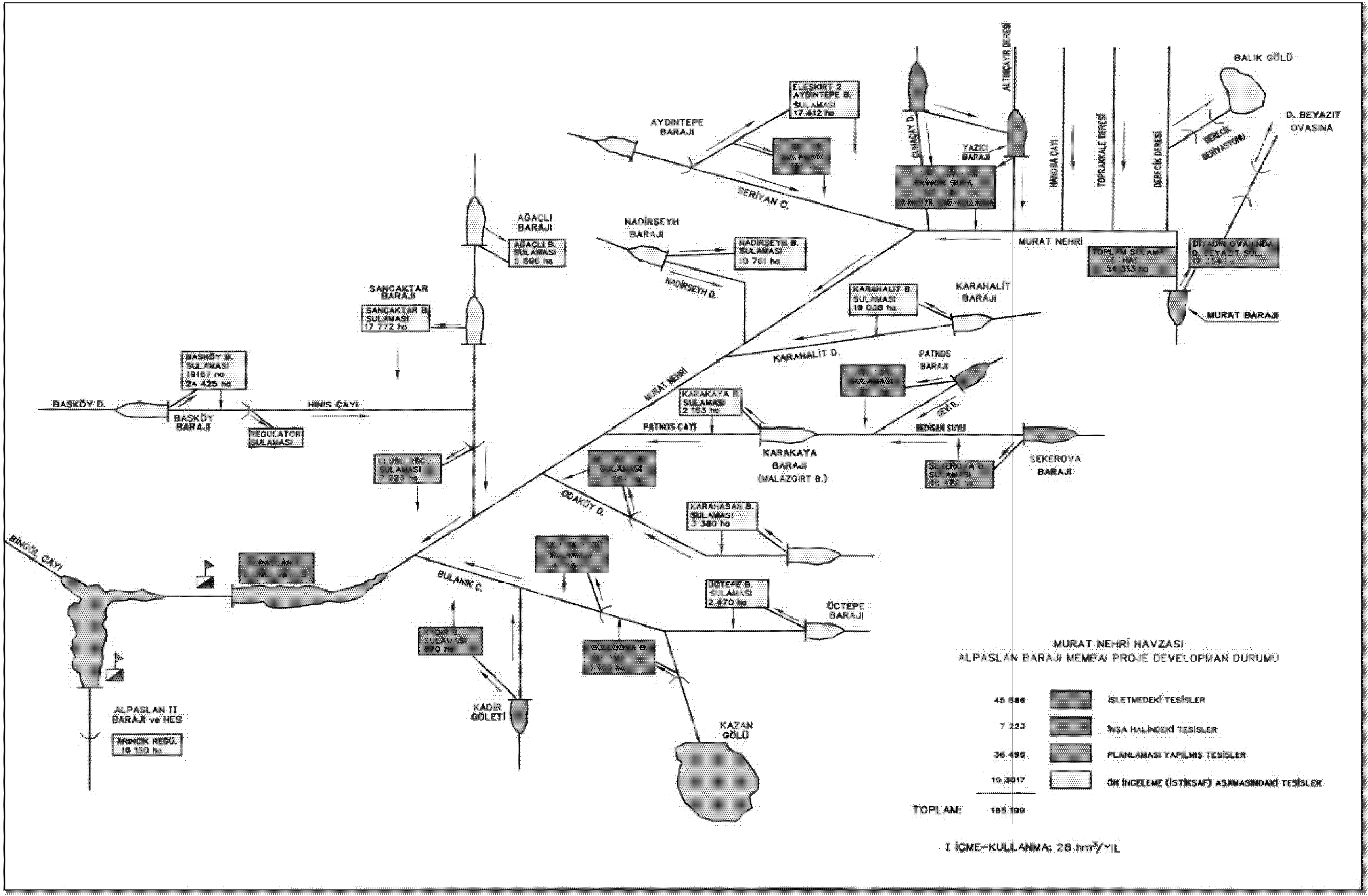


Figure IV.22. Alpaslan Dam Upstream Project Development Situations

Table IV.15. Upstream Irrigation Characteristics of Alpaslan I Dam Project

NO	PROJECT NAME	PROJECT STATUS	OPERATION DATE	REGULATOR/ DAM	IRRIGATION AREA GROSS (ha)	WATER REQUIREMENTS (HM^3)												
						JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL
1	**YUKARI MURAT PROJECT**																	
	Diyadin Irrigation	Feasibility		Murat Dam	15,927					0.50	4.41	25.53	19.57	6.99				57.00
	Dogubeyazit Irrigation	Feasibility		Murat Dam	38,386					2.65	21.19	72.10	62.50	32.52				190.96
	Derecek Derivation			Derecek River														17.73
2	**AGRI YAZICI PROJECT**																	
	Agri Plain Irrigation	Feasibility	2010	Yazici Dam	25,089					0.63	13.75	49.15	37.01	12.78				113.32
	Ekincik Plain Irrigation	Feasibility	2010	Yazici Dam	11,211					0.22	5.23	22.27	17.91	6.46				52.09
	Drinking-Potable Water	Feasibility	2010	Yazici Dam		2.38	2.15	2.38	2.30	2.38	2.30	2.38	2.38	2.30	2.38	2.30	2.38	28.00
3	**AGRI PATNOS PROJECT**																	
	Patnos Dam Irrigation	In Operation	1993	Patnos Dam	5,436					0.33	3.89	9.41	7.62	3.53	0.01			24.79
	Sekerova Dam Irrigation	Final Design		Sekerova Dam	18,457					1.13	13.22	31.94	25.87	11.99	0.05			84.20
4	**AGRI ELESKIRT PROJECT**																	
	Eleskirt Regulator Irrigation	In Operation	1966	Regulator	3,191					0.08	1.84	6.25	4.71	1.62				14.50
	Aydintepe Dam Irrigation	Pre-Feasibility		Aydintepe Dam	14,000					0.35	8.10	27.43	20.66	7.13				63.67
5	**AGRI TUTAK PROJECT**																	
	Nadirseyh Dam Irrigation	Pre-Feasibility		Nadirseyh Dam	11,600					0.63	9.98	36.04	28.37	13.91	0.02			88.95
	Karahalit Dam Irrigation	Pre-Feasibility		Karahalit Dam	12,500					0.75	12.12	43.63	32.70	15.68	0.02			104.90
6	**HINIS PROJECT**																	
	REgulator Irrigations	Pre-Feasibility		Regulator	3,342					0.01	1.44	5.86	4.33	1.71				13.35
	Baskoy Dam Irrigation	Pre-Feasibility		Baskoy Dam	17,950					0.04	8.30	33.63	24.89	9.61				76.67
	Sancaktar Dam Irrigation	Pre-Feasibility		Sancaktar Dam	17,350					0.05	11.31	45.83	33.92	13.37				104.48
7	**KOPAL PROJECT**																	
	Agacli Dam Irrigation	Pre-Feasibility		Agacli Dam	4,000					0.02	433	17.54	12.98	5.11				39.98
	Taht Dam Irrigation	Pre-Feasibility		Taht Dam	6,300					0.01	2.72	11.05	8.18	3.22				25.18
8	**KAZAN LAKE PROJECT**																	
	Gulluova Regulator Project Irrigation	In Operation	1971	Regulator	1,100					1.29	0.94	0.86	0.44	0.31	0.10			3.94
	Bulanik Irrigation	In Operation	1974	Regulator	4,016					4.72	3.42	3.13	1.60	1.14	0.37			14.38
9	**MUS-ADALAR Irrigation**	In Operation	1971	Regulator	2,234					2.63	1.90	1.74	0.89	0.63	0.20			7.99
10	**HINIS ULUSU Regulator**	On Construction	2010	Regulator	7,223					8.49	6.15	5.62	2.88	2.05	0.66			25.85
11	**KARAKAYA Dam Irrigation**	Pre-Feasibility	2010	Karakaya Dam	2,163					2.50	1.81	1.66	0.85	0.60	0.20			7.61
12	**KARA HASAN Dam Irrigation**	Pre-Feasibility		Kara hasan Dam	3,380					0.20	2.42	5.8-1	4.73	2.19	0.01			15.39
13	**UCTEPE Dam Irrigation**	Pre-Feasibility		Uctepe Dam	2,470					0.09	0.25	5.36	5.62	1.18	0.05			12.55
14	**KADİR Dam Irrigation**	Pre-Feasibility	2010	Kadir Dam	670					0.79	0.57	0.52	0.27	0.19	0.06			2.40
15	**KUSTEPE Dam Irrigation**	Pre-Feasibility		Kustepe Dam	2,915					2.50	1.81	1.66	0.85	0.60	0.06			7.48
16	**ARINCI Irrigation**	In Operation	1976	Arincik Regulator	12,000					0.72	5.71	11.92	11.29	4.14	0.02			33.79

Table IV.16. Mus Plain Irrigation Water Requirements

Traditional Irrigation Network

Months	Plant Irrigation Water Requirement	Farm Requirement Efficiency		Diversion Efficiency		Module	Total Water Taken from Dam			
							Including Arincik		Excluding Arincik (*)	
	(mm)		(m^3/ha)	(mm)	(m^3/ha)		(m^3/sec)	(hm^3)	(m^3/sec)	(hm^3)
		(0.60)		(0.85)		(l/s/ha)				
JANUARY	0	0	0	0	0	0	0	0	0	0
FEBRUARY	0	0	0	0	0	0	0	0	0	0
MARCH	0	0	0	0	0	0	0	0	0	0
APRIL	0	0	0	0	0	0	0	0	0	0
MAY	9.22	15.37	153.67	18.08	180.78	0.07	4.47	11.96	3.89	10.41
JUNE	73.07	121.78	1 217.83	143.27	1,432.75	0.55	36.57	94.80	31.83	82.50
JULY	153.82	256.37	2 563.67	301.61	3,016.08	1.13	**74.51**	199.56	**64.84**	173.66
AUGUST	140.05	233.42	2 334.17	274.61	2,746.08	1.03	67.84	181.70	59.03	158.12
SEPTEMBER	53.91	89.85	898.50	105.71	1,057.06	0.41	26.98	69.94	23.48	60.86
OCTOBER	0.72	1.20	12.00	1.41	14.12	0.01	0.35	0.93	0.30	0.81
NOVEMBER	0	0	0	0	0	0	0	0	0	0
DECEMBER	0	0	0	0	0	0	0	0	0	0
									0	0
TOTAL					**8,446.86**			**558.89**		**486.36**

Piped Irrigation Network

Months	Plant Irrigation Water Reguirement	Farm Requirement Efficiency		Diversion Efficiency		Modul	Total Water that Taken from Dam			
							Including Arincik		Excluding Arincik (*)	
	(mm)		(m^3/ha)	(mm)	(m^3/ha)	(l/s/ha)	(m^3/sec)	(hm^3)	(m^3/sec)	(hm^3)
		(0.80)		(0.93)						
JANUARY	0	0	0	0	0	0	0	0	0	0
FEBRUARY	0	0	0	0	0	0	0	0	0	0
MARCH	0	0	0	0	0	0	0	0	0	0
APRIL	0	0	0	0	0	0	0	0	0	0
MAY	9.22	11.53	115.25	12.39	123.92	0.05	3.16	8.46	2.75	7.36
JUNE	73.07	91.34	913.38	98.21	0 982.12	0.38	25.87	67.06	22.51	58.35
JULY	153.82	192.28	1 922.75	206.75	2,067.47	0.77	52.70	141.16	**45.86**	122.84
AUGUST	140.05	175.06	1 750.63	188.24	1,882.39	0.70	47.99	128.52	41.76	111.84
SEPTEMBER	53.91	67.39	673.88	72.46	724.60	0.28	19.09	49.47	16.61	43.05
OCTOBER	0.72	0.90	9.00	0.97	9.68	0.00	0.25	0.66	0.21	0.57
NOVEMBER	0	0	0	0	0	0	0	0	0	0
DECEMBER	0	0	0	0	0	0	0	0	0	0
TOTAL	**430.79**				**5 790.19**			**395.34**		**344.03**

(*) Total irrigation area of Mus Plain is 78,210 ha, if 10,150 ha Arincik Irrigation area is irrigated by Arıncık Regulator then total area to be irrigated by gravity becomes 68,060 ha (78,210 - 10,150)

IV.2.6. Water Usage in the Basin where the Project is Located (whether is it within a basin used for drinking and potable water purposes, if it is within such area the HEPPs to be constructed must be located outside the accurate and short distance protection zone, Rain-Flow Relation, Ecological Potential, Submission of Long term monthly Averages (m^3/sec) of water sources within the project, Long term flow records representing Regulator Area and Flow Metering Stations by taking the approval of the related Institution (the Institution from where these data were obtained)

Water Use Rights Report for Alpaslan II Dam and HEPP Project was prepared and approved by 17th Regional Directorate of SHW with the Official Letter No. 91570 on October 18, 2011. This certified report is given in App-12.

As it is stated in the above-mentioned report, irrigation canals of Arincik Regulator were determined in the project area with the purpose of irrigation. It is determined during the studies conducted in the Project site, approximately 2,000 agricultural lands in Akpinar and Kiyibasi Village were irrigated by pumping from the Murat River. However, Alpaslan II Dam will not have an adverse impact on these irrigations. Because, the water used for energy generation in Alpaslan II Dam will be discharged to the river bed. Therefore, there will not be any irrigation water shortage in Mus Plain, which is planned to be constructed.

No mills have been detected in Project site on Murat River. Alpaslan I Dam and HEPP Project were located at the upstream of Alpaslan II Dam. Arincik Regulator Irrigation and Mus Plain Irrigation Project, which is planned to be constructed, were located at the downstream of the Dam.

Approved flowrates of Alpaslan II Dam are given in App-20.

Project area is not located within a drinking water basin. Official Letter of Mus Municipality regarding this issue is presented App-2. In the Water Use Rights Report approved by 17th Regional Directorate of SHW and presented in App-2, any drinking water basin in the Project area is not mentioned.

IV.2.7. Soil Characteristics and Land Use (Classification of Physical, Chemical and Biological Characteristics and Land Use Classification of Soil, Erosion, Current Land Use)

Mus is located in the high and mountained locality. 34.9% of the province area is covered with mountains, which are the extensions of the South East of the Taurus. These young mountains are formed with the Himalaya Alpine folded system. Altitude is usually above 1,250 m. 27.2% of Mus Province is made up of plains covered with young and fertile alluvium. Murat Valley split the provincial land in the direction of east-west. Generally, 37.9% of land in Mus is covered with plateaus, which are located at 1,500-1,700 m ASL.

Map of major soil groups in Project area is given in App-5.

IV.2.7.1. Soil Characteristics

Information about soil characteristics in Mus Province that is compiled from data of Mus Province Environmental Status Report is given below.

In the course of time, depending on the topography and variations of base rock major soil groups were formed in Mus. The existing soil types within the boundaries of Mus province are as follows;

Alluvial Soils: In general alluvial soils are found on the base of surface waters or on the early sediments those are transported and agglomerated by the rivers. They are early soils with the slight slopes. The total area of this soil is 66,315 ha in the province.

Colluvial Soils: They are usually found at the skirts of the steep valley slopes. They are soils, which are formed on the drifted materials by gravity, landslide, surface flow and tributary rivers. The total area of this soil is 41,200 ha, in the province.

Chestnut Soil: They show distribution within an area of 307,425 ha.

Brown Forest Soils without Limestone: Chestnut Forest Soils without Limestone are usually formed under the forest cover of deciduous. These soils cover area of 50,675 ha.

Basaltic Soil: These soils show similar characteristics with the Brown and Reddish Brown soils in the same climate conditions, which are formed on limestone. These soils cover area of 37,780 ha.

Vertisol Soil: These soils cover area of 98,590 ha.

Brown Soils without Limestone: These soils cover area of 97,835 ha.

Regosol Soil: These soils cover area of 12,800 ha.

The major soil groups in the area within the reservoir of Alpaslan II Dam, Material Borrow Areas and HEPP Project that are obtained from Land Property of Mus Province are given in App-5.

According to the major soil group classification given in Land Property Map of Mus Province; the reservoir is mainly located within chestnut soils (76.38% and 76.07%).

Table IV.17. Soil Groups within the Reservoir

	Within the Boundaries of the Reservoir		**Outside the Boundaries of the Reservoir**	
Soil Groups	**Area (ha)**	**Percentage (%)**	**Area (ha)**	**Percentage (%)**
Alluvial Soil	695.73	13.89	-	-
Chestnut Soils	3848.54	76.38	255.15	76.07
River	135.84	2.71	-	-
Colluvial Soils	28.80	0.58	60.65	18.08
Basaltic Soils	260.69	5.20	19.16	5.85
Bear Rock	12.30	0.25	-	-
Settlement	27.42	0.55	-	-
Total	**5,009.32**	**100.0**	**335.40**	**100.0**

The degree of the water erosion within the area including the reservoir can be 1 (slight), 2 (medium), 3 (severe), 4 (extreme). According to Slope-Depth Combination, the project area and the material borrow areas are located within the areas A (slope: 0-2%), B (slope: 2-6%) and C (slope:6-12%) areas. According to the other classifications of soil characteristics, the project site is rocky, stony and poor drainage.

IV.2.7.2. Land Use

Mus is located in the high and mountained locality. Vegetation of Mus is composed of steppe plants, pasture grasses and oak forests. Oak forests are observed in mountains inserted into the north and some parts of the high plateaus. Because of the forest destructions, these forests turned into marshes. These forests, which consist of pure oaks, become short towards to the transition zones. The majority of the high plateaus are covered with well-developed grass. These grasses are observed as green all year round and are covered in snow in winter months. In the high mountains of Mus, the prevailing vegetation is mountain meadows. These meadows are observed as green.

According to the data obtained from Environmental State Report of Mus Province the total surface area of the city is 819,600 ha; while 335,049 ha of this is agricultural land, 278,673 ha is pasture land, 97,333 ha is meadow land, 57,147 ha is forest land. 7,149 ha is garden land and the rest 44,229 ha is nonarable lands. This distribution is given in Table IV.18 and in Figure IV.23.

Table IV.18. Table of the Land Asset in Mus Province

Usage	Area (Hectare)	Percentage %
Cultivated Area	335,049	40.9
Pasture	278,673	34.0
Meadow	97,333	11.9
Forest	57,147	6.9
Vineyards and Orchards	7,149	0.9
Non-agricultural Land	44,249	5.4
TOTAL	**819,600**	**100.0**

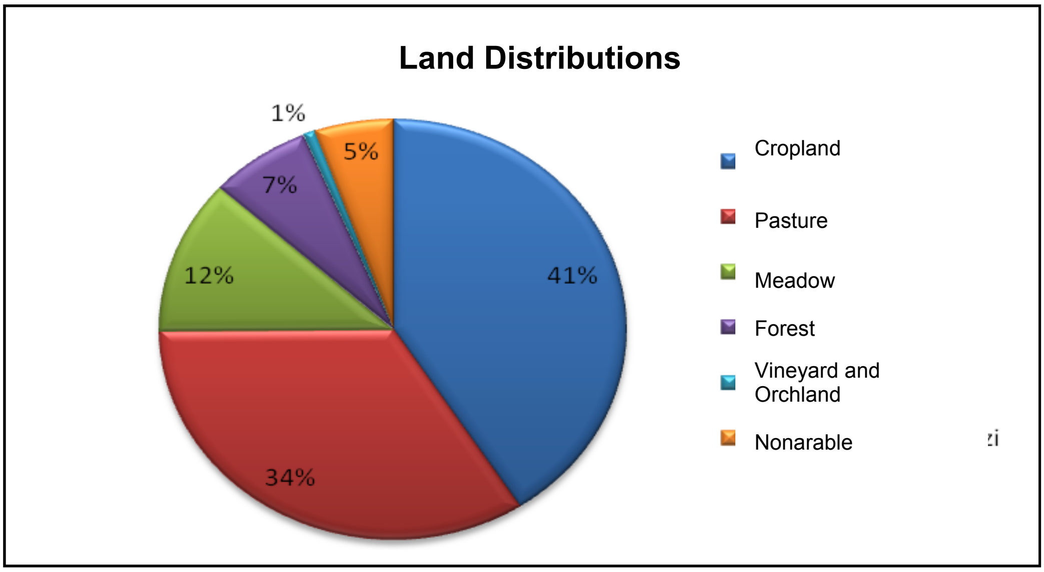


Figure IV.23. Land Distribution of Mus Province

As it is seen in the figure; proportion of meadow-pasture lands (34%) within Mus province is higher than the forest lands (7%). High proportion of meadow and pasture lands creates a significant potential for stockbreeding. However, they will also lead to constraints on the precipitates and landslides. According to the sub-regional distribution of the lands it is seen that the region with maximum field of cropland and pasture-meadow is Bulanik-Malazgirt-Varto districts, which is identified as 2^{nd} Sub-region.

Although the irrigable agricultural land is 158,215 ha; irrigated land is 64,280 ha. 19,261 ha of this land is being used by the General Directorate of Rural Services while 19,100 ha is being used by SHW. Besides, 26,459 ha of this area is being used by the locals.

The planted crops on this area are as follows; 190,150 ha of grain, 23,807 ha of pulse, 16,050 ha of industrial plant, 105,314 ha of forage plants, 2,179.08 ha of vegetable plants and 36,901 ha of fruit products.

In line with the information obtained from Land Use Assets of Mus Province, land use assets of area that will be inundated by the reservoir are given in Table IV.19.

Table IV.19. Table of the Land Use of the Area

Usage	**Within the Boundaries of the Reservoir**		**Outside the Boundaries of the Reservoir**	
	Area (ha)	**Percentage (%)**	**Area (ha)**	**Percentage (%)**
Meadow	514.80	10.28	-	-
Bare Rock	12.30	0.25	-	-
Scrub	126.43	2.52	-	-
River	135.84	2.71	-	-
Dry farming (Fallow)	117.64	2.35	-	-
Pasture	3,557.32	71.01	274.75	81.92
Irrigated Farming	517.56	10.33	60.65	18.08
Settlement	27.42	0.55	-	-
Total	**5,009.32**	**100.0**	**335.40**	**100.0**

In line with the data given in this table, the area that is anticipated to be affected is composed of pastures (71.01%). Irrigated farming and meadow are following this ranking with percentage of approximately 10%.

There are 8 land use capability classes. Characteristics of the land, in terms of agricultural production, vary from Class I to VII. First four classes have the ability of growing crops, forest, and meadow and pasture plants adapted to the region under the control of a good soil management. In case soil and water protection measures are taken some special plants can grow in Class V and VI. By the implementation of some kind of efficient and rehabilitation studies crop production can be actualized; however the produced crops will not meet the capital expenditure within the current market situations.

Distribution of the lands in Mus province, in terms of classes, is given in Table IV.20.

Table IV.20. Distribution of Lands in Mus Province, in terms of Classes

Class	Amount in the Province (ha)		Land Use Capability Status
	ha	%	
I	34,389	4.2	Smooth slope, well drained, easy machinable, deep, fertile, available to raise any kind of plant.
II	141,248	17.2	Available to raise any kind of plant, less available for planting as compared to Class-I lands, needs special mitigation measures for soil and water protection.
III	120,026	14.6	These are the lands those have severe restraint factors regarding the topography and surface flow , have fewer crops as compared to first two classes, and need special protection measures.
IV	70,004	8.5	Soil depth has severe restraint factors relevant to stony, wetness and slope. However, planting of special plant species can be implemented by appropriate plough
V	21	0.0	Agriculture cannot be implemented by plough, smooth/slightly smooth slope, stony or very wet lands. Can be utilized as meadow or woodland.
VI	141,303	17.3	Sloping, have severe restraint factors such as low soil depth. Can be utilized as meadow or woodland.
VII	302,333	36.9	Have severe restraint factors such as; low soil depth, stone, rock, slop and erosion. Not feasible for agricultural planting; however feasible for pasture and planting forest trees.
VIII	10,276	1.3	Not feasible for herbal products. Can be utilized as entertainment area and sanctuary for game animals.
TOTAL	**819,600**	**100.0**	

Source: Environmental State Report of Mus Province, 2008

Class I-IV agricultural land exists in Mus is 365,073 ha; and 335,049 ha of these areas are being used for cultivated agriculture. Pasture and forest areas, ranked as 2nd after the agricultural lands, are intensified on Class II, III and IV lands. There are 8 land use capability classes. Characteristics of the land, in terms of agricultural production, reduce from Class I to VII. The soil characteristics and distribution of soils of the province, in terms of classes are given below.

Class - I: Topography is smooth or nearly leveled (0-2%). The total area of Class I lands are 34,389 ha, which constitutes 4.2% of the surface area. Class I lands are composed of; 13,343 ha (38%) of alluvial soils, 3,212 ha (9.3%) of colluvial soils, 921 ha (2.6%) of brown forest soils without limestone and 16,913 ha (49.1%) of chestnut soils.

23,287 ha of these lands are being used for dry farming while 8,134 ha is being used for irrigated farming. Besides, 2,968 ha of these lands are being used as meadow-pasture (597 ha meadow, 2,371 ha pasture) areas.

Class - II: The total area of Class – II lands are 141,284 ha, which constitutes 17.2% of the surface area. Class II lands are composed of; 27,778 ha (19.6 %) of alluvial soils, 3,578 ha (2.5%) of colluvial soils, 69,785 ha (49.3%) of vertisol soils, 294 ha (0.2%) of regosol soils, 2,640 ha (1.8%) brown forest soils without limestone, 9,372 ha (6.63%) of limeless brown soils, 26,383 ha (18.6%) of chestnut soils and 1,454 ha (1.02%) basaltic soils.

98,996 ha of these lands are being used for dry farming while 6.942 ha are being used for irrigated farming. Besides, 33,888 ha of these lands are being used as meadow-pasture (7,888 ha meadow, 26,000 ha pasture) areas and 715 ha of is forest-scrub areas. Average slope is 1-6%.

Class - III: The total area of Class – III lands are 120,026 ha, which constitutes 14.6% of the surface area. Class II lands are composed of; 7,105 ha (5.9%) of alluvial soils, 3,345 ha (2.7%) of colluvial soils, 1,365 ha (1.13%) of vertisol soils, 2,480 ha

(2.06%) of regosol soils, 3,409 ha (2.8%) brown forest soils without limestone, 84,786 ha (70.6%) of chestnut soils, 4,656 ha (3,8%) basaltic soils and 6,762 ha (5.6%) limeless brown soils.

81,424 ha of these lands are being used for dry farming while 698 ha are being used for irrigated farming. Besides, 35,228 ha of these lands are being used as meadow-pasture (26,559 ha pasture, 8,669 ha meadow) areas and 2,585 ha of is forest-scrub areas.

Class – IV: The total area of Class – IV lands are 70,004 ha, which constitutes 8.5% of the surface area. Class II lands are composed of; 6,106 ha (8.72%) of alluvial soils, 836 ha (1.19%) of colluvial soils, 327 ha (0.46%) of regosol soils, 1,212 ha (1.7%) brown forest soils without limestone, 14,827 ha (21.1%) limeless brown soils, 34,619 ha (49.4%) of chestnut soils and 12,067 ha (17%) basaltic soils.

12,887 ha of these lands are being used for dry farming while 3.870 ha are being used for irrigated farming. Besides, 36,072 ha of these lands are being used as meadow-pasture (1,793 ha meadow, 34,279 ha pasture) areas and 2,737 ha of is forest-scrub areas.

Class - V-VIII: The total area of Class – V-VIII lands are 453,897 ha, which constitutes 55.3% of the surface area. Class II lands are composed of; 1,852 ha (0.4%) of alluvial soils, 857 ha (0.18%) of hydromorphic alluvial soils, 1.093 ha (0.24%) of colluvial soils, 4,469 ha (0.98%) of regosol soils, 99,191 ha (21.8%) brown forest soils without limestone, 43,935 ha (9.6%) limeless brown soils, 195,250 ha (43%) of chestnut soils and 94,810 ha (20.8%) basaltic soils. 7,308 ha of these lands are being used for dry farming; 168 ha of the land used for dry farming is Class VII while the rest 7,139 ha is Class VI. Besides, 19 ha of these lands are being used for irrigated farming on the soils regarded as Class VII. In addition, total of 857 ha is being used as meadow area while 809 ha of these areas are Class VII and the remaining 48 ha is regarded as Class V soil type. Although 335,267 ha of the land is pasture area, only 170,517 ha is available to be used as pasture lands; because the remaining part of this land has lost its characteristics. 83,895 ha of these lands are being used as forest-scrub areas.

Different topography of the province, variations of the climate and geological characteristics and variation of the vegetation lead to constitution of soils with different characteristics. This is also true for plant food elements.

Soil Texture: Agricultural lands of Mus province involve 4.2% loam, 48.5% clayey-loamy, 46.9% clay and 0.4% sand.

Soil Salinity: Soils used for cultivated agriculture are 100% saltless.

Calcerous Soil ($CaCO_3$): Calcerous status of the soils of the province; 5.1% slight calcerous; 34.1% medium calcerous; 17.7% high calcerous; and 7.1% very high calcerous.

Organic Substance: Most of the agricultural lands are poor in terms of organic substances. In line with the average of the results of the analysis; organic substance status of the soils are as follows: 5.7% slight, 17.1% low, 43.1% medium, 3.3% very good.

Phosphorus: Phosphorus status of the soils are as follows: 51.1% slight, 21.8% low, 16.1% medium, 7.3% high, 7.3% very high.

Potassium: Potassium level of the soils within the province is high and it is, in general, sufficient.

Land use capability classification of the area under the reservoir is given in Table IV.21, in line with the data obtained from the Land Assets of Mus Province.

Table IV.21. Land Use Capability Classification of the Area Under the Reservoir

Soil Classes	Within the Boundaries of the Reservoir		Outside the Boundaries of the Reservoir	
	Area (ha)	Percentage (%)	Area (ha)	Percentage (%)
I	273.87	5.47		-
II	421.86	8.42	60.65	18.08
III	863.26	17.23	-	-
IV	129.91	2.59	-	-
V	-	-	-	-
VI	1535.06	30.64	173.53	51.74
VII	1609.80	32.14	101.53	30.18
VIII	12.30	0.25	-	-
River	135.84	2.71	-	-
Settlement	27.42	0.55	-	-
Total	**5009.32**	**100.0**	**335.40**	**100.0**

According to the land capability classification, 32.14% of the dam reservoir (1609.80 ha) is of Class VII, and 30.64% (1535.06 ha) is of Class VI. Class VI and VII land comprise 62.78% of the total area. Following these two classes is Class III soils with the percentage of 17.23% (863.26 ha).

51.74% of the other areas outside of the dam reservoir (173.53 ha) is of Class VI and 30.18% (101.53 ha) is of Class VII. Class VI and Class VII land comprise 81.92% of the total area. Following these two classes is Class II soils with the percentage of 17.23% (60.65 ha).

IV.2.8. Agricultural Lands (agricultural development project lands, special product plantation lands), Size of the Dry and Irrigated Farming Lands, Product Patterns and Their Annual Outputs, Economical Aspects of Products and their Place in Country's Agricultural Status and Economic Value

According to the data from Environmental State Report of Mus Province, it is mostly fallow agriculture that is practiced. At all dry farming land, fallowing is practiced. However, if perennial crops are planted (like clover, trefoil) fallowing is not applied. In 61% of agricultural land in the province, there is dry farming. These areas products are mostly barley, wheat, clover, trefoil, common vetch and little amounts of watermelon, chickpea and beans. In areas where there is irrigated agriculture, products like vegetables, fruits, sugar beet, corn, and sunflower are grown, and there are also vineyards.

Even in areas of irrigated agriculture, due to climatic conditions and soil structure, there is only one product a year. The second product does not grow due to lack of rain, temperature, number of sunny days, and insolation.

The main product in Mus is grain. Forage crops have also increased in recent years and taken the second place, followed by industrial plants and legumes.

At agricultural facilities, animal husbandry and vegetative production are carried out together. The small-scale of these facilities,, which are comprised of many sections, causes the yield to stay at low levels.

Irrigated agricultural land in Mus, from a technical and an economic perspective, equals 1,582,150 decares. However, due to limited means of irrigation, only 649,480 decares of this land is irrigated. In 2008, approximately 2,440,921 decares land was used for vegetative production.

Agricultural land use status according to Environmental State Report of Mus Province is presented in Table IV.22

Table IV.22. Land Use Status of Cultivated Agricultural Land

Land Use		Area (Decares)	Percentage %
Vegetative Production	Graminae	1,593,428	51.0
	Legumes	26,445	0.8
	Forage Crops	693,875	22.2
	Industrial Plants	782,655	25.0
Garden Plants	Fruit Production	5,427	0.2
	Vegetable Production	23,341	0.8
TOTAL		**3.125.171**	**100.0**

Source: Environmental State Report of Mus Province, 2008.

In addition to the data presented above, within publicly owned Directorate of Alpaslan Agricultural Establishment, there is agricultural production on a land of about 64,035 decares.

As it seen from Table IV.19, irrigated farming area is 578.21 ha and dry forming area is 117.64 ha in Project area.

IV.2.9. Forest Lands (tree species and amounts, size and density, purposes of use and/ or conservation status, inspection and survey form of forest)

The prevailing vegetation in Mus is steppe. According to the data obtained for the Environmental State Report of Mus Province 7% of the lands of Mus is composed of forest areas. In last 10 year, 150 ha of plantation have been made. Most of the forests of the province are composed of oaks.

Distribution of forest areas within the province is given in Figure IV.24. 90% of the forest assets of the province are degraded. The province and its districts have very little amount of productive forest areas. The distribution of 57,147 ha of forest areas, only within Merkez province, is as follows: 1,280.5 ha of fertile high forest; 597.5 ha of degraded high forest; 4,039 ha of fertile coppice forest. Degraded coppice forest area generates an area of 33,683.5 ha in Merkez district; while it generates 4,785 ha in Bulanik, 4,730.5 ha in Haskoy; 2,702.5 ha in Malazgirt; 3,711.5 ha in Korkut and 1,617 ha in Varto. Total area of the degraded coppice forest areas are 51,230 ha.

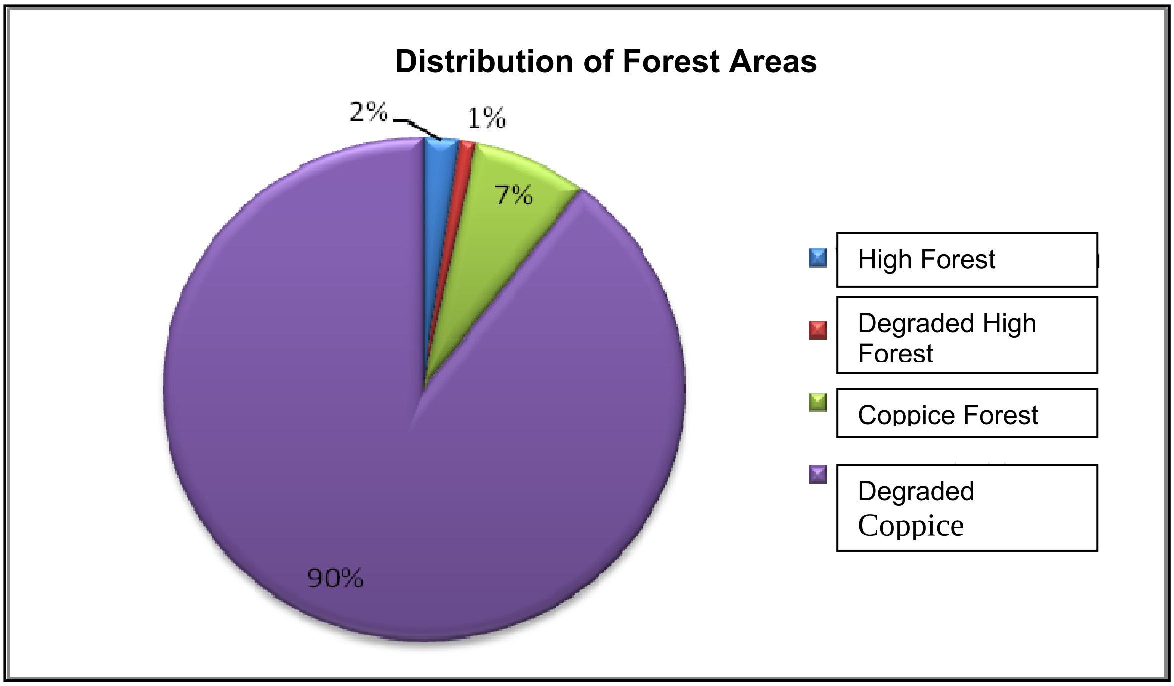
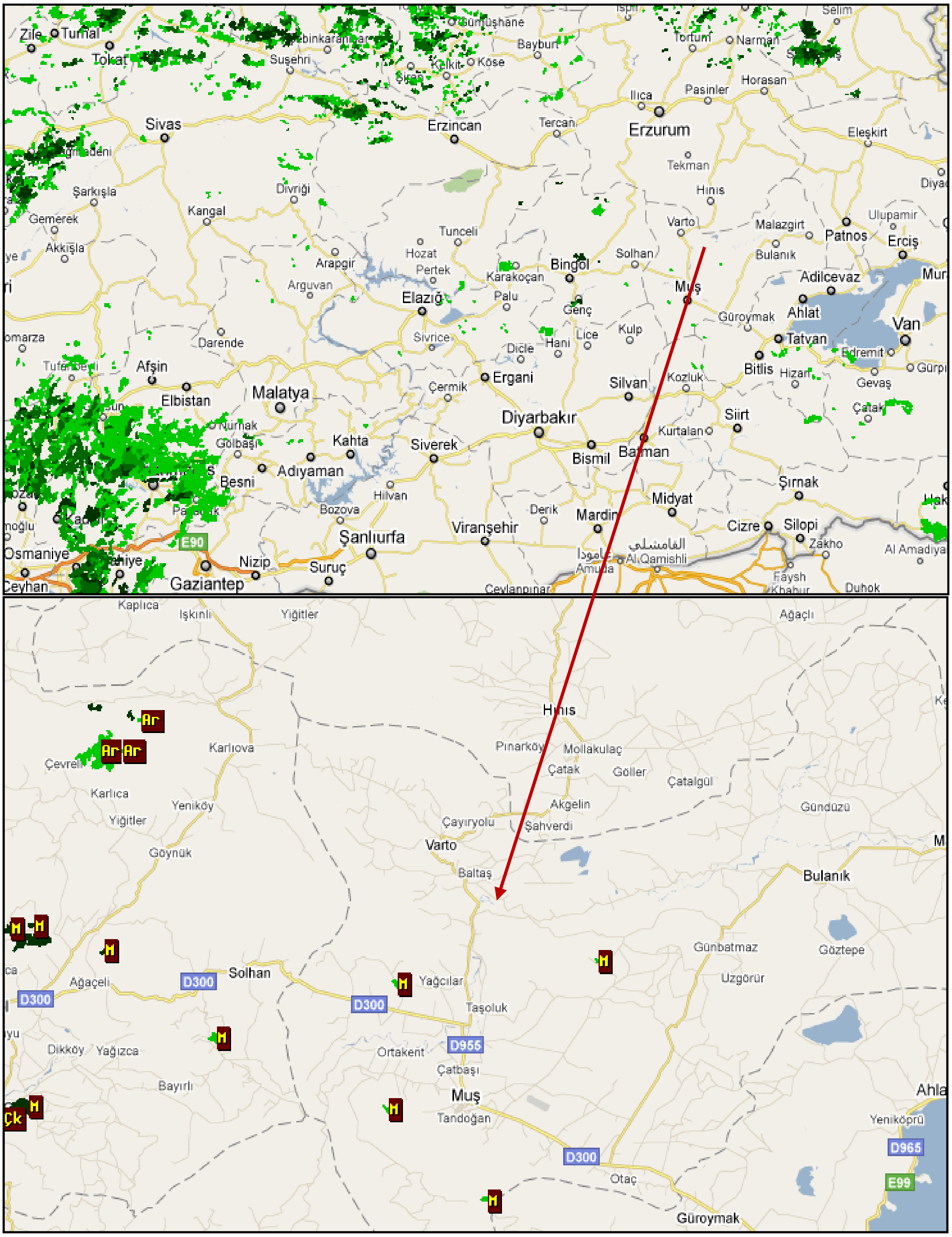


Figure IV.24. Distribution of Forest Areas within the Province

According to the data obtained from Land Assets of Mus Province the scrub area under the reservoir generates an area of 2.52% (126.43 ha, 1,264,300 m^2). Forest land under the reservoir is 550 ha (5,500,000 m^2) according to the data obtained from stand map. Map of forest lands near Project area received from Forest Information System of General Directorate of Forestry, is presented in Figure IV.26. As it can be seen from the figure, dense forest lands are not available in and around the Project site. The region is mostly covered with pasture areas. Views of the Project site is given in Section II.2. Rare tree communities are located in forest lands under the reservoir (see Figure IV.25).

Figure IV.25. Woodlands



Source : General Directorate of Foresty, Forest Information System, 2009

Figure IV 26. Forest Lands Near the Project Area

For forest areas in the Project site ”Inspection and Survey Form” prepared by Regional Directorate of Forestry of Mus is presented in App-13. According to this form, project site is located within the boundaries of Forestry Operation Directorate of Bitlis and Forestry Operation Directorate of Mus. Operation mode is coppice and major tree species is oak. Stand types are defined as unforested forest soil-very distorted oak coppice forest stand (OT-ÇBMBt), very distorted oak coppice forest stand (ÇBMBt), very distorted oak coppice forest stand, and unforested forest soil (ÇBMBt-OT). For these types of stands, the hill closure is provided in the range of 1-10%.

Following subjects for the project area are stated in the Official Letter (see App-13) of Regional Directorate of Forestry of Elazig No. B.18.OGM.1.12.00.255.03/7390 on October 3, 2011 and inspection and survey form of the project field is provided in the appendix of the official letter.

- Whether an another application is made regarding forest area
- The project area is not located within the forest area sustained fire, reserved for forestation or regeneration areas and located in dam reservoirs that are stated in Article 18 of Forest Law No:6831.
- The project area is not located within the seed stand area, national park, game wildlife, game breeding ground, truism area, special environmental protection area, prohibited military zone, and protected areas
- The project does not pose a risk to forestry activities and relation between public and forest.
- The forest fire sensitivity level of the project area is 5 and the necessary firefighting equipment will be present in the project area.
- Forest asset will be assessed by the forest management.
- There are no risks on forest areas on condition that obtaining a permit in compliance with Forest Law No: 6831 and taking measures against fire.

Required interviews were conducted with general Directorate of Forestry and forest map of the project area were obtained and used in Geographic Information Systems. Map of forest and vegetation distribution is given in App-5.

Expropriation will not be carried out for the mentioned forest areas. Required permits will be received according to the Forest Law No. 6831 Article 17/3 (Amanded Law No. 5192)

IV.2.10. Meadow and Pasture Lands (qualifications and capacity of pasture, the size of the area, representation of the pastures, meadows, summer, meadows and winter quarters on the map and their condition of use)

As can be seen in Figure IV.22, the ratio of meadow pasture lands in Mus Province is 34%. Meadow and pasture lands in Mus Province creates potential in order to ovine breeding, however, limited forest areas constitute precipitation constraint and cause landslides. According to sub-regioanl distributions of land, it is observed that area possessing great majority of meadow pasture land is Bulanik-Malazgirt-Varto Districts is II. Sub-regional.

Total pasture areas of Mus and in its all districts are 2,786,730 decares. Within the scope of Pasture Law (Law no: 4342), which came into force in 1998; 2,701,707 decare of this areas were partially determined and applications and assignments were performed in the pastures of 43 settlements units by the studies performed by the Provincial Directorate of Agriculture and by Pasture Commission and technical team of pastures. Pastures and meadows are being utilized by the villagers as for grazing.

The most important problem of the pastures in Mus is irregular and over capacity grazing. By the beginning of partial snowmelt, grazing starts. Grazing causes smashing of plants before they emerge from underneath the soil. Therefore, fertility decreases and the existing vegetation are replaced with weeds and plants that have lower nutritional value. Late grazing in fall, on the other hand, does not let pasture plants to store enough nutrition to survive through winter and grow again next spring. Plants in general are under the pressure of heavy grazing.

Meadows are one of the important roughages within the province. Meadows compose of lush developer and tall plants. Most of the meadow areas are present in Varto. 80% of the meadows in Varto are party lands. These lands are being utilized by the parties by mowing. 3.000 meadow lands belonging to treasure in Varto has been included into to the law No. 4342 by the pasture commission of the province.

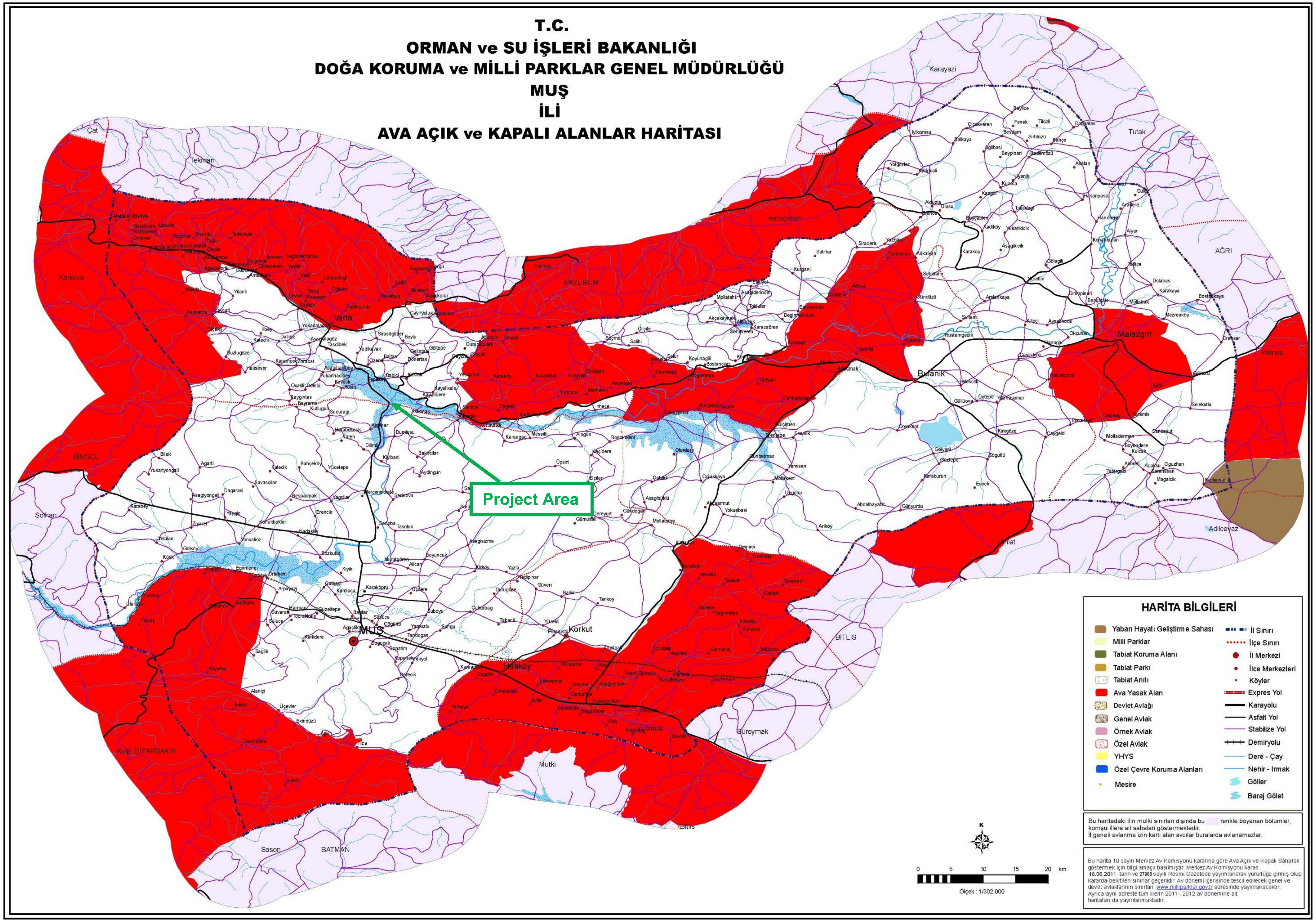
For the sustainability and fertility of the pasture lands, Provincial Directorate of Agriculture has implemented the Pasture Rehabilitation and Amenajman Project in total of 15,827 da of 5 villages, since 1998. The studies are still on progress in 8,026 decares of 3 villages.

As it seen from Table IV.19, meadow land that is inundated by reservoir is 3557.32 ha and rest of the meadow land that is located out of reservoir is 274.75 ha.

IV.2.11. Conservation Areas (National Parks, Natural Parks, Wetlands, Natural Monuments, Nature Reserve Areas, Wildlife Protection Areas, Biogenetic Reserve Areas, Biosphere Reserves, Natural Site and Monuments, Historical, Cultural Site, Specially Protected Environment Areas, Tourism Center and Areas, Areas under the Pasture Law)

Within the scope of survey carried out for conservation areas, all areas that are defined and protected with laws and regulations like national parks, natural life areas, protected habitats, genetic resources, limited development areas (touristic areas) were evaluated.

Specially protected environment area, natural park, national park, nature reserve area and natural park and wildlife protection area are not present within the boundaries of Mus Province. Within the Mus Province conservation areas with different status and areas where hunting is forbidden is given in Figure IV.25.



T.C.
ORMAN ve SU İŞLERİ BAKANLIĞI
DOĞA KORUMA ve MİLLİ PARKLAR GENEL MÜDÜRLÜĞÜ
MUŞ
İLİ
AVA AÇIK ve KAPALI ALANLAR HARİTASI

Bu haritadaki ilin mülki sınırları dışında bu renkle boyanan bölümler, komşu illere ait sahaları göstermektedir.
İl geneli avlanma izin kartı alan avcılar buralarda avlanamazlar.

Bu harita 10 sayılı Merkez Av Komisyonu kararına göre Ava Açık ve Kapalı Sahaları göstermek için bilgi amaçlı basılmıştır. Merkez Av Komisyonu kararı 18.06.2011 tarih ve 27968 sayılı Resmi Gazetede yayımlanarak yürürlüğe girmiş olup kararda belirtilen sınırlar geçerlidir. Av dönemi içerisinde tescil edilecek genel ve devet avlaklarının sınırları www.milliparklar.gov.tr adresinde yayınlanacaktır. Ayrıca aynı adreste tüm illerin 2011 - 2012 av dönemine ait haritaları da yayınlanmaktadır.

Figure IV.27. Map Showing Hunting-Allowed Areas Ad and Hunting-Forbidden Areas for Year 2011

According to the Provincial Environmental Status Report, the following wetlands are located within the Mus provincial boundaries that are protected by Regional Environmental Commission Decision:

- Buyuk Hamurpet Lake
- Kucuk Hamurpet Lake
- Hacli Lake
- Kaz Lake
- Degerli Lake
- Kumlukiyi Lake
- Yurttutan Kuru Lake
- Korkut Sazlikbasi
- Degerli Lake
- Kumlukiyi Lake
- Yurttutan Kuru Lake
- Korkut Sazlikbasi Marsh
- Merkez Bostankent Marsh
- Merkez Kiyi Marsh
- Bulanik Sorgol Marsh

These wetlands are not located within the project area. The nearest of these wetlands to the reservoir is Kucuk Hamurpet Lake and Kumlukiyi Lake. The distance between Kucuk Hamurpet Lake and the reservoir is about 8.5 km, and Kumlukiyi Lake is at a distance of about 2 km.

Construction and operation phases of the project will comply with the Regulation on Conservation of Wetlands (Official Gazette; Date: May 17, 2005, No: 25818). Necessary permissions (Wetland Activity Permit) is given in App-2.

As it mentioned before, within the Project area pasture and meadow areas are present.

Within scope of Alpaslan II Dam and HEPP Project, in accordance with determination of any cultural heritage are inundated or not, Ministry of Culture and Tourism transmitted the subject to Regional Directorate of Cultural and Natural Heritage of Van with the Official Letter No. 137223 on June 29, 2011 (App-2) relying on the application to General Directorate of Cultural Heritage and Museums.

A letter dated on September 15, 2011 (No: 188765 see Appendix-2) was issued by Ministry of Culture and Tourism of General Directorate of Cultural Heritage and Museums referring to responsive letter of Van Regional Committee Directorate of Cultural and Natural Properties Conservation. The letter states that there is cultural heritage to be inundated within the dam site according to the expert report, therefore studies of inventory and documentation shall be carried out within the framework of principle decision of Supreme Committee of Natural Properties Conversation that is entitled as Conservation of Affected Immovable Cultural Heritage in Dam Site. Additionally a decision made in the letter that a committee to be established shall consist of Assistant Professor Hanifi Biber, who is one of the members of Archaeology Department of 100. Yil University, and experts from Van Regional Directorate Committee of Cultural Heritage Conversation.

After completion of commission’s work, with the letter No. 366 on December 23, 2011 (App-2) of Ministry of Culture and Tourism, Regional Directorate of Cultural and Natural Heritage of Van;

Due to the decision of the Committee dated on December 8, 2011, with regard to Alpaslan Dam and HEPP Project that is located within the border of Merkez and Varto Districts of Mus Province, Tepekoy Tumulus, Dogdap and Kız Castles (located on Mescitli Village) shall be registered in accordance with the Article 7 of the Law of Cultural and Natural Properties Conservation (No: 2863) and identified as First Degree Archeological Site in order to having the characteristics indentified in the Article 6 of the same Law. Additionally, it is stated that decision is made on "Abdurrahman Pasa Bridge shall be reevaluated by the Archeological and Art Historian Experts of the Committee Directorate that is considered in the report of scientific committee that registration of it is not necessary, the studies of rescue excavations with regard to cultural heritage (to be inundated) and dam construction activities shall be carried out simultaneously, and cultural layer of to be inundated tumulus shall be excavated and documented".

IV.2.12. Inland Waters (Lake, River) Species (natural characteristics of these species, species protected by national and international legislation; reproduction, feeding, sheltering and living areas of these; protection order for these areas)

Alpaslan II Dam and HEPP is planned to be located on Murat River, in Firat basin, Eastern Anatolian Region, at a distance of about 34 km to Mus city center. Field studies were carried out in July and November 2010 in order to determine the aquatic fauna in the project area. The results are evaluated and project impact on aquatic ecosystem is discussed.

Murat River, on which the proposed project will be developed, has a length of about 600 km. It originates at Aladag Mountain to the north of Van Lake. After it merges with tributaries originating from Muratbasi Mountain, it takes up on others from Eleskirt region near Agri Province. Murat River then flows in the southwest direction and reaches Malazgirt Plain. It merges with Hinis Creek from Bingol Mountains and enters Mus Plain from the north, where it merges with another creek coming from Nemrut Mountain. It flows to the west passing through narrow channels and Palu, and then merges with Harinket Creek from Ulu Plain of Elazig Province and also Munzur-Peri Creek from Tunceli Province. Murat River also merges with Karasu at Keban region, which is another important tributary of Firat River, and then finally flows into Firat River.

IV.2.12.1. Material and method

In order to represent the project area, three sampling points were selected (see Figure IV.28). When these sampling points were determined, dam site upstream, area between the dam site and HEPP, dam site downstream and those areas preferred by fish species (sandy-slimy, stony-rocky and vegetation cover) were considered.

Aquatic ecosystems are composed of the following organisms; phytoplanktonic organisms at the producer level (free or attached algae), zooplanktonic and benthic organism that feed on these, which are primary and secondary consumers, and tertiary consumer fish species, which depending on their food preference can feed on either zooplanktonic and benthic organisms or smaller fish.

In this context, the main links of the aquatic food chain are algae (attached or free forms, phytoplanktonic organisms), zooplanktonic organisms, benthic organisms, and fish. Changes in aquatic systems can cause changes on these organisms. The relationship between hydrological system and aquatic flora and fauna species of Alpaslan II Dam and the

HEPP Project area were evaluated in “Assessment Report for HEPP Projects and Other Hydraulic Activities” (Ecosystem Evaluation Report).

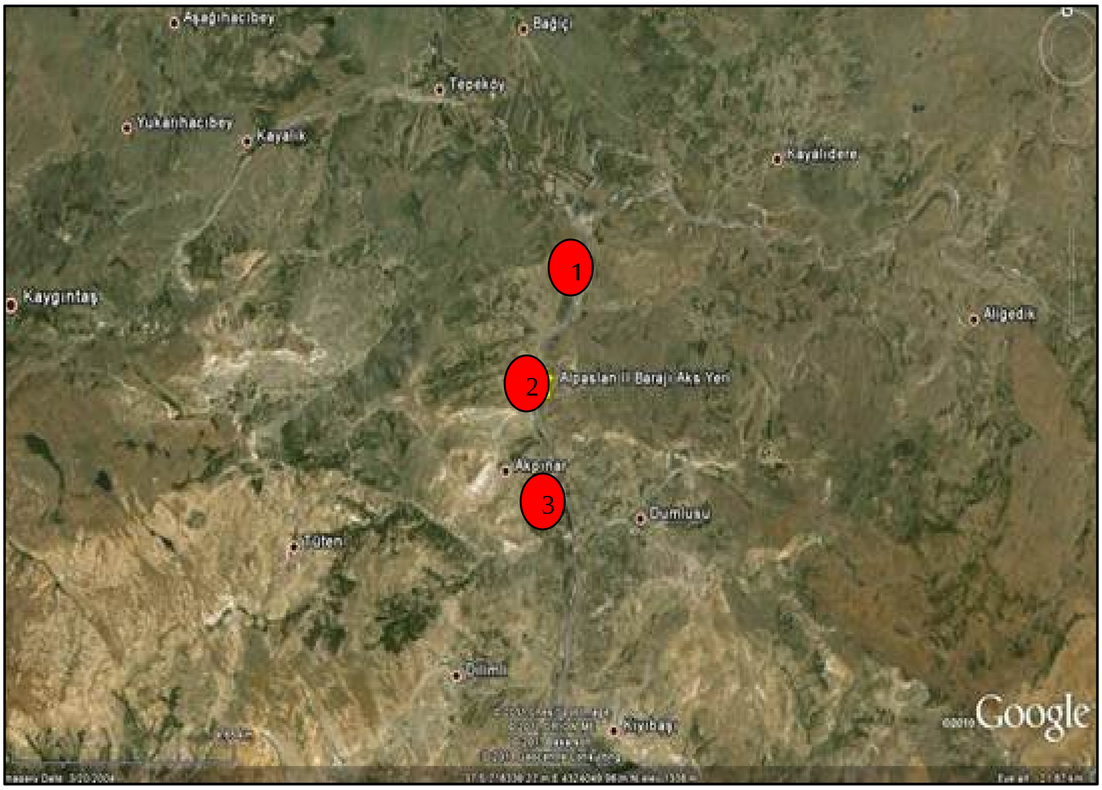


Figure IV.28. Alpaslan II Dam and HEPP Area Aquatic Flora and Fauna Sampling Stations

Resources that were utilized in determining terrestrial flora and fauna species of the project area and its surroundings, and impacts of the project on the biological environment can be listed as the following:

- Related literature and scientific sources
- Interviews with local people
- Satellite images of the project area and its surroundings
- Field surveys carried out in July and November of 2010, and April of 2011

Alpaslan II Dam and HEPP Project aquatic flora and fauna studies were carried out by Asst. Prof. S. Cevher OZEREN from Ankara University, Science Faculty, Department of Biology. National and international threat statuses of flora and fauna species identified in the area in light of the above-mentioned resources were determined according to the IUCN 2011 (International Union for Conservation of Nature), CITES 2004 (Convention on International Trade in Endangered Species of Wild Fauna and Flora, and BERN Convention 2002.

Classification made by CITES, which is an international convention signed by 164 countries (including Turkey), aims to prevent international trade from threatening lives of wild animals and plants. The principles of CITES are based on sustainable trade, which is important for conservation of ecological sources (various wildlife products derived from massive amounts of live animals and plants, products added to food items, exotic leather products etc.). CITES was signed in 1973 and came into force in 1975. Turkey signed this Convention in 1996.

Species covered in CITES are given under three different appendices according to their conservation status. Appendix I covers the species, which are under the threat of extinction. Trade in the specimens of these species is not allowed except extraordinary circumstances. Appendix II includes species, which are not threatened with extinction, but trade in specimens is restricted in order to prevent utilization incompatible with their survival. Appendix III includes species, for which other parties of CITES is applied for assistance in controlling trade and which are conserved at least in one country.

BERN Convention aims at conserving and promoting biodiversity, developing national policies for the conservation of wild flora and fauna and their natural habitats, protection of the wild flora and fauna from the planned development and pollution, developing trainings for protection practices, promoting and coordinating the researches made according to this subject. It has been signed by 26 member states of the European Council (as well as Turkey) with the aim of conserving the wild life in Europe.

All of the nations, which are party to the BERN Convention, have signed the Convention on Biological Diversity as well. Parties of this convention are responsible from ensuring sustainable use of resources in line with their national development trends and conserving the threatened species. (Council of Europe, 1994). Flora and fauna species, which are protected with this contract, are listed as App-1(Strictly Protected Flora Species), App-2 (Strictly Protected Fauna Species) and App-3 (Protected Fauna Species).

The IUCN Red List intends to draw attention to species whose populations are at risk or under threat. The IUCN places a species on the Red List only after studying its population and the reasons for its decline. Some countries pay greater attention to IUCN-listed species than Bern-listed species, since the Red List relies on more research. The 1994 (ver.2.3) and 2001 (ver.3.1) categories and criteria of the IUCN Red List are presented below in Table IV.23.

Table IV.23. IUCN Red List Categories and Criteria

IUCN Red List Categories and Criteria 1994 (ver. 2.3)		**IUCN Red List Categories and Criteria 2001 (ver. 3.1)***	
EX	: Extinct	EX	: Extinct
EW	: Extinct in the Wild	EW	: Extinct in the Wild
CR	: Critically Endangered	CR	: Critically Endangered
EN	: Endangered	EN	: Endangered
VU	: Vulnerable	VU	: Vulnerable
LR	: Lower Risk		
	cd: conservation dependent	NT	: Near Threatened
	nt: near threatened	LC	: Least Concern
	lc: least concern		
DD	: Data Deficient	DD	: Data Deficient
NE	: Not Evaluated	NE	: Not Evaluated

** IUCN Red List Categories and Criteria have been formed by means of extensive reviews for developing more transparent, more open and easy to use systems in the recent years. In this respect, corrections were made and adopted by IUCN Council in February 2000 and revised Categories and Criteria (IUCN Red List Categories and Criteria, version 3.1) were published in 2001*

Algae and phytoplanktonic organisms

The fundamental principle in sampling of phytoplanktonic organisms is collecting the phytoplankton from water through filtering. A Hydro Bios Kiel brand Hensen type with 10 μm and 55 μm aperture size plankton grab sampler was used. Samples that were kept in water for a certain period of time and then collected in the catch pit of the grab sampler were transferred into plastic containers and taken to the laboratory after fixated with 4% formaldehyde.

Attached algae were collected by scraping. Rocks (epilithic), sediment (epipelic), plants (epiphytic) and crustaceans (epizoic) were collected and their outer parts were scraped using a toothbrush or a hard object. The scraped part was cleaned with distilled water and put into sampling bottles. It was fixated with 4% formaldehyde and taken to the laboratory. The collected samples were identified at genus and/or species levels.

Zooplanktonic Organisms

Sampling method for zooplanktonic organisms is the same as that of the planktonic algae sampling.

Benthic organisms

Benthic organisms were collected from mud from sandy and puddles, gravels and underneath the rocks in stony areas. They were identified in-situ and at the laboratory at family and/or genus levels. Sieves of different pore sizes were used in sifting the bottom mud samples. Macrobenthic organisms were identified at genus level in-situ.

Fish

Fish samples, which constitute an important indicator of aquatic vertebrates, were sampled with a Samus 725 MP electroshocker where the current rate and water depth are low (see Figure IV.29). At higher depths and where flow rate is higher a casting net was used. Sampled fish species were taken to the laboratory after fixated with 4% formaldehyde and 96% alcohol.

In identifying algae the following resources were utilized; Krammer and Lange-Bertalot, 1986; 1988; 1991a; 1991b; Bold and Wynne, 1985; Czernecki and Blinn, 1978; Foged, 1982; Germain 1981; Hustedt, 1930; Prescott, 1982; Patrick and Reimer, 1966; Sreenivasa and Duthie, 1973; Van Heurck, 1962; Cox, 1996; Huber Pestalozzi, 1938; 1941; 1955; 1961; 1968; 1982; Komarek, 1983. In identification of Rotifera species Hutchinson (1967); Pejler (1962); Kuttikova (1970); Kolisko (1974); Koste (1978a; 1978b) and Ridder (1981) were used while for Cladocera and Copepoda species Kiefer (1978) was used. In identification of benthic organisms the resources that were utilized are Sennika, 1943; Mann, 1962; Needham and Needham, 1962; Macan, 1982; Quigley, 1977; Pennak, 1978; Illies, 1978; Elliot and Mann, 1979; Biro, 1981; Edington, 1981; Bellman, 1988; Sahin, 1991; Gloer, 1992; Ludwig, 1993. For fish species, on the other hand, Kuru (1975), Geldiay ve Balik (1999) were used.

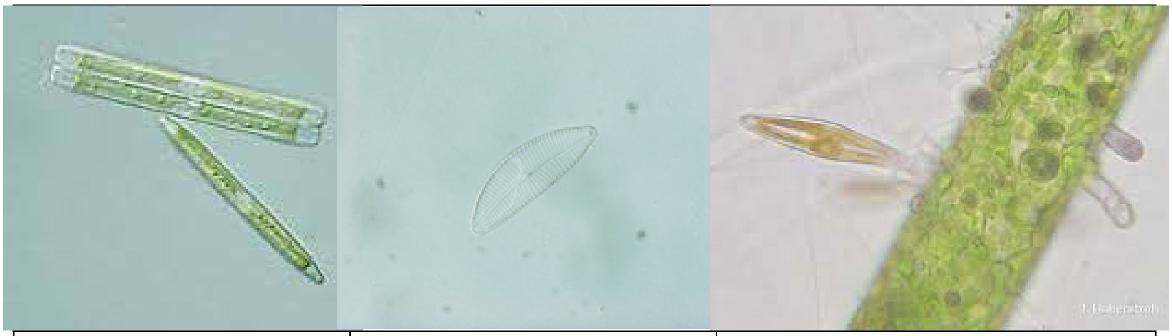
Figure IV.29. Fish Sampling

IV.2.12.2. Findings of the Aquatic Flora and Fauna

Freshwater Algae

Algae are primary producers in an aquatic environment. Using the pigments in their structure, they are capable of converting carbondioxide and water into carbohydrates under sunlight. This way they contribute to increasing the amount of nutrition and dissolved oxygen in an aquatic environment. They form the first link of the food chain by enhancing their own growth. They are important in terms of their contribution to production and relations with organisms at higher levels.

As a result of field studies carried out to identify phytoplanktonic organisms, the most dominant group at the three sampling stations is Bacillariophyceae, while Euglenophyceae and Pyrrophyceae are represented by one species each. Within the scope of the study, a total of 20 Bacillariophyceae, 5 Chlorophyceae, 4 Cyanophyceae, 1 Euglenaphyceae, and 1 Pyrrophyceae species were identified. Besides, it was determined that *Achnanthes microcephala, Cymbella affinis* and *Fragilaria ulna* from Bacillariophyceae were determined to be abundant (see Figure IV.30). Phytoplanktonic organisms identified in the area are listed in Table IV.



Fragialla ulna	*Cymbella affinis*	*Achnanthes microcephala*

Figure IV.30. Samples of Phytoplankton Species Identified in the Area

Table IV.24. Phytoplankton Organisms Identified in the Project Area

PHYLUM	CLASS	GENUS/SPECIES	STATION NO.
BACILLARIOPHYTA Haeckel 1878 emend Mann in Round et al.	PENNATIBACILLARIOPYCEAE	*Amphora ovalis*	2;3
		Achnanthes microcephala	1;2;3
		Anomoeonis sphaerophora	1;3
		Caloneis permagna	2
		Cocconeis placentula	1;2;3
		Cyclotella meneghiniana	1;3
		Cymbella affinis	1;2;3
		Cymatopleura solea	!;2
		Diatome vulgaris	2;3
		Epithemia argus	1;2
		Epithemia sorex	1;2;3
		Fragillaria contruens	2
		Fragilaria ulna	1;2;3
		Gomphonema sp	1
		Melosira varians	1;2
		Navicula cryptocephala	1;2;3
		Nitzchia sigmoidae	1;2;3
		Pinnularia viridis	1;2
		Surirella brebissonii	2;3
		Surirella ovalis	1;2
CHLOROPHYTA (Green Algae)	CHLOROPYCEAE	*Closterium aciculare*	2;3
		Cosmarium obtusatum	1;2
		Oocystis parva	1;2;3
		Pediastrum dublex	1;2
		Scenedesmus quadricauda	1;2;3
CYANOPTHYTA	CYANOPHYCEAE	*Microcystis sp.*	1;3
		Oscillatoria sp.	1;2;3
		Oscillatoria limosa	1;3
		Spirulina sp.	1;3
EUGLENOPHYTA	EUGLENOPHYCEAE	*Euglena sp.*	2
PYRROPHYTA	PHRROPHYCEAE	*Peridinium sp.*	2;3

Zooplanktonic organisms

Cladocera, Copepoda and Rotifera are microscopic organisms, which constitute the most important groups of zooplanktons. Most of these zooplanktonic organisms are spread in freshwater and in general can be found at limnetic zones of lakes and stagnant parts of river systems. In defining water quality of freshwater systems, Rotifera species are important indicators since a number of invertebrates and vertebrates feed on these species. There are a total of 6 species identified in the area; 3 species from Rotifera, 2 from Cladocera and 1 from Copepoda (see Figure IV.31). Zooplanktonic organisms identified in the study area are listed in Table IV.25. All of the zooplanktonic species identified in the area are cosmopolitan and are widespread in all kinds of water.

Keratella quadrata	*Daphnia cucullata*	*Cyclops sp*

Figure IV.31. Samples of Zooplankton Species Identified in the Area

Benthic organisms

Benthic organisms cover those organisms, which spend at least some part of their lives at the bottom of freshwater habitats (on sediment, deposits, macrophytes and filamentous algae). Nectons and buried forms are also included in the category of benthic organisms. Since mobility of benthic organisms is quite limited, it is possible to acquire information on the situation of the aquatic environment and monitor changes by monitoring benthic organisms. The list of benthic species identified in the area are given in Table IV.35,, which includes *Gyraulus sp*. from class Gastropoda, larvae of Diptera (Chrinomid larvae), Tricoptera, Plecoptera, Coleoptera and Ephemeroptera species (see Figure IV.32) and also *Potamon potamius* from Malacostraca (see Figure IV.32).

***Tricoptera* spp. larvae nests** **_Potamon potamius_**

Figure IV.32. Samples of Benthic Organisms Identified in the Area

Table IV.25 Zooplanktonic and Benthic Organisms Identified in the Project Area

PHYLUM	SUBPHYLUM	CLASS	ORDER	FAMILY	GENUS/SPECIES	STATION NO.
ARTHROPODA	CRUSTACEAE	BARANCHIOPODA	CLADOCERA	DAPHNIIDAE	*Daphnia cucullata*	1;2;3
				BOSMINIDAE	*Bosmina longirostris*	1;2;3
		MAXILLOPODA	CYCLOPOIDA	CYCLOPOIDAE	*Cyclops* sp.	2;3
			CALANOIDA	DIAPTOMIDAE	*Acanthodiaptomus denticornis*	1;2
		MALACOSTRACA	DECAPODA	POTAMIDAE	*Potamon potamius*	2;3
			AMPHIPODA	GAMMARIDAE	*Gammarus pulex*	2
	MANDIBULATA	INSECTA (HEXAPODA)	TRICOPTERA	-	Larva	1;2
			EPHEMEROPTERA	-	Larva	1;2;3
			COLEOPTERA	-	Larva	1;2
			PLEOCOPTERA	-	Larva	1;2;3
			DİPTERA	CHIRONOMODIEA	Larva	1;2;3
MOLLUSCA	-	GASTROPODA	-	PLANORBIDAE	*Gyraulus sp.*	1;2;3
ROTIFERA	-	MONOGONONTA	PLOIMA	LECANIDAE	*Lecane sp.*	1;2;3
				BRACHIONIDAE	*Keratella quadrata*	1;2;3
					Brachnious calyciflorus	1;2;3

Fish

Fish species are an important part of an aquatic system being at the top of the food chain. Fish species can feed on algae, zooplankton and benthic organisms. Some species are not only important ecologically, but also in economic terms.

The Firat River freshwater fish fauna was studied in detail by Kuru (1975). Based on field studies, total of 13 species were identified, which 9 of them from family Cyprinidae, 2 of them from Balitoridae and one from Sisoridae. The habitats of these identified species, threat status and endemism is given in Table IV.26. Bio-ecological characteristics about these species are explained below.

Acanthobrama marmid (Heckel, 1843)

Acanthobrama marmid is mostly common in Dicle and Firat River. Head and body is quite flat on sides, covered with small scales and mouth is small and positioned on terminal. (see Figure IV.33). Total length can reach up to 20 cm, weight up to 200 g. Color is grey-yellow but paddle colour is pinkish. It mostly occupies slow flowing rivers and streams and rarely lakes.

Figure IV.33. *Acanthobrama marmid*

Alburnoides bipunctatus (Bloch, 1782)

Body is quite flat on sides, and covered with small scales. Colour of dorsal side is dark and lateral sides and abdomen is silvery-white. Generally a thick strip could be seen on lateral sides of their body, especially at reproduction period. Adults are 10-12 cm tall, maximum 16 cm. (see Figure IV.34). They prefer pebbled and stony grounds and feed on insect larvae and ground organisms. The breeding period is between the months of May and June.

Figure IV.34. *Alburnoides bipunctatus* - Spirlin

Table IV.26. Fish Species Identified in the Project Area, Their Population Densities and Conservation Statuses

FAMILY	SPECIES	ENGLISH NAME	POPULATION DENSITY	SUITABLE HABITAT STREAM (A); RIVER (R); LAKE (L)	ENDEMIZM	IUCN RED LIST (2011)	BERN (2002)	CITES (2004)
CYPRINIDAE	*Acanthobrama marmid*	-	High	S / R / L	Fırat-Dicle	-	-	-
	Alburnoides bipunctatus	Spirlin	High	S / R / L	-	-	App-III	+
	Alburnus mossulensis	-	High	S / R / L	Fırat-Dicle	-	-	-
	Barbus lacerta	Kura Barbel	High	S / R / L	Fırat-Dicle			
	Capoeta umbla	-	High	S / R / L	-	-	-	-
	Capoeta trutta	-	High	S / R / L	-	-	-	-
	Chondrostoma regium	-	Medium	S / R / L	-	-	-	-
	Garra rufa	Doctor fish	High	S / R / L	-	-	-	-
	Luciobarbus mystaceus	-	Medium	S / R / L	Fırat-Dicle	-	-	-
	Squalius cephalus	Chup	Medium	S / R / L	-	LC	-	-
BALITORIDAE	*Oxynoemacheilus argyrograma*	-	High	S / R / L	Fırat-Dicle	-	-	-
	Oxynoemacheilus euphraticus	-	High	S / R / L	Fırat-Dicle	-	-	-
SISORIDAE	*Glyptothorax kurdistanicus*	-	High	S / R /	Fırat-Dicle	-	-	-

Alburnus mossulensis (Heckel, 1843)

This species prefers the littoral zone of stream and lakes. They can be easily separated from other species of genus with a thick strip on lateral sides of their body (see Figure IV.35). Their most important nutrient is benthic invertebrates. The breeding period is between the months of April and June and they lay their eggs to upper part of stones.

Figure IV.35. *Alburnus mossulensis*

Barbus lacerta (Heckel, 1843)

Barbus lacerta (35-40 cm tall) is a *bentopelagic* species, which is known "*Kura barbel"* (see Figure IV.36). This species, which can also well adapt to standing waters preferring habitats with high flow rates in 'Barbus Zones' and/or upstream of 'Abramis Zones'. Its reproduction period is between the months of April-July and they migrate to upstream portions of river for reproduction. This species are capable of omnivor feeding and their most important nutrients are zooplanktons at younger ages. Adult fish mostly consume benthic organisms and seed fishes.

Figure IV.36. *Barbus lacerta (Kura barbel)*

Capoeta trutta (Heckel, 1843)

Capoeta damascina is a bentopelagic and typical species of 'Abramis Zone'. It is called "Karabalik-Cepic" or "Berat" by local people. They can be easily separated from other species of genus with their ossified last dorsal fin (see. Figure IV.37). It can live in those parts of streams with both high and low flow rates and its ecological tolerance is rather high. They migrate to the lateral arms of the river. The most important nutrients are zooplanktons and aquatic invertebrates at younger ages. Adult fish mostly consume algae, parts of plants and detritus. The breeding period is between the months of April and July.

Figure IV.37. *Capoeta trutta*

Capoeta umbla (Heckel, 1843)

This is a benthopelagic fish species (see Figure IV.38). It can live in slow flowing rivers and streams, where the waterbed is semi-pebbled, sandy and slimy. In Turkey, the distribution is confined to Firat and Dicle upstreams and its ecological tolerance is rather high. The most important nutrients are zooplanktons and aquatic invertebrates at younger ages. Adult fish mostly consume algae, parts of plants and detritus. The breeding period is between the months of April and July.

Figure IV.38. *Capoeta umbla*

Chondrostoma regium (Heckel, 1843)

Chondrostoma regium is preferring habitats with low flow rates, stony or gravelly grounds in 'Abramis Zones' of rivers and can also well adapt to standing waters. (see. Figure IV.39). It generally feeds on algae and aquatic organisms. The breeding period is between the months of April and May.

Figure IV.39. *Chondrostoma regium*

Garra rufa (Heckel, 1843)

Garra rufa is a benthopelagic fish species, which can adopt different types of habitats like stream, lakes, rivers and hot spring. It generally feeds on algae over the stones and invertebrate at bottom owing to the vantouse under their mouth. They can called “Doctor Fish” because of their ability that cleaning up scattered skin who has psora (see Figure IV.40).

Figure IV.40. *Garra rufa* (Doctor fish)

Squalius cephalus (Linnaeus, 1758)

Squalis cephalus is called “Chup” by local people and known as a typical stream fish, which can adapt to lakes and hard waters. (see Figure IV.41). The breeding period is between the months of May and June. It mostly feeds on aquatic invertebrates, insect larvae, plant parts and small fish. The adults reach sexual maturity at about 3-4 years.

Figure IV.41. *Squalius cephalus* “Chup”

Luciobarbus mystaceus (Pallas, 1814)

This species mostly occupies streams and rivers, but can also adapt to standing water system well. The breeding period is between the months of April-June and they prefer upstream portions of river for reproduction. They lay their eggs to the areas with vegetation and the population density of this species found in the project area was assessed to be “medium”. This species are capable of omnivor feeding. The most important nutrients are zooplanktons at younger ages and benthic organisms and seed fishes at adult ages (see Figure IV.42).

Figure IV.42. *Luciobarbus mystaceus*

Oxynemacheilus argyrogramma (Heckel, 1846)

This species prefer stream system habitats with low/medium flow rates and gravelly, stony or sandy ground structures. Body is long in shape and quite flat on sides. Posterior of the body is covered with scales, anterior is withour scales. Edge of dorsal fin is slightly rounded. Free edge of ventral fin is round shaped and caudal fin is distinctly recessed. Body is cylindrical and flattened at posterior. They can be easily separated from other species of genus with 10-12 interrupted black-brown strips on lateral line of their body. Also brown stains can easily visible on and lateral sides of their head (see. Figure IV.43). Mouth is ventral-positioned and its most important nutrients are benthic organisms, zooplanktons and algea. The breeding period is between the months of April and July.

Figure IV.43. *Nemacheilus argyrogramma*

Oxynemacheilus euphraticus

This species prefer stream system habitats and gravelly, stony ground structures and they can easily adapt bank of lake or stream (see Figure IV.44). They feed on benthic organisms and zooplanktons. The breeding period is between the months of April and July. They can collect from stream systems with low flow rate and stony ground structures near bank.

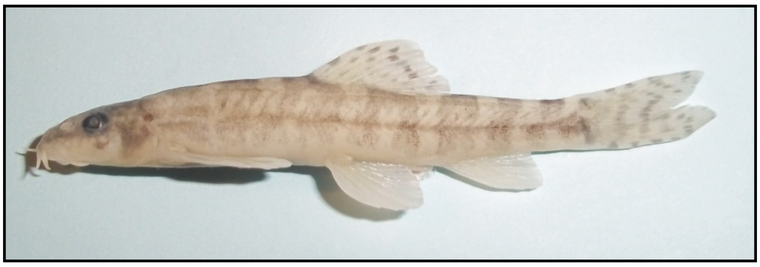


Figure IV.44.*Oxynemacheilus euphraticus*

Glyptothorax kurdistanicus (Berg, 1931)

These species are distributed in Firat-Dicle river system and body is not covered with scales. Head is flattened on top, mouth is ventrally positioned. 3 barbels can be defined near its mouth (see Figure IV.45). They can be easily separated from *Glyptotorax armeniacum* with flat nose and black dotted adipose fin. They have adhesive disc under their mouth. They prefer stream system and they live in benthic habitats.

Figure IV.45. *Glyptothorax kurdistanicus*

IV.2.13. Aquatic and terrestrial flora and fauna species, endemic, especially local endemic plant species, animal species naturally inhabiting the basin, their distribution in the area, points where they utilize water resources, species that are protected by national and international legislation, rare and endangered species and their distribution in the basin, names of game animals, their populations, and identification and listing of Central Hunting Commission Decisions for these animals

Floristic and faunistic characteristics of the area were determined by Prof. Hayri Duman from Gazi University Department of Biology and Assoc. Prof. Zafer Ayas from Hacettepe University Department of Biology. (see Figure IV.46). With this study, the aim was to evaluate both local fauna and flora characteristics and to determine the habitat quality. By this means, any ecological sensitivity in the study area is determined and serves as a basis for evaluating the level of impacts on the biological environment. For this reason, endemism and threat / protection status of species has been taken as basis for evaluation.

Figure IV.46. Flora and Fauna Studies in the Study Area

Resources that were utilized in determining terrestrial flora and fauna species of the project area and its surroundings, and impacts of the project on the biological environment can be listed as the following:

- Related literature and scientific sources
- Interviews with local people
- Satellite images and maps of the project area and its surroundings
- Field surveys carried out in July and November 2010, and April 2011

Study area for terrestrial flora and fauna surveys was selected to include the dam site, reservoir area and material borrow sites. The dam site and reservoir areas form the main project area. The area to be potentially affected from the project activities and structures (including the reservoir area) were considered as project impact area. Project impact area was defined including areas where physical (noise, dust, etc.) and biological (habitat loss, deterioration of vegetation, etc.) impacts would be observed. Also, considering roads that will be used by construction machinery and trucks, and dispersion potential of dust, an area with a diameter of about 1 km around the construction sites were studied. Areas along the river system that are outside the project and impact area were also considered and studied and areas that have similar habitats to project area were considered as alternative areas with suitable ecological carrying capacity. Alternative areas could be used by mobile species for feeding, sheltering and breeding.

National and international threat statuses of flora and fauna species identified in the area in the light of the above-mentioned resources were determined according to IUCN (International Union for Conservation of Nature) List of 2011, CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) of 2004, and BERN Convention of 2002. In addition, for flora species, Red Data Book of Turkish Plants (TRDB), which is based on 1994 (ver. 2.3) criteria of IUCN (Ekim et al., 2000), was used. Threat statuses for mammals, reptiles and amphibians have been determined according to the General Zoogeography and Turkey's Zoogeography of Demirsoy (2002). The

Pocket Book for Birds of Turkey (by Kiziroglu, 2009) was used for bird species. Additionally, hunting status of all fauna elements was determined according to 2011-2012 Decision of the Central Hunting Commission.

Classification made by CITES, which is an international convention signed by 164 countries (including Turkey), aims to prevent international trade from threatening lives of wild animals and plants. The principles of CITES are based on sustainable trade, which is important for conservation of ecological sources (various wildlife products derived from massive amounts of live animals and plants, products added to food items, exotic leather products etc.). CITES was signed in 1973 and came into force in 1975. Turkey ratified the Convention in 1996.

Species covered in CITES are given under three different appendices according to their conservation status. Appendix I covers the species, which are under threat of extinction. Trade in the specimens of these species is not allowed except extraordinary circumstances. Appendix II includes species, which are not threatened with extinction, but trade in specimens is restricted in order to prevent utilization incompatible with their survival. Appendix III includes species for which other parties of CITES is applied for assistance in controlling trade and which are conserved at least in one country.

BERN Convention aims at conserving and promoting biodiversity, developing national policies for the conservation of wild flora and fauna and their natural habitats, protection of the wild flora and fauna from the planned development and pollution, developing trainings for protection practices, promoting and coordinating the researches made regarding this subject. It has been signed by 26 member states of the European Council (as well as Turkey) with the aim of conserving the wild life in Europe

All of the nations, which are party to the BERN Convention, have signed the Convention on Biological Diversity as well. Parties of this convention are responsible from ensuring sustainable use of resources in line with their national development trends and conserving the threatened species (Council of Europe, 1994). Flora and fauna species, which are protected with this convention are listed in App-1 (Strictly Protected Flora Species), App-2 (Strictly Protected Fauna Species) and App-3 (Protected Fauna Species).

The IUCN Red List intends to draw attention to species whose populations are at risk or under threat. The IUCN places a species on the Red List only after studying its population and the reasons for its decline. Some countries pay greater attention to IUCN-listed species than Bern-listed species, since the Red List relies on more research. The 1994 (ver.2.3) and 2001 (ver.3.1) categories and criteria of the IUCN Red List are presented below in Table IV.27.

Table IV.27. IUCN Red List Categories and Criteria

IUCN Red List Categories and Criteria 1994 (ver. 2.3)		**IUCN Red List Categories and Criteria 2001 (ver. 3.1)***	
EX	: Extinct	EX	: Extinct
EW	: Extinct in the Wild	EW	: Extinct in the Wild
CR	: Critically Endangered	CR	: Critically Endangered
EN	: Endangered	EN	: Endangered
VU	: Vulnerable	VU	: Vulnerable
LR	: Lower Risk		
	cd: conservation dependent	NT	: Near Threatened
	nt: near threatened	LC	: Least Concern
	lc: least concern		
DD	: Data Deficient	DD	: Data Deficient
NE	: Not Evaluated	NE	: Not Evaluated

** IUCN Red List Categories and Criteria have been formed by means of extensive reviews for developing more transparent, more open and easy to use systems in the recent years. In this respect, corrections were made and adopted by IUCN Council in February 2000 and revised Categories and Criteria (IUCN Red List Categories and Criteria, version 3.1) were published in 2001.*

IV.2.13.1. Terrestrial Flora Studies

Material and Method

In order to determine the terrestrial flora of the study area, 3 field studies were carried out. In this respect, flora species that can be observed in the study area throughout the year could be identified. Species were identified based on analysis of samples collected in the study area and also via direct observations.

Flora list is given in the order of; ferns (Pteridophyta), open seed plants (Gymnospermae) and closed-seeded plants (Angiospermae). Families under each group are also listed according to the phylogenetic order and species are listed in alphabetical order. Species are listed with their local Turkish names (if available), phytogeographic regions, endemism, threat categories for endemic and rare species, whether/or not they are included in TRDB, BERN, CITES lists, their habitats and their relative abundance in the area (see App-19).

Samples collected in the area were identified according to the “Flora of Turkey and the East Aegean Islands”. Turkish names of species were based on “Plant Names in Turkish” by Prof. Dr. Turhan Baytop. In determining threat status of flora species identified within the study area “Red Data Book for Turkish Plants (Ekim *et al.*, 2000)” was utilized and treat categories was interpreted in accordance with 1994 IUCN Red List Categories and Criteria.

Flora and vegetation characteristics

Eastern Anatolia Region, especially Mus-Erzurum region, is not a well-studied area in terms of its floral composition. A new *Cirsium* species (*Cirsium yildizianum;* see Figure IV.47*)*, which was collected in the area within the scope of this study, was accepted to be published in *Ann. Bot. Fennici* journal as of end of 2011. This also reveals that the area has not been surveyed in detail up to date. Since habitat diversity in the region is rather low, the flora is not rich and endemism rate is quite low as well. The study area falls within Iran-Turan phyto-geographical region in terms of its flora characteristics. It is completely under the influence of terrestrial climatic conditions.

Figure IV.47. *Cirsium yildizianum*

As a result of field surveys carried out in the project area 1 species from a fern family, 1 species from 1 Gymnospermae family, and 255 species from 49 Angiospermae families were identified. A total of 257 plant taxa from 51 families were identified where 13 of these identified species are endemic. Endemic species and their IUCN threat categories are given in Table IV.28.

Table IV.28. Endemic Flora Species and Threat Categories

No.	Species	Endemizm	IUCN Threat Category (TRDB)
1	*Ferula huber-morathii* Pesmen	Regional	EN: Endangered
2	*Cirsium yildizianum* Arabacı & Dirmanci	Regional	EN: Endangered
3	*Centaurea fenzlii* Reichardt	Regional	VU: Vulnerable
4	*Verbascum macrosepalum* Boiss. & Kotschy ex Murb.	Regional	VU: Vulnerable
5	*Anthemis wiedemanniana*	Widespread	LC: Least Concern
6	*Achillea teretifolia* Willd.	Widespread	LC: Least Concern
7	*Alyssum filiforme* Nyar	Widespread	LC: Least Concern
8	*Bufonia calyculata* Boiss. & Bal.	Widespread	LC: Least Concern
9	*Rhamnus petiolaris* Boiss.	Widespread	LC: Least Concern
10	*Astragalus eriocephalus* Willd. Subsp. *elongatus* Chamb. & Mathews	Widespread	LC: Least Concern
11	*Verbascum oreophilum* C. Koch var. *joannis* (Bordz.) Hub.-Mor.	Widespread	LC: Least Concern
12	*Phlomis capitata* Boiss.	Widespread	LC: Least Concern
13	*Tulipa sintenisii* Baker	Widespread	LC: Least Concern

East Anatolian Region is located in Iran-Turan phyto-geographical region and steppe vegetation is dominant in the study area. Quercus forest could be seen in some regions where anthropogenic impacts are inactive. However, riperian vegetation, which has high water requirement, and meadows can develop on stream banks. Vegetation types of the study area and flora species characterizing these vegetations can be listed as the following.

1. ***Quercus robur* subsp *pedunculiflora* Forests:** These forests mostly spread through the Murat River, especially among the Serkistan village (see. Figure IV.48). Dominant plant of this vegetation is *Quercus robur* subsp. *Pedunculiflora.* Among these trees there are species like *Acer tataricum, Rhamnus petiolaris, Fraxinus angustifolius.*

Figure IV.48. *Quercus robur* subsp *pedunculiflora* Forest Vegetation

2. **Steppe Vegetation:** This is most common vegetation type in the study area. Dominant plants of this vegetation are *Astragalus amblolepis, Astragalus eriocephalus, Artemisia austriaca, Eryngium billardieri, Cirsium haussknechtii (*see Figure IV.49), *Euphorbia macroclada, gundelia tournefortii,* and *Phlomis capitata. S*pecies, such as *Crataegus pseudoheterophylla, Pyrus elaeagnifolia and Rhamnus petiolaris,* can rarely be seen where this vegetation is dominant. In addition, there are *Cirsium yildizianum* and *Ferula huber-morathii,* which have good population in this habitat and which will be published as a new record by the end of 2011.

Figure IV.49. *Cirsium haussknechtii*

3. **Riperian Vegetation:** This vegetation type is especially spread along the alluvial plains where Murat River and Bingol Creek meet. Dominant plants of this vegetation are *Salix triandra, Salix alba, Salix pseudodepressa, Acer tataricum,* and *Tamarix smyrnensis.* Among these trees and bushes there are species like *Phragmites australis, Sparganium erectum* and *Poa trivialis,* which have high water demand.

Threat Status and Endemism of Species

As a result of field surveys carried out in the project area a total of 257 plant taxa from 51 families were identified and 13 of these identified species are endemic. Considering that 34% of Turkish flora is endemic, endemism rate of the area is quite low.

However, when endemism rate of Eastern Anatolia plants are evaluated, the outcome is as expected. Since Eastern Anatolia Region of Turkey has low habitat diversity, the endemism rates are quite low in general. Endemic species in this region are concentrated mostly at high mountainous areas. Species of steppe habitat, on the other hand, have very low endemism rates. There are 4 regional endemic species identified in the area. These are; *Ferula huber-morathii* Pesmen (EN), *Cirsium yildizianum* Arabacı & Dirmanci (EN), *Centaurea fenzlii* Reichardt (VU) and *Verbascum macrosepalum* Boiss. & Kotschy ex Murb. (VU). These species are mostly distributed among the steppe habitat within the study area. When the vertical distributions of these species are considered, some of the populations will be inundated. However, some other populations will be above the water level and will not be affected. Other endemic species identified in the area are widespread species and their IUCN threat category is “LC: Least Concern”.

Figure IV.50. *Centaurea fenzlii*

Overall Assessment

As a result of field studies carried out in the area, 257 flora species and subspecies were identified. Among these 4 species are regional endemic and 9 of them are widespread endemic. Seeds of regional endemic species should be collected from the population in the project area. These seeds should be both sent to the gene bank and also planted at elevations above the reservoir normal water level. By this way, population that would be lost due to habitat loss would recover in a short time. *Cirsium yildizianum* is one of the species that is widespread in the area that would be inundated. However, this species, which has not been published yet, is also widespread in steppe habitats at higher elevations above the reservoir normal water level. Accordingly, in regional endemic species, a small amount of population loss is expected, but if appropriate measures are taken, populations would easily recover.

IV.2.13.2. Terrestrial Fauna Studies

Material and Method

Faunistic studies were carried out in the project area and surroundings (possible impact area) including the possible alternative sites with suitable habitats for the fauna species. The main objectives of these studies are to determine the potential effects on terrestrial fauna elements and to define mitigation measures for the significant impacts.

In this regard fauna studies were conducted to identify the fauna elements (amphibians, reptiles, birds and mammals) in the study area, to define the habitats these fauna elements inhabit, and make evaluations on faunal and ecological characteristics of the study area.

The project area includes mainly the dam site and the reservoir, and the areas of the auxillary facilities. In addition to this area, the impact area also includes the areas, which would be physically or biologically affected though they are outside the project area. The impact area includes areas in which physical (noise, dust formation etc.) and biological (habitat losses, extinction of the vegetation cover etc.) impacts would occur during construction and operation phases of the activity. In general terms, geographical coverage of the impact area was taken as the areas within about 1 km diameter around each project activity site. The roads to be used by construction vehicles and trucks were also taken into consideration.

Principles and methods used for fauna studies considering ecologic characteristics in the region and threatening status of species are summarized below:

- During faunistic studies; field surveys, literature survey and office studies were consecutively conducted on an area including not only the planned dam site and the reservoir area, but also the surrounding areas in order identify the species composition of the study area.

- Faunistic field studies were conducted along the river stretch to be affected and on the area above the reservoir normal water level that shows the inundation area. Whenever a different fauna structure due to varying topographic conditions and/or vegetative structure is observed, the study area was further extended.

- For establishing the fauna inventory, terrestrial fauna studies were conducted especially during the reproductive period (April 2011).

- Presence of suitable habitats for fauna species, nests, nestlings, pellets and tracks of species (especially for the determination of birds and macro mammals), excrete and food wastes (especially for the determination of mammals), skin-horn, shield and bone remains were checked for during the faunistic studies.

- Within the scope of faunistic field surveys, hunting-collection-killing activities were not conducted for the identification of species.

- For identification of birs and mammals, direct observations were used (with the aid of advanced optical instruments). For identification of small mamals, reptiles, amphibies and fish species, traps, nets and live traps were used. The animals were released back after the identification.

- For identification of birds, net capture (netting) and trapping was not used. Line and point counting methods were preferred. Especially for reptiles and other small mammalian species observations, non-living materials in nature, fauna literatures about same area, museum materials that were collected before and stuffed animals by local people and amateurs were utilized as information sources.

- Fauna field surveys were performed on foot and/or by driving around with vehicles. The study area was investigated using maps (1/25000) and coordinates and elevations within the study area were determined by means of Global Positioning System (GPS) receivers. Observations were started in early morning and continued till the sunset.

As mentioned earlier, BERN Convention entered into force in 1982 in order to ensure conservation of European wildlife and natural habitats. Flora species that are under protection according to the Bern Convention are listed under Appendix I of the Convention. Fauna species were classified in two categories. The “Strictly Protected Fauna Species” are listed in Appendix II. These species may or may not be under threat according to IUCN classification. The second category of BERN Convention “Protected Fauna Species” is listed in Appendix III. The aim of this appendix is to ensure survival of the populations of species and provide legislative and administrative measures to ensure the protection of all these species. It includes conservation and management of habitats. Third category of BERN Convention includes species that do not need special protection

The IUCN Red List intends to draw attention to species whose populations are at risk or under threat. The IUCN places a species on the Red List only after studying its population and the reasons for its decline. Some countries pay greater attention to IUCN-listed species than Bern-listed species, since the Red List relies on more research. Only three categories in IUCN Red List; Critically Endangered (CR), Endangered (EN), Vulnerable (VU), refers that the species is under treath. Therefore, in impact evaluation this list is used as a distinctive key.

National threat categories that were defined by Demirsoy (2002) for mammals, reptiles and birds, which are included in General Zoogeography of Turkey are given in Table IV.29.

Table IV.29. National Threat Categories (Demirsoy, 2002) for Fauna Species (Mammal-Reptile-Amphibian)

E	Endangered
Ex	Extinct
I	In determinate
K	Insufficiently known
nt	Widespread, abundant
O	Out of danger
R	Rare
V	Vulnerable

National hunting status of fauna species in the study area are assessed in three categories, which are defined by the General Directorate of Nature Conservation and National Parks Central Hunting Commission (CHC) Decisions of 2011-2012 (Official Gazette, Date: June 14, 2011, No: 27968):

- Appendix I; includes wildlife species, which are protected by the former Ministry of Environment and Forestry (now Ministry of Environment and Urbanization)
- Appendix II; includes game animals, which are protected by CHC
- Appendix III; includes game animals, which are allowed to be hunted in seasons predefined by CHC.

In addition, national threat statuses of bird species identified in the study area were assessed according to categories defined by Pocketbook for Birds of Turkey (Kiziroglu, 2009) and listed in Table IV.30.

Table IV.30. Threat Categories for Bird Species (Kiziroglu, 2009)

Category A		
A.1.2	(CR)	Critically endangered and breeding species in Turkey
A.2	(EN)	Endangered and breeding species in Turkey
A.3	(VU)	Vulnerable and breeding species in Turkey
A.3.1	(D)	Declining, vulnerable and breeding species in Turkey
A.4	(NT)	Near threatened, breeding species do not face to risk now but are likely to qualify for threatened category in the near future in Turkey
A.5	(LC)	Least concern, breeding species that are widespread in Turkey
A.6	(DD)	Data deficient, breeding species on which there is deficient information in Turkey
A.7	(NE)	Not evaluated, Breeding species, which have not been evaluated in Turkey
Category B		
B.1.2	(CR)	Critically endangered and non-breeding species in Turkey
B.2	(EN)	Endangered and non-breeding species in Turkey
B.3	(VU)	Vulnerable and non-breeding species in Turkey
B.3.1	(D)	Declining, vulnerable and non-breeding species in Turkey
B.4	(NT)	Near threatened, non-breeding species do not face to risk now but are likely to qualify for threatened category in the near future in Turkey
B.5	(LC)	Least Concern, non-breeding species that are widespread in Turkey
B.6	(DD)	Data deficient, non-breeding species on which there is deficient information in Turkey
B.7	(NE)	Not Evaluated, non-breeding species, which have not been evaluated in Turkey

Findings

Fauna species were identified by direct observations made in the project and impact areas, surveys conducted with local people and hunters, literature review on species and their habitats.

Upon identification of these species Tables 19.2-19.5 in App-19 were prepared displaying their systematic categories, existence in the project, impact, and alternative areas, protection status at the international (IUCN, Bern and CITES) and national (Demirsoy, 2002 and Kiziroglu, 2009) levels and methods of data collection.

Mammals (Class: Mammalia)

The project area and its surroundings do not bear any special habitat characteristics that would be suitable to be inhabited by threatened fauna species. Sixteen of the 18 mammal species identified in the area are listed as “LC: Least concern”, one species is in the category of “DD: Data deficient”. Only one mammal species *Spermophilus xanthophyrmnus* (Anatolian ground squirrel) is considered in the category of “NT: Near threatened” according to the IUCN Red List. Based on CITES categories, *Canis lupus* (Wolf) is listed under “Appendix 2: Species, which are not threatened with extinction, but trade in specimens is restricted in order to prevent utilization incompatible with their survival.”, while two other species; *Vulpes vulpes* (Red fox) and *Martes foinea* (Stone marten) are listed under “Appendix 3: Species, for which other parties of CITES is applied for assistance in controlling trade and which are conserved at least in one country”.

When considered in terms of national threat categories, 4 mammal species; *Rhinolophus hipposideros* (Lesser horseshoe bat), *Myotis blythii* (Lesser mouse-eared bat), *Pipistrellus pipistrellus* (Common pipistrelle) and *Canis lupus* (Wolf) are considered in the category of “V: Vulnerable species” according to Demirsoy (2002). In terms of 2011-2012 CHC Decisions, 13 species are listed under “Appendix 1: includes wildlife species, which are protected by the former Ministry of Environment and Forestry (now Ministry of Environment and Urbanization)”, 1 species under “Appendix 2; includes game animals, which are protected by CHC”, and 4 species under “Appendix 3; includes game animals, which are allowed to be hunted in seasons predefined by CHC”. Mammal species that are under protection and their threat statuses are given in Table IV.31.

Birds (Class: Aves)

Out of 97 bird species identified within the project area and its vicinity, 56 species are protected by the BERN Convention “Appendix 2: Strictly protected fauna species”, another 34 species are protected by “Appendix 3: Protected fauna species”. All of the bird species identified in the project area are considered in the category of “LC: Least concern” according to the IUCN. None of the identified bird species are endemic to the region or Turkey. According to the CITES classification, 10 bird species are listed under “Appendix 2: Species, which are not threatened with extinction, but trade in specimens is restricted in order to prevent utilization incompatible with their survival”. The national and international threat statuses of bird species are given in Table IV.32.

Table IV.31. National and International Conservation Status of Mammal Species

No.	Species	English Name	International Threat Status			National Threat Status	
			IUCN	BERN	CITES	Demirsoy (2002)	MAK 2011-2012
1	*Erinaceus concolor*	Hedgehod	LC	APP-3	-	nt	APP-1
2	*Crocidura leucodon*	Bicolored shrew	LC	APP-2	-	nt	APP-1
3	*Crocidura suaveolens*	Lesser white-toothed shrew	LC	APP-2	-	nt	APP-1
4	*Rhinolophus hipposideros*	Lesser horseshoe bat	LC	APP-2	-	V	APP-1
5	*Myotis blythii*	Lesser Mouse-eared bat	LC	APP-3		V	APP-1
6	*Pipistrellus pipistrellus*	Common pipistrelle	LC	-	-	V	APP-1
7	*Lepus europaeus*	Brown hare	LC	-	-	nt	APP-3
8	*Spermophilus xanthaphyrmnus*	Suslic	NT	-	-	nt	APP-1
9	*Arvicola terrestris*	European water vole	LC	-	-	nt	APP-1
10	*Spalax leucodon*	Lesser mole rat	DD	-	-	nt	APP-1
11	*Apodemus slyvaticus*	Wood mouse	LC	-	-	nt	APP-1
12	*Rattus rattus*	Black rat	LC	-	-	nt	APP-1
13	*Mus musculus*	House mouse	LC	APP-2	-	nt	APP-1
14	*Canis lupus*	Wolf	LC	-	APP-2	V	APP-1
15	*Vulpes vulpes*	Red fox	LC	APP-3	APP-3	nt	APP-3
16	*Mustela nivalis*	Weasel	LC	APP-3	-	nt	APP-2
17	*Martes foinea*	Marten	LC	APP-3	APP-3	nt	APP-3
18	*Sus scrofa*	Wild boar	LC	APP-3	-	nt	APP-3

Table IV.32. National and International Conservation Status of Bird Species

No.	Species	English Name	International Threat Status			National Threat Status	
			IUCN	BERN	CITES	MAK (2011-2012)	Kiziroglu (2009)
1	*Tachybaptus ruficollis*	Little grebe	LC	APP-2		APP-1	A.3.1
2	*Podiceps cristatus*	Great crested grebe	LC	APP-3		APP-1	A.5
3	*Phalacrocorax carbo*	Cormorant	LC	APP-3		APP-2	A.3
4	*Ixobrychus minitus*	Little Bittern	LC	APP-2		APP-1	A.2
5	*Nycticorax nycticorax*	Night heron	LC	APP-2		APP-1	A.3.1
6	*Ardeola ralloides*	Squacco heron	LC	APP-2		APP-1	A.3
7	*Egretta garzetta*	Little egret	LC	APP-2		APP-1	A.3.1
8	*Casmerodius albus*	Great egret	LC	APP-2		APP-1	A.3
9	*Ardea cinerea*	Grey heron	LC	APP-3		APP-2	A.3.1
10	*Ardea purpurea*	Purple heron	LC	APP-2		APP-1	A.2
11	*Ciconia ciconia*	White stork	LC	APP-2		APP-1	A.3.1
12	*Tadorna tadorna*	Common shelduck	LC	APP-2		APP-1	A.3.1
13	*Tadorna ferruginea*	Ruddy shelduck	LC	APP-2		APP-1	A.4
14	*Anas crecca*	Common teal - Eurasian treal	LC	APP-3		APP-3	A.5
15	*Anas platyrhynchos*	Mallard	LC	APP-3		APP-3	A.5
16	*Milvus migrans*	Black kite	LC	APP-3	APP-2	APP-1	A.3
17	*Neophron percnopterus*	Egyptian vulture	EN	APP-3	APP-2	APP-1	A.3
18	*Circaetus gallicus*	Short-toed eagle	LC	APP-3	APP-2	APP-1	A.4
19	*Circus cyaneus*	Hen harrier	LC	APP-3	APP-2	APP-1	A.1.2
20	*Accipiter nisus*	Eurasian (or Northern) sparrowhawk	LC	APP-3	APP-2	APP-1	A.3
21	*Buteo buteo*	Buzzard	LC	APP-3	APP-2	APP-1	A.3
22	*Buteo rufinus*	Long-legged	LC	APP-3	APP-2	APP-1	A.3
23	*Falco tinnunculus*	Common kestrel	LC	APP-2	APP-2	APP-1	A.2
24	*Alectoris chukar*	Chukar partrdige	LC	APP-3		APP-3	A.2
25	*Perdix perdix*	PartrIdge	LC	APP-3		APP-2	A.2

Table IV.32. National and International Conservation Status of Bird Species (Continued)

No.	Species	English Name	International Threat Status			National Threat Status	
			IUCN	BERN	CITES	MAK (2011-2012)	Kiziroglu (2009)
26	*Coturnix coturnix*	QuaIl	LC	APP-3		APP-3	A.3
27	*Gallinula chloropus*	Moorhen	LC	APP-3		APP-2	A.3.1
28	*Fulica atra*	Eurasian coot	LC	APP-3		APP-3	A.5
29	*Grus grus*	Common crane	LC	APP-2	APP-2	APP-1	A.3
30	*Charadrius dubius*	Little ringed plover	LC	APP-2		APP-1	A.3
31	*Vanellus vanellus*	LapwIng	LC	APP-3		APP-2	A.5
32	*Larus armenicus*	Armenian gull	LC	APP-3		APP-1	A.4
33	*Sterna (Hydroprogne) caspia*	Caspian tern	LC	APP-2		APP-1	A.2
34	*Sterna hirundo*	Common tern	LC	APP-2		APP-1	A.3
35	*Sterna albifrons*	Little tern	LC	APP-2		APP-1	A.3.1
36	*Columba livia*	Domestic pigeon	LC	APP-3		APP-3	A.5
37	*Streptopelia decaocto*	Collared dove	LC	APP-3		APP-2	A.5
38	*Streptopelia turtur*	Turtle dove	LC	APP-3		APP-3	A.3.1
39	*Athene noctua*	LIttle owl	LC	APP-2	APP-2	APP-1	A.2
40	*Apus apus*	Swift	LC	APP-3		APP-1	A.3.1
41	*Merops apiaster*	Bee-eater	LC	APP-3		APP-1	A.3.1
42	*Upupa epops*	Hoopoe	LC	APP-2		APP-1	A.2
43	*Dendrocopus syriacus*	Syrian woodpecker	LC	APP-2		APP-1	A.2
44	*Dendrocopus medius*	Middle spotted woodpacker	LC	APP-2		APP-1	A.1.2
45	*Melanocorypha calandra*	Calandra lark	LC	APP-2		APP-1	A.5
46	*Melanocorypha bimaculata*	Bimaculated lark	LC	APP-2		APP-1	A.3
47	*Galerida cristata*	Crested lark	LC	APP-3		APP-2	A.3
48	*Ptyonoprogne rupestris*	Crag martin	LC	APP-2		APP-1	A.5
49	*Hirundo rustica*	Swallow	LC	APP-2		APP-1	A.5
50	*Delichon urbicum*	Common house martin	LC	APP-2		APP-1	A.3
51	*Anthus (novaeseelandiae) richardi*	Richard's pipit	LC	APP-2		APP-1	A.2
52	*Anthus campestris*	Tawny pipit	LC	APP-2		APP-1	A.2
53	*Anthus spinoletta*	Water pipit	LC	APP-2		APP-1	A.3
54	*Motacilla flava feldegg*	Black-headed wagtail	LC	APP-2		APP-1	A.3
55	*Motacilla alba alba*	White wagtail	LC	APP-2		APP-1	A.3.1
56	*Cinclus cinclus*	White-throated dipper	LC	APP-2		APP-1	A.1.2
57	*Erithacus rubecula*	Robin	LC	APP-2		APP-1	A.3
58	*Luscinia luscinia*	Thrush nightingale	LC	APP-2		APP-1	A.2
59	*Luscinia megarynchos*	Nigtingale	LC	APP-2		APP-1	A.2
60	*Luscinia svesica*	Bluethroat	LC	APP-2		APP-1	A.2
61	*Phoenicurus ochruros*	Black redstart	LC	APP-2		APP-1	A.2
62	*Phoenicurus phoenicurus*	Common redstart	LC	APP-2		APP-1	A.3
63	*Saxicola rubetra*	Whinchat	LC	APP-2		APP-1	A.3
64	*Saxicola torquata*	Stonechat	LC	APP-2		APP-1	A.3
65	*Oenanthe isabellina*	Isabelline wheather	LC	APP-2		APP-1	A.3
66	*Oenanthe oenanthe*	Wheather	LC	APP-2		APP-1	A.3
67	*Turdus torquatus*	Ring ouzel	LC	APP-2		APP-1	A.1.2
68	*Turdus merula*	Blackbird	LC	APP-2		EK-3	A.3
69	*Turdus viscivorus*	Mistle thrush	LC	APP-2		APP-2	A.2
70	*Cettia cetti*	CettI's warbler	LC	APP-2		APP-1	A.2
71	*Sylvia melanocephala*	Sardinian warbler	LC	APP-2		APP-1	A.3
72	*Phylloscopus collybita*	ChIff chaff	LC	APP-2		APP-1	A.3.1
73	*Muscicapa striata*	Spotted flycatcher	LC	APP-2		APP-1	A.3
74	*Parus major*	Great tit	LC	APP-2		APP-1	A.3.1
75	*Sitta neumayer*	Rock nuthatch	LC	APP-2		APP-1	A.2

Table IV.32. National and International Conservation Status of Bird Species (Continued)

No.	Species	English Name	International Threat Status			National Threat Status	
			IUCN	BERN	CITES	MAK (2011-2012)	Kiziroglu (2009)
76	*Sitta europaea*	Eurasian nuthatch	LC	APP-2		APP-1	A.3
77	*Lanius collurio*	Red-backed shrike	LC	APP-3		APP-1	A.2
78	*Lanius excubitor*	Graet grey shrike	LC	APP-3		APP-1	A.1.2
79	*Garrulus glandarius*	Jay	LC	-		APP-3	A.3.1
80	*Pica pica*	Magpie	LC	-		APP-3	A.5
81	*Pyrrhocorax graculus*	Yellow-billed chough	LC	APP-2		APP-1	A.3
82	*Corvus monedula*	Jackdaw	LC	-		APP-3	A.5
83	*Corvus frugilegus*	Field raven	LC	-		APP-3	A.5
84	*Corvus corene*	Hooded crow	LC	-		APP-3	A.5
85	*Corvus corax*	Common raven	LC	APP-3		APP-2	A.5
86	*Sturnus vulgaris*	Starling	LC	-		APP-2	A5
87	*Sturnus roseus*	Rosy starling	LC	APP-2		APP-1	A.4
88	*Passer domesticus*	House sparrow	LC	-		APP-3	A.5
89	*Passer montanus*	Tree sparrow	LC	APP-3		APP-2	A.3
90	*Petronia brachydactyla*	Pale rock sparrow	LC	APP-3		APP-2	A.2
91	*Fringilla coelebs*	Chaffinch	LC	APP-3		APP-2	A.4
92	*Serinus pusillus*	Red-fronted serin	LC	APP-2		APP-1	A.3
93	*Carduelis chloris*	Green finch	LC	APP-2		APP-1	A.3
94	*Carduelis carduelis*	Gold finch	LC	APP-2		APP-1	A.3.1
95	*Carduelis spinus*	Eurasian siskin	LC	APP-2		APP-1	A.3
96	*Emberiza hortulana*	Ortolan bunting	LC	APP-3		APP-2	A.3
97	*Miliaria calandra*	Corn bunting	LC	APP-3		APP-2	A.4

Reptiles (Class: Reptilia)

As a result of the studies carried out in the project area and its surroundings, 20 reptile species were identified. Only one of these species *Testudo grecea* (Common tortoise) is considered in the category “VU: Vulnerable“ according to IUCN. Based on the classification made by CITES, 2 species; *Testudo grecea* (Common tortoise) and *Eryx jaculus* (Javeline sand boa), are included in “Appendix II: Species, which are not threatened with extinction, but trade in specimens is restricted in order to prevent utilization incompatible with their survival“. Among the 20 reptile species 13 of them are protected under Bern Convention “Appendix II: Strictly protected fauna species“, and 7 of them are protected under “Appendix III: Protected fauna species“. Considering national threat categories, one of the reptile species; *Eryx jaculus* (Javeline sand boa) is considered in the category of “R: Rare”, while all of the other species are in the category of “nt: Widepread, aboundant”. Conservation statuses of reptile species identified in the area are given in Table IV.33.

There are also 7 amphibian species identified within the study area. Among these, 2 species; *Bufo viridis* (European green toad) and *Hyla arborea* (European tree frog) are considered in Appendix 2 of the Bern Convention, while all of the other species are considered in Appendix 3. One of the amphibian species in considered as “VU: Vulnerable” according to the IUCN Red List, while the rest of the species are evaluated as “LC: Least Concern”. None of the amphibian species identified in the area are considered by CITES. Amphibian species and their conservation status are given in Table IV.34.

Table IV.33. National and International Conservation Status of Reptile Species

No.	Species	English Name	International Threat Status			National Threat Status	
			IUCN	BERN	CITES	MAK (2011-2012)	Demirsoy (2002)
1	*Mauremys caspica*	Stripe-necked	LC	APP-2	-	APP-1	nt
2	*Testudo graeca*	Common tortoise	VU	APP-2	APP-2	APP-1	nt
3	*Cyrtopodion kotschyi*	Kotschy's gecko	LC	APP-2	-	APP-1	nt
4	*Hemidactylus turcicus*	Mediterranean house gecko	LC	APP-3	-	APP-1	nt
5	*Laudakia stellio*	star lizard	LC	APP-2	-	APP-1	nt
6	*Ophisaurus apodus*	European legless lizard	LC	APP-2	-	APP-1	nt
7	*Parvilacerta parva*	Dwarf Lizard	LC	APP-2	-	APP-1	-
8	*Lacerta (Darevskia) trilineata*	Balkan green lizard	LC	APP-2	-	APP-1	nt
9	*Ophisops elegans*	Snake-eyed lizard	LC	APP-2	-	APP-1	nt
10	*Trachylepis aurata*	-	LC	APP-3	-	APP-1	nt
11	*Eryx jaculus*	Sand boa	LC	APP-3	APP-2	APP-1	R
12	*Coluber (Dolichopis) jugularis*	Black whip snake	LC	APP-2	-	APP-1	nt
13	*Platyceps najadum*	Dahl's whip snake	LC	APP-2	-	APP-1	nt
14	*Hemorrhois ravergieri*	Spotted whip snake	NE	APP-3	-	APP-1	nt
15	*Dolichopis schmidti*	Coluber schmidti	LC	APP-3	-	APP-1	nt
16	*Eirenis modestus*	Ring-headed dwarf snake	LC	APP-3	-	APP-1	nt
17	*Elaphe quatuorlineata*	Four-lined snake	LC	APP-2	-	APP-1	nt
18	*Natrix natrix*	Grass snake	LR/lc	APP-3	-	APP-1	nt
19	*Natrix tasellata*	Dice snake	LC	APP-2	-	APP-1	nt
20	*Vipera labetina*	Levantine viper	NE	APP-2	-	APP-1	nt

Table IV.34. National and International Conservation Status of Amphibian Species

No.	Species	English Name	International Threat Status			National Threat Status	
			IUCN	BERN	CITES	MAK (2011-2012)	Demirsoy (2002)
1	*Neurergus strauchii*	Strauch's spotted newt	VU	APP-3	-	-	nt
2	*Bufo bufo*	Common toad	LC	APP-3	-	-	nt
3	*Pseudepidalea viridis*	Green Toad	LC	APP-2	-	-	nt
4	*Hyla arborea*	European tree frog	LC	APP-2	-	-	nt
5	*Hyla savignyi*	Common tree frog	LC	APP-3	-	-	nt
6	*Rana macrocremis*	Long-legged Wood Frog	LC	APP-3	-	-	nt
7	*Pelophylax ridibundus*	Eurasian marsh frog	LC	APP-3	-	-	nt

IV.2.13.3. Possible Effects of Project on Terrestrial Flora and Fauna and Mitigation Measures

The most important impact of the Alpaslan II Dam and HEPP Project on terrestrial flora and fauna elements would be in the form of habitat loss. Flora and fauna species identified as a result of field surveys and vulnerable species that might be impacted by project activities are given above.

Regional endemic species within the project area and its surroundings are generally of steppe vegetation, rather than the riparian zone. Although, some of the regional endemic species populations will be inundated, it is not expected to have any major impacts at species level since populations at higher parts of the steppe vegetation will continue to survive in the area. Species that are found within the riparian zone are widespread species like *Salix triandra, Salix alba, Salix pseudodepressa, Acer tataricum* and *Tamarix smyrnensis*. These species do not have any conservation status. Therefore, they are expected to be adversely impacted by project activities.

There are terrestrial bird species in the area, like herons, cormorants, ducks and plovers, which are dependent on water. However, these species are not expected to be affected with the transformation of the riverine water regime into a stagnant reservoir. On the other hand, since some of the terrestrial habitats will be transformed into aquatic ones, populations of water-dependent fauna elements in the area are expected to increase. As a result of field surveys, it was concluded that vulnerable fauna species in the area inhabit higher steppe vegetations. In addition, most fauna species, due to their higher mobilities, are expected to leave the project activity areas, and utilize nearby alternative areas.

Construction Phase

It is inevitable for flora and fauna species to be adversely impacted by the project due to the loss of habitat that would be caused by intense construction activities and permanent facilities to be built. However, the presence of alternative habitats for fauna species within the vicinity of the project area, most species having high mobility, and the fact that the area is mostly utilized by fauna species for roaming and feeding indicate that the degree of impacts would be low.

There will be permanent habitat loss within areas where there would be permanent structures during the construction and operation phases of the project. There will be also high levels of noise and light generated that would cause considerable disturbances on the ecosystem. With the establishment of facilities, some of the rocky areas as well as agricultural fields will be lost. However, these habitats are quite widespread outside project activity areas, and also in alternative areas within the vicinity of the project area. This is another indicator that the impact on fauna groups would be low.

Animals would be leaving the project area due to intense construction activities. In order to minimize impacts on especially underground and ground-nesting species, these species should be transferred to alternative areas during construction activities if they are encountered.

Although some of the fauna species identified in the project area are considered in the IUCN categories, these area widespread species in Turkey and the entire western palearctic region. When faunistic study results are evaluated, impacts of the project were assessed to be rather low and localized due to the following reasons:

- The surroundings of the project area show similar habitat diversity
- Fauna species considered within threat categories are widespread species
- There are no endemic fauna species

In addition due to noise levels that would be generated during construction activities, fauna species might temporarily leave the area. Alternative habitats that mammal and bird species would be expected to inhabit during construction activities are present within the vicinity of the project area. For those species that have limited mobility, personnel who would be operating such machinery should be informed on the existence of these species in the area.

Operation Phase

With the formation of the reservoir, part of the terrestrial habitat will be changed into an aquatic habitat. This will result in changes in land use, and water and food chains. Some of the woodland, which provides a habitat for terrestrial fauna species, would be inundated. These woodlands have already been disrupted through illegal deforestation, and formation of agricultural lands. When these areas are inundated, the living habitats of certain mammal, reptile and bird species will be narrowed. Alternative habitats, that would potentially be used by impacted fauna species, in terms of their living and feeding habitats, like small mammals (rodents, etc.), reptiles (tortoises, lizards, etc.) and birds, are present both at higher elevations, and also within the vicinity of the project area.

As a result of field studies carried out in the area, 257 flora species belonging to 51 families were identified and 13 of these species are endemic. Considering that 34% of Turkish flora is endemic, endemism rate of the area is quite low. However, when endemism rate of Eastern Anatolia plants are evaluated, the outcome is as expected. Since Eastern Anatolia Region of Turkey has low habitat diversity, the endemism rates are quite low in general. Endemic species in this region are concentrated mostly at high mountainous areas. There are 4 regional endemic species identified in the area. These are; *Ferula huber-morathii* Pesmen (EN), *Cirsium yildizianum* Arabacı & Dirmanci (EN), *Centaurea fenzlii* Reichardt (VU) and *Verbascum macrosepalum* Boiss. & Kotschy ex Murb. (VU). These species are mostly distributed within the steppe habitat within the project area. Looking at the vertical distribution of these species, some of the populations would be inundated. However, considerable populations would be left above the water level. Other endemic species identified in the area are widespread species and their IUCN threat category is “LC: Least Concern”.

Seeds of especially regional endemic species will be collected from the project area. These seeds will be both sent to the gene bank, and also planted at heights above the water elevation. By this way population that would be lost due to habitat loss would recover in a short time. *Cirsium yildizianum* is one of the species that is widespread in the area that would be inundated. However, this species, which has not been published yet, is also widespread in steppe habitats above the dam site.

While terrestrial fauna would be leaving the area that would be inundated, aquatic fauna will be developing in the area. Fauna species that live by lentic environments (amphibians, water snakes, etc.) will be positively impacted by the formation of the reservoir. Also, the reservoir will provide a suitable breeding, sheltering and feeding habitat for a number of bird species. This way, it would also be possible for migratory and predatory bird species to inhabit the area. During the migration season, with the presence of suitable lentic water habitats, it would be possible for the ornitho-ecological significance of the area to increase. Similar situations have been observed at other reservoirs in our country. One of the positive impacts of a dam is the increase in fish populations in the reservoir, which might provide an additional income for local people.

IV.2.14. High Landscape Value and Recreation Areas

The visual qualification of Alpaslan II Dam Area has a character, which takes shape with junction of two different rivers and by two different types of valley. These two different surface water sources are Bingol Creek and Murat River. Willow and poplar trees are present on the holm, which is formed at the junction region of these rivers (see Figure IV.51 and Figure IV.52).

Bingol Creek Valley represents a wide and topographically smooth structure. Topography forms a wide corridor and hills are punctuated with rising in here. Within the region, where this passage way is located, the river awakes feelings of calm/stagnation in observers' mind while some small and short trees create liveliness within the area (see Figure IV.53). During summer and autumn, yellow and dry sight of steppe vegetation limits the visual effect of the area. Colors of soil and blue colors of surface water make a contrast impact. With the willow, poplar and oak color changes in autumn, the area gain mobility. Visual color changes make this region attractive (see Figure IV.54).

In case a wider area is included into the visual observation area, it can be observed that small agricultural areas, highways and settlements are the dominant units of the cultural landscape pattern. When getting further away from the valley and including a wide area to the investigating area, small cultivated areas, roads and settlements are the basic elements that dominate the landscape.

Figure IV.51. Junction Region of Bingol Creek and Murat River

Figure IV.52. Vegetation Cover of the Holm located at the Junction of Bingol Creek and Murat River

Figure IV.53. Rare and Dispersed Trees over the Natural Surface Cover

Figure IV.54. Color Change of the Vegetation in Autumn

When observer moves towards the Murat River from the Bingol Stream, dynamism of the topography increases. In this area, valley gets narrow and hills, which occupy both sides of the corridor, get more strict lines. In this part of the study area, forest areas could be seen in the form of small groups of trees. The steppe characteristic within the region and the routinized color changes due to the color fluctuation during autumn and becomes more attractive in terms of visual sense for the observers.

IV.2.15. Mine and Fossil Fuel Resources (reserve amounts, current and planning operation status, annual production and its importance for state or local use and economic values)

Mus and its vicinity is not rich in terms of metal mines. In the locality, economic formations can be mentioned in terms of raw materials. These are gypsum, baryte, brick-tile, quartzite and cement.

Within the scope of studies on ores in the Southern and Eastern Anatolia Region between the years 2007 and 2008 conducted by General Directorate of Mineral Research and Exploration, clay intercalated gypsium fields were determined in Huri Komu and Siradere Villages in Bulanic District. In Siradere Field 3,173,144 tons of proved reserve (contents of 33.45% CaO, 37.67% SO_3 and 15.60% crystal water) and in Huri Komu Field 1,340,768 tons of proved reserve (contents of 35,07% CaO, 36,60% SO_3 and 17% crystal water) was defined.

Within the same study, quartzite formation in schist was determined in Merkez-Kerpenek and Haskoy-Buvetli locality. In Merkez-Kepenek Field 85,716,550 tons of quartzite formation with reserve for ceramic industry and in Haskoy-Buvetli Field 15,906,751 tons of quartzite formation with visible reserve for ceramic and refractory industry was determined.

Within the Mus Province, certain barite deposites are bein extracted and are exported to Syria and Yemen. In 1993, 15,000 tons of barite was produced in this locality. Important barite deposites are Bilir Village, Kasar Village and Kizilkilise Barite Deposit in Merkez District. In these deposits 94% $BaSO_4$ content of 2,490,000 ton probable+possible reserve (755,000 tons of this are proved reserve) was determined. Major barite deposits in the region are given in Table IV.35.

Tablo IV.35. Barite Deposits and Reserve Status in Mus Province

Location	Grade (% $BaSO_4$)	Rezerve
Merkez-Bilir Village	94	570,000 proved
	94	1,530,000 probable + possible
Merkez-Kasar Village	94	48,000 proved
	94	250,000 probable + possible
Merkez-Kizilkilise	94	137,000 proved
	94	700,000 probable + possible
TOTAL	94	755,000 proved
	94	2,490,000 probable + possible

Source: www.mta.gov.tr

In addition, gypsium, clay and argillaceous marn formations and brick-tile raw materials that can be used for cement raw material are present in Mus Province. Total of proved+possible reserve of well-medium quality brick-tile raw materials are approximately 22 million tons. Furthermore, 48 million tones of limestone (contents of 54% CaO, 3.9% SiO2 ve 0.6% MgO) was determined. Except fort the aforementioned mines, as a result of studies that carried out for energy raw material, lignite formations within Neogene aged sediment units were defined in Ziyaretkoy Field. Proved reserve of Lignite is 6,204,000 tons in the field. Lignite with dustlike coking heat value in original coal is 1,231 Kcal/kg.

Mineral reserves in Mus Province are shown in Figure IV.55. As can be seen from the figure, there are no mining site in the Project area.

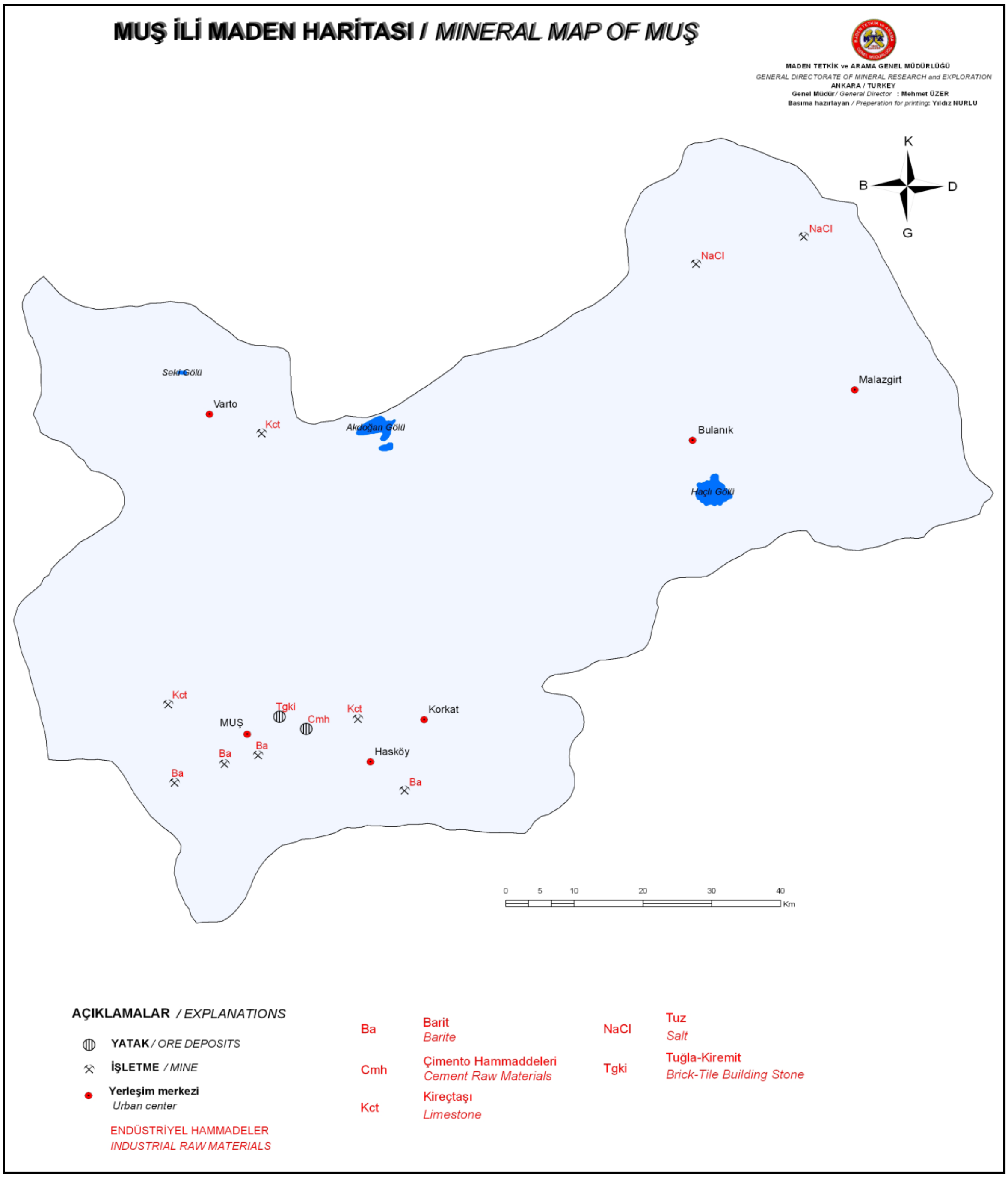


Figure IV.55. Mineral Reserves Map of Mus Province

Grade and reserve information of minerals in Mus are summarized below.

- **GYPSUM**
  Bulanik-Huri Komu Village
  Grade: Average 35.07% CaO, 36.60% SO_3 and 17% Crystal water
  Reserve: 1,340,768 tons proved reserve (gypsum reserve with clay intercalation)

  Bulanık-Siradere Village
  Grade: Average 33.45% CaO, 37.67% SO_3 and 15.60% Crystal water
  Reserve: 3,173,144 tons proved reserve (gypsum reserve with clay intercalation)

- **BARITE (Ba)**
  Within Mus Province certain barite deposits are bein extracted exported to Syria and Yemen. In 1993, 15.000 tons of barite was produced. Major barite deposits are given below:

  Merkez-Bilir Village
  Grade: 94% $BaSO_4$
  Reserve: 570,000 tons proved, 1,530,000 tons proved+possible reserve

  Merkez-Kasar Village
  Grade: 94% $BaSO_4$
  Reserve: 48,000 tons proved, 250,000 tons proved+possible reserve

  Merkez-Kizilkilise
  Grade: 94% $BaSO_4$
  Reserve: 137,000 tons proved, 700,000 tons proved+possible reserve

- **CEMENT RAW MATERIALS (Cmh)**
  In overall Mus Province
  Grade: -
  Reserve: 1,416,000,000 tons proved+probable limestone, 17,500,000 tons proved+probable clay, 17,000,000 tons proved+probable marn, 200,000,000 tons proved+probable clay+marn reserve.

- **LIMESTONE (Kct)**
  Pertah-Karaagacli Field
  Grade: 54% CaO, 3.9% SiO_2, 0.6% MgO
  Reserve: 48,240,000 tons probable reserve

- **QUARTZITE (Qzt)**
  Merkez-Kepenek Field
  Grade: Suitable for use in Ceramic industry
  Reserve: 85,716,550 tons proved reserve

  Haskoy-Buvetli Field
  Grade: Suitable for use in Ceramic and Refactory industries
  Reserve: 15,906,751 tons proved reserve

- **BRICK-TILE (TgKi)**
  Alican Village-Avak Field
  Grade: Medium-well
  Reserve: 21,870,000 tons proved + possible reserve

IV.2.16. Animal Husbandry (species, feeding area, annual production amounts, their value and place in the national economy)

Meadow and pasture lands in Mus Province provide potential for animal husbandry. Provincial structure and climatic conditions are convenient for stock farming. Pasture livestock is the most common animal husbandry type in this region. Stockfarming is made for selling them in religious sacrifice holiday. Since there is no live animal market in the Mus Province, trade of these animals in other parts of the country are limited. The farmers generally sell their livestock directly to the butchers or to Bingol Et Balik Kurumu (Bingol Meat and Fish Company).

IV.2.16.1. Bovine Breeding

Culture race Holstein and Simmental Montofon Cattle are used as bovine breeding in Mus Province. Especially, culture race used in term of milk yield. Culture race animal amounts are 31,633. Culture hybrids are used for cross breeding to improve the quality of native cattle. Total amounts of hybrid cattles are 79,179. East Anatolian Red species are most common native race in this region. Total amounts of native race cattles are 91,251. Native race buffalo is present in the region. Total amounts of buffalo are 3,657. The number of bovine breeding animals is 205,720 in the whole province, where 48,607 in Merkez District, 17,345 in Varto District and 68.000 in Bulanik District. Small businesses are active in this field. Animal shipments to outside of the province are increasing especially during the religious feast of sacrifice (Kurban Bayramı). Livestock are not exported to foreign countries from the province. Bovine milk is used for making yougurt, cheese and butter, water buffalo milk is used for making yougurt and butter.

IV.2.16.2. Ovine Breeding

Native race sheeps and hair goat, which is a native goat race, are the basic components of ovine breeding. Ovine breeding is common especially in mountain villages, which have less cropland and more pasture area. Animal shipments to outside of the province are increasing especially during the feast of sacrifice. Livestock are not exported to foreign countries from the province. Sheep and goat milk is used for making yougurt and cheese.

Total number of sheeps is 565,116 and goat is 119,028 in Mus Province. Total amounts of ovine breeding animals are 684,144 in the whole province, 200,000 in Merkez District, 131,875 in Varto District and 151,500 in Bulanik District.

IV.2.17. State-Owned Lands (prohibited military zone, lands are allocated for state institutions and organizations, etc.)

A military zone in Dogdap Tepe area, which is located between Tepekoy and Dogdap Districts, will be inundated by the reservoir.

IV.2.18. Determining the Existing Pollution Load in the Project and Impact Area in terms of Air, Water, Soil and Noise

IV.2.18.1. Air Quality

Sulphur dioxide (SO_2) and particular matter (PM_{10}) measurements carried out for the period 2007-2008 that are given in Environmental State Report are presented in Table IV.36.

Table IV.36. Average Monthly Values for Air Pollution Measurements (2007-2008)

Months	Parameters	Measurement Value (µg/m^3)
January 2007	PM_{10}	63.0
	SO_2	61.99
February 2007	PM_{10}	178.0
	SO_2	61.16
March 2007	PM_{10}	156.2
	SO_2	52.57
April 2007	PM_{10}	54.3
	SO_2	8.42
May 2007	PM_{10}	259.6
	SO_2	4.31
June 2007	PM_{10}	205.0
	SO_2	3.71
July 2007	PM_{10}	74.2
	SO_2	3.29
August 2007	PM_{10}	87.5
	SO_2	2.3
September 2007	PM_{10}	107.2
	SO_2	1.08
October 2007	PM_{10}	502.3
	SO_2	6.54
November 2007	PM_{10}	-
	SO_2	28.08
December 2007	PM_{10}	353.7
	SO_2	19.7
January 2008	PM_{10}	263.6
	SO_2	38.49
February 2008	PM_{10}	104.8
	SO_2	9.3
March 2007	PM_{10}	174.6
	SO_2	2.97
April 2008	PM_{10}	97.1
	SO_2	2.63
May 2008	PM_{10}	63.2
	SO_2	2.66
June 2008	PM_{10}	82.4
	SO_2	3.5
July 2008	PM_{10}	102.7
	SO_2	2.28
August 2008	PM_{10}	115.8
	SO_2	-
September 2008	PM_{10}	66.3
	SO_2	1.15
October 2008	PM_{10}	113.2
	SO_2	5.68
November 2008	PM_{10}	120.9
	SO_2	51.51
December 2008	PM_{10}	124.9
	SO_2	52.85

Source: Environmental State Report of Mus Province, 2009

As the results of SO_2 and PM_{10} measurements, given in Table III.4., are compared with the limit values given in Regulation on Air Pollution Control Sourced from Industry (RAPCSI) (Official Gazette date: July 3, 2009, No: 27277) (Long-term limit value for SO_2: 150 $\mu g/m^3$, Short-term Limit Value for SO_2: 370 $\mu g/m^3$; Long-term limit value for PM_{10}: 132 $\mu g/m^3$, Short-term limit value for PM_{10}: 260 $\mu g/m^3$) it is observed that the PM_{10} exceeds the limit value especially during winter. This situation shows that, the fuel especially used for heating leads to air pollution. On the other hand, for SO_2 the measurement results it is determined that the values are under the limit values for both long-term and short-term values.

Besides, there is not any source that could adversely affect the air quality between Mus Province and Varto district where Murat River is located.

In order to determine the existing air quality in the Project site, 24-hour measurements were performed in Kusluk and Akpinar Villages between August 25 and 26, 2011 by Cankaya Cevre Olcum ve Analiz Laboratuvarı. Particulate matter (PM_{10}) measurements were carried out with micro PNS-LVS1 PM_{10} sampling device. Measurement report is presented in App-14. PM_{10} value of Kusluk Village is 0.0893 mg/Nm^3 and PM_{10} value of Akpinar Village is 0.123 mg/Nm^3.

IV.2.18.2. Water Quality

According to Environmental State Report of Mus Province, there are not any studies regarding the quality of groundwater.

There are several facilities at the upstream of Alpaslan II Dam with the purpose of irrigation, energy production and drinking-potable water. The most important one of these is Alpaslan I Dam and its construction is almost completed. Impoundment has been commissioned in the reservoir. Alpaslan I Dam is located at the upstream of Alpaslan II Dam. In order to evaluate the potential of the basin water, construction activities of Patnos Dam, Sekerova Dam, Yazici Dam, Nadirseyh Dam, Murat Dam, Aydintepe Dam, Karahalit Dam, Baskoy Dam, Agacli Dam and Sancaktar Dam, which will be located at the upstream of the project, has been planned. Construction activities of Patnos and Yazici Dam have been finished while the others are at the planning and design phase.

Quality Observation Studies of 21-17-00-335 (Mus Karasu Stream, Karasu Bridge-1), 21-17-00-336 (Mus Karasu Stream, Karasu Bridge-3), 21-17-00-338 (Murat River, Murat Bridge) of 172th Branch Office of SHW were started in 1991 and Large Scaled Quality Observation Studies were started in 2001. Within the context of water quality studies, the results of these three stations are given in Table IV.37.

Table IV.37. Water Quality Observations Made by SHW in Mus Province

Station Location	Station No	Quality Classes According to the Parameters of Pollution				
		NO_3-N	NH_4-N	NO_2-N	PO_4-P	Cl
Karasu Bridge - 1	211700335	I	II	III	IV	II
Karasu Bridge - 3	211700336	I	I	I	IV	II
Murat Bridge	211700338	I	II		IV	II

Source: Environmental State Report of Mus Province, 2008

Water samples were collected from Dam axis, Murat River and Bingol Stream by ENCON Environment Laboratory in August, 2010 and analysis were assessed. Results of these analyses are presented in App-15.

Results of the analysis are evaluated according to Water Pollution Control Regulations Table 1 (Quality Criteria for Classes of Inland Water Resources) (Official Gazette; Date: December 31, 2004, No: 25687) and given in Table IV.38, sampling points are presented in Figure IV.56.

TableIV.38. Water Quality of Rivers in the Project Area

Parameters	**Unit**	**Location of Dam Axis (Samp10.0167)**		**Bingol Creek (Samp10.0168)**		**Murat River (Samp10.0169)**	
		Value	**Class**	**Value**	**Class**	**Value**	**Class**
Suspended Solid	mg/L	10	**-**	45	**-**	< 5.172	**-**
Biochemical Oxygen Demand (BOD)	mg/L	< 4.894	**I**	14.05	**III**	13.55	**III**
Dissolved Oxygen	mg/L	7.4	**II**	7.2	**II**	6.8	**II**
Chemical Oxygen Demand (COD)	mg/L	6.80	**I**	29.60	**II**	23.20	**I**
pH	-	7.98	**I**	8.11	**I**	8.37	**I**
Nitrate	mg/L	< 1.473	**I**	< 1.473	**I**	< 1.473	**I**
Nitrite	mg/L	< 0.030	**I-III**	< 0.030	**I-III**	< 0.030	**I-III**
Total Kjeldahl Nitrogen	mg/L	0.538	**II**	0.762	**II**	0.493	**I**
Total Nitrogen	mg/L	0.538	**-**	0.762	**-**	0.493	**-**
Total Phosphorus	mg/L	< 0.090	**I-II**	< 0.090	**I-II**	< 0.090	**I-II**
Total Coliform	number/ 100mL	>500	**II-IV**	>500	**II-IV**	>500	**II-IV**

As it can be seen from the table, while dam axis has I Class water quality in terms of BOD and COD parameters, which are the main pollutant parameters, water quality decrease to the level of III Class in Bingol Stream and Murat River. There are no big differences between these three points in terms of other parameters. Due to the blur in the sample, which was obtained from Bingol River, suspended solid concentrations in this point were significantly higher than the other points.

Before construction period of the project, according to WPCR Table 1 (excepting radioactivity), water analyses will be carried out with the above-mentioned points in an accredited laboratory.

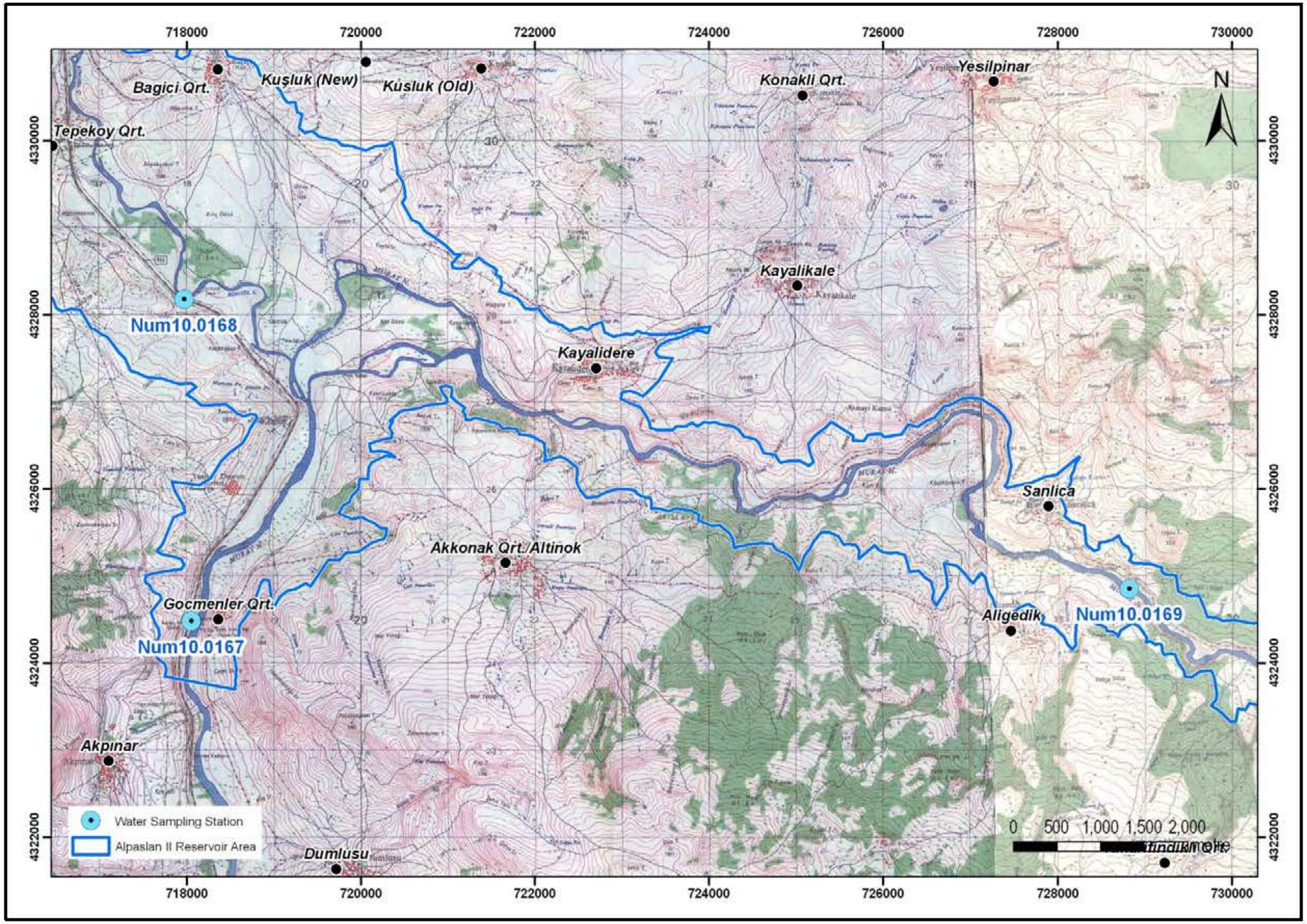


Figure IV.56. Water Quality Sampling Points

IV.2.18.3. Soil Quality

Industrial activities, fossil fuels used for heating, the exhaust gases and thermal power plants using fossil fuels for energy production pollutes the air and release sulphur dioxide, nitrous oxide, particulate matter and hydrocarbon. These pollutants, which are remained suspended in the air between 2 to 7 days react chemically and physically and could be transported away. Water particulates in the atmosphere react with other components and caused the formation of pollutants such as sulfurous acid (HSO_3), sulphuric acid (H_2SO_4) and nitric acid (HNO_3). SO_2, SO_3, NO_x gases are involved in the air as a result of combustion reaction and combine with the rain and create acid rain. They reach to the ground in the form of dry and wet acid deposition. In wet deposition, all products in the atmosphere are transported to the earth inside the rain or snow. However, in dry deposition, particles are transported inside the fog in the form of aerosol. As it stated within this scope, all other forms of precipitation could be acidic. Acid rains impacted the chemical and biological structure of the soil. Also it can cause the low efficiency and weakening of the soil with eliminating the calcium, magnesium, which is in the structure of soil.

Substances that contribute to soil acidification are sulphur compounds, which pass to soil as a result of accumulation in the atmosphere. Nitrogen compound play a role in soil acidifation in case of its amount more than the plant assimilation. One of the most important acidifying impacts on environment is acid humidity that results of industrial activities. Mercury can react with toxic substance like, cadmium or aluminum. Normally, these components are insoluble but with the reaction of acidic humidity, they reach to plant, animal or humans by water and create toxic impact. Aluminum, which becomes active in soil due to acidification, is responsible for the deterioration of nutrition collection ability of the roots of the trees.

Within the context of this project, the wastes, those will lead to soil pollution will be disposed in a controlled manner. Therefore any soil pollution is not anticipated. Wastes will not be discharged into the soil without any treatment. Project workers will be trained and informed by the project owner about being cautious on these issues. These kinds of produced wastes will be disposed in line with the provisions of the relevant regulations.

IV.2.18.4. Noise

With the purpose of evaluating the cumulative effect that comprises of noise caused by the project and current background noise, 8-minutes measurements that represent daytime, evening and nighttime zones was carried out in 5 different locations on August 25-26, 2011 by Cankaya Cevre Olcum ve Analiz Laboratuvari.

Information and results of measurements is presented in Table IV.39, and report of the measurement is presented in App-16.

Table IV.39. Results of measurement

Location of Measurement	Coordinate of Measurement	Measurement Time (minute)	Date of Measurement	Result of measurement (dBA)	
					L_{eq}
Akpinar Village	X:717306,42 Y:4322717,07	8	25.08.2011	$L_{daytime}$	46.22
				$L_{evening}$	43.98
				$L_{nighttime}$	44.45
Dogdap Quarter	X:714694,09 Y:4331533,75	8	25.08.2011	$L_{daytime}$	46.88
				$L_{evening}$	42.15
				$L_{nighttime}$	41.10
Dumlusu Village	X:719693,46 Y:4321630,31	8	25.08.2011	$L_{daytime}$	50.12
				$L_{evening}$	44.86
				$L_{nighttime}$	40.68
Kayalidere Village	X:722483,19 Y:4327046,22	8	26.08.2011	$L_{daytime}$	44.45
				$L_{evening}$	43.28
				$L_{nighttime}$	41.85
Kusluk Village	X:719882,03 Y:4330809,81	8	26.08.2011	$L_{daytime}$	43.95
				$L_{evening}$	45.54
				$L_{nighttime}$	42.73

dBA = Is the noise assessment unit that stressed medium and high frequencies. dBA unit, which is used to control or reduce the noise level effectively is related with subjective evaluation of loudness.

In accordance with TS 9315 ISO 1996-1:2005 and TS ISO 1996-2:2009 standards about the methods and technic used for measurement of background noise, measurements were carried out 1.5 m above from ground considering topographical and meteorological structure of the region, distance the nearest receiver and possible noise point. Present noise level measurements were carried out with SVANTEK 958 Type 1, 1/1 and 1/3 Octave Noise Measuring Device (Serial No. 14294).

IV.2.19. Other Characteristics

There are no other agreements to be issued about this topic.

IV.3. Socio – Economic Environmental Characteristics

In this section, current demographic, economic, social and cultural conditions of the settlements that are located around the project area, which were studied within the scope of Alpaslan II Dam and HEPP Project EIA studies, are presented.

During the construction and operation period of the project, possible socio-economic impacts will be felt mostly in the project area and its surroundings. Alpaslan II Dam and HEPP Project planned to be constructed by Alpaslan II Enerji Uretim Madencilik San. Tic. A.S., was designed on Murat River, which is sub-basin of Firat River Basin in Mus, and approximately 34.00 km away to Mus city center.

At the residential units to be partially affected due to the dam axis and reservoir, the impacts are mostly resulting from the expropriation studies and also the impacts that might be observed during the construction phase (dust, noise, traffic density, etc.).

Within the scope of Alpaslan II Dam and HEPP Project the residential units that will be affected from the reservoir are given below:

Settlements Affected from the Reservoir

- Tepekoy (45 households)
- Dogtap Quarter (15 households)
- Gocmenler (Muhacir Zorova) Quarter (25 households)
- Bagici (Çarbuhur) Quarter (50 households)
- Asagi Hinzor Quarter (Kayalıdere Village, 50 households)
- Sanlica Village (25 households
- Algedik Village (15 households)

Settlements Affected from Construction Work and Material Borrow Areas

- Dumlusu Village
- Akkonak Quarter
- Akpinar Village
- Kayalik Village
- Ulusirt Village
- Kayalidere Village

The project impact area is assessed in two levels with respect to socio-economic characteristics. Firstly, data related to the Province and Districts covering the project affected settlements gathered from Turkish Statistics Institute (TurkStat), State Planning Organization (SPO) and other relevant public authorities were used to evaluate the socio-economic characteristics of Mus Province and Varto and Merkez Districts. Secondly, the data obtained from the structured surveys conducted on June 06-08, 2011 with the headmen of the villages determined to be directly affected by the project were used for evaluation of the socio-economic characteristics of the project affected settlements. Within the scope of the project, socio economic studies were carried out by Sociologist Oksan Gurtuna.

Photographs from the field survey are presented in Figure IV.57.

The villages and districts headmen of which were interviewed are the following; Aligedik Village, Akpinar Village, Kayalik Village, Tepekoy, Ulusirt Village, Bagici District, Kayalidere Village, Sanlica Village, Dumlusu Village, Gocmenler District.

Tepekoy **Kayalidere Village**

Sanlica Village **Bagici Village**

Ulusirt Village

Figure IV.57. Photographs from Socio Economic Field Studies, 2011

When Statistical Region Units Classification of SPO are considered, Mus Province is placed at the 5th Development Level (SPO, 2003) Mus Province ranks the 81st (among 81 provinces) according to the provincially based socio economic development rating system. Its development index is -1.43956.

According to the research of the socio-economic development rating of the districts, Merkez District of Mus Province ranks the 649th among 872 districts with a development index of -0.59441 and is within the 4th development group, whereas Varto District ranks 802nd with a development index of -1.0381 (SPO, 2004).

IV.3.1. Economic Characteristics (Major sectors composing the local economic structure, distribution of the local labor force within the sectors, places and the significance of commodity and service production of the sectors within local and national economy, other information)

IV.3.1.1. Provincial and District Level

The economy of Mus is composed of agriculture and animal husbandry. Agriculture and husbandry are made with traditional methods in Mus, productivity is low.

In Mus city center, a large part of the population is working in the agricultural sector, while the remaining part of the labor force is in the service and industry sector. However, this is not true for all districts, in which this proportion changes.

In Varto District, which is affected from the project, economic structure is based on the animal husbandry -especially herd husbandry-. In addition, beekeeping is common in this district. In cultivated areas, forage plant breeding and fruit growing are carried out. But these activities have no commercial significance as families meet their own needs with these activities.

Comparative employment indicators for Mus Province, East Anatolian region and Turkey is given in Table IV.28 according to development performance studies of State Planning Organization in 2003 according to the data of 2000.

The rate of involvement to the work force is 41.4% in Mus (TurkStat, 2009). The distribution of the employed population among sectors is given below in Table IV.40, for Mus Province, East Anatolian Region and Turkey for comparison purposes (SPO, 2003). As can be seen from Table IV.40, 83.44% of the employed population is in the agricultural sector, which is higher than the averages of both East Anatolian Region and Turkey. On the other hand, 14.37% of the employed population works as waged labor, which is lower than both East Anatolian Region and Turkey. This is not considered to be unexpected since the employment pattern in agriculture is based generally on unwaged family labor in Turkey. However the rate of working women as waged workers is strikingly low with a figure of 1.33%. 1.86% of the employed population works in the trade sector and 1.54% in the industry.

Table IV.40. Employment Indicators for Mus Province, East Anatolian Region and Turkey (*SPO, 2003)*

Year	Employment Indicators	Mus (%)	East Anatolian (%)	Turkey (%)	Rank (within 81 province)
2000	The rate of those working in the agricultural sector to the total employment	83.44	66.41	48.38	1
2000	The rate of those working in the industrial sector to the total employment	1.54	3.26	13.35	77
2000	The rate of those working in the trade sector to the total employment	1.86	4.44	9.67	81
2000	The rate of those working in the financial sector to the total employment	0.39	1.05	3.11	81
2000	The rate of those working as waged workers to the total employment	14.37	28.83	43.52	81
2000	The rate of women working as waged workers to the total employment	1.33	2.69	8.81	81
2000	The rate of employers to the total employment	0.48	1.08	2.61	80

In Table IV.41 below, employment indicators by gender of Mus Province and Varto Districts are presented. Both males and females in Mus Province are stick to agriculture, hunting, forestry and fishing while in Varto it is common stick to community service. Agriculture, hunting, forestry and fishing facilities are ranked as the second in Varto Districts. 49.11% of male population in Merkez District is working on community service while the ratio of females working in this service is 6.33%. Majority of males (31.13%) and females (17.32%) in Bulanik District are working on agriculture, hunting, forestry and fishing sectors.

The ratio of working population is 53.29% for male and 46.71% for female population in Mus Province whereas these rates are 87.91% for male and 12.09% for female in Varto Districts.

Table IV.41. The Distribution of the Working Population in Mus Province and Varto Districs according to the Sectors

Economic Activities		**Mus (Provincial Wide)**	**%**	**Varto District**	**%**	**Merkez District**	**%**	**Bulanik District**	**%**
Agriculture, Hunting, Forestry and Fishery Production	Male	65,565	38.004	245	14.03	467	3.98	922	31.13
	Female	78,395	45.441	44	2.52	203	1.73	513	17.32
Mining and Quarrying	Male	33	0.019	-	-	10	0.09	-	-
	Female	-	-	-	-	-	-	-	-
Manufacture Industry	Male	2,171	1.258	43	2.46	1.305	11.13	74	2.50
	Female	152	0.088	6	0.34	107	0.91	4	0.14
Electricity, Gas and Water	Male	283	0.164	20	1.15	105	0.90	15	0.51
	Female	11	0.006	1	0.06	8	0.07	1	0.03
Construction and Public Works	Male	3,464	2.008	146	8.36	696	5.93	232	7.8
	Female	18	0.010	-	-	1	0.01	2	0.1
Wholesale and Retail Trading, Dining, Lodging	Male	3,164	1.834	221	12.66	1415	12.07	292	9.9
	Female	49	0.028	3	0.17	29	0.25	8	0.3
Transportation, Communication and Storage	Male	1,549	0.898	62	3.55	523	4.46	67	2.3
	Female	31	0.018	1	0.06	17	0.14	3	0.1
Financial Institutions, Insurance, Real Estates and Ancillary Works	Male	588	0.341	47	2.69	235	2.00	68	2.3
	Female	80	0.046	15	0.86	36	0.31	10	0.3
Community, Social and Individual Service Works	Male	14,984	8.685	743	42.55	5.760	49.11	562	19
	Female	1,840	1.067	140	8.02	742	6.33	176	5.9
Activities Not Well Defined	Male	139	0.081	8	0.46	69	0.59	13	0.4
	Female	5	0.003	1	0.06	-	-	-	-
Total Working Population	**Male**	**91,940**	**53.29**	**1,535**	**87.91**	**10,585**	**90.25**	**2,245**	**75.8**
	Female	**80,581**	**46.71**	**211**	**12.09**	**1,143**	**9.75**	**717**	**24.2**
	Total	**172,521**	**100.0**	**1,746**	**100.0**	**11,728**	**100.00**	**2,962**	**100.0**

Source: (TurkStat, 2000)

According to the regional indicators in 2009, which is prepared by TurkStat and published on April, 2010, working areas in Mus Provincial-wide and number of intrapreneurship in these areas are given in Table IV.42.

Table IV.42. Number of Intrapreneurship in Mus Province

	Mus (Provincial Wide)	**%**
Mining and Quarrying	-	-
Manufacture Industry	526	6.5
Electricity, Gas and Water	-	-
Construction and Public Works	417	5.1
Wholesale and retail Trading, Dining,Hotel	3,222	39.8
Transportation, Communication and Storage	2,522	31.1
Financial Institutions, Insurance, Real Estates and Ancillary Works	73	0.9
Community Works	415	5.1
Hotel, Dining, Coffeehouse	588	7.3
Real estate Rental and Work Activities	238	3.0
Education	19	0.2
Sanitary Affairs and Social Services	73	0.9
Total	**8,098**	**100.0**

In Mus Provincial-wide, Intrapreneurship of Wholesale and retail Trading, Dining, Hotel sectors (39.8%) are placed on the top. It is followed by “Transportation, Communication and Storage” (31.1%). “Education” (0.2%) and “Sanitary Affairs and Social Services” (0.9%) does have low rates in Mus Province intrapreneurship.

In Table IV.34, number of bovine and ovine animals in the affected settlements are given. As it can be seen from the Table, ovine breeding is common in two districts (Bulanik and Varto Districts), additionally, beekeeping is also seen as an important source of income.

Table IV.43. Number of Animals in Mus Province and its Districts

Settlement	**Bovine Animal**	**Ovine Animal**	**Barnyard Fowl**	**Beekeeping (Hive)**
Mus (Provincial Wide)	205,720	684,114	464,805	23,141
Merkez District	48,607	200,000	175,500	12,040
Varto District	17,345	131,875	45,000	5,405
Bulanik District	68,000	151,500	47,000	1,100

Source: TurkStat, 2009

IV.3.1.2. Settlement Level

Questions to determine the economical characteristics of the villages/quarters were included the questionnary, which is used during the Socio-Economic Field Study realized with the headmen of the villages/quarters that are likely to be affected from the project within the scope of the Alpaslan II Dam and HEPP Project EIA studies on June 6-8, 2011. In this section, these information will be evaluated.

According to the results obtained from the fieldwork, in the affected villages the major means of livelihood is agriculture. In addition, animal husbandry and beekeeping are important income sources for some of the villages. Also, in Gocmenler District located near Murat River fishery facilities were observed between September - April months. In some villages, garden agriculture is common for some households to ensure their own livelihood.

Especially Young male employees in Tepekoy, Aligedik and Kayalik Villages work in construction activities in Izmir, Bursa, Istanbul, Mersin Province for 4 months from June.

In villages with fertile soil and wetland areas agriculture is observed commonly whereas animal husbandry is the main source of livelihood in villages located in higher elevations and having infertile land.

According to the results of field research rates of females working on paid employment is significantly lower when it is compared to males. It is observed that women are involved in houseworks (child care, housekeeping, etc.) and help men for daily routine (working in field, grazing, etc.). Throughout the region, it is not common to sale handcrafted products among women. Only in Kayalik Village, it is learned that 2-3 people sell their handcraft products in their village or in the locals markets.

Annual incomes of households seem to vary in different intervals. Some village headmen state that, most of the villagers do not have much cash but use the products they cultivated or the animals they raised for living. In addition, some households have retirement salary or earn 300-400 TL monthly by selling the remaining products in the city center and markets established in districts in the close vicinity.

IV.3.2. Population (Urban and Rural Population in the Region, Population Movements; Migrations, Population Increase Rates, Average Household Sizes, Other Information)

IV.3.2.1. Provincial and District Level

According to the data received from the Address-Based Population Registration System carried out in 2010, the population of Mus Province (8,196 km^2) is 143,624. Population distribution is denser in town/villages. According to the results of Address-Based Population Registration System (ABPRS), general census of TurkStat, population growth by years is given in Table IV.44 and distribution of population by gender and age groups is presented in Table IV.45.

Population in Mus city center is 34.5% of total population of Mus Province. According to this, rural population is more common in the province. On the other hand, population density of Mus is 50 people for each km^2 with the population increase rate of 0.4%. With these values, Mus is the 53rd and 66th in Turkey, respectively (TurkStat, 2009).

Table IV.44. Population Growth by Years

YEARS	POPULATION
1965	166,213
1970	189,361
1975	212,480
1980	231,329
1985	261,015
1990	275,389
2000	453,654
2007	405,509
2008	404,309
2009	404,484
2010	406,886

Source:TurkStat, ABPRS 2010

Table IV.45. Distribution of Population by Gender and Age Groups in Mus Province

AGE GROUP	TOTAL	MALE	FEMALE
Total	**406,886**	**207,115**	**199,771**
00 - 04	53,015	27,577	25,438
05 - 09	55,854	28,552	27,302
10 - 14	55,993	28,713	27,280
15 - 19	49,268	25,679	23,589
20 - 24	36,954	17,582	19,372
25 - 29	32,479	16,592	15,887
30 - 34	27,263	14,090	13,173
35 - 39	21,605	11,346	10,259
40 - 44	14,635	8,078	6,557
45 - 49	16,390	8,763	7,627
50 - 54	10,330	5,369	4,961
55 - 59	10,619	5,017	5,602
60 - 64	6,871	3,015	3,856
65 - 69	5,802	2,777	3,025
70 – 74	3,896	1,674	2,222
75 – 79	2,786	1,294	1,492
80 – 84	1,806	569	1,237
85 – 89	1,042	370	672
90+	278	58	220

Source:TurkStat, ABPRS 2010

The population of the province, which was 453,654 in 2000 reduced to 405,509 in 2007, 404,309 in 2008, 404,484 in 2009, and 406,886 in 2010 according to data received from the Address-Based Population Registration System carried out in 2010. As it can be seen in the demographic characteristics of Mus Province, all values are under the average limit values of Turkey and East Anatolian Region (see Table IV.46).

Table IV.46. Demographic Aspects of Mus Province, East Anatolian Region and Turkey in 2000

Year	Unit	Demographic Aspects	Mus	East Anatolian Region	Turkey
2000	People	Total Population	453,654	6,137,414	67,803,927
2000	Percentile	Urbanization Rate	35.16	53.05	64.90
1990-2000	Per mille	Annual Average Population Growth Rate	18.63	13.75	18.28
2000	People/Km^2	Population Density	56.29	42	88
2000	Number of Child	Fertility Rate	4.18	3.92	2.53
2000	People	Average H	8.19	6.27	4.50

Source: SPO, 2003

Mus Province is one of the provinces in Turkey in which out-migration is observed. The reason for this is the economic and political conditions in the region. However, during the recent years, in-migration was observed due to the political stability. Seasonal workers from Mus go to neighbouring provinces for lentil harvest and return to their homes after harvest. There is no information, other than the out-migration, whether people go to the other provinces in order to work.

As it can be seen from the Table IV.47, total population of rural areas are more than the urban populations and population density is always lower than country's population density.

Population densities are 56/km^2 in Mus Province and 30-105/km^2 in districts. It is 66 people/km^2 in Merkez District (largest district in terms of area) and 105 people/km^2 in Hasköy (smallest district in terms of area).

Table IV.47. Urban and Rural Population and Population Density According to Gender

		Total			**Province and District Center**			**Town and Villages**			**Population Density**
		Total	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	
31.12.2007	**Turkey**	**70,586,256**	**35,376,533**	**35,209,723**	**49,747,859**	**24,928,985**	**24,818,874**	**20,838,397**	**10,447,548**	**10,390,849**	**92**
	Mus	405,509	206,589	198,920	142,913	72,901	70,012	262,596	133,688	128,908	50
31.12.2008	**Turkey**	**71,517,100**	**35,901,154**	**35,615,946**	**53,611,723**	**26,946,806**	**26,664,917**	**17,905,377**	**8,954,348**	**8,951,029**	**93**
	Mus	404,309	207,270	197,039	138,089	71,921	66,168	266,220	135,349	130,871	50
31.12.2009	**Turkey**	**72,561,312**	**36,462,470**	**36,098,842**	**54,807,219**	**27,589,487**	**27,217,732**	**17,754,093**	**8,872,983**	**8,881,110**	**94**
	Mus	404,484	207,251	197,233	139,332	72,917	66,415	265,152	134,334	130,818	50
31.12.2010	**Turkey**	**73,722,988**	**37,043,182**	**36,679,806**	**56,222,356**	**28,308,856**	**27,913,500**	**17,500,632**	**8,734,326**	**8,766,306**	**96**
	Mus	406,886	207,115	199,771	143,624	74,131	69,493	263,262	132,984	130,278	50

Source: TurkStat, 2010

Urban and rural populations of the districts of Mus Province in 2000-2010 and annual population growth rate are given in Table IV.48. Comparison of population growth rate of Mus and Turkey in 1935-2000 is shown in Figure IV.58. There is a population movement in this region considering the population of the districts in 2000 and 2010. Migratory seasonal workers during the harvest, cause the population movements that are not reflected in the tables. This situation can be seen between the years 1990-2000.

Table IV. 48. Urban and Rural Populations by Districts and Gender, Annual Population Growth Rate

	2000			2010			Annual Population Growth Rate (%)
Districts	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	
Merkez	171,023	89,657	81,366	173,771	88,860	84,911	-7.07
Bulanik	99,819	51,584	48,235	84,315	43,122	41,193	-5.21
Haskoy	39,915	21,053	18,862	28,732	14,379	14,353	14.7
Korkut	32,416	17,210	15,206	27,016	13,507	13,509	0.41
Malazgirt	68,990	35,444	33,546	59,276	30,412	28,864	-8.75
Varto	41,491	21,266	20,225	33,776	16,835	16,941	-4.29
Total	**453,654**	**236,214**	**217,440**	**406,886**	**207,115**	**199,771**	**-1.08**

Source: TurkStat, 2000 General Census and ABPRS, 2010

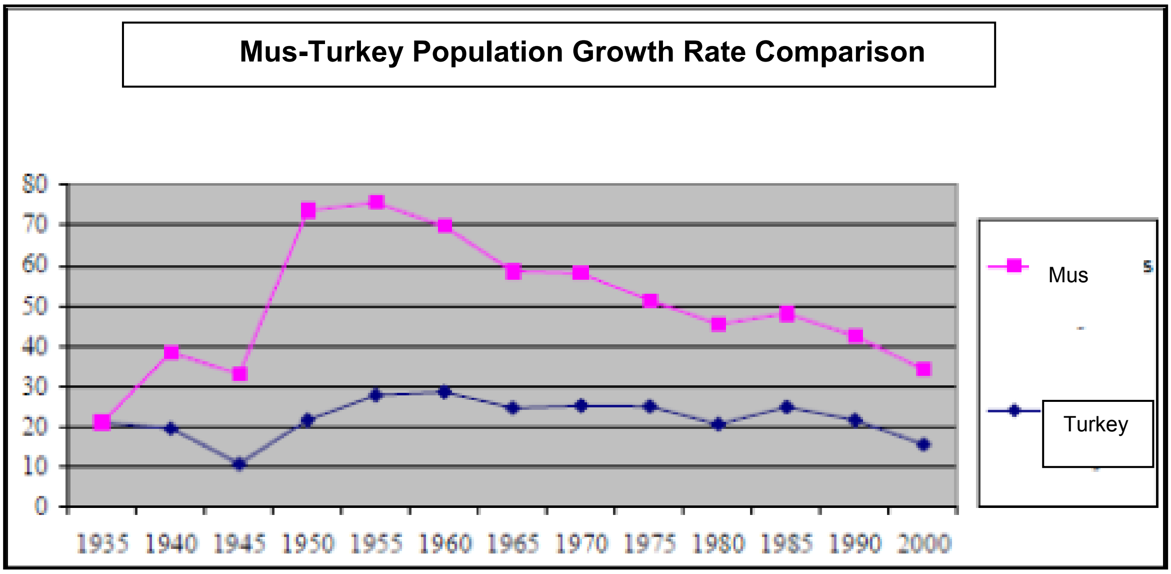


Figure IV.58. Mus-Turkey Population Growth Rate Comparison (Provincial Environmental Status Report, 2009)

In 2010, with the population of 173,771, Merkez District is the most crowded city in Mus Province while it is 27,016 in Korkut District, which has the least population in Mus.

The distribution of city and village population in Mus districts by years is given in Table IV.49. According to the percentage of rural and urban population, since 2007, 35.25% of the population of Mus Province (142,913 people) lives in urban areas and 64.75% of the population of Mus Province (262,596 people) lives in rural areas. In 2000, rural and urban population rates has been 35.16 % and 64.84% respectively while they were 26.86% and 73.14% in 1990. Since 1990, despite a decrease in the percentage of the rural population, rural population in the province of Mus is still observed predominantly.

Table IV.49. The Distribution of City and Village Population by Years

Census Year	Total Population	City Population	Village Population	Rural population Rate (%)	Population Density (km^2/People)
1990	376,543	101,154	275,289	73.14	46
1997	427,812	153,941	273,871	64.02	52
2000	453,654	159,503	294,151	64.84	55
2007	405,509	142,913	262,596	64.75	49.5

Source: Provincial Environmental Status Report in Mus, 2008.

Average household (HH) size, number and population of households of Mus Province and Turkey are given comparatively in Table IV.50. According to this table, the values of districts and villages in Mus Province are observed over the average values of Turkey.

Table IV.50. Distribution of City and Village Population by Census Years

	Total			Settlement					
				Provincial and District Centers			Towns and Villages		
	Population of HH	Number of HH	Average Size of HH	Population of HH	Number of HH	Average Size of HH	Population of HH	Number of HH	Average Size of HH
Turkey	**67,809,048**	**15,070,093**	**4.50**	**43,140,431**	**10,314,439**	**4.18**	**24,668,617**	**4,755,654**	**5.19**
Mus	458,256	55,926	8.19	151,368	21,172	7.15	306,888	34,754	8.83

Table IV.51. Age Distribution for Varto and Merkez Districts by Gender

	Varto District			Merkez District		
Age Groups	Total	Male	Female	Total	Male	Female
0-4	3,440	1,780	1,660	22,267	11,486	10,781
5-9	3,942	2,001	1,941	22,519	11,424	11,095
10-14	4,206	2,219	1,987	22,603	11,488	11,115
15-19	3,625	1,917	1,708	20,909	10,941	9,968
20-24	2,780	1,232	1,548	16,526	8,100	8,426
25-29	2,722	1,423	1,299	15,247	7,849	7,398
30-34	2,391	1,218	1,173	13,020	6,750	6,270
35-39	2,028	1,030	998	9,597	5,084	4,513
40-44	1,440	727	713	6,477	3,615	2,862
45-49	1,458	748	710	7,518	4,013	3,505
50-54	1,036	530	506	4,480	2,374	2,106
55-59	1,279	556	723	4,180	2,007	2,173
60-64	955	378	577	2,661	1,217	1,444
65-69	810	376	434	2,178	1,094	1,084
70-74	548	238	310	1,448	619	829
75-79	510	264	246	1,014	452	562
80-84	354	118	236	663	204	459
85-89	199	72	127	350	118	232
90+	53	8	45	114	25	89
Total	**33,776**	**16,835**	**16,941**	**173,771**	**88,860**	**84,911**

Source: TurkStat, ABPRS, 2010

Population distribution pyramids for both Varto and Merkez Districts, which are prepared according to Table IV.51, are given below in Figure IV.59 and IV.60.

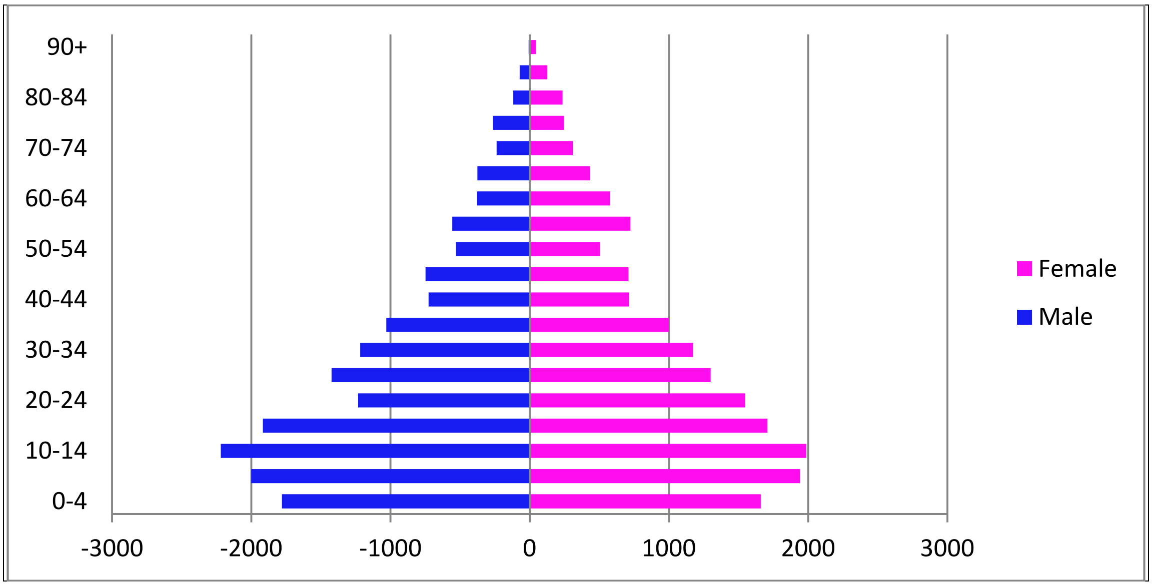


Figure IV.59. Population Pyramid of Varto District

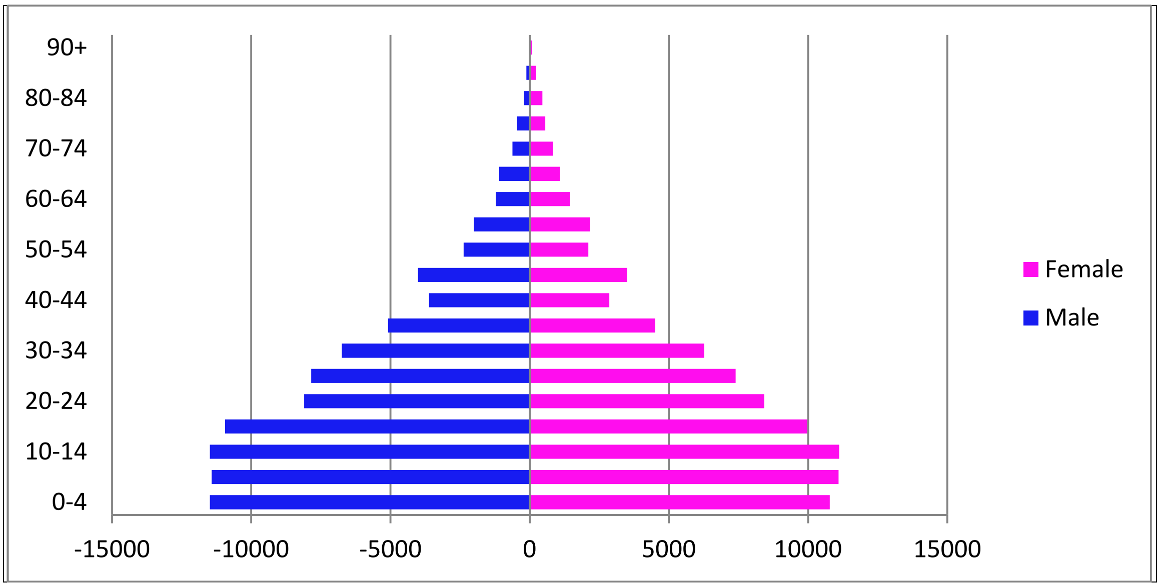


Figure IV.60. Population Pyramid of Merkez District

Age distributions in districts affected from the project by gender are given in Table IV.51, Figure IV.59, and Figure IV.60. In both districts young people and economically active population (between the age of 15-64) are seemed to more abundant.

In the project affected settlements, people sustain their living through agriculture, stock-breeding and seasonal labor. In these settlements, the villagers make income as well as contributing to a significant extent to their subsistence economies through agriculture and stock-breeding. In other words, the villagers consume a part of the agricultural and animal product they produce, and turn the remaining into cash in the provincial center and markets established in districts in the close vicinity. Another source of income is seasonal works (construction works) done in certain periods of the year in large cities like Istanbul, Izmir and Bursa. During the recent years, due to unemployment, the young population living in the area has migrated to the other cities in the winter months and worked seasonally, then returned to their villages in the summer months.

IV.3.2.2. Settlement Level

The total populations with gender distribution of total populations of affected settlements are given below in Table IV.52, based on the ABPRS (2010) data received from TurkStat.

Table IV.52. Total Populations and Gender Distribution of Total Populations in Affected Villages

		Total Population	Male Population	Female Population
Varto District	**Tepekoy**	457	229	228
	Sanlica	193	101	92
	Kayalidere	100	52	48
	Bagici	196	94	102
	Ulusirt	111	52	59
	Dumlusu	350	173	177
Merkez District	**Aligedik**	494	244	250
	Akpinar	501	252	249
	Akkonak	817	437	380
	Kayalik	186	89	97

Source: TurkStat, ABPRS (2010)

As it is seen from the above table, the total populations of the affected villages vary between a minimum population of 100 and a maximum population of 817. The least crowded village is Akkonak, whereas the most crowded village is Kayalidere. The gender distribution of the populations of the affected villages can be said as balanced. However, it is noteworthy that the headmen of villages of Merkez and Varto Districts stated the populations of their villages to be significantly higher than the figures received from TurkStat (2010) during field surveys.

The village headmen were asked during surveys whether the population of their villages has shown any increase or decrease during the last five years. In some villages, there was no population change in the last 5 years whereas the others have shown a population increase or decrease. There are some villages to show population decrease due to shortage of security and employment. However in last 5 years, with the start of returns to these villages, rural populations are increasing. On the other hand, increase in birth rates causes an increase in the population. None the less, in the villages where the unemployment problem is solved, population growth is observed. Whereas in the other villages where the unemployment problem still exists, population decrease was observed in the last 5 years.

Mus Province gives out-migration due to its limited employment opportunities. The most effected part from this situation is the young population. During the field studies, it was observed that there are seasonal variations in village populations. Especially young population goes to Istanbul, Izmir and Bursa during winter months and work in construction sector. In summer, these people who migrated to different provinces to work in the construction sector return their own villages to carry out their agricultural activities.

The average ages were asked to the village headmen. The economically active population (at the age of 15-64) is defined as predominantly.

<u>Vulnerable Groups</u>

Within the scope of the social field survey, interviews with the headmen were carried out about the vulnerable groups (disabled people, women/child headed households, providing their livelihoods by supports etc.).

Almost in every village, at least one mentally/physically disabled person exists. Most of these people are young. In addition to these, in most of the villages, women/child-headed households exist. Especially in Dumlusu Village, it is stated by the headman that 35% of the households are child headed. In most of the villages there are people providing their livelihoods by the supports of other villagers. Besides, the governmental authorities also support the villagers by coal aid, during winter.

IV.3.3. Income (Distribution of the Regional Income among Sectors, Per Capita Maximum, Minimum and Average Income for Sectors)

IV.3.3.1. Provincial and District Level

In Table IV.53, some financial indicators of Mus Province are given. According to the data in Table IV.53, Mus Province ranks the 71st with respect to its share within the Gross Domestic Product and the 73rd with respect to per capita export amount.

Table IV.53. Financial Indicators of Mus Province

Mus Province Financial Indicators	Year	Unit	Mus	Rank
Share within the Gross Domestic Product	2000	%	0,16	71
Per Capita Gross Domestic Product	2000	Million ₺	453	81
Per Capita Municipality Expenses	2000	Million ₺	23	78
Per Capita General Budget Expenses	2000	Million ₺	21	81
Per Capita Income and Corporate Tax Amount	2000	Million ₺	13	80
Per Capita Public Investments Amount	1995-2000	Million ₺	288	22
Per Capita Export Amount	1995-2000	US Dollar	0	73
Per Capita Import Amount	1995-2000	US Dollar	0	72

Source: SPO, 2003

Mus Province ranks below the Turkey averages with respect to per capita gross domestic product and the rate of those employed in the industrial sector to total employment. However with respect to the rate of annual population growth and the rate of those employed in the agricultural sector to total population, Mus Province ranks above the Turkey averages (SPO, 2003).

In Table IV.54, some financial indicators of Merkez and Varto Districts are given. According to the data in Table IV.54, Merkez ranks better than Varto in terms of per capita general budget income and share of tax revenue within the country. In addition, Merkez has a higher share of agricultural production within the country total, which means other two districts give a more urban outlook than Merkez.

Table IV.54 Financial Indicators of Varto, Merkez and Bulanik Districts

	Merkez	Varto
Per Capita General Budget Income (Thousand ¨)	42,622 (387)	12,863 (710)
Share of Tax Revenue within the Country (%)	0.03839 (138)	0,00288 (560)
Share of Agricultural Production within the Country (%)	0.18956 (146)	0,00496 (831)

Note: Figures in parenthesis shows the rank of the district within 872 districts of the country in relation to the indicator in question.
Source: SPO, 2004

IV.3.3.2. Settlement Level

The main income sources of the households in the affected villages are agriculture and animal breeding. In this region, not only dry farming is common mainly but also irrigated farming is carried out in some irrigable areas or where the fertile soil exists. In addition, especially between the months of September-April, fishing activities were conducted in Gocmenler district. Another source of some household income is trading. Some employees migrate to different provinces to work in construction industry during certain periods of the year. Animal breeding is carried out as subsistence breeding mainly while agricultural activity is oriented towards market and not for household consumption only.

During the field survey, the village headmen were asked to state the average household income in their villages. Average household income varies depending on their economical activity. During the field survey, some households engaged in subsistence farming were also observed.

During the field survey, headmen of Tepekoy and Kayalik Villages of Varto District stated that the welfare of their villages to be high while among three option; low, intermediate and high. On the other hand, headmen of Ulusirt, Sanlica and Bagici Villages of Varto District stated the welfare of their villages to be intermediate while the rest of the village headmen stated the welfare level of their villages to be low.

IV.3.4. Unemployment (the rate of active population and unemployment population in the region)

IV.3.4.1. Provincial and District Level

The employee rate is 90.27% for male population and 9.72% for female population. 28.17% of male population and 31.28% of female population are working on Community, Social and Individual Service Work Sector. Although the working women rate is low, working women rate in Textile and Textile Products Manufacturing Sector is higher than the working men rate in this sector (ISKUR Final Report of Labor Market in Mus Province, 2009).

In Table IV.55, distribution of the unemployed population of Mus by gender is presented according the data by General Directorate of Turkish Employment Agency. Unemployment problem is more common for males between the ages of 20-29. Also, it is possible to say that unemployment problem for females are more common between the ages of 20-24. Registered unemployment in Mus is more common among males graduated from elementary and secondary education (see Table IV.56).

Total Registered unemployed population in Mus Province is 6,997 (5,822 of them is male and 1,175 of them is female). Male population of registered unemployment constitutes 1.43% of the total population of Mus while female unemployment constitutes 0.29% of Mus population.

IV.3.4.2. Settlement Level

During the field survey, village headmen were requested to mention the problems of their villages. All of the headmen mentioned unemployment as the major problem in their villages. Especially the young population living in the area goes seasonally to other cities and also other countries to work and some of them return to their villages. It is also stated that some of these immigrants still live in these countries. Additionally, in some villages, some people live in the city but they obtain additional income with cultivating their farm land in the villages.

Table IV.55. Distributions of Registered Unemployment in Mus Province According to Educational Background

	Illiterate		**Literate**		**Elementary Education**		**Secondary Education**		**Associate Degree**		**Bachelor's Degree**		**Post Graduate**		**Doctorate Degree**		**Total**		
MUS	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Total
	270	255	249	70	2,747	412	2,197	363	223	48	133	23	3	4	0	0	5,822	1,175	6,997

Table IV.56. Distribution of Registered Unemployment in Mus Province by Age Group

	Age Group	**Gender**	**Person**
MUS	15-19	Male	484
		Female	202
	20-24	Male	1,376
		Female	333
	25-29	Male	1,401
		Female	225
	30-34	Male	976
		Female	138
	35-39	Male	1,031
		Female	98
	40-44	Male	263
		Female	48
	45-54	Male	214
		Female	63
	55-64	Male	65
		Female	62
	65+	Male	12
		Female	6
	Total	Male	5,882
		Female	1,175
		Total	6,997

IV.3.5. Social Infrastructural Services in the Area (Education, Health, Cultural Services and Utilization of Such Services)

IV.3.5.1. Provincial and District Level

Education:

There is a university in Mus Province, Mus Alparslan University, established in 2007. The following faculties are giving education under the body of Mus Alparslan University: Education, Science and Letters, Economics and Administrative Sciences, Communication and Engineering and Architecture. Also there are Health High School and two Vocational High Schools under the body of Mus University.

Illiteracy statistics of Mus Province and Turkey are given below in Table IV.57. These data were received from Regional Statistics (2009). As can be seen from the table, illiteracy population in Mus Province composes 13.6% of the total population. This ratio displays higher rate than Turkey (6.29%) and Merkez, Varto and Bulanik Districts. The rate of illiterate women to total population of Mus Province is 10.35% while this rate is 0.35% for male population. This means women are more deprived of education opportunities than men. This situation is also true for the affected districts. It should be noted that the data values in Table IV.57 are valid for the population above the age of 15.

Table IV.57. Statistics of Literacy of Mus Province, Merkez, Varto and Bulanik Districts and Turkey (Above the age of 15)

		Illiteracy	Literacy	Unknown	Total
Turkey	**Total**	4,645,638	45,942,369	2,962,823	**53,550,830**
	Female	908,628	24,175,728	1,626,257	**26,710,613**
	Male	3,737,010	21,766,641	1,336,566	**26,840,217**
Mus	**Total**	55,483	158,673	24,945	**239,101**
	Female	12,437	98,222	11,504	**122,163**
	Male	43,046	60,451	13,441	**116,938**
Merkez District	**Total**	21,646	73,783	9,695	**105,124**
	Female	5,340	45,523	4,127	**54,990**
	Male	16,306	28,260	5,568	**50,134**
Varto District	**Total**	5,135	13,935	3,065	**22,135**
	Female	3,840	5,956	1,454	**11,250**
	Male	1,295	7,979	1,611	**10,885**
Bulanik District	**Total**	12,376	29,980	5,232	**47,588**
	Female	9,981	10,694	2,791	**23,466**
	Male	2,395	19,286	2,441	**24,122**

Source: TurkStat, 2009

In the Table IV.58 given below, the distribution of educational level by gender in Turkey, Mus and affected districts Merkez, Bulanik and Varto is represented.

Based on the data received from TurkStat (2009), it was estimated that primary school graduates in Mus Province compose 10.98% of the total population, elementary school graduates 8.25%, high school graduates 6.23% and college graduates 1.5%. The same figures for Turkey are 24.6%, 8.57%, 13.9% and 5.81%, respectively. Mus Province displays lower rate than Turkey for primary and elementary school graduates. As can be seen from these figures, all of these districts display same performance with each others with respect to attendance to education after elementary school graduation and do not show any differences according to college graduates. College graduates populations are lower rate than the total populations in all affected villages. It should be pointed out that the figures given in this paragraph are valid for the population above the age of 15.

According the data received from Regional Statistics of TurkStat, for Mus, the number of students per teacher is 26 in elementary education for the education year 2009/2010. In Turkey, this number is 22 for the same years.

Table IV.58. The Distribution of Educational Level by Gender in Turkey, Mus and Affected Districts Merkez, Bulanik and Varto (Above the Age of 15)

		Illiterate	Literate but Does not Finish any School	Primary School Graduate	Elementary School Graduate	Secondary School or Equivalent School Graduate	High School or Equivalent School Graduate	College Graduate or Bachelor	Master Degree	Doctor's Degree	Unknown	Total
Turkey	**Total**	4,614,329	3,196,916	18,204,448	6,323,053	2,738,286	10,284,366	4,290,454	279,809	73,846	3,545,323	53,550,830
	Male	903,969	1,269,486	8,779,173	3,408,038	1,748,816	5,944,685	2,515,145	166,392	47,330	1,927,579	26,710,613
	Female	3,710,360	1,927,430	9,425,275	2,915,015	989,470	4,339,681	1,775,309	113,417	26,516	1,617,744	26,840,217
Mus	**Total**	54,832	40,851	44,680	33,585	5,112	25,385	6,132	229	54	28,241	239,101
	Male	12,363	18,668	28,923	21,415	391	19,209	4,344	165	38	13,123	122,163
	Female	42,469	22,183	15,757	12,170	1,197	6,176	1,788	64	16	15,118	116,938
Merkez District	**Total**	5,135	3,388	4,646	2,741	465	2,113	557	19	6	3,065	22,135
	Male	1,295	1,623	2,642	1,500	341	1,476	382	11	4	1,611	10,885
	Female	3,840	1,765	2,004	1,241	124	637	175	8	2	1,454	11,250
Varto District	**Total**	1,248	647	1,200	913	219	1,385	445	15	4	644	6,720
	Male	312	301	524	470	142	926	298	8	3	361	3,345
	Female	936	346	676	443	77	459	147	7	1	283	3,375
Bulanik District	**Total**	12,376	10,183	9,631	5,550	773	3,117	690	27	9	5232	47,588
	Male	2,395	5,103	6,989	3,716	606	2,379	471	17	5	2441	24,122
	Female	9,981	5,080	2,642	1,834	167	738	219	10	4	2791	23,466

Source TurkStat, 2009

Health:

There are 8 hospitals in Mus Province. According to the data received from Regional Statistics of TurkStat (2009), the number of hospital beds per hundred thousand people is 155. With the rates mentioned, Mus Province is 69th among 81 city in Turkey.

Infant mortality is ‰14 in 2008 (with 113 infant deaths) and ‰16 in 2009 (with 191 infant deaths). According to data received from TurkStat and SPO, health percentage of Mus Province is under health average of Turkey (see Table IV.59).

Table IV.59. Health Indicators of Mersin Province in Comparison with east Anatolian and Turkey

Health Indicators	Mus	East Anatolian	Turkey
Infant Mortality Rate (‰)	‰ 55.00	‰ 53.36	‰ 43.00
Number of Physicians per Ten Thousand People	2.76	7.54	12.70
Number of Dentists per Ten Thousand People)	0.22	0.61	2.22
Number of Pharmacies per Ten Thousand People	0.75	1.21	2.94
Number of Hospital Beds per Ten Thousand People	7.94	17.87	23.04

Source: SPO, 2003

Other Infrastructural Services:

Some other stimulating indicators related to the infrastructural services are given below in Table IV.60 for Mus Province in comparison with Turkey and East Anatolian Region.

Table IV.60. Other Infrastructural Indicators of Mus Province in Comparison with East Anatolian and Turkey

Other Infrastructural Indicators	Mus	East Anatolian	Turkey
Asphalt Road Rate in Rural Settlements (%)	34.98	25.97	45.23
Population Ratio Having Adequate Drinking Water (%)	82.11	78.51	84.98
State and County Roads, Asphalt Road Rate (%)	69.01	79.92	91.28

Source: SPO, 2003

IV.3.5.2. Settlement Level

In this section, an assessment of infrastructure of villages will be given.

Education

Among all the village headmen of whom were surveyed, educational problems were pointed out. Elementary schools in the villages are capable of giving education first 5 years, and the rest could be finished with boarding school in district center. In this matter transportation problem draw the attention. Parents do not prefer to send their children to boarding school due to financial difficulties. In addition the transportation problems, it is reported that children who live in villages with poor economic conditions have to work to contribute to household economy. All of these reasons cause educational level to remain at lower levels.

In the region, there are some problems about housing assigned to teachers. There are two kindergartens in Sanlica Village and Tepekoy.

Health

Among all the villages surveyed, there are not any medical institution (health center, health cabinet etc.). Village people use the health care institutions in nearby district centers with rental vehicle or taxi.

In some villages family practice service exists. But their disorganized working schedule creates some problems for villages. Accordingly, headmen stated that, ambulance services are not sufficient. There is no problem about procurement of medicine.

In the interviewed villages it is observed that green card usage is common but people without health insurance also exist. The number of people having insurance in the villages is very low.

Electricity and Water

In the interviewed villages within the scope of field survey, all the villages have electricity and mains water system (there are only two villages, which have not mains water system).

Village headmen stated that there occurs electricity cut-offs due to voltage change or low voltage for long periods like one week. In parallel with electricity cut-offs and landslides, there are water problems in some villages. Limited water sources cause water shortage in spring and summer months.

Roads and Sewer Systems

There is no sewer system in the interviewed villages. In some villages, it is stated that roads will be closed to traffic because of landslides and heavy rains. But generally roads are open to access all the year round (except for the closure depending on storm and rain). In some villages asphalt works were completed but also there are some villages in which asphalt works were partially completed or having broken asphalt.

The households use cesspool wells for waste problems. However these wells cause smell and formation of germ but have not caused any health problems (epidemic illness) up to the present.

IV.3.6. Urban and Rural Land Uses (Distribution of Settlements, Existing and Planned Land Uses, Industrial Areas, Houses, Tourism Areas, etc. within This Context)

There are no industrial facilities around the Alpaslan II Dam and HEPP Project area. There are rural settlements and agricultural lands in the area. As there is no urban settlement in the area, agricultural land and meadow use are common.

The detailed information related to the present land uses are presented in Section IV.2.7. Detailed information on land characteristics are presented in this section.

IV.3.7. Other Characteristics

There is no other point to be given about this topic.

CHAPTER V

THE IMPACTS OF THE PROJECT ON THE AREA DEFINED AT CHAPTER IV AND THE MEASURES TO BE TAKEN

CHAPTER V. THE IMPACTS OF THE PROJECT ON THE AREA DEFINED AT CHAPTER IV AND THE MEASURES TO BE TAKEN

(In this chapter, the impacts of the project on the physical and biological environment, the legal, administrative and technical measures to be taken to prevent, minimize and improve these impacts are described separately and in detail under V.1 and V.2 headings.)

The following list provides the possible impact sources that can be observed during the construction and operation phases.

Construction Phase

- Construction activities
- Worksite area and increasing human use
- The roads and tunnels to be opened due to construction
- Derivation of the tunnel
- Change in the use of the area
- Expropriation activities commenced before the construction activities

Operation Phase

- Water retaining at the dam
- Minimum flow to be discharged at the dam
- Bank erosion
- Bed carving that may be observed at the region after the dam axis
- Inability to feed the delta plains after the axis with alluvial material

V.1. Preparation of the Land, Projects in Construction and Installation Phase, Their Impacts on the Physical and Biological Environment and the Measures to be Taken (Including the Regulator, HEPP, transmission line (Tunnel and Channel), Concrete Plant, Crusher), (The Impacts during the Construction Phase shall be Elaborated Separately for Each Regulator, HEPP and the Transmission Facilities thereof and the Other Structures)

V.1.1. The Place and Amount of Excavations to be Made in the Scope of the Works to be Undertaken for the Land Preparation, the Amount of Excavations, The Place to Transport the Substances such as Excavation Residual Soil, Rock, Sand, etc., The Place for their Storage and the Purpose for which they shall be Used, the Location of the Excavations Dump Sites, the Materials to be Used during Excavations

Excavation shall be made for the cofferdams, dam body, power plant building, switchgear site and derivation constructions to be made in the scope of Alpaslan II Dam and HEPP Project. Among the material to come out from the excavation works to be undertaken in the area, the ones that can be usable shall be utilized as concrete aggregate material, laying material at the transport roads and filling material at the unit constructions. The remaining part shall be stored at the depot sites as excavations material. Six depot sites have been planned for the storage of the excess excavations material to occur during the project. The mentioned depot areas shall be inundated by the reservoir after the operation of the project. The location of these depot sites within the project are given at App-1.

Trucks and loaders shall be used during the excavations works. A new road needs to be constructed to access the dam body and the reservoir area. Again similarly, filling works shall be performed at the dam body, spill way, tail race, power plant and switchgear site. The excavation and filling amounts to be realized during the construction works are given in Table V.1. The excess excavation material shall be retained at the depot sites as explained above and excavations soil transport off-site shall not be performed. On the other hand, the relevant provisions at the Regulation on the Control of the Excavations Soil, Construction and Debris Wastes that has been enacted by being published at the Official Gazette no 25406 of 18.03.2004 shall be complied with.

Table V.1. The Excavation and Filling Amounts to be Realized in the Scope of the Project

Facility	Excavation Amount (m^3)	Filling Amount (m^3)
Cofferdams		27,264
Tunnel No. 1	70,027	-
Tunnel No. 2	76,030	
Dam body	3,003,428	1,922,714
Injection and Drainage Gallery	40,950	-
Spill way	7,243,309	123,666
Bottom outlet Entrance Structure	135,200	9,862
Bottom outlet Exit Structures	199,625	336
Energy Tunnel Hatch Shafts	14,726	-
Energy Tunnel No. 1	9,963	-
Energy Tunnel No. 2	9,833	-
Power Plant Building	441,575	159,086
Power Plant Exit Arrangement	230,607	-
Switchgear Site	-	425,000
Relocation Road	275,000	180,000
TOTAL	**11,475,273**	**2,847,928**

During the excavations activity, the top soil layer shall be stripped to prevent the pollution of the top soil and this layer shall be stored such that it shall not lose its productivity. The bottom soil providing the formation of the top soil shall also be stripped and shall be amassed such that it shall not lose its horizons. While stripping the top soil layer, all the non-soil material has to be separated from the soil. The plant parts ensuring the continuity of plant special such as seed and buds shall be separated. Furthermore, the top level of the vegetal soil shall be protected against erosion, drying and weeding, and coated with vegetal cover such as grass, meadow, grassland plants, etc. to ensure the maintaining of the soil livelihood. This stripped vegetal soil shall then be used at the landscape renovation of the area and the vegetal landscaping of the recreational areas.

V.1.2. Flood Prevention and Drainage Activities

Flood analysis studies were performed at the project area in the scope of the feasibility studies. Near Alpaslan II Dam and on Murat River; Murat River – Murat Bridge FMS (Flow Monitoring Station) no. 21-034 has been operated by General Directorate of SHW General Directorate. At this station with a precipitation area of 17,623.00 km^2, observations were made in the period of 1960-1967 (excluding 1965).

Electrical Works Survey Administration General Directorate (EIE) has operated Murat River – Mus FMS no. 2152 Murat River – Akkonak FMS no. 2174. Of these stations FMS no. 2152 has a precipitation area of 17,623.00 km^2 and was operated in the period of 1970-1983, whereas FMS no. 2174 has a precipitation area of 17,773.60 km^2 and was operated in the periods of 1983 – 1988 and 1995 – 2005. Since these three stations are in the form of continuation of one another, they have been considered as a single station during the assessments. Frequency analysis was performed on the annual instantaneous maximum flowrates for 1960-1967, 1970-1983, 1983-1988 and 1995-2006 at the mentioned FMS's and several repetitive flood flowrates according to the optimum distribution function were calculated for FMS no. 2174. The point flood frequency analysis results of the biggest flood flowrates calculated for Murat River – Akkonak FMS no. 2174 are given below at Table V.2.

Table V.2. Flood Flowrates for the Flow Observation Station no. 2174

FMS No. 2174	Flood Flowrate (m^3/sec)
Q_2	1,003.00
Q_5	1,349.00
Q_{10}	1,554.00
Q_{25}	1,791.00
Q_{50}	1,954.00
Q_{100}	2,108.00

The floods of Alpaslan II Dam and HEPP Project was reviewed and as a result of the assessments made, it was determined that the flood flowrates given at the final project were suitable. Table V.3 provides the flood flowrates for Alpaslan II dam location. Alpaslan II Dam and HEPP Project has been designed in the East Anatolian Region, in the province of Mus, on Murat River being one of the main branches of Euphrates River. It is known that the ratio of the biggest possible flood flowrate to the flood flowrate with 100-year frequency changes in the range of 2 to 6.

Table V.3. Flood Flowrates for Alpaslan II Dam Location

Alpaslan II Dam Location	Flood Flowrate (m^3/sec)
$Q_{2.33}$	1,032.00
Q_5	1,375.00
Q_{10}	1,597.00
Q_{25}	1,874.00
Q_{50}	2,078.00
Q_{100}	2,280.00
Q_{final}	7,542.00

Alpaslan II Dam has been designed on 1,272.00 m thalweg elevation of Murat River and has a precipitation area of 17,505.00 km^2. It has been built for energy generation and flood control purposes. The places over 1,000.00 m elevation are covered with snow. The snow fall and frost events start with the end of the fall until the month of March. The duration of snow cover remaining on the ground is approximately 3-5 months. With the beginning of summer, a fast temperature increase and rains are observed. With the melting of snow during the spring, floods occur.

The maximum flood flowrate calculated at the final project is 7,542.00 m^3/sec. The ratio of this value to the flood flowrate with 100-year frequency being 2,280.00 m^3/sec is, Qomf / Q100 = 3.3. It was concluded that this value was suitable for the basin, and thus the maximum possible flood flowrate of Alpaslan II Dam would be suitable for the project as well.

Regarding the measures to be taken to safeguard the art works of the mentioned facility against floor during the project construction, the Prime Ministry Circular no. 2006/27 published under the name of “River Beds and Flood” enacted on September 9, 2006 no. 26284 shall be complied with.

V.1.3. The transport, Storage and Use of the Inflammable, Explosive, Hazardous, Toxic and Chemical Substances to be Used during the Land Preparation and the Construction of the Units, the Tools and Machines to be Used for this Purpose

In case tough rock formations are encountered during the preparation of the land and construction of the units, explosion works shall be undertaken. As explosives, ANFO and Powergel Magnum 365 is planned to be used. If explosion is conducted, the regional community shall be informed beforehand, no one shall be permitted inside the detonation area. Sirens shall be sounded before detonation to warn the regional community. Explosive substances shall not be stored on site. The amount of the explosives necessary for the daily explosion shall be transported to the site with trucks.

The tools and machinery to be used in case explosion works are undertaken are as follows:

- Penetrant machine,
- Explosive sensitive to feeding,
- Explosive sensitive to capsule,
- Electrical or non-electrical capsule,
- Detonative fuse (in case needed),
- Flow measurement device,
- Firing magneto.

The following regulations and bylaws shall be abided during the use, protection and transport of explosive substances:

- Bylaw related to the Procedures and Conditions of the Production, Import, Transport, Storage, Retaining, Sales, Use, Destruction and Inspection of the Explosive Substances, Hunting Materials and Similar Items Left outside the Monopoly enacted by being published at the Official Gazette no. 19589 of 29.9.1987,
- Regulation on the Transport of Hazardous Substances on Highways enacted by being published at the Official Gazette no. 26479 of 31.03.2007,
- Bylaw related to the Worker Health and Work Safety Measures to be Taken in Mine and Quarry Operations and Tunnel Construction enacted by being published at the Official Gazette no. 18553 of 22.10.1984,
- Bylaw related to the Measures to be Taken at the Workplaces and Works Where Inflammable, Explosive, Hazardous and Toxic Substances are Used enacted by being published at the Official Gazette no. 14752 of 24.12.1973,
- Regulation on the Protection of Workers Against the Threats of Explosive Surroundings enacted by being published at the Official Gazette no. 25328 of 26.12.2003.

Furthermore, application shall be made to and necessary permits shall be obtained from Mus Governorship in the scope of the use, storage and transport of explosive substances.

Other than these, liquid fuels such as fuel oil – gasoline to be used by the construction equipment during the construction phase of the project shall be obtained from the fuel stations at Mus Merkez or Varto District. An agreement shall be made with the fuel station so that the fuel oil shall be distributed to the machines by its own distribution vehicle at certain periods (daily – once every 2 days, etc.) depending on the use of the construction equipment. Thereby, storage shall not be made at the worksite.

Stove or air conditioners are primarily considered for heating however, radiator system working on fuel oil is also among the considered options. In vase the radiator system working on fuel oil is used, the fuel shall be stored in a 5-ton impermeable fuel tank. Necessary safety precautions shall be taken at the fuel tank against fire, sabotage and leakage.

V.1.4. The Amounts of the Rock, Sand, Gravel and Similar Materials to be Extracted due to Activities such as Excavation, Bottom Sweeping, etc. to be Realized for Whatsoever Reason at the Water Bodies within the Project Area, Places to Transport Them or the Purposes for their Use

No bottom sweeping or excavation activity shall be performed at any water body in the scope of the project. However, bed arrangement shall be made to regulate the water flow at the downstream of the power plant. The material extracted from here shall be used in building seawall of the tail race channel.

Apart from this, material borrow areas E, F and G shall be opened at the areas around the river bed for the requirement of permeable materials. Detailed information regarding these borrow areas is provided at Chapter V.1.5.

Furthermore, no intervention shall be made at the river bed outside the knowledge and permission of General Directorate of SHW, material shall not be spilled to the river bed, the bed cross section shall not be reduced and suitable flow conditions shall be provided at the river bed.

V.1.5. The Place and Method to Obtain the Material to be Used for Building the Facilities in the scope of the Project

For the building of the facilities in the scope of the project, impermeable, permeable and rock filling-purposed material borrow areas shall be opened. The locations of the material borrow areas in the scope of the project are given in App-1, whereas their properties are given in Table V.4. In obtaining materials from the borrow areas, excavation and/or explosion methods shall be used to perform open borrow area operation. In case necessary in the scope of the project, material can also be obtained from the material borrow areas for which EIA Positive Decision / EIA Not Required Decision has been taken.

The permeable and impermeable material borrow areas shall be inundated by the reservoir except for impermeable material borrow area A. Among the rock material borrow areas K-1 shall be completely and K-2 and K-5 shall be partially inundated by the reservoir. All the material borrow areas left outside the reservoir are mostly located on grassland and partially on agricultural land.

Table V.4. Information on the Material Borrow Areas

Material Borrow Area	Amount of Material to be Used			Road Status
	Impermeable (m^3)	Permeable (m^3)	Rock (ton)	
A	9,000,000	-	-	Road is present
B	250,000	-	-	Road is present
C	650,000	-	-	Road is present
D	600,000	-	-	Road is present
E	-	1,200,000	-	Road is present
F	-	1,000,000	-	Road is present
G	-	1,800,000	-	Road is present
K-1	-	-	2,000,000	Road is present
K-2	-	-	2,000,000	4,679 m road construction
K-3A	-	-	2,000,000	2,985 m road construction
K-5	-	-	2,000,000	5,099 m road construction
K-6A	-	-	2,000,000	6,082 m road construction
K-6B	-	-	2,000,000	

V.1.6. The Place, Method and Amount of the Material to be Obtained that will be Used in the Construction of the Regulator, HEPP, Transmission Channel, Tunnel and Service Roads

There is no regulator in the scope of the mentioned project. The material to be used for the construction of the HEPP, transmission channel, tunnel and service roads shall again be obtained from the material borrow areas mentioned at Table V.4.

V.1.7. Capacity of the Crusher Facility, Its Technology, Operation Periods of the Production Amounts (Day-Month-Year) Transport Infrastructure Plan, Activities related to the Infrastructure Construction, the Machinery and Equipment to be Used

There will be one crushing-screening-washing facility in the scope of the project. The location of the facility in the scope of the project is provided at the layout plan in App-1.

The sand and gravel brought from the basalt and material site taking place within the project site at the crusher-screening-washing facility shall be reduced to the desired size for aggregate and concrete production. The material to be used for production purposes at the crusher-screening-washing facility shall be transported with trucks. After the materials brought in to the facility are fed to the feeder unit from the trucks, they shall be sent to the crusher, pass on the sieve with conveyor bands where they shall be separated according their size. The materials that can pass under the sieve shall be stored at a separate unit as final product. The materials left on the sieve can be resized with the repetition of the same process.

The materials reduced to the desired size shall be transferred on to the trucks from the storage unit and sent to the concrete plant to be used as raw material. The aggregate material to be processed at the crusher-screening-washing facility shall be temporarily stored here.

It is planned for the crusher-screening-washing facility to operate with a capacity of 288 days a year, 24 days a month and 8 hours a day. The crusher capacity for the facility has been determined as 400 ton/hour. 5 personnel shall be employed at the crusher-screening-washing (Crusher) facility.

The crusher-screening-washing facility is located adjacent to the permeable material borrow area E. Access to the area shall be possible via the existing roads and the transport roads that will be newly constructed. The existing and to-be-constructed transport roads to be used in the scope of the project are shown at the maps in App-1.

The work flow scheme of the Crusher facility is provided at Figure V.1.

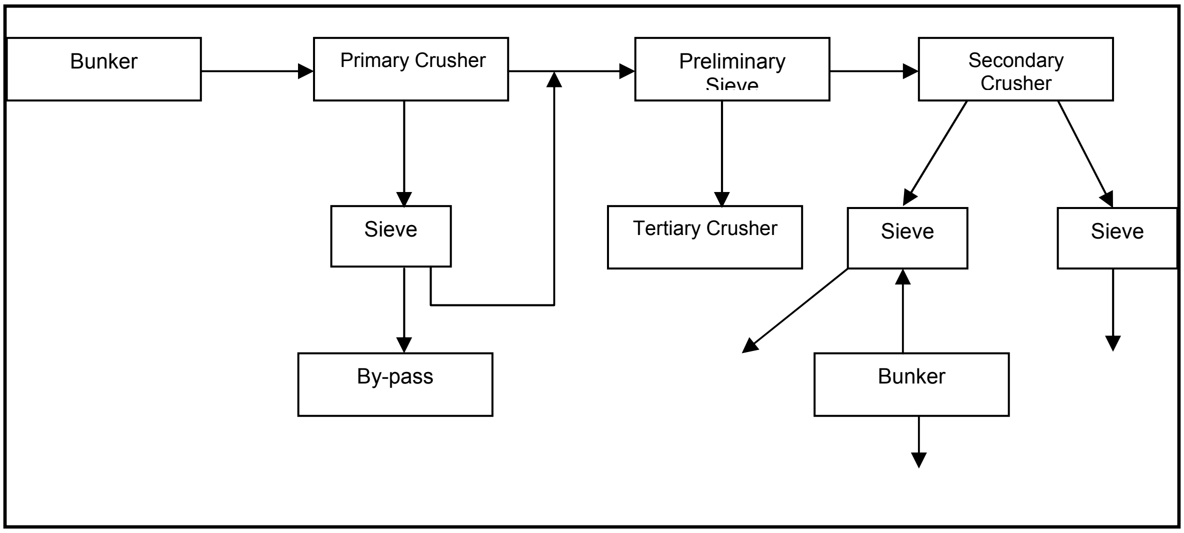


Figure V.1. Crusher Facility Work Flow Scheme

Other than the equipment stated at the above figure, loader, truck, etc. vehicles shall be used.

V.1.8. The Number of Material Borrow Areas to be Opened such as Stone Borrow Area, Sand Borrow Area, Clay Borrow Area to be Used during the Construction Phase, The Size of the Borrow Areas, Operation Area Size and Coordinates, Annual Scheduled Production Amounts, Production Methods to be Employed, Cascade Height, Inclination Angle, Number of Cascades, Display of the Initial and Final Status of the Borrow Areas on Production Maps

In the scope of the project, there are 6 rock, 3 impermeable and 4 permeable material borrow areas. The amount of the material to be obtained from the borrow areas is given in Table V.4. The production maps of the material borrow areas are shown at App-17.

As per article 2 and 4 of the Mine Law and the relevant articles of the Mining Activities Application Regulation, the mining operation activities shall be conformant to the operation projects to be submitted to the Mining Works General Directorate.

Necessary licenses shall be obtained for the material borrow areas.

Detailed information on the material borrow areas is given below.

Impermeable (Clay) Material Borrow Area A

The impermeable material borrow area A has a size of 1,200,000 m^2. The coordinates of the borrow area is provided in Chapter II.

It is planned extract 1,800,000 m^3 material as an annual average from the impermeable material borrow area A. The amount of material to be extracted as per the years is shown at Table V.5.

Table V.5. Amount of Material to be Produced as per the Years from the Impermeable Material Borrow Area A

Years	2012	2013	2014	2015	2016
Production Amount (m^3)	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000

Considering production at 12 months a year, the monthly material production amount is calculated as 150,000 m^3/month. Considering production at 24 days a month, the daily material production amount is calculated as 6,250 m^3/day. Considering production at 8 hours a day, the hourly material production amount is calculated as approximately 781 m^3/h.

Impermeable (Clay) Material Borrow Area B

The impermeable material borrow area B has a size of 175.000 m^2. The coordinates of the borrow area is provided in Chapter II.

It is planned extract 50,000 m^3 material as an annual average from the impermeable material borrow area B. The amount of material to be extracted as per the years is shown at Table V.6.

Table V.6. Amount of Material to be Produced as per the Years from the Impermeable Material Borrow Area B

Years	2012	2013	2014	2015	2016
Production Amount (m^3)	50,000	50,000	50,000	50,000	50,000

Considering production at 12 months a year, the monthly material production amount is calculated as 4,166 m^3/month. Considering production at 24 days a month, the daily material production amount is calculated as 173 m^3/day. Considering production at 8 hours a day, the hourly material production amount is calculated as approximately 22 m^3/h.

Impermeable (Clay) Material Borrow Area C

The impermeable material borrow area C has a size of 325,000 m^2. The coordinates of the borrow area is provided in Chapter II.

It is planned extract 130,000 m^3 material as an annual average from the impermeable material borrow area C. The amount of material to be extracted as per the years is shown at Table V.7.

Table V.7. Amount of Material to be Produced as per the Years from the Impermeable Material Borrow Area C

Years	2012	2013	2014	2015	2016
Production Amount (m^3)	130,000	130,000	130,000	130,000	130,000

Considering production at 12 months a year, the monthly material production amount is calculated as 10,833 m^3/month. Considering production at 24 days a month, the daily material production amount is calculated as 451 m^3/day. Considering production at 8 hours a day, the hourly material production amount is calculated as approximately 57 m^3/h.

Impermeable (Clay) Material Borrow Area D

The impermeable material borrow area D has a size of 250,000 m^2. The coordinates of the borrow area is provided in Chapter II.

It is planned extract 120,000 m^3 material as an annual average from the impermeable material borrow area D. The amount of material to be extracted as per the years is shown at Table V.8.

Table V.8. Amount of Material to be Produced as per the Years from the Impermeable Material Borrow Area D

Years	2012	2013	2014	2015	2016
Production Amount (m^3)	120,000	120,000	120,000	120,000	120,000

Considering production at 12 months a year, the monthly material production amount is calculated as 10,000 m^3/month. Considering production at 24 days a month, the daily material production amount is calculated as 416 m^3/day. Considering production at 8 hours a day, the hourly material production amount is calculated as approximately 53 m^3/h.

Permeable (Sand-Gravel) Material Borrow Area E

The permeable material borrow area E has a size of 400,000 m^2. The coordinates of the borrow area is provided in Chapter II.

It is planned extract 240,000 m^3 material as an annual average from the impermeable material borrow area E. The amount of material to be extracted as per the years is shown at Table V.9.

Table V.9. Amount of Material to be Produced as per the Years from the Permeable Material Borrow Area E

Years	2012	2013	2014	2015	2016
Production Amount (m^3)	240,000	240,000	240,000	240,000	240,000

Considering production at 12 months a year, the monthly material production amount is calculated as 20,000 m^3/month. Considering production at 24 days a month, the daily material production amount is calculated as 833 m^3/day. Considering production at 8 hours a day, the hourly material production amount is calculated as approximately 104 m^3/h.

Permeable (Sand-Gravel) Material Borrow Area F

The permeable material borrow area F has a size of 375,000 m^2. The coordinates of the borrow area is provided in Chapter II.

It is planned extract 200,000 m^3 material as an annual average from the permeable material borrow area F. The amount of material to be extracted as per the years is shown at Table V.10.

Table V.10. Amount of Material to be Produced as per the Years from the Permeable Material Borrow Area F

Years	2012	2013	2014	2015	2016
Production Amount (m^3)	200,000	200,000	200,000	200,000	200,000

Considering production at 12 months a year, the monthly material production amount is calculated as 20,000 m^3/month. Considering production at 24 days a month, the daily material production amount is calculated as 833 m^3/day. Considering production at 8 hours a day, the hourly material production amount is calculated as approximately 104 m^3/h.

Permeable (Sand-Gravel) Material Borrow Area G

The permeable material borrow area G has a size of 350,000 m^2. The coordinates of the borrow area is provided in Chapter II.

It is planned extract 360,000 m^3 material as an annual average from the permeable material borrow area G. The amount of material to be extracted as per the years is shown at Table V.11.

Table V.11. Amount of Material to be Produced as per the Years from the Permeable Material Borrow Area G

Years	2012	2013	2014	2015	2016
Production Amount (m^3)	360,000	360,000	360,000	360,000	360,000

Considering production at 12 months a year, the monthly material production amount is calculated as 30,000 m^3/month. Considering production at 24 days a month, the daily material production amount is calculated as 1,250 m^3/day. Considering production at 8 hours a day, the hourly material production amount is calculated as 156.25 m^3/h.

Rock (Basalt) Borrow Area K-1

The size of the rock borrow area K-1 is 5.95 hectares whereas its operation area size is 5,31 hectares. The coordinates of the operation area of the borrow area is provided .in Chapter II.

The reserve in this area is distributed over an area of about 217 m x 245 m (53,165 m^2) in Polygon no. 1 and 28 m x 50 m (6,400 m^2) in Polygon no. 2. The ore thickness in this area regarding the visible reserve is 45 m on the average although this value can occasionally reach much higher figures within the area. The density of basalt in the site is accepted as 2.7 ton/m^3. Furthermore, it is considered that there will be an operation loss at about 25% due to the topographical structure. Accordingly;

Total Visible Reserve:

Total Visible Reserve at the Site

=(53,165 m^2+6,400 m^2)x45 mx2.7x0.75

= 5,427,860 tons.

During the operation period, it is considered that formation of totally 4 cascades will be sufficient. The cascade cross section formed during production is shown in Figure V.2.

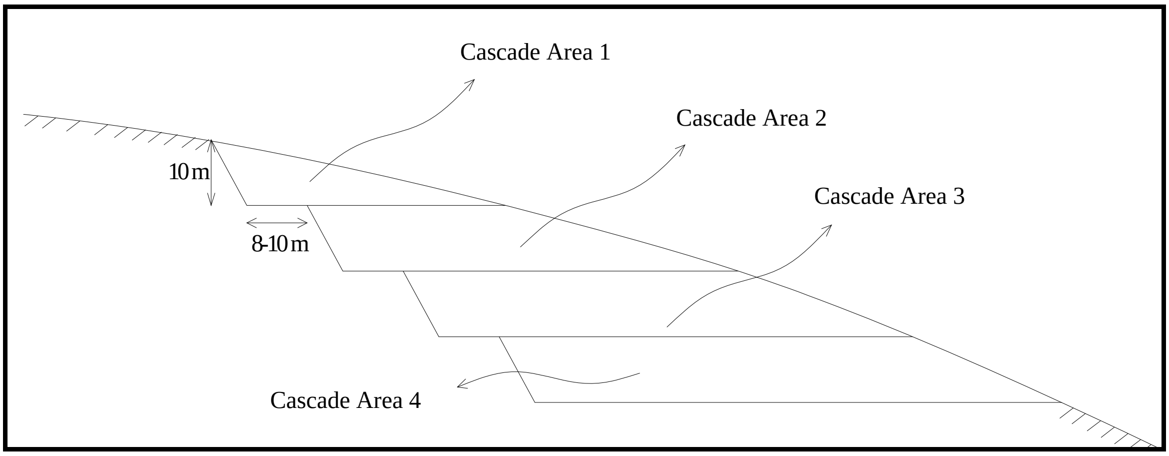


Figure V.2. Cascade Cross Section Formed in the Production of Rock Borrow Area K-1

At the production planned to be commenced at the elevation of 1,360 and finished at 1,320, the first cascade to be formed shall cover an area of approximately 8,965 m^2, the second cascade 17,295 m^2, the third cascade 21,515 m^2 and the fourth cascade shall cover an area of approximately 26,305 m^2. The height of the four cascades shall be adjusted to be 10 m and the ore density shall be taken as 2.7 ton/m^3. According to the calculations made, the material to be extracted from the first cascade will be 242,055 tons, material from the second cascade will be at 466,965 tons, material from the third cascade will be at 580,905 tons, and the material from the fourth cascade will be at 710,235 tons. Thus, the visible reserve that can be processed within the requested operation permit area will be 2,000,160 tons.

Visible Reserve that can be Processed:

(Amount of Reserve Planned to be Produced for a 5-Year Duration)
= 242,055 + 466,965 + 580,905 + 710,235
= **2,000,160 tons.**

The basalt amount to be produced at the rock borrow area K-1 as per the years is provided at Table V.12. It is planned to produce 400.000 tons of material as an annual average at the rock borrow area scheduled to be operated for 5 years.

Table V.12. Amount of Material to be Produced as per the Years from the Rock Borrow Area K-1

Years	2012	2013	2014	2015	2016
Production Amount (tons)	400,000	400,000	400,000	400,000	400,000

Considering production at 12 months a year, the monthly material production amount is calculated as 33,333 ton/month. Considering production at 24 days a month, the daily material production amount is calculated as 1,388 ton/day. Considering production at 8 hours a day, the hourly material production amount is calculated as 173 ton/h.

The production at the site shall be realized with drilling-detonation as being one of the open operation methods at the cascades and this activity shall be realized by a subcontractor firm. According to the planned production amount, the production shall be continued by paying due care to the borrow area boundaries at the site, inclination to be provided at the side walls and the risk of landslide. The inclination heights shall be adjusted according to the technical and work safety condition of the used work machinery. There is no side stone problem to be encountered during production.

Basalt production shall be realized with detonation. Holes shall be drilled with Wagon-Drill, the suitable amount of explosive substance (dynamite and ANFO) shall be placed, detonation shall be conducted by taking the necessary safety precautions, the exploded basalt ore shall be extracted with an excavator, loaded on the trucks with loaders and transferred to the dam area.

The annual basalt production amount scheduled in this phase is about 400.000 tons on the average.

It is planned for the production to be continued at sufficient quantity of layers depending on the change of the ore thickness. The cascade widths shall be arranged so that the work machinery can move comfortably. It is contemplated for the cascade height to be 10 m, and the width to be about 8–10 m. It is planned for the cascade angle to be 55° and the general inclination angle at the site to be around 30°.

The production maps of the material borrow area are provided at App-17.

Rock (Basalt) Borrow Area K-2

The size of the rock borrow area K-2 is 30,34 hectares whereas its operation area size is 15.03 hectares. The coordinates of the operation area of the borrow area is provided in Chapter II.

The reserve in this area is distributed over an area of about 352 m x 862 m. The ore thickness in this area regarding the visible reserve is 45 m on the average although this value can occasionally reach much higher figures within the area. The density of basalt in the site is accepted as 2.7 ton/m^3. Furthermore, it is considered that there will be an operation loss at about 25% due to the topographical structure. Accordingly;

Total Visible Reserve:

Total Visible Reserve at the Site
= 352 m x 862 m x 45 m x 2,7 x 0,75
= **27,649,512 tons.**

During the operation period, it is considered that formation of totally 4 cascades will be sufficient. The cascade cross section formed during production is shown in Figure V.3.

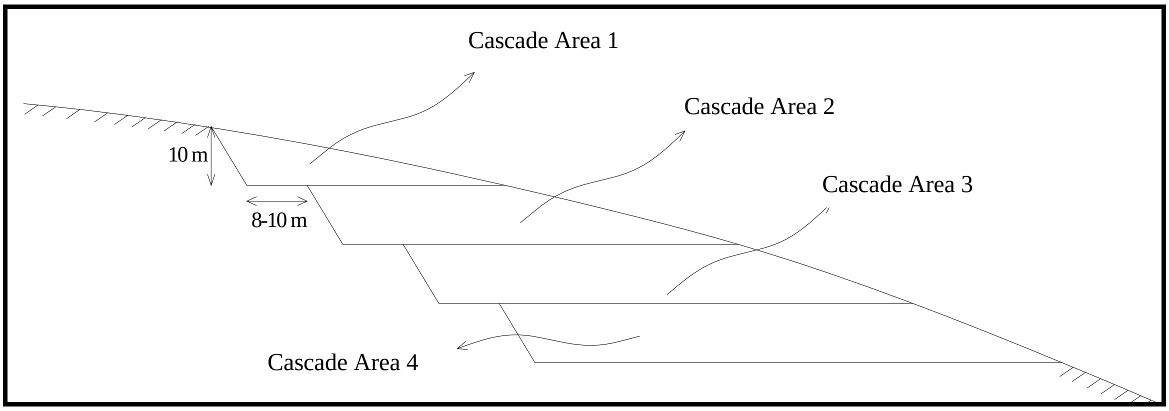


Figure V.3. Cascade Cross Section Formed in the Production of Rock Borrow Area K-2

At the production planned to be commenced at the elevation of 1,390 and finished at 1,350, the first cascade to be formed shall cover an area of approximately 6,825 m^2, the second cascade 15,730 m^2, the third cascade 24,740 m^2 and the fourth cascade shall cover an area of approximately 26,795 m^2. The height of the four cascades shall be adjusted to be 10 m and the ore density shall be taken as 2.7 ton/m^3. According to the calculations made, the material to be extracted from the first cascade will be 184,275 tons, material from the second cascade will be at 424,710 tons, material from the third cascade will be at 667,980 tons, and the material from the fourth cascade will be at 723,465 tons. Thus, the visible reserve that can be processed within the requested operation permit area will be 2,000,430 tons.

Visible Reserve that can be Processed:

(Amount of Reserve Planned to be Produced for a 5-Year Duration)
= 184,275 + 424,710 + 667,980 + 723.465
= 2,000,430 tons.

The basalt amount to be produced at the rock borrow area K-2 as per the years is provided at Table V.13. It is planned to produce 400,000 tons of material as an annual average at the rock borrow area scheduled to be operated for 5 years.

Table V.13. Amount of Material to be Produced as per the Years from the Rock Borrow Area K-2

Years	2011	2013	2014	2015	2016
Production Amount (tons)	400,000	400,000	400,000	400,000	400,000

Considering production at 12 months a year, the monthly material production amount is calculated as 33,333 ton/month. Considering production at 24 days a month, the daily material production amount is calculated as 1.388 ton/day. Considering production at 8 hours a day, the hourly material production amount is calculated as 173 ton/h.

The production at the site shall be realized with drilling-detonation as being one of the open operation methods at the cascades and this activity shall be realized by a subcontractor firm. According to the planned production amount, the production shall be continued by paying due care to the borrow area boundaries at the site, inclination to be provided at the side walls and the risk of landslide. The inclination heights shall be adjusted according to the technical and work safety condition of the used work machinery. There is no side stone problem to be encountered during production.

Basalt production shall be realized with detonation. Holes shall be drilled with Wagon-Drill, the suitable amount of explosive substance (dynamite and ANFO) shall be placed, detonation shall be conducted by taking the necessary safety precautions, the exploded basalt ore shall be extracted with an excavator, loaded on the trucks with loaders and transferred to the dam area.

The annual basalt production amount scheduled in this phase is about 400,000 tons on the average.

The ore thickness in the area where production shall be made in the site is 45 m on the average although this value can occasionally reach much higher figures within the area. It is planned for the production to be continued at sufficient quantity of layers depending on the change of the ore thickness. The cascade widths shall be arranged so that the work machinery can move comfortably. It is contemplated for the cascade height to be 10 m, and the width to be about 8–10 m. It is planned for the cascade angle to be 55° and the general inclination angle at the site to be around 30°.

The production maps of the material borrow area are provided at App-17.

Rock (Basalt) Borrow Area K-3

The size of the rock borrow area K-2 is 40.62 hectares whereas its operation area size is 13.59 hectares. The coordinates of the operation area of the borrow area is provided in Chapter II.

The reserve in this area is distributed over an area of about 913 m x 445 m. The ore thickness in this area regarding the visible reserve is 30 m on the average although this value can occasionally reach much higher figures within the area. The density of basalt in the site is accepted as 2,7 ton/m^3. Furthermore, it is considered that there will be an operation loss at about 25% due to the topographical structure. Accordingly;

Total Visible Reserve:

Total Visible Reserve at the Site

= 913 m x 445 m x 30 m x 2,7 x 0,75
= **24,681,814 tons.**

During the operation period, it is considered that formation of totally 3 cascades will be sufficient. The cascade cross section formed during production is shown in Figure V.4.

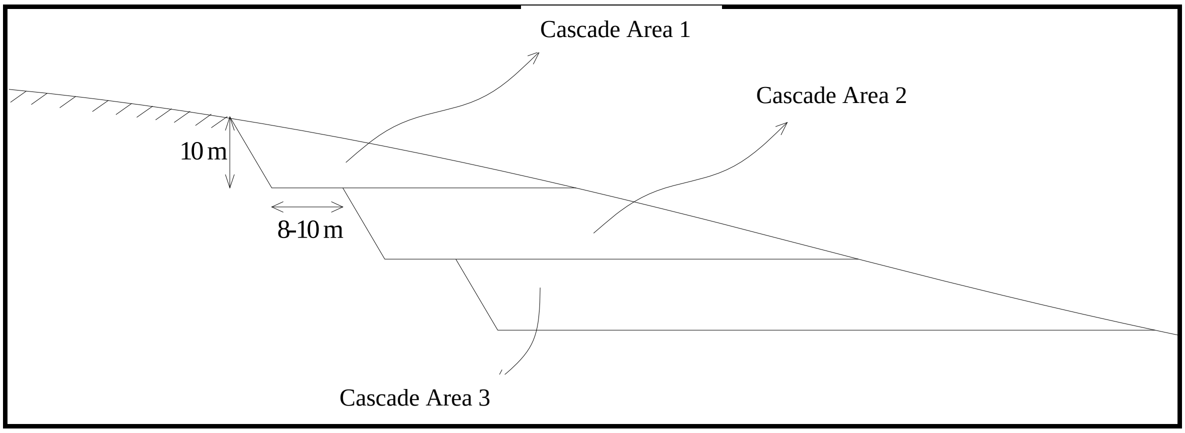


Figure V.4. Cascade Cross Section Formed in the Production of Rock Borrow Area K-3

At the production planned to be commenced at the elevation of 1,490 and finished at 1.460, the first cascade to be formed shall cover an area of approximately 9,805 m^2, the second cascade 26,710 m^2, and the third cascade shall cover an area of approximately 37.580 m^2. The height of the three cascades shall be adjusted to be 10 m and the ore density shall be taken as 2,7 ton/m^3. According to the calculations made, the material to be extracted from the first cascade will be 264,735 tons, material from the second cascade will be at 721,170 tons, and the material from the third cascade will be at 1,014,670 tons. Thus, the visible reserve that can be processed within the requested operation permit area will be 2,000,430 tons.

Visible Reserve that can be Processed:

(Amount of Reserve Planned to be Produced for a 5-Year Duration)
= 264,735 + 721,170 + 1,014,670
= 2,000,430 tons.

The basalt amount to be produced at the rock borrow area K-3 as per the years is provided at Table V.14. It is planned to produce 400,000 tons of material as an annual average at the rock borrow area scheduled to be operated for 5 years.

Table V.14. Amount of Material to be Produced as per the Years from the Rock Borrow Area K-3

Years	2012	2013	2014	2015	2016
Production Amount (tons)	400,000	400,000	400,000	400,000	400,000

Considering production at 12 months a year, the monthly material production amount is calculated as 33,333 ton/month. Considering production at 24 days a month, the daily material production amount is calculated as 1,388 ton/day. Considering production at 8 hours a day, the hourly material production amount is calculated as 173 ton/h.

The production at the site shall be realized with drilling-detonation as being one of the open operation methods at the cascades and this activity shall be realized by a subcontractor firm. According to the planned production amount, the production shall be continued by paying due care to the borrow area boundaries at the site, inclination to be provided at the side walls and the risk of landslide. The inclination heights shall be adjusted according to the technical and work safety condition of the used work machinery. There is no side stone problem to be encountered during production.

Basalt production shall be realized with detonation. Holes shall be drilled with Wagon-Drill, the suitable amount of explosive substance (dynamite and ANFO) shall be placed, detonation shall be conducted by taking the necessary safety precautions, the exploded basalt ore shall be extracted with an excavator, loaded on the trucks with loaders and transferred to the dam area.

The annual basalt production amount scheduled in this phase is about 400,000 tons on the average.

The ore thickness in the area where production shall be made in the site is 30 m on the average although this value can occasionally reach much higher figures within the area. It is planned for the production to be continued at sufficient quantity of layers depending on the change of the ore thickness. The cascade widths shall be arranged so that the work machinery can move comfortably. It is contemplated for the cascade height to be 10 m, and the width to be about 8–10 m. It is planned for the cascade angle to be 55° and the general inclination angle at the site to be around 30°.

The production maps of the material borrow area are provided at App-17.

Rock (Basalt) Borrow Area K-5

The size of the rock borrow area K-5 is 57.61 hectares whereas its operation area size is 25.76 hectares. The coordinates of the operation area of the borrow area is provided in Chapter II.

The reserve in this area is distributed over an area of about 681 m x 846 m. The ore thickness in this area regarding the visible reserve is 20 m on the average although this value can occasionally reach much higher figures within the area. The density of basalt in the site is accepted as 2.7 ton/m^3. Furthermore, it is considered that there will be an operation loss at about 25% due to the topographical structure. Accordingly;

Total Visible Reserve:

Total Visible Reserve at the Site

= 681 m x 846 m x 20 m x 2,7 x 0,75
= **23,333,103 tons.**

During the operation period, it is considered that formation of totally 2 cascades will be sufficient. The cascade cross section formed during production is shown in Figure V.5.

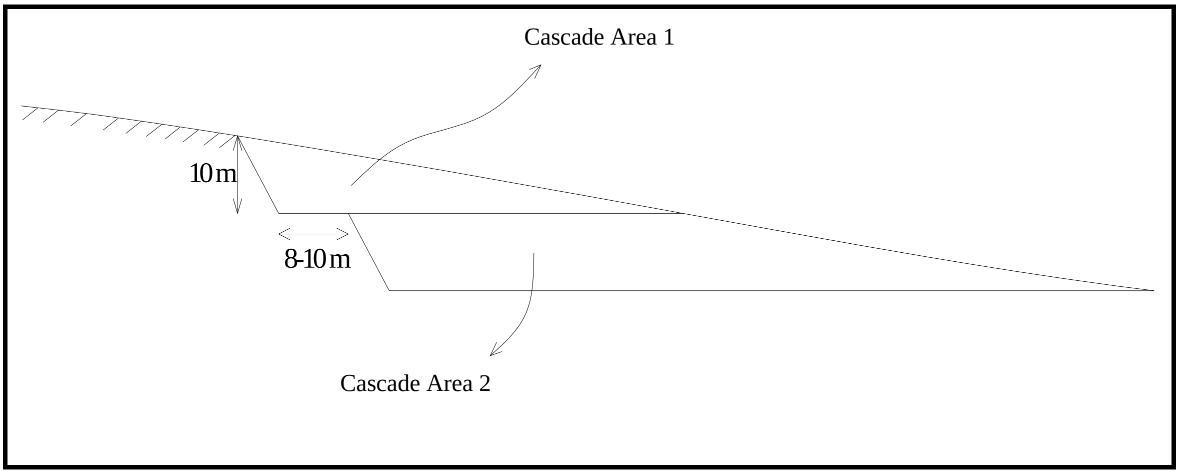


Figure V.5. Cascade Cross Section Formed in the Production of Rock Borrow Area K-5

At the production planned to be commenced at the elevation of 1,320 and finished at 1,300, the first cascade to be formed shall cover an area of approximately 33,430 m^2, and the second cascade shall cover an area of approximately 40,660 m^2. The height of the two cascades shall be adjusted to be 10 m and the ore density shall be taken as 2.7 ton/m^3. According to the calculations made, the material to be extracted from the first cascade will be 902,610 tons, and the material from the second cascade will be at 1,097,820 tons. Thus, the visible reserve that can be processed within the requested operation permit area will be 2,000,430 tons.

Visible Reserve that can be Processed:

(Amount of Reserve Planned to be Produced for a 5-Year Duration)
= 902,610 + 1,097,820
= **2,000,430 tons.**

The basalt amount to be produced at the rock borrow area K-5 as per the years is provided at Table V.15. It is planned to produce 400,000 tons of material as an annual average at the rock borrow area scheduled to be operated for 5 years.

Table V.15. Amount of Material to be Produced as per the Years from the Rock Borrow Area K-5

Years	2012	2013	2014	2015	2016
Production Amount (tons)	400,000	400,000	400,000	400,000	400,000

Considering production at 12 months a year, the monthly material production amount is calculated as 33,333 ton/month. Considering production at 24 days a month, the daily material production amount is calculated as 1,388 ton/day. Considering production at 8 hours a day, the hourly material production amount is calculated as 173 ton/h.

The production at the site shall be realized with drilling-detonation as being one of the open operation methods at the cascades and this activity shall be realized by a subcontractor firm. According to the planned production amount, the production shall be continued by paying due care to the borrow area boundaries at the site, inclination to be provided at the side walls and the risk of landslide. The inclination heights shall be adjusted according to the technical and work safety condition of the used work machinery. There is no side stone problem to be encountered during production.

Basalt production shall be realized with detonation. Holes shall be drilled with Wagon-Drill, the suitable amount of explosive substance (dynamite and anfo) shall be placed, detonation shall be conducted by taking the necessary safety precautions, the exploded basalt ore shall be extracted with an excavator, loaded on the trucks with loaders and transferred to the dam area.

The annual basalt production amount scheduled in this phase is about 400,000 tons on the average.

The ore thickness in the area where production shall be made in the site is 20 m on the average although this value can occasionally reach much higher figures within the area. It is planned for the production to be continued at sufficient quantity of layers depending on the change of the ore thickness. The cascade widths shall be arranged so that the work machinery can move comfortably. It is contemplated for the cascade height to be 10 m, and the width to be about 8–10 m. It is planned for the cascade angle to be 55° and the general inclination angle at the site to be around 30°.

The production maps of the material borrow area are provided at App-17.

Rock (Basalt) Borrow Area K-6A

The size of the rock borrow area K-6A is 95.83 hectares whereas its operation area size is 29.08 hectares. The coordinates of the operation area of the borrow area is provided in Chapter II.

The reserve in this area is distributed over an area of about 1,235 m x 551 m. The ore thickness in this area regarding the visible reserve is 20 m on the average although this value can occasionally reach much higher figures within the area. The density of basalt in the site is accepted as 2.7 ton/m^3. Furthermore, it is considered that there will be an operation loss at about 25% due to the topographical structure. Accordingly;

Total Visible Reserve:

Total Visible Reserve at the Site

= 1,235 m x 551 m x 20 m x 2.7 x 0.75
= **27,559,642 tons.**

During the operation period, it is considered that formation of totally 2 cascades will be sufficient. The cascade cross section formed during production is shown in Figure V.6.

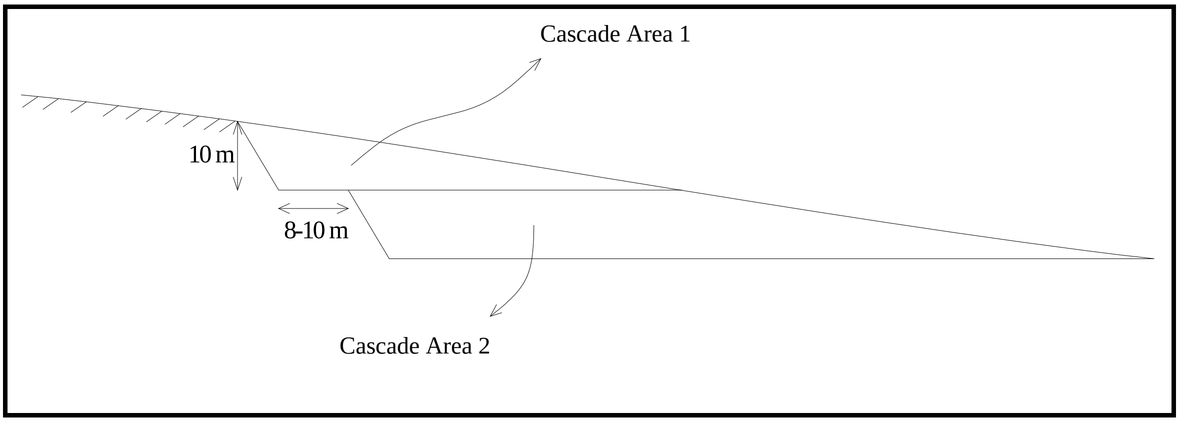


Figure V.6. Cascade Cross Section Formed in the Production of Rock Borrow Area K-6A

At the production planned to be commenced at the elevation of 1,910 and finished at 1,890, the first cascade to be formed shall cover an area of approximately 26,170 m^2, and the second cascade shall cover an area of approximately 47,960 m^2. The height of the two cascades shall be adjusted to be 10 m and the ore density shall be taken as 2.7 ton/m^3. According to the calculations made, the material to be extracted from the first cascade will be 706,590 tons, and the material from the second cascade will be at 1,294,920 tons. Thus, the visible reserve that can be processed within the requested operation permit area will be 2,001,510 tons.

Visible Reserve that can be Processed:

(Amount of Reserve Planned to be Produced for a 5-Year Duration)
= 706,590 + 1,294,920
= **2,001,510 tons.**

The basalt amount to be produced at the rock borrow area K-6A as per the years is provided at Table V.16. It is planned to produce 400,000 tons of material as an annual average at the rock borrow area scheduled to be operated for 5 years.

Table V.16. Amount of Material to be Produced as per the Years from the Rock Borrow Area K-6A

Years	2012	2013	2014	2015	2016
Production Amount (tons)	400,000	400,000	400,000	400,000	400,000

Considering production at 12 months a year, the monthly material production amount is calculated as 33,333 ton/month. Considering production at 24 days a month, the daily material production amount is calculated as 1,388 ton/day. Considering production at 8 hours a day, the hourly material production amount is calculated as 173 ton/h.

The production at the site shall be realized with drilling-detonation as being one of the open operation methods at the cascades and this activity shall be realized by a subcontractor firm. According to the planned production amount, the production shall be continued by paying due care to the borrow area boundaries at the site, inclination to be provided at the side walls and the risk of landslide. The inclination heights shall be adjusted according to the technical and work safety condition of the used work machinery. There is no side stone problem to be encountered during production.

Basalt production shall be realized with detonation. Holes shall be drilled with Wagon-Drill, the suitable amount of explosive substance (dynamite and anfo) shall be placed, detonation shall be conducted by taking the necessary safety precautions, the exploded basalt ore shall be extracted with an excavator, loaded on the trucks with loaders and transferred to the dam area.

The annual basalt production amount scheduled in this phase is about 400,000 tons on the average.

The ore thickness in the area where production shall be made in the site is 20 m on the average although this value can occasionally reach much higher figures within the area. It is planned for the production to be continued at sufficient quantity of layers depending on the change of the ore thickness. The cascade widths shall be arranged so that the work machinery can move comfortably. It is contemplated for the cascade height to be 10 m, and the width to be about 8–10 m. It is planned for the cascade angle to be 55° and the general inclination angle at the site to be around 30°.

The production maps of the material borrow area are provided at App-17.

Rock (Basalt) Borrow Area K-6B

The size of the rock borrow area K-6B is 93.68 hectares whereas its operation area size is 22.61 hectares. The coordinates of the operation area of the borrow area is provided in Chapter II.

The reserve in this area is distributed over an area of about 2,281 m x 336 m. The ore thickness in this area regarding the visible reserve is 20 m on the average although this value can occasionally reach much higher figures within the area. The density of basalt in the site is accepted as 2.7 ton/m^3. Furthermore, it is considered that there will be an operation loss at about 25% due to the topographical structure. Accordingly;

Total Visible Reserve:

Total Visible Reserve at the Site
= 2,281 m x 336 m x 20 m x 2.7 x 0.75
= **31,039,848 tons**

During the operation period, it is considered that formation of totally 2 cascades will be sufficient. The cascade cross section formed during production is shown in Figure V.7.

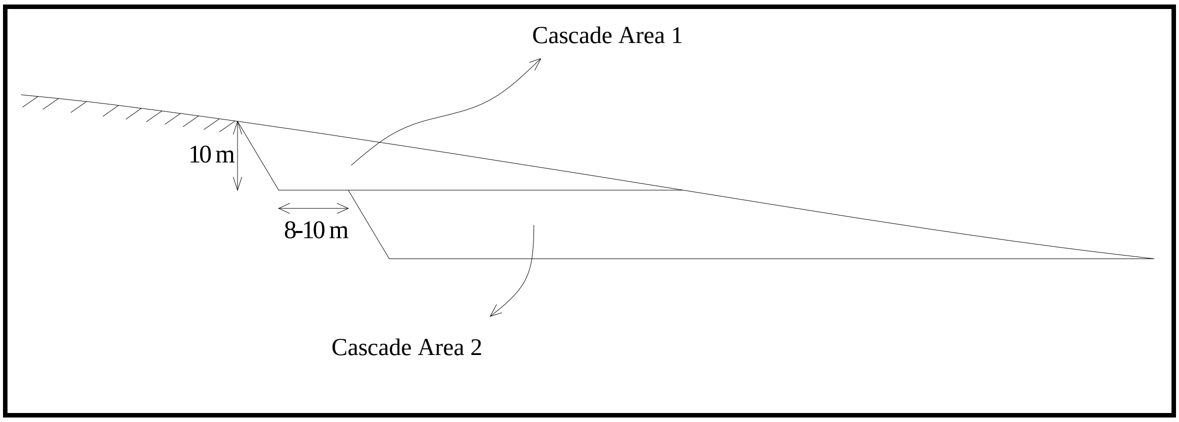


Figure V.7. Cascade Cross Section Formed in the Production of Rock Borrow Area K-6B

At the production planned to be commenced at the elevation of 1,940 and finished at 1.920, the first cascade to be formed shall cover an area of approximately 29,835 m^2, and the second cascade shall cover an area of approximately 44,260 m^2. The height of the two cascades shall be adjusted to be 10 m and the ore density shall be taken as 2.7 ton/m^3. According to the calculations made, the material to be extracted from the first cascade will be 805,545 tons, and the material from the second cascade will be at 1,195,020 tons. Thus, the visible reserve that can be processed within the requested operation permit area will be 2,000,565 tons.

Visible Reserve that can be Processed:

(Amount of Reserve Planned to be Produced for a 5-Year Duration)
= 805,545 + 1,195,020
= **2.000,565 tons.**

The basalt amount to be produced at the rock borrow area K-6B as per the years is provided at Table V.17. It is planned to produce 400,000 tons of material as an annual average at the rock borrow area scheduled to be operated for 5 years.

Table V.17. Amount of Material to be Produced as per the Years from the Rock Borrow Area K-6B

Years	**2012**	**2013**	**2014**	**2015**	**2016**
Production Amount (tons)	400,000	400,000	400,000	400,000	400,000

Considering production at 12 months a year, the monthly material production amount is calculated as 33,333 ton/month. Considering production at 24 days a month, the daily material production amount is calculated as 1,388 ton/day. Considering production at 8 hours a day, the hourly material production amount is calculated as 173 ton/h.

The production at the site shall be realized with drilling-detonation as being one of the open operation methods at the cascades and this activity shall be realized by a subcontractor firm. According to the planned production amount, the production shall be continued by paying due care to the borrow area boundaries at the site, inclination to be provided at the side walls and the risk of landslide. The inclination heights shall be adjusted according to the technical and work safety condition of the used work machinery. There is no side stone problem to be encountered during production.

Basalt production shall be realized with detonation. Holes shall be drilled with Wagon-Drill, the suitable amount of explosive substance (dynamite and anfo) shall be placed, detonation shall be conducted by taking the necessary safety precautions, the exploded basalt ore shall be extracted with an excavator, loaded on the trucks with loaders and transferred to the dam area.

The annual basalt production amount scheduled in this phase is about 400,000 tons on the average.

The ore thickness in the area where production shall be made in the site is 20 m on the average although this value can occasionally reach much higher figures within the area. It is planned for the production to be continued at sufficient quantity of layers depending on the change of the ore thickness. The cascade widths shall be arranged so that the work machinery can move comfortably. It is contemplated for the cascade height to be 10 m, and the width to be about 8–10 m. It is planned for the cascade angle to be 55° and the general inclination angle at the site to be around 30°.

The production maps of the material borrow area are provided at App-17.

The information on the restoration plan to be implemented at the rock (basalt) borrow areas that will not be inundated by the dam in the scope of the project is provided herein below.

The gaps to occur at the borrow area where production shall take place will be filled with tallow material and these gaps will not be filled with water.

The preparation phase for the vegetation activity of the land is comprised of reclamation activities. The reclamation activities shall be commenced at the sites for which topographical arrangement has been completed and is comprised of development of the soil and re-vegetation works in this site.

The flat area and cascades to be formed at the site after production shall be laid with tallow material that may be extracted from the site. Vegetal soil layer shall be laid on top of the tallow material. In order to increase the vegetation success of the vegetal soil to be laid on the site, reclamation works are foreseen. In this context, fertilization can be made at and after the vegetal soil laying phase. It is planned to adjust the depth of the vegetal soil to be laid according to the root length of the antecedent plants desired to be planted. Turf, humus or clay addition can be made where deemed necessary to increase the organic content, enrich and increase the water-retaining capacity of the soil. Thereby, a medium more suitable for plant culturing shall be obtained. The last phase in preparing the laid soil for vegetation will be the plowing of the land with the equipment to be inserted on the work machinery. In this manner, the site shall be made ready for plantation.

While performing reclamation activities at the site, generally pre-vegetation is applied before starting with permanent vegetation. The aim here is to prevent or minimize erosion, protect the soil from extreme low or high temperatures, increase the insufficient nutrients at the laying soil and to improve the water retaining capacity of the soil. The vegetation activities shall be commenced with trial plantations. Suitable antecedent plants shall be planted according to the climatic properties of the region and the soil status, their growth shall be observed and the plant species that best fits the environment shall be used in the overall site.

The grassy plants to be used at preliminary and permanent vegetation shall be planted to the site in lines. After the preliminary vegetation, saplings with organic substance-rich soil shall be used to attain success in the plantation of the saplings.

The plants to be planted, their seeds and saplings to be planted shall be obtained from the market at culture greenhouses according to the size of the plants and transported with pickup trucks or trucks.

Sapling plantation at the site shall be realized at least 1-1,5 years after the preliminary vegetation. The sapling plantation works can be realized during the resting period of the trees provided that the weather is not too cold. Therefore, sapling plantation at the site shall be arranged to be realized after the winter months.

At the area where saplings will be planted, the sapling locations shall be determined before plantation and it shall be made sure that these are with regular order and at regular intervals.

The tree species shall be carefully selected for forestation. The species selection shall be based on soil status, climate and vegetation cover. After the sapling plantation, the ones that could not get rooted and could not adapt to the environment shall be replaced with other sapling species that can adapt and develop in the area.

There will be no polluted area within the application area. Some of the small amount of wastes that can occur in the production areas shall be used at construction activities and the others shall be accumulated at the tallow areas in accordance with the topographical structure of the region, in a manner that will not affect the production and harm the environment; as to be used at the future rehabilitation activities.

During the production activities, no building, etc. structures shall be built at the site. The ore to be produced at the borrow area shall be transferred to the dam area as to be used as filling material in Alpaslan II Dam's body construction. The social needs of the personnel to work during the production shall be obtained from the worksite building planned to be built at the dam area. Consequently, there will not be any demolition or dismantling at the application area.

The roads to be opened in the site within the borrow area shall be rehabilitated during the production activities and after the completion of these activities in a manner that will not pose any threat.

The signs placed at the site corner points to determine the boundaries of the production area and the fences or warning plates to prevent the entrance and exits into/from the site at unsuitable locations and to ensure the safety of the environment shall be removed after the completion of all the works such as rehabilitation, etc. provided that there is no situation that can threaten the safety.

V.1.9. Description of the Method of Detonation Process at the Material Borrow Areas, Explosion Pattern, the Amount of Explosive Substance to be Used at Single Detonation, Transport, Storage and Use Thereof, Calculation of Air Shock and Rock Spatter and the Evaluation of the Impacts

Detonation shall be made at the K1, K2, K3, K5, K6A and K6B rock borrow areas in the scope of the project. Production at the mentioned rock borrow areas shall be made via open borrow area operation. Drilling-detonation method shall be employed in production and explosive substance shall be used. For this aim, it is foreseen to utilize capsule, dynamite and ANFO as explosive substances. In the rock material borrow areas, work shall be performed only during day time and in one shift, thus the detonations shall be carried out during the day time.

ANFO is an explosive mixture, widely used in the world and Turkey, obtained by the mixture of ammonium nitrate and fuel-oil at 5-6% ratio. During the application, it was observed that the highest explosion speed can be obtained with ANFO in 75–250 mm sized holes. In order to fire up ANFO, explosive substances with higher energy, like dynamite, are required. The technical properties of ANFO are provided at Table V.18.

Table V.18. Technical Properties of ANFO

Appearance	White – In the form of Prill Particulates
Total Nitrogen ratio (% min)	34,5
NH_4NO_3 (%min)	98,5
Substances Insoluble in Water (% max)	1,0
Humidity (according to Fisher method)	% 0,2
pH @ 15 ^{0}C	4,5 - 6
Anti-caking material	Organic
Coating	Mineral
Fuel-Oil Absorption Capacity (%)	8,0-12,0

Source: Mechanical and Chemical Industry Institution, Barutsan Data

ANFO is ignited with dynamites detecting capsules and millisecond delayed capsules, making the rock dissolve into pieces and suitable for excavation. The electrical or non-electrical capsules at the step detonation method to be employed increase the efficiency of detonation by providing a delay between the detonation rows or holes, aid in reducing the air and ground vibration levels to be formed due to the amount of explosive substance used. This application is realized by drilling holes within the rock structure, placing explosive substance and ignition thereof.

The following regulations and bylaws shall be abided during the use, protection and transport of explosive substances:

- Bylaw related to the Procedures and Conditions of the Production, Import, Transport, Storage, Retaining, Sales, Use, Destruction and Inspection of the Explosive Substances, Hunting Materials and Similar Items Left outside the Monopoly enacted by being published at the Official Gazette no. 19589 of 29.9.1987,
- Regulation on the Transport of Hazardous Substances on Highways enacted by being published at the Official Gazette no. 26479 of 31.03.2007,
- Bylaw related to the Worker Health and Work Safety Measures to be Taken in Mine and Quarry Operations and Tunnel Construction enacted by being published at the Official Gazette no. 18553 of 22.10.1984,
- Bylaw related to the Measures to be Taken at the Workplaces and Works Where Inflammable, Explosive, Hazardous and Toxic Substances are Used enacted by being published at the Official Gazette no. 14752 of 24.12.1973,
- Regulation on the Protection of Workers Against the Threats of Explosive Surroundings enacted by being published at the Official Gazette no. 25328 of 26.12.2003.

Furthermore, application shall be made to and necessary permits shall be obtained from Mus Governorship in the scope of the use, storage and transport of explosive substances.

During the construction phase of the project, the explosive substance shall be supplied by the relevant firm depending on the requirement. There will be no explosive substance storage at the project area.

Non-authorized persons shall not be permitted to the ignition site. The explosive substance inside un-exploded holes shall be rendered ineffective after taking the necessary safety precautions.

For performing the ignition of the explosive material, trained and qualified personnel shall be employed. The detonation process shall be realized by the persons with ignition license.

The dynamites and capsules shall be transported separately.

After ignition, the responsible surveillance officer of the region shall make the necessary controls and take necessary measures if dangerous blocks have been left suspended at the inclination of the cascade.

Precautions such as irrigation or explosion cover shall be taken to repress the dust to occur during explosion.

K1, K2, K3, K5, K6A and K6B rock borrow areas to the used in the scope of the project have basalt ores, being a Group II mine, and cascade open borrow area method shall be employed during the operation. Each mentioned basalt borrow area shall be provide an annual production of 400.000 Tons. In this respect, the same detonation design shall be used at each basalt borrow area and detailed information on the detonation design is provided below.

Basalt Borrow Area Detonation Design

Hole Diameter = 3.5" = 88.9 mm

Density of Explosive Substance = 0.82 g/cm^3 (ANFO)

Charge density (L_b) can be determined from Table V.1.19 for an ANFO with 88.9 mm hole diameter and 0.82 g/cm^3 density.

Table V.19. Determination of Charge Density of Detonation Hole

Charge Density of the Explosion Hole (kg/m)							
Hole Diameter		**Density of Explosive Substance**					
inch	**mm**	**0.8**	**0.82**	**0.9**	**0.95**	**1**	**1.1**
1.25	31.75	0.63	0.65	0.71	0.75	0.79	0.87
1.375	34.93	0.77	0.79	0.86	0.91	0.96	1.05
1.5	38.1	0.91	0.93	1.03	1.08	1.14	1.25
1.625	41.28	1.07	1.1	1.2	1.27	1.34	1.47
1.75	44.45	1.24	1.27	1.4	1.47	1.55	1.71
2	50.8	1.62	1.66	1.82	1.92	2.03	2.23
2.25	57.15	2.05	2.1	2.31	2.44	2.56	2.82
2.5	63.5	2.53	2.6	2.85	3.01	3.17	3.48
2.75	69.85	3.06	3.14	3.45	3.64	3.83	4.21
3.0	76.2	3.65	3.74	4.1	4.33	4.56	5.01
3.5	88.9	4.96	5.09	5.58	5.89	6.2	6.82
4.0	101.6	6.48	6.64	7.29	7.7	8.1	8.91

Source: TMMOB Chamber of Mining Engineers, www.maden.org.tr

Hole Charge-Load: (Since of Hole to the Step Mirror, B_{max})

For ANFO = (1.36 x $\sqrt{L_b}$)

L_b =Charge Density of Detonation Hole (kg/m)
(Source: Longefors, U., Kihlstrom, 1963)

B_{max} = (1.36 x $\sqrt{5.09}$)

B_{max} has been taken as = 3.07 m ˜ 3 m.

Step Height: It is suggested to take the cascade step height as 10 m considering the operation parameters.

Distance Between the Holes: It can be taken as 1 to 1.5 times of B_{max}. (Source: Acık İsletmelerde Delme-Patlatma (Drilling-Detonation at Open Operations); A. Konuk, R. M. Goktan, O. Patir, Ankara University Engineering and Architecture Faculty Press, No: 102)

Considering that the holes can be drilled at six-five arrangement, this value has been taken as 1.15. (Source: Official website of TMMOB Chamber of Mining Engineers)

Distance Between Holes = 1.15 x B_{max}
= 1.15 x 3
= 3.45 m

Hole Base Margin: Step Height x 0,1
= 10 m x 0.1= 1 m

Total Hole Length: 10 m + 1 m = 11 m
The hole geometry to be employed has been given schematically at Figure V.8.

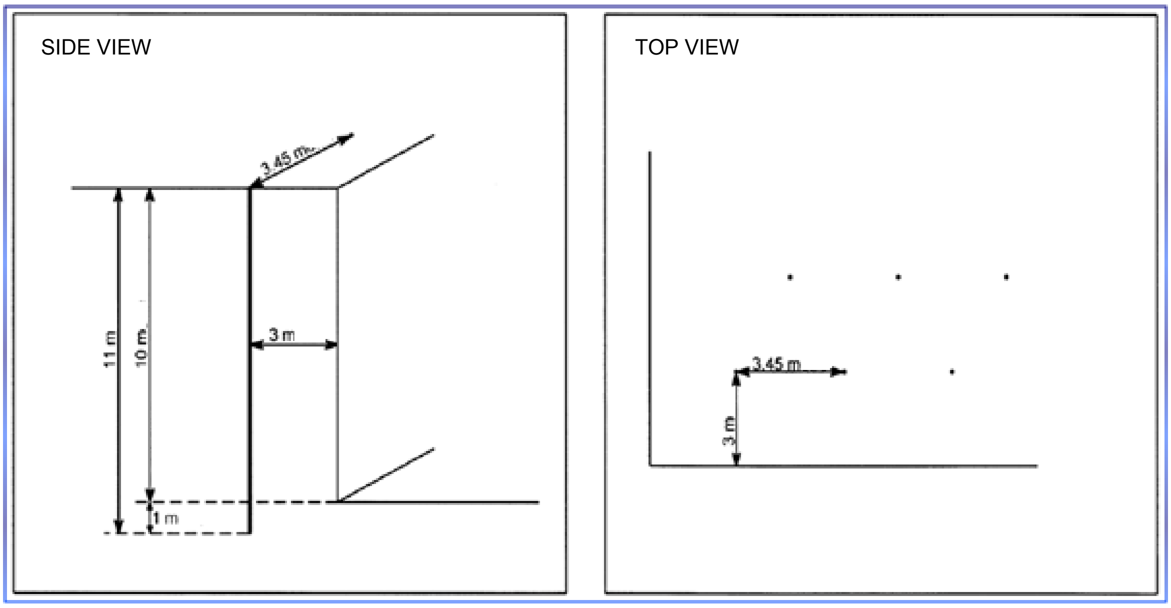


Figure V.8. K1 Rock Material Borrow Area Step Heights and Placement of Holes in Six-Five Arrangement in Two Rows

Considering that the holes would be drilled at six-five arrangement in two rows, the detonation charge order shall be as follows.

Hole Design

Tightening Length = 4 m

Charge Length (Q) = 7m

Hole Length = 11 m

Charge amount in one hole = 35 kg ANFO+1 kg Dynamite

Material amount to be obtained from one hole = B x S x K
= 3 x 3.45 x 10
= 103.5 m^3
= 274.5 tons

From each of the basalt borrow areas in the scope of the project, it is planned to produce 400,000 tons of material for riprap and protective cover material. For this production, the work period shall be 12 months a year, 24 days/month and a single 8 hour shift/day. In order to realize this production, the total amount of holes that need to be drilled is given below.

Annual quantity of holes to be drilled: 1,440 ea (120 ea x 12)
Monthly quantity of holes to be drilled: 120 ea (30 ea x 4)
Weekly quantity of holes to be drilled: 30 ea (10 ea x 3)
Number of holes to be drilled for each detonation: 10 ea (5 ea/row x 2 rows)

120 holes shall be drilled month, corresponding to 3 detonations per week, 12 per month, where 10 holes are to be drilled at every detonation. The holes shall be arranged in two rows, each row with five holes and ignited in a six-five hole order. Accordingly, 350 kg ANFO and 10 kg dynamite shall be used per detonation in the scope of the activity.

L_{in} = Max. Rock Spatter Distance:

d = Hole Diameter

It is foreseen as $L_{in} = 260 \times d^{2/3} = 260 \times (0,0889)^{2/3} = 52$ m. This distance can vary according to the in situ geological conditions.

Φ = Size of the Rocks Spattering Due to Explosion:

d = Hole Diameter

It is foreseen as $\Phi = 0.1 \times d^{2/3} = 0.1\ (0.0889)^{2/3} = 0.02$ m.

The production at the basalt borrow areas will commence with the preparation works of the first cascade. After the formation of the first cascade, the cascade detonation model to be used shall provide the optimum contribution to the production. As is known, the priority variable in these detonated excavation methods is the rock formation and the contained discontinuities. The mentioned discontinuities, cracked structures or water entrance can reduce the explosion efficiency. In this case, the detonation arrangement and explosive substance can be redesigned to increase the efficiency and reduce the vibration.

The detonation data and vibration status related to the rock borrow area has been calculated as below. In the calculations, the rock density was taken as 2,7 ton/m^3.

Annual Production Amount : 148,148 m^3 (400.000 tons)
Monthly Production Amount : 12,346 m^3 (33.333 tons)
Weekly Production Amount : 3,087 m^3 (12.346 tons)

Annual Working Period : 12 months
Monthly Working Period : 24 days
Monthly Working Period : 4 weeks
Daily Working Period : 8 hours
Daily Working Shift : Single shift
Total Hole Length : 11.0 m
Cascade Length : 10.0 m
Additional Drill Length : 1.0 m
Hole Diameter : 89 mm (3,5 inch)
Hole Charge : 3.00 m
Distance Between Holes : 3.45 m
Charge Amount : 35 Kg explosive sensitive to feeding (ANFO)+1.0 Kg explosive sensitive to capsule (dynamite) and delayed electrical / non-electrical capsule
Hole Charge : 7.0 m explosive substance +4.0 m tightening material
Material to be Obtained from One Hole : 103.5 m^3
Material to be Obtained from One Hole : 279.5 ton

The detonation arrangement to be employed at the basalt borrow areas is provided at Figure V.9.

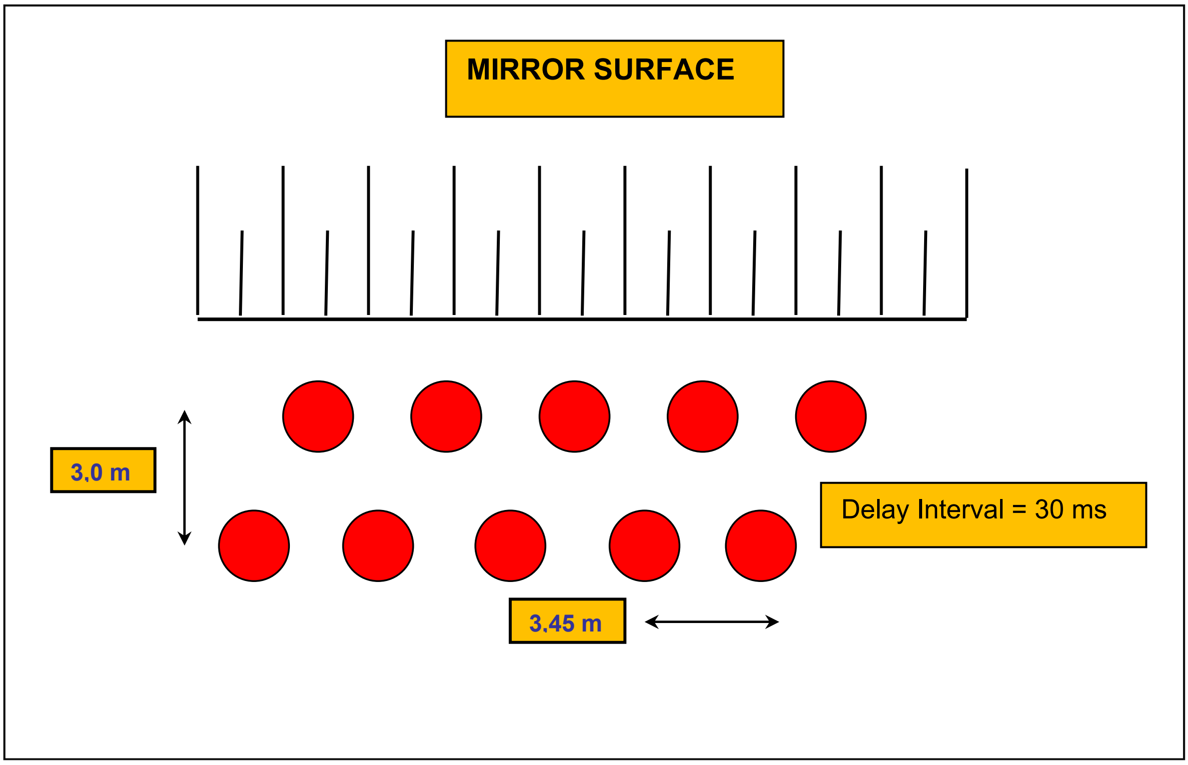


Figure V.9. Detonation Model to be Employed at the Basalt Borrow Areas

The summary table for the mentioned detonation activity is provided at Table V.20.

Table V.20. Summary Table for the Detonation Process

	Basalt Borrow Areas
Annual amount of material to be obtained from the borrow area	400,000 tons
Total number of work days	288 day/year
Daily production amount	1,389 ton/day
Monthly production amount	12,346 m^3, (33,333 tons)
Monthly amount to be processed	12,346 m^3, (33,333 tons)
Monthly area to be processed	373 m^2
Number of holes necessary for monthly production	120
Monthly number of explosions	12
Number of holes to be detonated in one explosion (delayed capsule)	10
Amount of material to be obtained from one hole	103.5 m^3
Amount of material to be obtained in one explosion	1,035 m^3
Amount of explosive substance to be used in one hole	25 kg ANFO, 1 kg dynamite
Number and height of steps	2-3 steps, 10 m
Hole length required for monthly production	1,320 m
Explosive substance: charge rate in a hole	0.64
Hole tightening rate	0.36
Charge length required for monthly production	840 m
Hole diameter	88.9 mm
Hole length	11 m
Monthly charge volume	20.85 m^3
Tightened ANFO density	0.82
Monthly ANFO requirement	4,200 kg

V.1.10. The Work Periods for the Production Amounts at the Material Borrow Areas (Day-Month-Year), Shipment Routes, Transportation Infrastructure Plan, Processes Related to the Construction of the Infrastructure, Machine-Equipment to be Used

The information regarding the work periods for the production amounts at the material borrow areas, transportation infrastructure and the equipment to be used are provided below. Furthermore, the existing roads and transportation roads to be built for this purpose are shown at the maps in App-1.

Impermeable (Clay) Material Borrow Area A

The nearest residential location to the impermeable material borrow area A is Dumlusu Village. The distance of the material borrow area to the Village is 620 m. The existing roads to access the material borrow area are adequate. The material to be produced shall be directly transferred to the dam area, therefore a facility shall be established at the material area. It shall be worked at 8 hours a day, 24 days a month and 288 days a year at the impermeable material borrow area A.

The work machinery to be used at the impermeable material borrow area A are provided at Table V.21.

Table V.21. Work Machinery and the Quantity Thereof to be Used at the Impermeable Material Borrow Area A

Equipment	Quantity
Excavator	1
Loader	1
Truck	4

Impermeable (Clay) Material Borrow Area B

The nearest residential location to the impermeable material borrow area B is Akpinar Village. The distance of the material borrow area to the Village is 1,860 m. The existing roads to access the material borrow area are adequate. The material to be produced shall be directly transferred to the dam area, therefore a facility shall be established at the material area. It shall be worked at 8 hours a day, 24 days a month and 288 days a year at the impermeable material borrow area B.

The work machinery to be used at the impermeable material borrow area B are provided at Table V.22.

Table V.22. Work Machinery and the Quantity Thereof to be Used at the Impermeable Material Borrow Area B

Equipment	Quantity
Excavator	1
Loader	1
Truck	4

Impermeable (Clay) Material Borrow Area C

The nearest residential location to the impermeable material borrow area C is Akkonak Village. The distance of the material borrow area to the Village is 1,900 m. The existing roads to access the material borrow area are adequate. The material to be produced shall be directly transferred to the dam area, therefore a facility shall be established at the material area. It shall be worked at 8 hours a day, 24 days a month and 288 days a year at the impermeable material borrow area C.

The work machinery to be used at the impermeable material borrow area C are provided at Table V.23.

Table V.23. Work Machinery and the Quantity Thereof to be Used at the Impermeable Material Borrow Area C

Equipment	Quantity
Excavator	1
Loader	1
Truck	4

Impermeable (Clay) Material Borrow Area D

The nearest residential location to the impermeable material borrow area D is Akkonak Village. The distance of the material borrow area to the Village is 2,390 m. The existing roads to access the material borrow area are adequate. The material to be produced shall be directly transferred to the dam area, therefore a facility shall be established at the material area. It shall be worked at 8 hours a day, 24 days a month and 288 days a year at the impermeable material borrow area D.

The work machinery to be used at the impermeable material borrow area D are provided at Table V.24.

Table V.24. Work Machinery and the Quantity Thereof to be Used at the Impermeable Material Borrow Area D

Equipment	Quantity
Excavator	1
Loader	1
Truck	4

Permeable (Sand-Gravel) Material Borrow Area E

The nearest residential location to the permeable material borrow area E is Kayalidere Village. The distance of the material borrow area to the Village is 1,450 m. The existing roads to access the material borrow area are adequate. The material to be produced shall be directly transferred to the dam area, therefore a facility shall be established at the material area. It shall be worked at 8 hours a day, 24 days a month and 288 days a year at the permeable material borrow area E.

The work machinery to be used at the permeable material borrow area E are provided at Table V.25.

Table V.25. Work Machinery and the Quantity Thereof to be Used at the Permeable Material Borrow Area E

Equipment	Quantity
Excavator	1
Loader	1
Truck	4

Permeable (Sand-Gravel) Material Borrow Area F

The nearest residential location to the permeable material borrow area F is Kayalidere Village. The distance of the material borrow area to the Village is 1,980 m. The existing roads to access the material borrow area are adequate. The material to be produced shall be directly transferred to the dam area, therefore a facility shall be established at the material area. It shall be worked at 8 hours a day, 24 days a month and 288 days a year at the permeable material borrow area F.

The work machinery to be used at the permeable material borrow area E are provided at Table V.26.

Table V.26. Work Machinery and the Quantity Thereof to be Used at the Permeable Material Borrow Area F

Equipment	Quantity
Excavator	1
Loader	1
Truck	4

Permeable (Sand-Gravel) Material Borrow Area G

The nearest residential location to the permeable material borrow area G is Kayalidere Village. The distance of the material borrow area to the Village is 2,860 m. The existing roads to access the material borrow area are adequate. The material to be produced shall be directly transferred to the dam area, therefore a facility shall be established at the material area. It shall be worked at 8 hours a day, 24 days a month and 288 days a year at the permeable material borrow area G.

The work machinery to be used at the permeable material borrow area G are provided at Table V.27.

Table V.27. Work Machinery and the Quantity Thereof to be Used at the Permeable Material Borrow Area G

Equipment	Quantity
Excavator	1
Loader	1
Truck	4

Rock (Basalt) Material Borrow Area K-1

The project site is located near Ozenc Village of Varto District in Mus Province. It is possible to access the site by continuing towards Varto District from Mus – Bitlis highway.

The material to be produced shall be used at the dam body construction. The nearest residential location to the material borrow area is Dogdap town at a distance of 770 m. The existing roads generally permit access during the whole year.

The transportation of the produced basalt ore shall be with trucks. Tonnage limitation shall be complied with for the roads to be used for transportation. The existing transportation roads for rock borrow area K-1 are adequate.

The work machinery to be used at the rock borrow area K-1 are provided at Table V.28.

Table V.28. Work Machinery and the Quantity Thereof to be Used at the Rock Borrow Area K-1

Equipment	Quantity
Wagon Drill	1
Compressor	1
Excavator	1
Loader	1
Truck	4

Rock (Basalt) Material Borrow Area K-2

The project site is located near Yedikavak Village of Varto District in Mus Province. It is possible to access the site by continuing towards Varto District from Mus – Bitlis highway. The material to be produced shall be used at the dam body construction. The nearest residential location to the material borrow area is Dogdap town at a distance of 1,470 m. The existing roads generally permit access during the whole year.

The transportation of the produced basalt ore shall be with trucks. Tonnage limitation shall be complied with for the roads to be used for transportation.

In order to access the project site, an additional 4,679 m transportation road is required other than the existing roads.

The work machinery to be used at the rock borrow area K-2 are provided at Table V.29.

Table V.29. Work Machinery and the Quantity Thereof to be Used at the Rock Borrow Area K-2

Equipment	Quantity
Wagon Drill	1
Compressor	1
Excavator	1
Loader	1
Truck	4

Rock (Basalt) Material Borrow Area K-3

The project site is located near Kusluk Village of Varto District in Mus Province. It is possible to access the site by continuing towards Varto District from Mus – Bitlis highway. The material to be produced shall be used at the dam body construction. The nearest residential location to the material borrow area is Kusluk town at a distance of 700 m. The existing roads generally permit access during the whole year.

The transportation of the produced basalt ore shall be with trucks. Tonnage limitation shall be complied with for the roads to be used for transportation.

In order to access the project site, an additional 2,985 m transportation road is required other than the existing roads.

The work machinery to be used at the rock borrow area K-3 are provided at Table V.30.

Table V.30. Work Machinery and the Quantity Thereof to be Used at the Rock Borrow Area K-3

Equipment	Quantity
Wagon Drill	1
Compressor	1
Excavator	1
Loader	1
Truck	4

Rock (Basalt) Material Borrow Area K-5

The project site is located near Kayalidere Village of Varto District in Mus Province. It is possible to access the site by continuing towards Varto District from Mus – Bitlis highway. The material to be produced shall be used at the dam body construction. The nearest residential location to the material borrow area is Kayalidere town at a distance of 520 m. The existing roads generally permit access during the whole year.

The transportation of the produced basalt ore shall be with trucks. Tonnage limitation shall be complied with for the roads to be used for transportation.

In order to access the project site, an additional 5,089 m transportation road is required other than the existing roads.

The work machinery to be used at the rock borrow area K-5 are provided at Table V.31.

Table V.31. Work Machinery and the Quantity Thereof to be Used at the Rock Borrow Area K-5

Equipment	Quantity
Wagon Drill	1
Compressor	1
Excavator	1
Loader	1
Truck	4

Rock (Basalt) Material Borrow Area K-6A

The project site is located near Dumlusu Village of Varto District in Mus Province. It is possible to access the site by continuing towards Varto District from Mus – Bitlis highway. Then by following 4 km to the east, it can be reached to Dumlusu Village, after which the application area can be reached via the 3 km shipment road. The material to be produced shall be used at the dam body construction. The nearest residential location to the material borrow area is Dumlusu town at a distance of 1,260 m.

The transportation of the produced basalt ore shall be with trucks. Tonnage limitation shall be complied with for the roads to be used for transportation.

In order to access the project site, an additional 6.082 m transportation road is required other than the existing roads for the use of both K-6A and K-6B rock borrow areas.

The work machinery to be used at the rock borrow area K-6A are provided at Table V.32.

Table V.32. Work Machinery and the Quantity Thereof to be Used at the Rock Borrow Area K-6A

Equipment	Quantity
Wagon Drill	1
Compressor	1
Excavator	1
Loader	1
Truck	4

Rock (Basalt) Material Borrow Area K-6B

The project site is located near Dumlusu Village of Varto District in Mus Province. It is possible to access the site by continuing towards Varto District from Mus – Bitlis highway. Then by following 4 km to the east, it can be reached to Dumlusu Village, after which the application area can be reached via the 3 km shipment road. The material to be produced shall be used at the dam body construction. The nearest residential location to the material borrow area is Dumlusu town at a distance of 1,260 m.

The transportation of the produced basalt ore shall be with trucks. Tonnage limitation shall be complied with for the roads to be used for transportation.

In order to access the project site, an additional 6,082 m transportation road is required other than the existing roads for the use of both K-6A and K-6B rock borrow areas.

The work machinery to be used at the rock borrow area K-6B are provided at Table V.33.

Table V.33. Work Machinery and the Quantity Thereof to be Used at the Rock Borrow Area K-6B

Equipment	Quantity
Wagon Drill	1
Compressor	1
Excavator	1
Loader	1
Truck	4

V.1.11. The Technology of the Area Where the Crushing-Screening Facility will be Established, the Working Periods for the Production Amounts (Day-Month-Year), Transportation Infrastructure Plan, Processes Related to the Construction of the Infrastructure, Machinery and Equipment to be Used

The information on the Crushing-Screening Facility (Stone Crusher) is provided at Chapter V.7.

V.1.12. The Capacity of the Concrete Power Plant, Technology, the Working Periods for the Production Amounts (Day-Month-Year), Transportation Infrastructure Plan, Processes Related to the Construction of the Infrastructure, Machinery and Equipment to be Used

It is planned to install 3 concrete power plant in the scope of Alpaslan II Dam and HEPP project. The capacity of each concrete power plant will be 180 m^3/h. It will be worked 8 hours/day, 24 days/month and 288 days/year at the concrete power plants.

Ready concrete; is an important structure material obtained by mixing cement, aggregate, water and, where necessary, certain additives with a specific production technology, being first in a plastic temper, that can be shaped but then solidifies, hardens and gains strength.

The raw materials that will be used in concrete production to be realized in the scope of the project is sand-gravel (aggregate), water, concrete additive and cement. Concrete production will be realized by combining the raw materials via mixing.

Ready concrete will be produced at the concrete power plant in the project as per dry system. The measurement of aggregate and cement at the nun concrete power plant as per the formula shall be made automatically, the aggregate and cement at the amounts indicated in the formula shall be weighed and transferred to the trans-mixer. Water shall be directly fed to the trans-mixer at the amounts stipulated in the formula and the mixing of the three components shall be made at the tank of the trans-mixer. In the production of ready concrete with dry mixing, the amount of water fed to the mixture (ensuring that the amount is not more than stipulated at the formula) and mixing duration (sufficient time to obtain a homogeneous mixture) should be paid due care. The work flow scheme of the ready concrete power plant planned to be installed is given in Figure V.10.

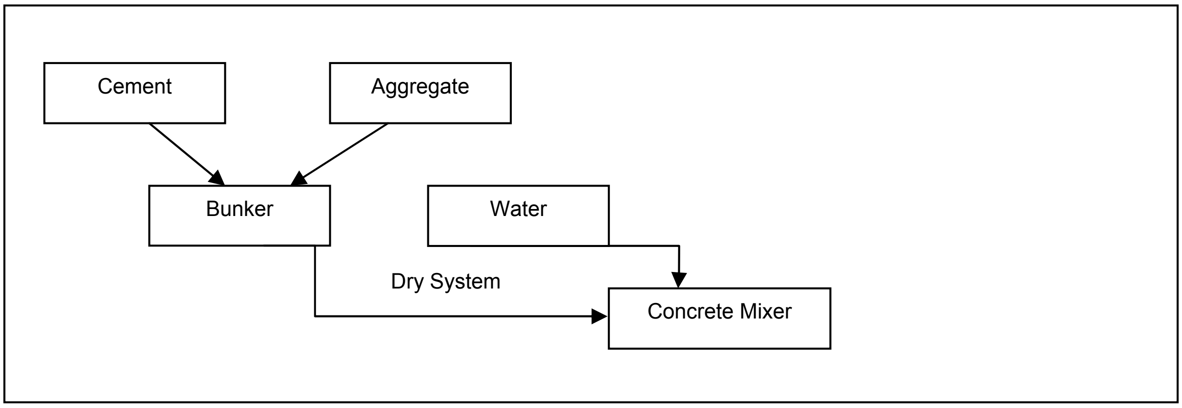


Figure V.10. Work Flow Scheme of the Concrete Plant

V.1.13. Dust Emitting Activities During Construction such as Crushing Grinding, Washing-Screening, Transport and Storage, Cumulative Values

While evaluating the possible impacts to be created on the air quality due to the activities to be realized in the construction phase of Alpaslan II Dam and HEPP Project, both dust and gas emissions have been examined. The air quality modeling where these emissions are analyzed is given in App-21. Summarized information on the modeling study is provided herein below.

According to the Regulation on the Control of Air Pollution Sourced from Industry (RCAPSI), the limit values from stack and non-stack sources that require the calculation of the contribution values to the air pollution in case exceeded are given in App 2. These values are presented in Table V.34.

Table V.34. Emission Values Caused from the Stack and Non-Stack Sources

Parameters	Mass Flowrates (kg/h)	
	From the Stack	From Places other than the Stack
CO	500	50
NO_x	40	4
SO_x	60	6
PM	10	1

A 4-year construction period has been foreseen in the scope of Alpaslan II Dam and HEPP Project. The construction activities are planned to be commenced in 2012 in the scope of the project and dust formation shall occur during these activities comprised of the excavation-filling works during the construction of the facilities, loading and unloading the extracted excavations material on to / from the trucks, obtaining material from the material borrow areas and construction of the access roads. Since some of these activities shall take place underground and some will be performed in wet environment, dust emission shall not occur from these activities.

The above-listed activities shall be realized at different periods within the 4-year construction phase of the project. In the calculation of the project-sourced emission, the worst case scenario has been considered and the most intense period of the project in terms of dust formation has been taken into account. The excavation and filling amounts to be caused by the construction activities in this period are provided in Table V.35.

Table V.35. Excavation and Filling Amounts to be Realized During the Construction Activities

Emission Source	Material Amount (ton)
K-1 Rock Borrow area	400,000
K-2 Rock Borrow area	400,000
K-3A Rock Borrow area	400,000
K-5 Rock Borrow area	400,000
K-6A Rock Borrow area	400,000
K-6B Rock Borrow area	400,000
A Impermeable Material Borrow area	3,240,000
B Impermeable Material Borrow area	90,000
C Impermeable Material Borrow area	234,000
D Impermeable Material Borrow area	216,000
Dam Axis Excavation and Filling	5,500,000
TOTAL	**11,680,000**

The dust emission amounts expected to occur from the construction activities in the scope of the project is provided below in Table V.36.

Table V.36. The Amounts of Dust Emissions Expected to Occur from the Construction Activities

Emission Source	Emission Amount (PM10)	
	Uncontrolled (kg/h)	Controlled (kg/h)
K-1 Rock Borrow area	2.0254	1.0127
K-2 Rock Borrow area	2.0254	1.0127
K-3A Rock Borrow area	2.0254	1.0127
K-5 Rock Borrow area	2.0254	1.0127
K-6A Rock Borrow area	2.0254	1.0127
K-6B Rock Borrow area	2.0254	1.0127
A Impermeable Material Borrow area	16.4062	8.2031
B Impermeable Material Borrow area	0.4558	0.2279
C Impermeable Material Borrow area	1.1848	0.5924
D Impermeable Material Borrow area	1.0938	0.5469
Crushing Screening Facility	16.4844	8.2422
Dam Axis Excavation and Filling	18.8078	9.4039
TOTAL	**66.5852**	**33.2926**

Other emission sources in the construction phase are the construction equipment to be used. The primary exhaust emissions from the vehicles are NO_2, CO, HC, SO_2, PM and the lead within the PM. Emission properties depend on parameters such as the age of the vehicle, engine speed, operation temperature, ambient temperature, pressure, gasoline type and quality. Table V.37 lists down the emission of the leaded gasoline and diesel gasoline pollutant emissions measured for an average vehicle in USA by EPA.

Table V.37. Emissions Caused by Vehicles (USEPA)

POLLUTANTS	**EMISSIONS (g/km/vehicle)**	
	Leaded Gasoline	Diesel Fuel
Nitrogen Oxides (NO_x)	1.2	9.0
Carbon Monoxide (CO)	39.0	15.0
Sulfur Dioxide (SO_2)	0.08	1.5
Hydrocarbons (HC)	2.6	2.9
Particulate Matter (PM)	0.4	0.8
Lead (Pb) [1]	0.064	--

[1] *Diesel fuel does not contain lead.*

The gaseous and PM emissions expected to be caused from the exhaust of the equipment planned to be used at the plant's construction and operation phases are given in Table V.38.

Table V.38. Emission Amounts Expected to be Caused from the Exhaust of the Construction Equipment

Emission Values (kg/h)				
NO_X	**CO**	**SO_2**	**HC**	**PM**
0.198	0.330	0.033	0.064	0.018

Model Results

As a result of the modeling study, the daily and annual maximum dust concentration and dry depositions expected to occur at the residential areas nearby the project area have been determined. These results and the comparison thereof with the regulation values for the construction phase is given in Table V.39.

Table V.39. Maximum Dust Concentration and Depositions Expected at the Residential Areas as per the Modeling Study (Construction Phase)

Residential Area	Modeling Result	Regulation Value RCAPSI*
Dogdap		
Daily PM Concentration	7.72 μg/m^3	140 μg/m^3
Annual PM Concentration	2.01 μg/m^3	78 μg/m^3
Short Term Dry Deposition	30 mg/m^{2}day	442 mg/m^{2}day
Long Term Dry Deposition	2.08 mg/m^{2}day	238 mg/m^2 day
Bagici		
Daily PM Concentration	13.13 μg/m^3	140 μg/m^3
Annual PM Concentration	3.54 μg/m^3	78 μg/m^3
Short Term Dry Deposition	30 mg/m^2 day	442 mg/m^2 day
Long Term Dry Deposition	3.56 mg/m^2 day	238 mg/m^2 day
Kayalidere		
Daily PM Concentration	27.67 μg/m^3	140 μg/m^3
Annual PM Concentration	14.78 μg/m^3	78 μg/m^3
Short Term Dry Deposition	90 mg/m^2 day	442 mg/m^2 day
Long Term Dry Deposition	12.90 mg/m^2 day	238 mg/m^2 day
Akkonak		
Daily PM Concentration	33.13 μg/m^3	140 μg/m^3
Annual PM Concentration	14.65 μg/m^3	78 μg/m^3
Short Term Dry Deposition	90 mg/m^2 day	442 mg/m^2 day
Long Term Dry Deposition	15.95 mg/m^2 day	238 mg/m^2 day
Dumlusu		
Daily PM Concentration	14.86 μg/m^3	140 μg/m^3
Annual PM Concentration	3.73 μg/m^3	78 μg/m^3
Short Term Dry Deposition	130 mg/m^2 day	442 mg/m^2 day
Long Term Dry Deposition	4.14 mg/m^2 day	238 mg/m^2 day
Akpinar		
Daily PM Concentration	22.54 μg/m^3	140 μg/m^3
Annual PM Concentration	5.47 μg/m^3	78 μg/m^3
Short Term Dry Deposition	80 mg/m^2 day	442 mg/m^2 day
Long Term Dry Deposition	5.92 mg/m^2 day	238 mg/m^2 day

*** 2012 year limit values**

Contour plots for PM concentration the construction period are given in Figure V.11 and Figure V.12, whereas contour plots for PM deposition are given in Figure V.13 and Figure V.14.

Among the emission amounts caused due to the construction activities in the project area, since PM is above the emission limit value caused from non-stack sources as per Table V.34, ISCST3 model has been used to examine the distribution of the dust under meteorological and topographic conditions. The other parameters are below the limit values, therefore a modeling has not been applied for them.

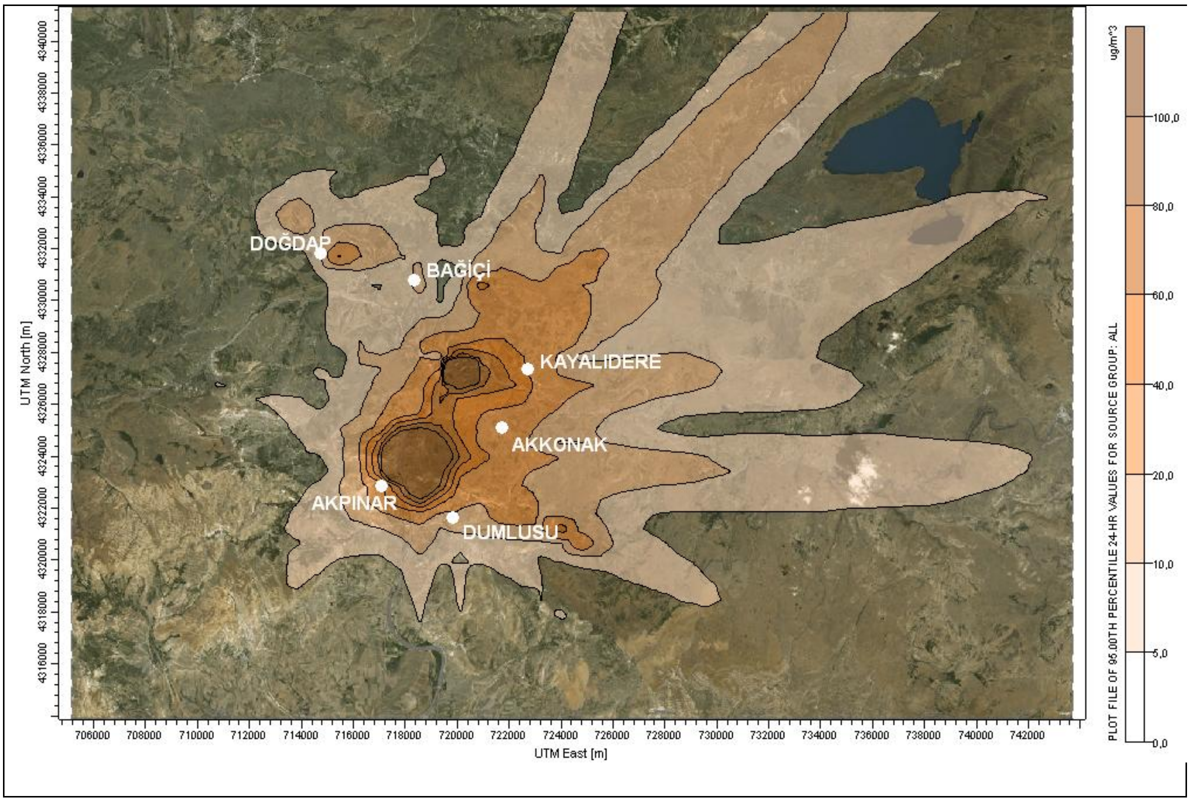


Figure V.11. Short Term Limit (STL) Concentrations of the Construction Phase

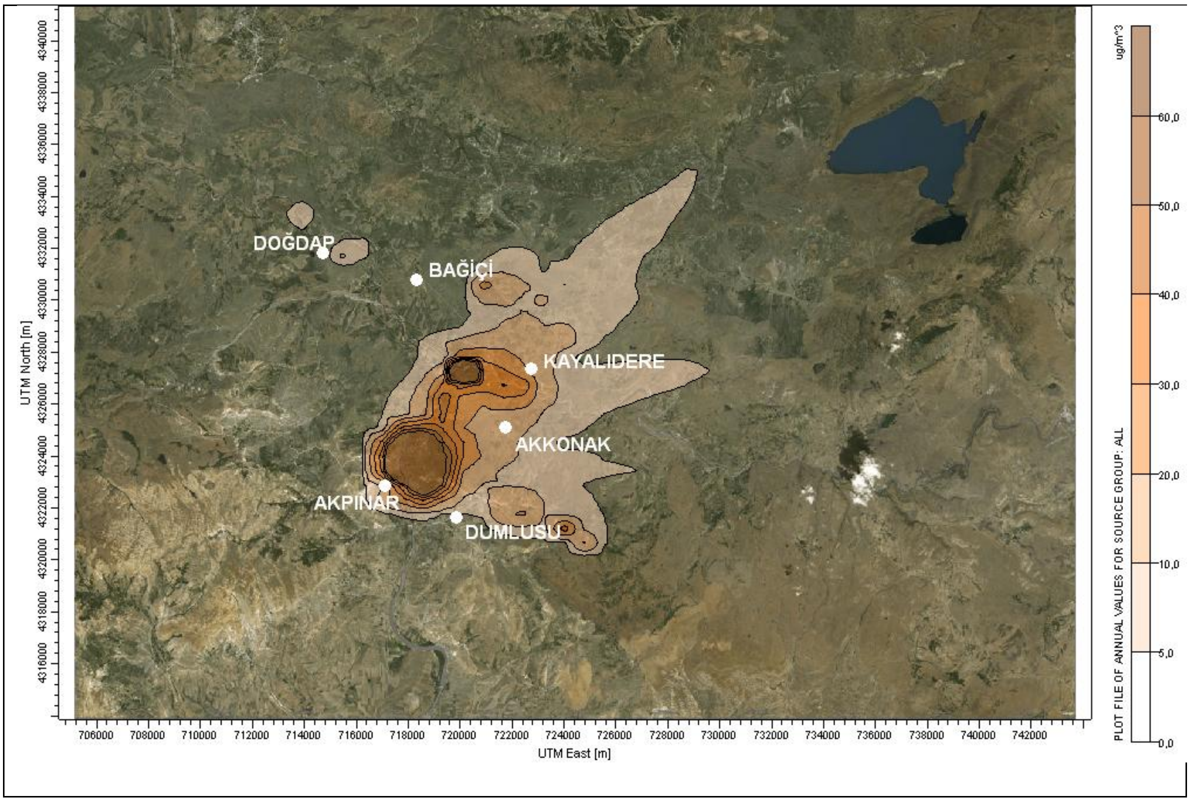


Figure V.12. Long Term Limit (LTL) Concentrations of the Construction Phase

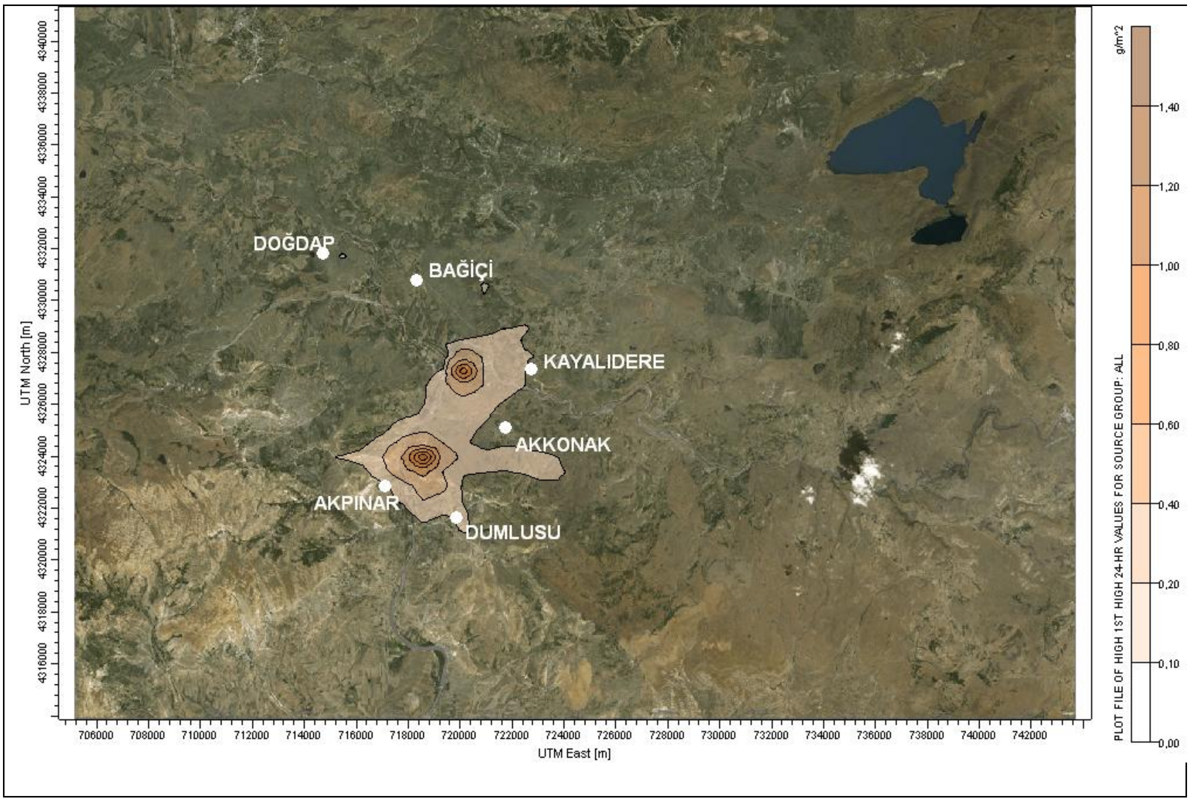


Figure V.13. Short Term Limit (STL) Depositions of the Construction Phase

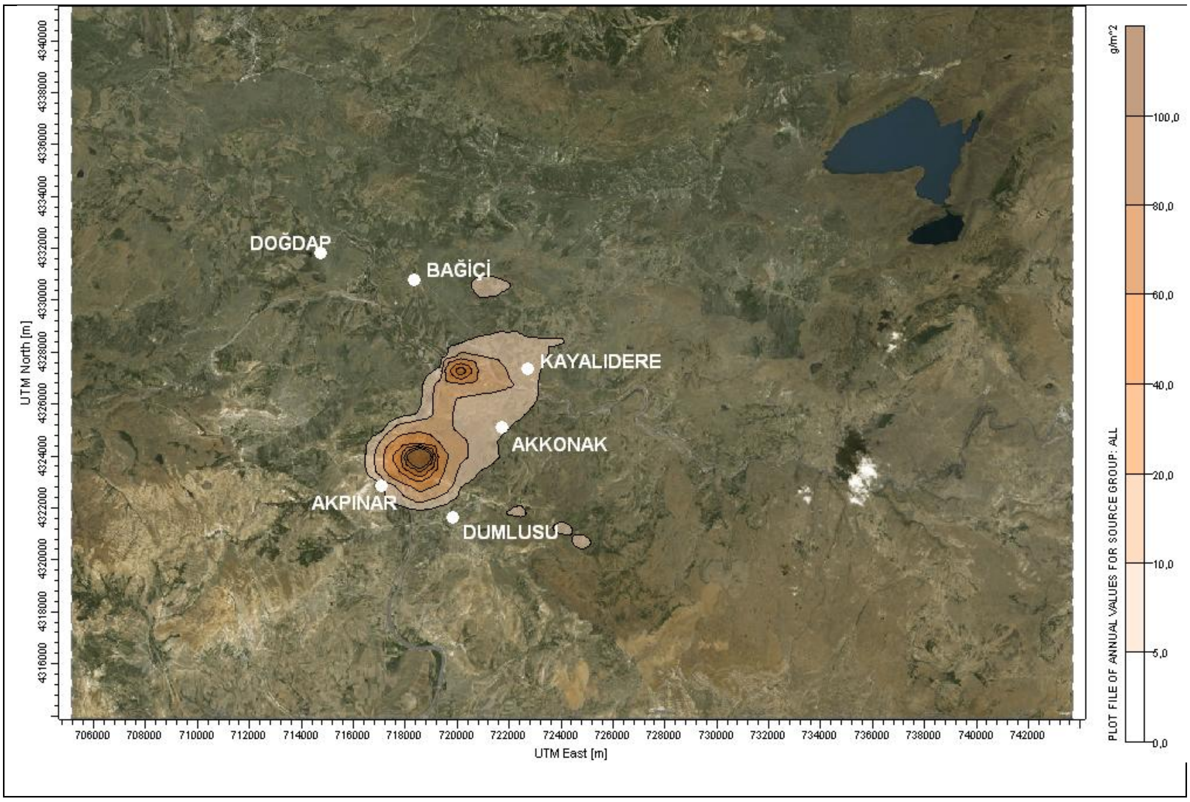


Figure V.14. Long Term Limit (LTL) Depositions of the Construction Phase

According to the Regulation on the Control of Industrial Based Air Pollution, at the facilities where loading, unloading, separation, screening, transport, crushing and grinding activities are performed, the dust density (PM_{10}) at 3 m distance from the source should not exceed 3 mg/Nm3 by considering the dominant wind direction as well. Accordingly, it is expected that the maximum daily dust concentration within the boundaries of the borrow area during the construction phase to be 1.84 mg/m3 which is below the Regulation limit value.

General Evaluation

In this section, the emission values expected to occur during the construction phase of Alpaslan II Dam and HEPP Project Operations have been calculated and their manner of distribution under meteorological and topographical factors has been examined.

The construction activities are planned to be commenced in 2012 in the scope of the project and dust formation shall occur during these activities comprised of the excavation-filling works during the construction of the facilities, loading and unloading the extracted excavations material on to / from the trucks, obtaining material from the material borrow areas and construction of the access roads. Another emission source in the construction phase shall be the exhaust gases from the construction equipment to be used.

Other than these, there will be NOx, SOx, CO, HC, PM and lead of PM emissions from the exhausts of the equipment to be used.

When it is considered that no measure is taken, the expected PM emission value is calculated as 66.59 kg/h for the construction phase and this value is above the 1 kg/h dust emission that requires the calculation of the contribution to the air pollution as per App-2 of RCAPSI; thus a modeling study was performed to determine the distribution pattern of dust. Since the HC, NOx CO, PB within PM and SOx emission values from the exhausts of the construction equipment are below the threshold values of the regulation, it was decided that there is no need to make a model study for them.

All of the values obtained from the model study were below the limit values foreseen at the RCAPSI.

Watering shall be made to keep the dust emission occurring in the scope of project under control, speed limitation shall be applied for the vehicles, new and well-maintained vehicles shall be used as much as possible. The detonation activities shall be performed as per the regulations and rules. Furthermore, the following precautions shall be taken as indicated in App 1 of the Regulation on the Control of the Industrial Based Air Pollution to meet the air quality standards during the storage of the soil cover in the open:

- Loading and unloading shall be made without scattering.
- The top of the material shall be covered with a nylon canvas or substances with a grain size above 10 mm.
- The top layers shall be retained at 10% humidity and necessary apparatus shall be installed to ensure this status.

To reduce the emission amounts caused by the work machinery and trucks to be operated at the construction phase and to ensure that these amounts do not exceed the predefined limit values, the provisions of Air Quality Evaluation and Management

Regulation enacted by being published at the Official Gazette no. 26898 of 06.06.2008 and the Regulation on the Control of the Industrial Based Air Pollution enacted by being published at the Official Gazette no. 27277 of 03.07.2009 shall be complied with. Furthermore, dust (particulate matter) measurements shall be made at the residential areas nearby the project area in the scope of the prepared monitoring plan. The assessments related to this topic are provided at Chapter VIII.

V.1.14. Ground Safety, The Actions to be Taken to Avoid Water Leak from the Regulator and Channel Structures

After abandoning the rock filling body type with concrete coated front surface, the project studies were conducted according to the clay core rock filling body type. In the beginning it was designed for the waters taken from the reservoir to be transmitted to the power plant via penstock from the surface and with the water intake structure located on the body. However, according to the data obtained from the drill wells opened at the water intake structure foundation, a concern emerged that bearing capacity problems might be encountered at the ground when a water intake structure is designed on the body with a concrete weighted type; therefore this design was also abandoned.

At the power plant location, the foundation rock is the Adilcevaz formation formed with the layering of sandstone – clay stone. According to the data of the drill wells no. SSK-1 and SSK-2 opened at the power plant location, there is a clay cover material at 11.0-12.0 m thickness over the Adilcevaz formation.

Pressiometer tests were performed at each 2 meters in the wells in the range of 0.00 – 35.00 m. According to the pressiometer test results, the safe bearing capacity of the ground was calculated as qa=18.00 kg/cm2. No problem is expected at the power plant location in terms of bearing capacity.

At the temporary excavations of the power plant location, it is considered to be suitable to use 1 horizontal – 3 vertical for excavation-inclination ratio at the main rock, 1 horizontal – 2 vertical at permanent excavations, 1.5 horizontal / 1 vertical at the clay materials on top. In the inclinations of all the permanent excavations, drainage precautions shall be taken against the possible negative impacts of surface waters and the permanent excavation inclinations shall be supported with (spray concrete + wire cage + bolts) in order to prevent dissociation.

Since Adilcevaz Formation has an impermeable texture, a significant groundwater problem is not anticipated during the power plant location excavations.

The base rock of the dam location is the Zırnak and Adilcevaz formations. Clay hillside rubble is present on the base rock with varying thickness and blocked alluvial with 2-4 m thickness is present on the river bed.

In order to determine the permeability at the dam location, pressurized water tests were performed at every 5 m at the drill wells no. SK-1, SK-2, SK-3, SK-4, SK-5, SK-6, SK-7, SK-10 and SK-14, and at every 2 m at the drill wells no. SK-15, SK-16, SK-17 and SK-18. According to the pressurized water test results, 0-1 lusion values have been obtained at the Adilcevaz formation in the form of base rock; thus it has been understood that this formation is impermeable.

Although the Zırnak Formation has occasional 8-15 Lusion-low permeability) and permeable 8-5010 lusion-permeable) layers, the lusion values are in the range of 0-1 in general. As a result of the pressurized water tests, the highest permeability values (in general 5-10 LU) was obtained at the well no. SK-15 opened at thalweg. Based on the pressurized water test results, although Zırnak formation contains occasional low permeability-permeable levels, it generally has an impermeable texture.

According to the groundwater level measurements taken at the drill wells, the groundwater levels are above the river level and feed the river at both hillsides.

Although the Zırnak and Adilcevaz formation located at the dam foundation are generally impermeable, when the dam height at the occasionally low permeability-permeable levels of Zırnak Formation are considered, an injection web shall be built at thalweg along the dam axis, approximately 50 m at the right hillside and at gradually decreasing depths in the left hillside.

The injection depth shall be taken as 20.00 m under the spill way threshold; shall start at 30.00 m at the hillsides under the dam body and shall be taken as 50.00 m at the river bed.

V.1.15. The Type and Quantity of the Trees to be Cut for the Land Preparation and the Provision of the Land Required for the Construction Area, the Impact of the Trees to be Cut on the Forest Ecosystem in the Region, the Natural Plant Species to be Removed and the Total Area on which these Activities shall be Performed, the Possible Impacts on the Fauna

The excess excavation material to be obtained at the land preparation and the construction phase shall be stored in a suitable manner at the storage sites which have been explained in detail at the previous sections. The mentioned storage sites shall be inundated by the reservoir and none of these sites are located on areas deemed as forest.

As indicated at Section IV2.9, within the area with the operation type of coppice forest, oaks are present at tree species, the stand types are unforested forest soil-very distorted oak coppice forest stand (OT-CBMBt), very distorted oak coppice forest stand CBMBt, very distorted oak coppice forest stand, and unforested forest soil (CBMBt-OT). For these types of stands, the hill closure is provided in the range of 1-10%. Approximately 1,400-1,500 trees shall be cut under the reservoir. As can be seen from the map displaying the forest areas near the project obtained from the Forest Information System of the Forestry General Directorate shown at Figure IV.24, there are no forest areas present at and at the near vicinity of the project site. The region is generally covered with grasslands. At the forest areas to be inundated by the dam reservoir, there are very rare tree gatherings (see Figure IV.25).

The areas near the project site display the same features as the project area. Therefore, it is not expected for the cut trees to have a negative impact on the forest ecosystem of the region. Furthermore, it is anticipated that during the construction period, most of the terrestrial fauna will leave the area surrounding the construction site to go to similar areas for a temporary duration depending on the intensity of the construction activities. Since the mentioned habitats start right in the vicinity of the construction site and the region display a homogeneous ecosystem structure, the migration shall not be long-ranged. Although some of the animal species identified in the project area are included in IUCN categories, they are species widely distributed over our country and the west pale-arctic zone. When the findings of the fauna studies are assessed, it is considered that the activity will have very low and local negative impacts on the fauna since the nearby environment displays a similar habitat diversification, the fauna species in the endangered category are widely spread species and there are no endemic species.

Since the project area is located in the East Anatolian Region, it is suitable for the tree species widely distributed over the Iran-Turan phyto-geographical zone. When Alpaslan II Dam project is completed, there will be a big reservoir at the valley base. Provided that the surrounding of the reservoir is forested with trees conforming to the regional climate, a beautiful nature can be obtained much better than the present state. For this aim, stalky oak (*Quercus robur* subsp. *pedunculiflora*) species should be used for forestation since this is the species that has a natural distribution in the region. Thus, in parallel to the commencement of construction, oak acorns should be collected, sufficient saplings should be cultured and these should be planted in a line around the reservoir to be formed after the completion of construction. Furthermore, the naturally growing ashen (*Fraxinus angustifolia*) species of the region can also be used for this purpose. When the trees reach a certain height, they both contribute to the organic richness of the soil and minimize the erosion that can occur due to precipitation, and a visually beautiful nature view shall be created. When the organic matter in the soil reaches a sufficient level, the *Tulipa sintenisii* species, named after this region, can also be planted in the gaps within the forestation area.

V.1.16. The Size of the Agricultural Areas to be Disposed for the Land Preparation and the Provision of the Land Necessary for the Construction Area, their Land Utilization Capabilities and Types of Agricultural Products

In line with the information obtained from the 1/25,000 scaled Turkey soil data, it is anticipated that 632.5 hectares of dry and irrigated agricultural land will be affected from the reservoir and 60.65 hectares of dry and irrigated agricultural land will be affected at the areas outside the dame lake in the scope Alpaslan II Project. The detailed information regarding the utilization capabilities of the agricultural lands for the mentioned project site are given in detail at Section IV.2.7.2.

At the influenced agricultural lands, the crop that is mostly planted is wheat. This is followed by barley and chickpea. Furthermore, clover plantation is present for stockbreeding. As vegetables and fruits, apple, pear, watermelon, melon, potato, etc. products are being cultivated.

In the framework of a study prepared for the reservoir in the scope of the project, an application has been made to the Turkish Ministry of Agriculture and Village Affairs in 2003 for land use permit of non-agricultural areas and in the framework of the Agricultural Survey Report prepared by the Provincial Agricultural Directorate, the land use permit of non-agricultural areas has been granted with the 22.02.2003 dated and TSD/250.11.11.11-2844/9803 referenced letter of the Agricultural Production and Development General Directorate of the Turkish Ministry of Agriculture and Village Affairs. The mentioned letter is presented in App-2. In the framework of the project modification made, the dam location was moved 4 km towards the upstream with the new formulation in this report. Thereby, the reservoir formed in this new formulation covers a smaller area that the lake area for which a land use permit of non-agricultural areas had been obtained. Therefore, the land use permit of non-agricultural areas that had been granted covers the whole reservoir.

For the areas outside the reservoir, necessary applications shall be made if necessary, after EIA studies, to obtain a land use permit of non-agricultural areas in line with the provisions of the Soil Protection and Land Use Law no. 5403 and Soil Protection and Land Use Application Regulation no. 26024. A Soil Protection Project shall be prepared for the whole project. Furthermore, application shall be made to the Provincial Food, Agriculture and Stockbreeding Directorate to obtain the necessary permits as per the Grassland Law no. 4342.

V.1.17. Types and Properties of the Fuels to be Used in the Works to be Performed Starting with the Land Preparation until the Opening of the Units, the Emissions to be Created

The fuels to be used in the works to be performed starting with the land preparation until the opening of the units are liquid fuels such as fuel oil and gasoline to be used for the construction equipment. The properties related to the fuel types to be used are given in Table V.40.

New and well-maintained vehicles shall be used to control the emission caused from the equipment to be used in the scope of the project and furthermore, the provisions of the “Regulation on the Control of the Exhaust Gas Emissions Caused by the Motorized Vehicles in Traffic” published at the Official Gazette no. 25869 of 08.07.3005 shall be complied with.

Table V.40. General Properties of the Fuels Used

Properties	
Chemical formula	C6-8H13-18
Molecules	86-115
Specific Weight (kg/L)	0.73-
Boiling point (oC)	30-225
Lower calorific value (Mj/kg)	44.03
Ignition point (oC)	-
Ignition Limits	-
Burning rate (m/sec)	0.35
Stoichiometric ratio	14.5
Research octane number	95
Engine octane number	90

(Gasoline: http://www2.bayar.edu.tr/somamyo/docs/dergi/sayi9/9sayi6.pdf)

In the worksite, stoves, air conditioners or radiator system working on fuel oil are primarily considered for heating. In vase the radiator system working on fuel oil is used, the obtained fuel shall be of good quality and the radiator system shall be kept in well-maintained state. The fuel to be used shall be brought to the project area with tankers and stored in a 5-ton impermeable fuel tank. Necessary safety precautions shall be taken at the fuel tank against fire, sabotage and leakage.

New and well-maintained vehicles shall be used to control the emission caused from the equipment to be used in the scope of the project and furthermore, the provisions of the “Regulation on the Control of the Exhaust Gas Emissions Caused by the Motorized Vehicles in Traffic” published at the Official Gazette no. 25869 of 08.07.3005 shall be complied with.

V.1.18. The Amounts of Water to be Taken from the Sources of Water to be Used in the Scope of the Project, Water Supply System and the Amounts of these Water According to the Purposes of Use, The Type and Amounts of Wastes to Occur, the Discharge Environments

The main water use in the construction phase of the project shall be for concrete production, washing of concrete aggregate material, preventing of dusting and drinking-utilization water for the workers. The water for concrete power plants, washing of concrete aggregate material and prevention of dusting shall be obtained from Murat River and the side branches that feed the river. The drinking water shall be obtained from canned water whereas utilization water shall be obtained from the residential areas in the vicinity of the worksite.

The per capita daily water requirement is assumed to be maximum 200 liters in the construction phase and it is considered that 1,126 persons will work during the construction period, thus the daily residential water requirement is estimated to be 225.2 m^3 (200 L/person x 1,126 persons = 225.2 m^3).

The waters to be obtained as drinking and utilization water shall be controlled and verified for compliance with the criteria indicated at the Regulation on Human Consumption-Purposed Waters enacted by being published at the Official Gazette no. 25730 of 17.02.2005. In this scope, canned waters (demijohn) shall be purchased from companies approved by the Ministry of Health in this scope. The amount of water to be used in addition to the measures to be taken to prevent the dust formation during the construction activities shall depend on the surface geometry of the material to be transported, the meteorological conditions of the environment before and after watering and the topographical conditions of the excavation site. Although the amount of water to be used for preventing dusting cannot be exactly calculated, watering shall be realized to ensure that the soil top layer at the excavation areas or where excavations materials shall be laid to remain 10% humid. The water necessary for this process to be applied other than the rainy and snow covered days shall be supplied from Murat River.

Residential type of wastewater shall be created by the personnel working during the construction phase. Considering that all of the daily water requirement of the workers transform into residential type wastewater, the daily amount of wastewater to result will be 225.2 m^3. The residential type of wastewater to be created during the construction phase shall be treated with the package treatment system to be installed at the worksite. A general process flow scheme for the package treatment system is provided at Figure V.15. The treated water to come out of this system shall be discharged to the Murat River after being treated to meet the standard values indicated at the Water Products Law no. 1380 and the Regulation thereof, plus Table 21.1 of “Water Pollution Control Regulation” (WPCR) enacted by being published at the Official Gazette no. 25687 of 31.12.2004. Necessary approvals and permits shall be obtained from the Provincial Environment and Urbanization Directorate for the package wastewater treatment plant.

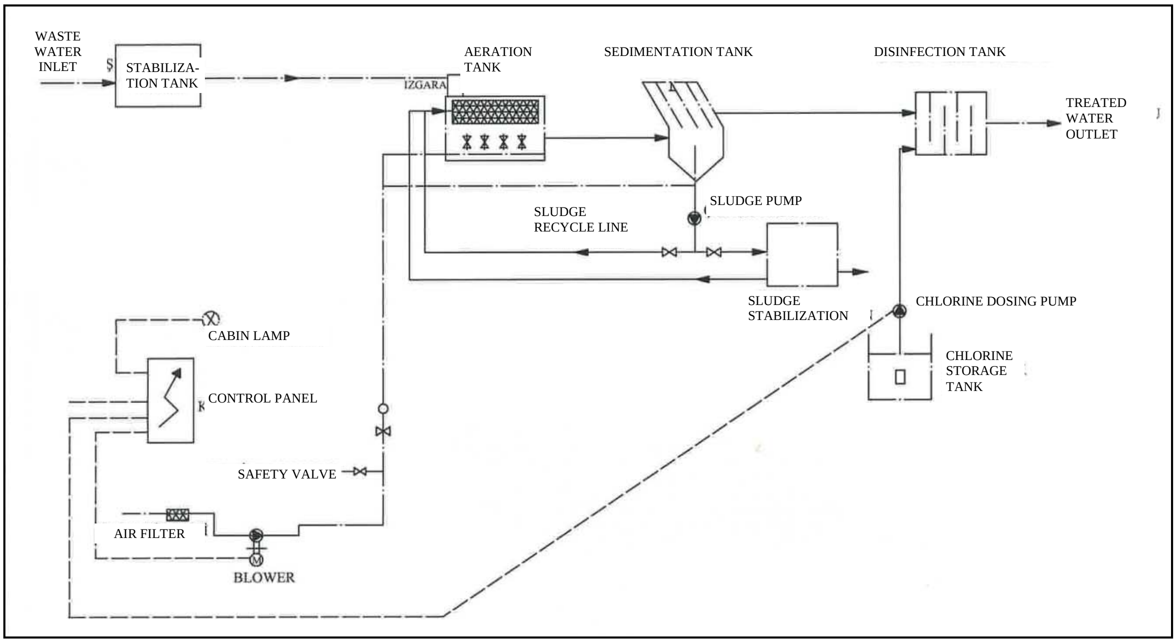


Figure V.15. General Flow Scheme of the Package Wastewater Treatment Plant

The typical properties of the residential wastewater expected to occur in the construction phase is provided at Table V.41, whereas the typical properties of a residential wastewater is provided at Table V.42.

Table V.41. The properties of the Residential Wastewater Expected to Occur in the Construction Phase

Parameter	Literature Value Expected to be Present in Wastewater (g/capita-day)	Expected Value in the Scope of the Project (kg/day)
BOD_5	45-54	1.5
COD	1.6-1.9 x BOD_5	2.55
Total Organic Carbon	0.6-1.0 x BOD_5	1.2
Suspended Solid Matter	70-145	3
Total Nitrogen	6-12	0.27
Total Phosphorus	0.6-4.5	0.09

Table V.42. Typical Properties of Raw Residential Wastewater

Pollutants	Concentration (mg/L)		
	Weak	Medium	Strong
BOD_5	110	220	400
COD	250	500	1,000
Total Organic Carbon	80	160	290
Suspended Solid Matter	100	220	350
Total Nitrogen	20	40	85
Total Phosphorus	4	8	15

Since the water used to prevent dust formation will evaporate and vanish, wastewater formation is not expected as a result of this activity.

The aggregate material coming out of the crushing-screening-washing facilities have to be washed before being used at concrete making. Washing drum and sedimentation tank shall be prepared for the washing process. At the washing drum, the washed aggregate material and the washing water shall be separated from each other. Then, this wash water rich in suspended solid matter shall be transferred to the sedimentation tank where the solid matter shall be made to settle with a physical separation process. The wash water of the trans-mixers shall also be kept for a duration at this sedimentation tank to settle the solid matter. The treated water can then be reused for washing process. The unused water can be discharged to Murat River. In this regard, the provisions of the Water Pollution Control Regulation enacted by being published at the Official Gazette no. 25687 of 31.12.2004 and the Water Products Law no. 1380 shall be complied with

V.1.19. The Amount of Solid Waste to Occur Starting with Land Preparation up to the Opening of the Units, the Disposal Method Thereof

Solid wastes shall occur during the land preparation, construction of the units and due to the personnel to work at these jobs in the scope of the project. The solid wastes to occur in this phase can be classified under four main headings:

- Construction and excavations wastes
- Residential type solid wastes
- Waste sludge resulting from the package treatment plant,
- The sludge coming from the sedimentation tank where the aggregate wash water is present.

Wastes like mould log wastes, construction iron and iron pipes are recyclable wastes. These wastes shall be collected at suitable regions within the project area and sent out to licensed recycling facilities. Excess concrete materials shall be used as filling material. Some of the excavations wastes shall be used as laying material for the roads to be built/rehabilitated or laid into the gaps from where aggregate was obtained. The amounts of excavation planned to be made is given in Table V.1.

During the construction period, 1,126 persons shall work at the worksite. Considering that the per capita daily solid waste amount will be 1.34 kg/person-day, the residential type solid waste amount from the workers shall be daily 1508.84 kg (1126 persons x 1.34 kg/person-day = 1508.84 kg). These wastes shall be collected in suitable containers and taken by Mus Municipality at regular intervals. The letter of Mus Municipality in this regard in provided at App-2.

The residential type of solid wastes caused by the personnel working at the construction and operation phases of the project shall be retained at the project site inside closed containers suitable for short term retaining and periodically unloaded to the garbage site of Mus Municipality. The residential type solid wastes occurring at the project area shall be collected and disposed of as per the “Solid Wastes Control Regulation” enacted by being published at the Official Gazette no. 20814 of 14.03.1991 and the “Packaging Wastes Control Regulation” enacted by being published at the Official Gazette no. 26562 of 24.06.2007.

The packaging wastes to occur during the construction and operation and the other wastes planned to be disposed shall be collected separately and stored at temporary storage areas within the plan. The place and properties of the temporary storage area shall be according to the provisions stated at the related regulations.

Additionally, it is possible for waste oils to occur in the scope of the project. For the waste oils to occur in this phase, disposal shall be realized as per the “Waste Oils Control Regulation” enacted by being published at the Official Gazette no. 26952 of 30.07.2008 and the “Hazardous Wastes Control Regulation” enacted by being published at the Official Gazette no. 25755 of 14.03.2005.

As for the sludge coming from the sedimentation tank and the package wastewater treatment plant, disposal shall be realized, after dewatering, as per the Solid Wastes Control Regulation enacted by being published at the Official Gazette no. 20814 of 14.03.1991, Hazardous Wastes Control Regulation enacted by being published at the Official Gazette no. 25755 of 14.03.2005, Regulation on the Amendment of Hazardous Wastes Control Regulation enacted by being published at the Official Gazette no. 27339 of 04.09.2009 and Regulation on the Regular Storage of Wastes enacted by being published at the Official Gazette no. 27533 of 26.03.2010.

The following regulation provisions shall be complied with related to the wastes to occur in the scope of the project:

- ✓ “Solid Wastes Control Regulation” enacted by being published at the Official Gazette no. 20814 of 14/03/1991,
- ✓ “Hazardous Wastes Control Regulation” enacted by being published at the Official Gazette no. 25755 of 14/03/2005 and “Regulation on Amending the Hazardous Wastes Control Regulation” enacted by being published at the Official Gazette no. 27339 of 04/09/2009,
- ✓ “Packaging Wastes Control Regulation” enacted by being published at the Official Gazette no. 28035 of 24/08/2011,
- ✓ “Vegetal Waste Oils Control Regulation” enacted by being published at the Official Gazette no. 25791 of 19/04/2005,
- ✓ “Waste Oils Control Regulation” enacted by being published at the Official Gazette no. 26952 of 30/07/2008,
- ✓ “Regulation on the Control of Excavations Soil, Construction and Debris Wastes” enacted by being published at the Official Gazette no. 25406 of 18/03/2004,
- ✓ “Waste Batteries and Accumulators Control Regulation” enacted by being published at the Official Gazette no. 25569 of 31/08/2004,
- ✓ “Regulation for the Control of the Tires that have Outlived their Useful Life” enacted by being published at the Official Gazette no. 26357 of 25/11/2006,
- ✓ “Medical Wastes Control Regulation” enacted by being published at the Official Gazette no. 25883 of 22/07/2005,
- ✓ “Regulation on the Regular Storage of Wastes” enacted by being published at the Official Gazette no. 27533 of 26/03/2010.

V.1.20. The Sources, Level and Cumulative Values of the Vibration and noise to Occur Starting with Land Preparation up to the Opening of the Units

For the vibration and noise to occur at the works starting with land preparation until the units are opened for operation, necessary measurements have been taken at the residential locations within the project site on 25-26.08.2011 by Cankaya Environmental Measurement and Analysis Laboratory and an Acoustic Report has been prepared (See App-16).

The calculations for the noise levels foreseen to occur at the construction phase of the project and the noise to occur due to detonation are provided in the following sub-headings.

The information on the background measurements taken at the project site and the measurement results are provided at Section IV.2.18.

The Noise Level to Occur During the Construction Activities

In the scope of the project, the construction activities are foreseen to last for 5 years. Work at the material sites shall be performed during day time and as a single shift.

In the scope of the evaluation of the noise caused by the activities, cumulative values have been calculated at the residential areas nearest to the project site, the noise values expected to occur at the construction phase of the project have been calculated based on worst case scenarios.

In the framework of the provisions of the “Regulation on the Environmental Noise Emission Created by the Equipment Used Outdoors” enacted by being published at the Official Gazette no. 26392 of 30.12.2006, the Noise Intensity Levels to be caused by the machines and the production flow schemes are provided in Figure V.16.

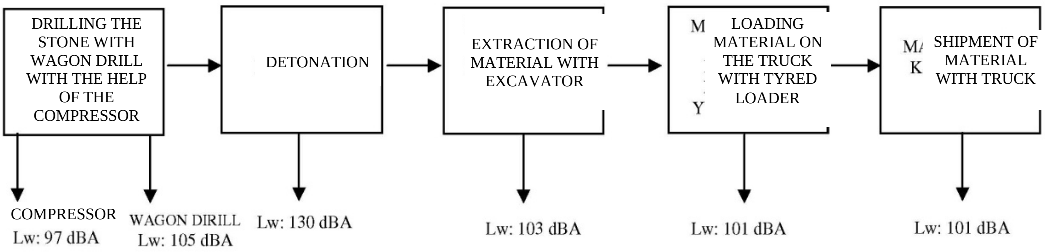


Figure 1. Production Flow Scheme for the Rock Material Borrow Areas K-1, K-2, K-3A, K-5, K-6A, K-6B and the Noise Intensity Levels

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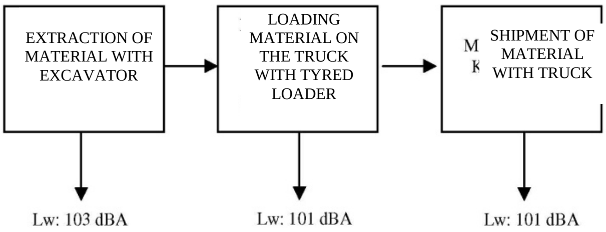

Figure 2. Production Flow Scheme for the Permeable and Impermeable Material Sites A, B, C, D, E, F, G and the Noise Intensity Levels

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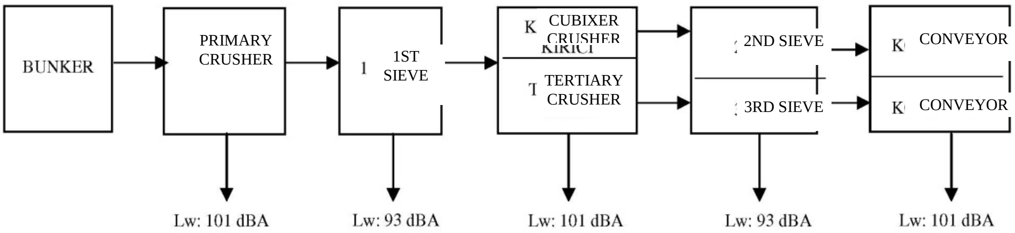

Figure 3. Production Flow Scheme for the Crushing Sieving Washing Plant and the Noise Intensity Levels

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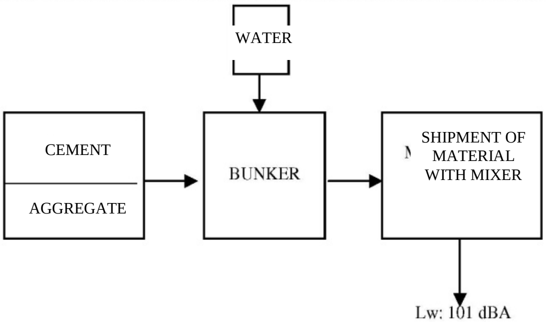

Figure 4. Production Flow Scheme for the Concrete Plant and the Noise Intensity Levels

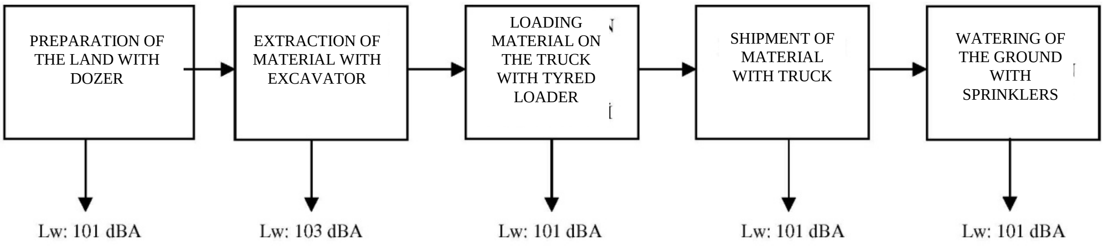

Figure 5. Production Flow Scheme for the Dam Body Construction and the Noise Intensity Levels

Figure V.16. The Noise Intensity Levels to be Caused by the Machines and Production Flow Schemes

Average Noise Pressure Level $Lport = 10\log \Sigma\ 10^{Lpi/10}$ dBA

Noise pressure at distance r (model) $Lpi = Lp + 10\log (Q/4\pi\ r^2)$

Atmospheric absorption $A_{Atm} = 7.4 \times 10^{-8} \times [(f^2) \times r/Q]$

f = Frequency of noise source = 2,000 Hz

r = distance

Q = Relative humidity = 63% (meteorological data)

Real noise pressure occurring at distance r, L_{pg};

At the first 100 meters, $L_{pg} = L_{Port}$

After 100 meters $L_{pg} = L_{Port} - A_{Atm}$

$L_{port} = 10\log \Sigma\ 10^{Lpi}/10$

The average noise pressure levels calculated with the above formula are given in Table V.43.

Table V.43. Average Noise Pressure Levels

Facilities	Distance (m)	Nearest Residential Area	Lport
K-1 Rock Material Borrow area	770	Dogdap Town	113.8
K-2 Rock Material Borrow area	1,470	Dogdap Town	
K-3A Rock Material Borrow area	700	Kusluk Village	110.7
K-6 Rock Material Borrow area	1,260	Dumlusu Village	113.1
A Impermeable Material Site	620	Dumlusu Village	
B Impermeable Material Site	1,860	Akpinar Village	114.2
Concrete Power plant-1	1,650	Akpinar Village	
Concrete Power plant-2	1,560	Akpinar Village	
Concrete Power plant-3	1,150	Akpinar Village	
K-5 Rock Material Borrow area	520	Kayalidere Village	115.7
E Permeable Material Site	1,150	Kayalidere Village	
F Permeable Material Site	1,980	Kayalidere Village	
G Permeable Material Site	2,860	Kayalidere Village	
C Impermeable Material Site	1,900	Akkonak Village	111.8
D Impermeable Material Site	2,390	Akkonak Village	
Crushing-Screening-Washing Facility	2,025	Akkonak Village	

As can be seen at the Acoustic Report detailed in App-16, the total noise levels to be perceived at the residential areas calculated with the modeling prepared by evaluating the above formula together with the background noise level are provided at Table V.44.

Table V.44. The Total Noise Level to be Perceived at the Residential Areas Caused by the Construction Equipment

Residential Area	Closest Distance (m)	Lpg (dBA) (Equipment Noise Perceived at the Residential Area)	L_{day} (dBA) (Background Noise at the Residential Area)	Total Noise Level Perceived at the Residential Area due to Construction Equipment (dBA)
Dogdap Town	770	42.3	46.88	48.18
Kusluk Village	700	39.5	43.95	45.28
Dumlusu Village	620	43.3	50.12	50.94
Akpinar Village	1,100	37.2	46.22	46.73
Kayalidere Village	520	47.9	44.45	49.52

The noise levels to occur due to the machines at the construction phase of the project (L_{day}) have been calculated in line with the above-given formula and these calculations are evaluated according to App VII Table 4 of the “Regulation on the Assessment and Management of Environmental Noise” (RAMEN) enacted by being published at the Official Gazette no. 27601 of 04.06.2010 (See Table V.45).

Table V.45. Environmental Noise Limit Values for Industrial Facilities

Areas	L_{day} (dBA)	$L_{evening}$ (dBA)	L_{night} (dBA)
Areas sensitive noise where educational, cultural and health care areas, summer houses and camping areas are present	60	55	50
Commercial buildings and areas sensitive noise (residential houses) are present together	65	60	55
Commercial buildings and areas sensitive noise (workplaces) are present together	68	63	58
Industrial areas	70	65	60

As can be seen from the table, even according to the worst case scenario, the noise levels calculated at the residential areas are below the limit values of the regulation.

Furthermore, 70 dBA limit value given for the noise level being emitted to the environment from worksite activities as per App-VII, Table 5 of the RAMEN is also met.

With a conservative approach at the calculations, it has been assumed that all the work machinery operate simultaneously. However, since the worst case scenario, being the simultaneous operation of all equipment at the same spot, shall never occur in the scope of the construction activities; the noise to be caused by the activities shall not negatively impact the residential areas. All the provisions of RAMEN in this respect shall be obeyed.

The Noise Level to Occur During the Detonation Activities

During detonation, it is assumed that all the other activities are being halted and the noise occurrence from only the detonation has been calculated. Therefore, the noise calculations from material extraction has been kept separate. Furthermore, since the detonations shall take place during the day, evaluation was not made for the evening and night times.

Average Noise Pressure Level $Lport = 10\log \Sigma\ 10^{Lpi/10}$ dBA

The noise level to occur during detonation shall be: 130 dBA.

Noise pressure at distance r (model) $Lpi = Lp + 10\log (Q/4\pi\ r^2)$

Atmospheric absorption $A_{Atm} = 7.4 \times 10^{-8} \times [(f^2) \times r/Q]$

f = Frequency of noise source = 2,000 Hz

r = distance

Q = Relative humidity = 63% (meteorological data)

Real noise pressure occurring at distance r, L_{pg};

At the first 100 meters, $L_{pg} = L_{Port}$

After 100 meters $L_{pg} = L_{Port} - A_{Atm}$

Table V.46. Change of the Noise Level after Detonation According to the Distance (dBA)

R (m)	L_{port}, dBA	A_{ATM}	L_{pg}, dBA
0	130.00	0	130.00
10	99.01	0	99.10
50	85.03	0	85.03
100	79.00	0.47	78.50
200	73.00	0.94	72.00
520	64.70	2.44	62.20
700	62.10	3.29	58.80
770	61.30	3.62	57.70
1,000	59.00	4.70	54.30
1,150	57.80	5.40	52.40
1,260	57.00	5.92	51.10

As a result of the calculations given above, the total noise levels at the residential areas at close distance to the Rock Material borrow areas where detonation shall be made are given in Table V.47.

Table V.47. Total Noise Level to be Perceived at the Residential Areas

Residential Area	Closest Distance (m)	L_{day} (dBA) (Background Noise at the Residential Area)	Lpg (dBA) (Perceived Detonation Noise)	Total Noise Level Perceived at the Residential Area (dBA)
Dogdap Town	770	46.88	57.7	58.05
Kusluk Village	700	43.95	58.8	58.94
Dumlusu Village	1,260	50.12	51.1	53.65
Akpinar Village	1,100	46.22	52.4	53.34
Kayalidere Village	520	44.45	62.2	62.27

The noise levels calculated according to the worst case scenario and to be perceived at the residential areas shown at the table are below the limit values of the regulation.

The calculation details are given in the Acoustic Report in App-16.

The Vibration Level to Occur During the Detonation Activities

Vibration shall occur due to the drilling-detonation method to be applied at the production method of the basalt borrow area in the scope of the project. Depending on the amount of the explosive substance used at each delay present in the hole order, the vibration to occur after the detonation can be calculated with the formula below (Olofsson, 1991):

$$V = K \times (Q / R^{3/2})^{1/2}$$

V : Vibration speed(mm/sec) (value to be calculated)
Q : Exploded substance amount (kg) (180 kg)
R : Distance to the explosion site (m) (Varies in the range of 0-1,000 m)
K : Transmission coefficient ($\leq$ 400) (worst case K=400)

The vibration speed limits recommended in order not to damage the structures in the vicinity of the explosion site according to the geological structure is provided in Table V.48 with the vibration speed calculated with the above parameters. This table summarizes the possible damages on the structures by the vibration speeds caused by the explosions.

Table V.48. The Impacts that can be Caused on the Buildings by the Vibration Speeds at Surface Detonations

	Sand, Clay and Groundwater	Soft Limestone	Granite, Hard Limestone, Quartz	Possible Impacts on Structures
Vibration Speed (mm/sec)	18	35	70	Undamaged
	30	55	100	Small cracks
	40	80	150	Visible cracks
	60	115	225	Serious deformation

Source: (Olofsson, 1991).

Considering that maximum 180 kg (worst case) shall explode at the detonations made in the scope of the project, the vibration speeds to occur as per the distance have been calculated with the above formula and shown in Figure V.17. In order to be on the safe side at these calculations, the transmission coefficient has been taken as K=400.

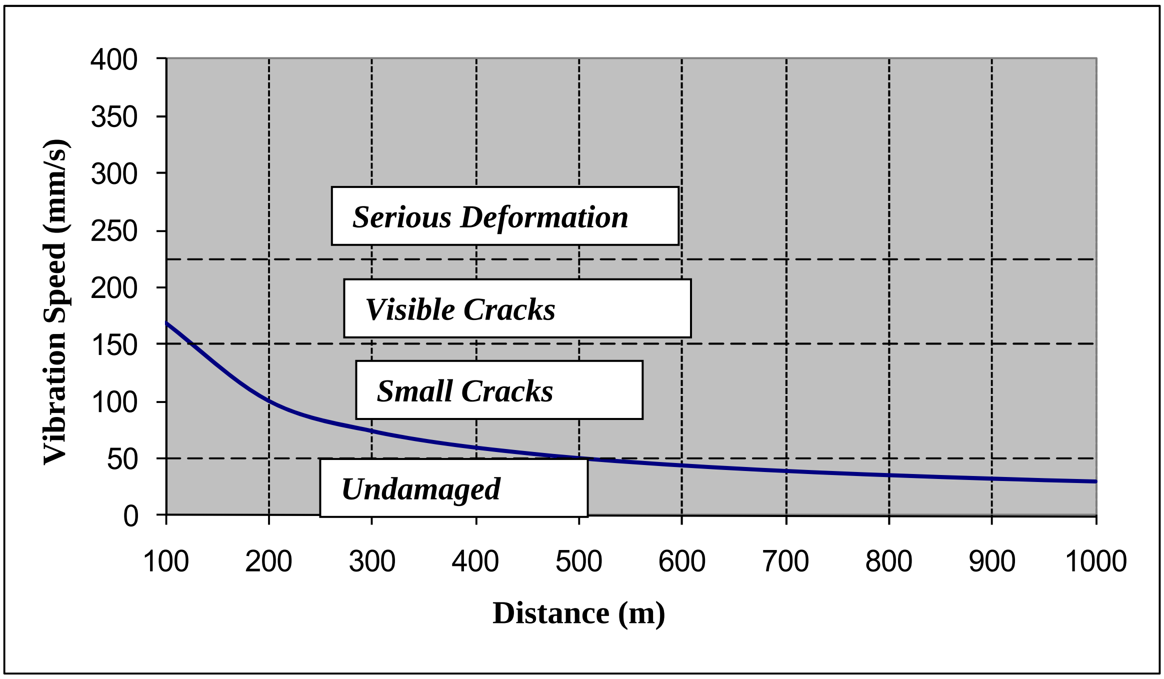

Figure V.17. Change of Vibration Speed According to Distance

As can be seen from Table V.48, the vibration speed that will not create any damage at the surface detonations on tough and sound grounds is 70 mm/sec. However, the vibration value limit at App-VII Table 6 of the Environmental Noise Assessment and Management Regulation enacted by being published at the Official Gazette no. 27601 of 04.06.2010 is 50 mm/sec. In this case, as can be seen from Figure V.17, the detonations shall have no impact starting with a distance of 500 m. The nearest residential area to the Rock Material borrow areas is Kayalidere town at 520 m from Rock Material borrow area K5. Since this residential area will be inundated by the reservoir, it will be expropriated. In line with the above given calculations, it is not expected for the explosions to have any impact on the residential areas even in the worst case scenario.

V.1.21. Place and Method of Meeting the Accommodation and Other Technical/Social Infrastructural Needs of the Dependants of the Personnel and the Personnel Themselves to Work at the Tasks to be Undertaken Starting with the Land Preparation up to the Opening of the Units

It is considered to build a worksite for the accommodation and other social needs of the personnel to work during the construction. It is planned to employ 1,126 persons in total at the construction activities starting with land preparation up to opening of the units for operation. It can be said that this figure might change at different periods of the construction activities. The personnel to work as an unqualified worker at the basic construction works will be first of all tried to be obtained from the nearby region. As the worksite facilities; main office building, land office buildings, machine repair and maintenance workshops, hydro-mechanical equipment production workshop, carpenter's shop, construction iron processing workshop, storehouses, single engineer and administrative personnel houses and worker and foremen dormitories shall be built. Within the worksite and camp facilities, there will be open air sports facilities, closed multipurpose cultural facilities, worshipping facilities, restaurants and cafeterias. The technical/social infrastructure needs will be tried to be met primarily from the nearby residential areas, and if not, they shall be supplied from the city center. Thereby, the technical and infrastructure needs of the workers of the construction phase shall be met.

In all the worksite facilities, central heating installation shall be built working on liquid fuel. Electrical energy shall be partially used at single facilities. The education needs of the children of the working personnel shall be met from the schools at Mus Province and Varto District.

The health care services of the personnel working during the construction period shall be met from the health care clinics located nearby or from the health institutions located at Mus Province or Varto District. First aid in case of work accidents that may occur at the project area shall be provided by emergency intervention team with a knowledge of first aid and/or worksite doctor. The first aid materials required for the worksite and the necessary medical equipment shall be kept ready.

V.1.22. Among the Works to be Undertaken Starting with the Land Preparation up to the Opening of the Units, the Ones that are Risky and Dangerous for Human Health and the Environment

Heavy duty machines shall be used in the works in the scope of the project. Work accidents can happen in case of inattentiveness of the personnel and noncompliance with the safety instructions and not using safe vehicles and tools. In order to minimize work accidents, qualified personnel shall be employed at the personnel shall be trained on work safety.

At this phase, warning plates shall be placed in the work field and personal protective equipment shall be provided to the personnel in order to prevent any kind of work accidents. Short breaks shall be provided between work periods to avoid the risk of occurrence of work accidents due to the diminishing of concentration.

In case a very hard ground is encountered during the construction of the transmission tunnel that is about 256 m long, small scale detonation can be made. If explosion is conducted, the regional community shall be informed beforehand, no one shall be permitted inside the detonation area. Sirens shall be sounded before detonation to warn the regional community

In the scope of the project ANFO and Powergel Magnum 365 is planned to be used as explosives and storage shall not be made within the project site. Bylaw related to the Procedures and Conditions of the Production, Import, Transport, Storage, Retaining, Sales, Use, Destruction and Inspection of the Explosive Substances, Hunting Materials and Similar Items Left outside the Monopoly enacted by being published at the Official Gazette no. 19589 of 29.9.1987 shall be abided during the use, protection, transport and storage of explosive substances.

In these regards, the provisions of the Public Sanitation Law no. 1593 of 24.04.1930; Work Health and Safety Regulation no. 25311 of 9.12.2003; Safety and Health Signals Regulation no. 25325 of 23.12.2003; Regulation on the Equipment and Protective Systems Used in Probable Explosive Environments no. 24919 of 27.10.2002;

Environmental Noise Assessment and Management Regulation no. 26809 of 07.03.2008 shall be obeyed.

Furthermore, the detailed information on the actions to be taken in case of any accident, natural disaster, etc. are provided at the Emergency Intervention Plan in App-22.

V.1.23. The Total Area and Method of the Site Arrangements to be Made at the Project Area to Create Landscape Elements or Other Purposes (Forestation and/or Green Field Arrangements, etc.), the Plant and Tree Species to be Selected for this Purpose

The visual character of Alpaslan II Dam Area has a character formed with the joining of two different surface waters and shaped with the impact of two different valley structure. There is no anthropogenic pressure at the project area.

With the planned project, it is evident that a load will be placed on natural resources. However, the important thing here is to execute the development and environment phenomena in a balance. In this respect, the Europe Landscaping Contract to which Turkey has become a party on June 17, 2003, it is stated that landscaping is the key to personal and social welfare and its protection, management and planning brings about rights and responsibilities to every individual in the community; landscaping is convenient for economic activities and that its protection, management and planning has an important public benefit in the cultural, ecological, environmental and social areas.

Landscaping character to change during the construction phase of the project, shall be irreversibly modified as with the operation period at the parts where the lake structure is formed. The sources of change at the landscaping character can be listed as follows:

- Changing surface cover (in terms of surface water)
- Vegetal cover to be stripped (in limited amount)
- Units to be constructed / uses
- Change in the land pattern / use
- Topography.

The biggest change to occur visually will be the transformation of the river structure into a lake structure. Since the region's landscaping features does not contain and remarkable and memorable element, in other words, since the most influencing landscaping element is the Murat and Bingol rivers; the fact that these river structures transforming into a reservoir shall create an impression for the presence of an impressive water presence and thus, create an attraction.

In terms of landscaping features, the negative impact to be created by the lake area will be the erosion impact observed at the bank as a result of seasonal changes. In these regions, there is no vegetal cover due to the seasonal water movements and erosion marks can be observed. This situation both increases the turbidity in water and filling of the reservoir with sediments. However, this impact shall be prevented with the optimization of the flow values during the operation period.

There will be limited reduction in the amount of plants due to the areas being inundated. In order to compensate for the diminishing vegetal cover, prevent erosion at the excavation and filling slopes and create a better visual impact, vegetation studies shall be performed at the areas where the power plant building and turbine is to be built, furthermore vegetal landscaping projects shall be formulated at the regions where recreative features can be created.

During the construction activities, before the commencement of the excavations activities, the top soil layer shall be stripped to prevent the pollution of the top soil and this layer shall be stored such that it shall not lose its productivity. The bottom soil providing the formation of the top soil shall also be stripped and shall be amassed such that it shall not lose its horizons. While stripping the top soil layer, all the non-soil material has to be separated from the soil. Furthermore, the top level of the vegetal soil shall be protected against erosion, drying and weeding, and coated with vegetal cover such as grass, meadow, grassland plants, etc. to ensure the maintaining of the soil livelihood. This stripped vegetal soil shall then be used at the landscape renovation of the area and the vegetal landscaping of the recreational areas.

Erosion can be observed due to the removal of vegetal cover, stripped top soil and slope during the construction and operation phase. For this aim, after the construction works, terraces shall be formed at high slope and land slide areas, thereby flatter surfaces shall be obtained and these regions shall be vegetated. These studies will both reduce the surface water flow on the soil and decrease the sediment transport to the lake, thus the economic life of the dam shall be extended. In order to attain success at the vegetation studies to be realized at places where erosion is observed, necessary warning plates shall be placed, fences or vegetal barriers shall be created, as necessary, to restrict entrance to the areas.

During the forestation works, the dominant vegetal cover of the region shall be considered and the type of trees to be used in forestation shall be selected accordingly. The pedunculate oak species (*Quercus robur* subs. *pedunculiflora*) found to be widespread at the project site shall be used during the landscaping studies. Concurrently with the construction commencement, the oak acorns should be collected, sufficient quantity of saplings should be grown and these shall be planted in the form of a line around the reservoir and other fields suitable for forestation (borrow areas, etc.) after the completion of construction. Again, the use of *Fraxinus angustifolia* species shall be appropriate for this purpose. In addition to the tree species, owing to their ability to spread on the surface much rapidly and holding the soil surface together, seeding studies shall be performed (before the forestation works) especially as of the construction phase and thus it shall be ensured that the herbaceous texture quickly covers the surface.

The details related to the sedimentation and erosion control measures to be taken and the landscaping project to be applied at the project area of Alpaslan II Dam and HEPP project is provided at App-25 “Project of Sedimentation, Soil Erosion Control Measures & Landscaping and Biorestoration at Alpaslan II Dam and Hydroelectric Power Plant”. The implementation plant related to the Landscaping Project is provided at Table V.49.

Together with the operation period, visual change shall be clearly perceived at the areas providing a wide vista that can be defined as impression spots. The change in the land shall be inundated by the reservoir. However, the visual impact of the units to be constructed at the operation phase and the changing landscape shall be clearly observed.

The power plant buildings / turbine systems providing the transformation of the power obtained at HEPP projects into energy shall commence with the operation period. The power plant buildings / turbines shall create a contracts within the natural landscape texture in terms of stripes, color and texture, whereas the night lighting will cause negative influence on the natural landscape features, especially the fauna. Therefore, the power plant buildings shall be built, as much as possible, by designing in a manner to provide veiling with the vegetation studies in the surrounding where local materials are used, not creating a dominant mark within the natural structure in terms of color and texture, and that does not strain the eyes.

Thanks to the lake to be formed with the completion of the dam construction, it will be possible for the emergence of tourism and recreational activity areas. The main activities shall be fishing in terms of recreative activities and hiking, running, biking, etc. nearside the dam in terms of sports activities. In addition to these activities, provided that necessary measures are taken against water pollution and fire, new recreative opportunities can also be created with picnic areas and public parks. The recreative activities and tourism potential that can emerge with the reservoir formation can be put to life by the entrepreneurs working in this field.

Table V.49. Alpaslan II Dam and HEPP Project Landscaping Project Plan

Phases of the Landscaping Project*	**Project Activity Periods**																											
	Pre-Construction Period				**Construction Period**																				**Operation Period**			
					Year 1				**Year 2**				**Year 3**				**Year 4**				**Year 5**							
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Land Works of the Landscaping Project			🟫																									
Stripping of the Top Soil					🟦	🟦			🟦				🟦				🟦											
Seed Collection Activities																						🟩						
Taking Erosion Control Measures					🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧				
Taking Sediment Control Measures					🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧				
Laying the Top Soil																			🟪	🟪			🟪	🟪				
Biorestoration																						🟥	🟥			🟥	🟥	
Vegetation																										🟦	🟦	
Top Soil Management																					🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨
Application of the Monitoring Plan					🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫	🟫

** The Phases of the Landscaping Project is described in detail at the “Project of Sedimentation, Soil Erosion Control Measures & Landscaping and Biorestoration” at App 25.*

V.1.24. Determination of the Possible Impacts on the Cultural and Natural Assets (Traditional Urban Texture, Archeological Remains, Natural Areas to be Protected) Present Above and Under Ground at and Near the Project Area (Including the Material Borrow Areas, Concrete Power Plant and Crushing-Screening Facility)

In the scope of the Alpaslan II Dam and HEPP Project, an application has been made to the Cultural Assets and Museums General Directorate of the Ministry of Culture and Tourism to get information as to whether there is any cultural asset to be inundated at the dam site. The Ministry of Culture and Tourism has forwarded this query to the Regional Directorate of Van Cultural and Natural Assets Protection Board with its 29.06.2011 dated and 137223 referenced letter (See App-2).

Based on the response letter of the Regional Directorate of Van Cultural and Natural Assets Protection Board, the Cultural Assets and Museums General Directorate of the Ministry of Culture and Tourism has decided as follows with its 15.09.2011 dated and 188765 referenced letter (See App-2): *"the expert report indicates that there are cultural assets to be inundated at the dam site; therefore, in the framework of the principal decision titled 'The Protection of the Immovable Cultural Assets Being Affected from Dam Sites' of the Regional Directorate of Van Cultural and Natural Assets Protection Board dated 22.04.2010 with no. 765 being enacted after being published at the Official Gazette no. 27575 of 08.05.2010, inventory and documentation studies have to be conducted and a committee has to be formed comprised of Assoc. Prof. Dr. Hanifi Biber and the experts of the Regional Directorate of Van Cultural and Natural Assets Protection Board."*

After the completion of the study of the mentioned committee, the 23.12.2001 dated letter of the Regional Directorate of Van Cultural and Natural Assets Protection Board reference no. 366 (See App-2), it is stated as follows:

"As per the 08.12.2011 dated and 64 referenced decision of the Board; in relation to the Alpaslan II Dam and HEPP Project located within Mus Province's Merkez and Varto District, since Tepekoy Tumulus, Dogdap Castle and also Kız Castle at Mescitli Village bear the features mentioned at article 6 of the Law no. 2863 on the Protection of the Cultural and Natural Assets, these locations have been decided to be registered as per article 7 of the same Law and that they have been determined as 1st Degree Archeological Site Area, furthermore, Abdurrahman pasa Bridge decided to have no need to be registered as per the scientific committee report to be re-examined by the Archeological and Art History experts of the Board Directorate, the rescue excavations to be made concerning the cultural assets to be inundated by the bridge and the dam studies to be executes simultaneously and the cultural layers of the tumuluses to be inundated to be documented and discovered".

In this respect, the rescue excavations to be conducted related to the cultural assets to be inundated by the dam and the dam works shall be performed simultaneously as per the decision of the Regional Directorate of Van Cultural and Natural Assets Protection Board, and the necessary activities shall be undertaken in the framework of the opinions, suggestions and demands of the Ministry of Culture and Tourism and the liabilities stated at the decision No. 765.

V.1.25. Other Properties

There is no other issue to be elaborated in this section.

V.2. Activities in the Operation Phase of the Project, the Impacts thereof on the Physical and Biological Environment, and the Measures to be Taken

V.2.1. The Properties of all the Units in the Scope of the Project, The Units Where the Activities are to be Realized and Types of the Activities, Capacities, The Goods and/or Services to be Produced at the Units, Production Amounts of the Final and By-Products

Derivation and Bottom Outlet Structures

At the location of Alpaslan II Dam, the flood flowrate repeated every 25 years is 1,791.00 m^3/sec and the flood flowrate repeated every 50 years is 1,954.00 m^3/sec. Alpaslan II Dam is one of our big dams in terms of volume. At the evaluations made in this framework, it has been decided to design and thus dimension Alpaslan II Dam's derivation tunnels and cofferdam structures with a freeboard for the 25-year recurring flood and permitting the passage of the 50-year recurring flood without freeboard.

As a result of the flood routing works performed, it has been decided to design the derivation tunnels of Alpaslan II Dam, each with 8.00 m inner diameter, as two in the left bank due to the geological conditions. In this case the length of T1 Tunnel will be 875.00 m and T2 Tunnel will have a length of 950.00 m. In each of the tunnels, ventilation pipe has been arranged on the tunnel route at 501,473 km from the upstream. The wall thickness at the tunnels will be taken as 0.85 m.

In this framework, as a result of the optimization studies undertaken, the upstream cofferdam crest elevation has been proposed as 1 301.50 m and the inclination slope has been taken as equal to the upstream inclination slope. The downstream cofferdam crest elevation has been proposed as 1,278.00 m.

The derivation tunnels shall then be used as energy tunnels. The inner tunnel has been named as Tunnel no. 1 and the outer tunnel has been named as tunnel no. 2. In this framework, after the derivation process is completed, the inner tunnel shall be used as an energy tunnel starting with 727,162 km and the water, after this part, shall be taken into water energy tunnels via stoppers. The entrance and exit base elevation of the derivation tunnels shall be 1,274.00 m and 1,270.00 m, respectively.

The outer tunnel shall be arranged as a bottom outlet after 796.386 km. At this cross section, this tunnel shall be used as a bottom outlet with 2.50 diameter penstock to be installed inside the tunnel with check valves.

Spillway

Due to the reliability of the geological structure at the right bank, it has been proposed to build the spillway of Alpaslan II Dam on the left bank. At the location of Alpaslan II Dam, the catastrophic flood peak has been calculated as 7,542.00 m^3/sec. In order to discharge this flowrate safely to the downstream, spillways with 6 radial covers have been proposed.

Spill way threshold elevation has been calculated as 1,355.50 m; approach channel base elevation as 1,350.00 m; spill way width has been calculated as 86.00 m gross and 66.00 m net. The width of each of the spill way pedestals has been foreseen as 4.00 m.

The width of each of the spill way hatches shall be 11.00 m and height shall be 12.00 m.

Starting from the spill way threshold, the length of the discharge channel is 505.00 m and an energy breaker tank has been arranged at the end of this channel. The first 60.00 m part shall be sloped and the catastrophic flood peak whose energy shall be broken down in this tank of 126.00 m shall be discharged to the river bed at the river thalweg elevation arranged as 1,265.00 m with a sloped structure as 5 horizontal and 1 vertical. Under the spill way threshold, the injection depth shall be taken as 20.00 m.

The base elevation of the energy breaker tank has been determined as 1,250.00 m.

Energy Irrigation Structure and Cover Shaft

The derivation tunnels of Alpaslan II Dam shall be converted into energy tunnels after the derivation is complete. For this aim, the entrance of the derivation tunnel shall be coated with concrete and the water shall be taken into the HEPP from 1,303.27 m elevation of the reservoir via the shaft. The water intake structure to be built on this elevation shall have a top elevation of 1,313.50 m. These structures shall be arranged at the left bank, at the inlet part of the derivation tunnels.

In this case, the water load needs to be minimum 10.50 m from the tunnel entrance to prevent vortex. Therefore, the minimum operation water elevation has to be 1,313.77 m. However, since the dam also has an energy purpose, as a result of the firm and total energy optimization made, the minimum operation water elevation of Alpaslan II Dam has been decided to be 1,340.00 m.

Energy Tunnel

After Alpaslan II Dam's derivation tunnels complete their derivation functions, they shall be used as energy tunnels. First of all, the entrance opening of these derivation tunnels shall be coated with concrete and they shall be equipped as a water intake structure with one each shaft. As to be located at the dam axis upstream part of the mentioned tunnels, one each cover shaft shall be installed at 0 + 483,530 km of Tunnel no. 1 and at 0 + 539,451 km of Tunnel no. 2. After this cross section, they shall be coated with steel. Then, starting with 0+727,162 km of Tunnel no. 1 and 0 + 796,386 km of Tunnel no. 2, two energy tunnels shall be constructed as separated from the derivation tunnels with a curve. The inside of these tunnels shall also be coated with steel. In this section, the inner diameter shall be 6.30 m.

Until the cross section where the energy tunnels are separated from the derivation tunnels, the inner diameters will be 8.00 m, after which the energy tunnel diameter shall be 6.30 m.

The cross section of derivation tunnel no. 1 where the energy tunnel starts shall be closed with concrete stopper after the water is taken from the energy tunnel.

The outer tunnel no. 2 shall be used as a bottom outlet starting from the energy tunnel cross section, therefore the water shall be controlled with the valve to be placed here and in need, this valve shall be opened and the water shall be sluiced with 2.00 m size penstock to be installed inside the derivation tunnel.

Since the diameters of the derivation tunnels are fixed, there was no need to make diameter optimization at the energy tunnels.

Surge Tank

At the studies made for the present status, it is foreseen that a surge tank will not be necessary. However, the final decision on this topic shall be given after the discussions to be held with the electro-mechanic equipment manufacturers.

Valve Chamber and Penstock

The water shall be controlled via the penstock and valves to be installed at the power plant entrance at the end of the energy tunnels. At this part, the penstock diameter shall be 4.50 m at big units and 2.40 m at small units. The length of each penstock shall be 35.00 m.

Switchgear Building and Tailrace Channel

Alpaslan II Dam HEPP Project shall be constructed as four units. The flow turbined in the power plant shall be discharged to Murat River via the tailrace channel.

The tailrace elevation at the power plant shall be maximum 1,270.00 m and in case of flood, it shall be 1,278.54 m. The power plant's landscaping elevation is 1,280.00 m.

At the outlet of Alpaslan II HEPP, the base elevation of Murat River bed has been designed as 1,267.40 m. However, sweeping and arrangement shall be made at the bed until the cross section being the original axis location and the thalweg elevation at the power plant outlet is planned to be 1,265.00 m. In this case, the tailrace elevation shall be 1,267.60 m and thus, energy shall be generated by utilizing the whole elevation.

The power plant building shall be 33.00 m wide and 85.00 m long.

Turbine Power, Unit Power and Quantity

The turbine type has been selected as vertical axis Francis for Alpaslan II HEPP. Alpaslan II Dam and HEPP is comprised of four units, two big-scale and two small-scale (2 x 110.00 MW + 2 x 30.00 MW), with a total installed power of, 280.00 MW; and the project flowrate of the power plant is totally 344.00 m^3/sec. The unit flowrates are 2 x 136.00 m^3/sec and 2 x 36.00 m^3/sec. Thereby, in case the power plant is operated at peak level, the flows to be discharged to the downstream from the small units shall meet the sap of the river bed and the irrigation water requirement of Mus plain. The gross head in the power plant is 98.00 m.

Switchyard

A switchyard shall be constructed in the open near the right bank, at the skirts of the dam and the energy to be generated at Alpaslan II HEPP shall be fed to be transmission lines via this switchyard.

154 kV 130.00 m x 160.00 m has been planned for Alpaslan II HEPP.

V.2.2. The Impacts on the Areas That Need to be Protected as per the National and International Legislation

As indicated at Section IV.1.24, there is a cultural asset to be inundated by the reservoir. In this respect, the rescue excavations to be conducted related to the cultural assets to be inundated by the dam and the dam works shall be performed simultaneously as per the decision of the Regional Directorate of Van Cultural and Natural Assets Protection Board, and the necessary activities shall be undertaken in the framework of the opinions, suggestions and demands of the Ministry of Culture and Tourism and the liabilities stated at the principle decision No. 765. These works shall be completed before the water retaining phase of the dam.

Within the limits of Mus, there are no special environmental protection zones, nature parks, national parks, nature protection areas or wild life development sites.

As indicated at Section IV.2.11, according to the Provincial Environmental Status Report data, the wetlands placed under protection inside the boundaries of Mus with the Decision of the Local Environmental Board are given below:

- Buyuk Hamurpet Lake
- Kucuk Hamurpet Lake
- Hacli Lake
- Kaz Lake
- Degerli Lake
- Kumlukiyi Lake
- Yurttutan Kuru Lake
- Korkut Sazlikbasi Reeds
- Merkez Bostankent Reeds
- Merkez Kiyiı Reeds
- Bulanik Sorgol Reeds

These wetlands are not located within the project site. The closest of these wetlands to the reservoir area are the Small Hamurpet Lake and Kumlukiyi Lake. The Kucuk Hamurpet Lake is about 8.5 km away from the reservoir, whereas the Kumlukiyi Lake is about 2 km away.

In the construction and operation phases of the project, action shall be taken as per the Marshland Protection Regulation enacted by being published at the Official Gazette no. 25818 of 17.05.2005 and the necessary permits (App-2 Marshland Activity Permit Certificate) shall be obtained.

V.2.3. The Possible Impacts on the Water Quality and the Fauna in the Aquatic System as a Result of the Use of the Source and Water Retaining at the Regulator Structures, The Passage Structures for the Existing Fish Species in the River

Layering is formed especially during the summer months, where the heated water at the lake surface cannot intermix with the underlying cold water due to the created density difference. There also might be a thermal pollution as result of the accumulation of the water at the reservoirs, depending on the reservoir volume and area, as a result of the temperature gradient formed between the base and top level of the still water. Consequently, certain algae and phytoplankton population increase can be observed at the lakes. For example, the population of the green and blue-green algae increases. However in time, together with the fast drop in the oxygen level, an anaerobic medium can be formed and this can threaten the living beings.

Since there will be a continual water circulation at Alpaslan Dam, the negative impacts due to layering at the reservoir shall be limited.

Since water discharge from the dam shall be controlled, the oxygen level in the water shall be sufficient and a suitable environmental shall be provided for the fish life. The existing water quality data for the Project area and its surroundings is provided at Section IV.2.18.

High phosphorus and nitrogen levels are the major reasons for eutrophication. In general, the main parameter causing eutrophication is phosphorus. Since the water quality analysis results of Murat River demonstrate a very low level of total nitrogen and phosphorus, it can be concluded that such a problem will not be encountered at the reservoir lake.

Since the total nitrogen and total phosphorus values are very low according to the water quality analysis results of Murat River, it can be deduced that such a problem shall not be encountered at the reservoir lake.

Before the commencement of water retaining, the biomass amount to negatively affect the water quality of the lake should be minimized. For this aim, the Villagers shall be notified before the commencement of water retaining and thereby, the agricultural crops can be gathered. The project owner shall support this and similar activities in the scope of equipment and training provision.

Especially in order to preserve the water quality criteria downstream, vegetal cover cleaning will be completed within the lake area. Otherwise, organic pollution will increase, oxygen level and pH drops and this will create undesirable water quality at the downstream section.

The dam projects can have impacts on the living and reproduction habitats and migration behaviors of the fish. In general, the fauna types living in the river environments after the formation of the reservoir are replaced with the species that live in stationary waters. Impacts will emerge for the aquatic beings starting with the water retaining phase of the dam. Furthermore, since November month is a time when the plants are inactive in terms of biological activity and thus the green biomass is at the lowest level, it will be suitable for water retaining.

Since HEPPs cause changes in the flow structure of the region, there will also be some habitat changes as well. When we evaluate all these from the perspective of the aquatic beings:

- This means that the existing habitats of algae among the aquatic beings shall decrease and a new habitat will be formed. Instead of the algae species living as dependent at the river bed, the free-living phytoplankton species shall become more dominant with the formation of the lake and pond. In the still zones, again the forms living dependent on sediments, rocks and plants shall continue their existence. The increasing phytoplankton organism (freely moving algae) shall become a nutrient source for the zooplankton species in the lake area. In general, there will not be situation that negatively influences the fresh water algae flora of the region since the fresh water algae shall be able to continue their living within the lake system as well.

- The still water body to form at the reservoir area shall form suitable niches for the zooplankton organisms. The increase of the phytoplankton organisms at the regulator site shall create a positive situation for the zooplankton and there will be an increase thereof both in terms of density and species diversity. The zooplankton organisms, currently at a low level of species diversity and population density at the river and stream systems in the region, shall be started to be represented with abundant species and density after the formation of the regulator lake. As a result, optimum conditions shall be created for the zooplankton organisms after the planned activity takes place.

- Some of the benthic beings can distance away from the reservoir area where the current water transforms into still water. However, other benthic species will become prevalent at the section that has become still. These species prefer to live in deep environments with a bottom structure comprised of intense silt and sedimentation. Thereby, in addition to the benthic species living at the current environment at the downstream part of the HEPP, the presence of species adapting to the still water system at the reservoir area shall be positive in terms of biological diversity.

- The increase of the plankton species forming a nutrient for the fish at the reservoir area shall have a positive impact in the growth of fish species that can live at the still water system as well.

- Another factor that will enable the increase of the biological diversity in the region shall be the still water habitat to be formed after the creation of the reservoir area and the environments with current at the downstream. Consequently, the species composition accommodated by the two habitats will be different.

Considering the fact that Alpaslan II Dam and HEPP is a skirt type power plant, at the water retaining process of the environmental flowrate covering the reproductive period of the fish with high flow period Q_sap= 27.0 m^3/sec (Q_sap/YOA (%)=19.6), and at the low flow period Q_sap= 18.5 m^3/sec (Q_sap/YOA (%)=13.4) (See App-18).

In general, the fish living at the river, brooks and/or streams migrate from the downstream to the upstream at certain periods to reproduce, feed and overwinter. In order not to prevent the reproduction of the fish species present in the area, it is foreseen to establish a 'Carriage Station' to build fish passages at the mentioned dam and HEPP or to ensure that sub populations are not created. The details related to the fish passages and carriage station is provided at Section V.2.16.

The completion of the water retaining phase in the shortest time possible is important both in terms of operation logic and in terms of discharging the water downstream at the amount to ensure the continuity of natural life and preservation of the natural cycle of the area. For this reason, until the sufficient water level is reached for operation, certain amount of water has to be regularly discharged for the preservation of the downstream habitats and species.

The level drops that can be seen at the reservoir cause erosion at the bank section. A change to occur at the flow currents at this section devoid of vegetal cover or intense rain shall influence the stability and cause small scale soil movements. For this reason, the prevention of long term minimum level operation shall be ensured with the optimization of the flow regime and restrict erosion occurrence at the sections at the bank with no vegetal cover.

V.2.4. Calculation of Sap to be Discharged to the River Bed, {Considering the Basin Flows, Precipitation-Flow Relationship, Ecological Potential, Average Flowrates for the Last Decade, Fish Special Protected with National and International Legislation if any and their Possible Requirements, Fish Passages, Water Rights (Drinking-Utilization or Other Purpose Uses, Irrigation Water Required for Agricultural Lands, etc.)}, Drawings Displaying the Precipitation Area, Flow Observation Stations and the Downstream Sap Outlet Location

Alpaslan II Dam and HEPP is a project with skirt type power plant. The discharge of environmental flow separately to the downstream can only be possible when the dam works for peak purposes. In this case, by considering environmental flow and irrigation water, the 4 units of Alpaslan II HEPP shall be arranged as two big and two small units with equal capacity (2 x 136.00 m^3/sec and 2 x 36.00 m^3/sec). Under these circumstances, 3 different situations has been evaluated for the environmental flowrate to be discharged from Alpaslan II Dam (1: water retaining phase, 2: peak flow operation state, 3: operation state in the form of a skirt type power plant). When the HEPP is operated as a skirt type power plant, all the of incoming flow shall be turbined and discharged to the downstream, thus there is no need to determine an environmental flowrate value.

In the Water Retaining phase, it is aimed for the dam to reach normal water level (NSS= 1368 m) as soon as possible. At this level, the lake volume is approximately 2.1 * 10^9 m^3. The time when the dam will attain NSS at the water retaining phase shall depend on the season when the water retaining was commenced, the average floe in the water retaining phase and the magnitude of the environmental flowrate to be discharged to the downstream.

The model calculation results of wet environment show that the flowrate values meeting the aquatic habitat minimum flowrate and minimum water depth criteria will have a magnitude in the range of 0.40 m^3/sec to 0.49 m^3/sec. However, the flowrate range meeting this criteria is much below the Q_YOA10% (= 13.757 m^3/sec) flowrate. According to the wet environment method, at the two different break points in the non-dimensional wet environment and non-dimensional flowrate, the critic flowrate figures for the aquatic habitat are 27.0 m^3/sec and 18.5 m^3/sec. At the feasibility study, the environmental flowrate was foreseen at the level of Q_YOA10%= 13.757 m^3/sec. For the dam volume at NSS (2.1 * 10^9 m^3) to be filled without releasing environmental flow to the downstream, 178 days is required as per the long-term annual average flow (Q_YOA =136.26 m^3/sec). In order to reach the dam volume at NSS with the reservoir inlet flow at the same magnitude (Q_YOA =136.26 m^3/sec), when environmental flow at Q_YOA% (= 13.757 m^3/sec) is released to the downstream, the required number of days is 197 days; when environmental flow at Q_kr (= 18.5 m^3/sec)) is released to the downstream, the required number of days is 206 days; and when environmental flow at Q_kr (= 27.0 m^3/sec) is released to the downstream, the required number of days is 222 days. In this case, when compared with the situation where no environmental flow is released to the downstream at the water retaining phase, the period of reaching NSS with Q_sap=

13.757 m^3/sec is 19 days, with Q_sap= 18.5 m^3/sec it is 28 days, and with Q_sap= 27.0 m^3/sec it will take 44 days longer.

The high flow period at Alpaslan II Dam cross section (March-June) also corresponds to the aquatic habitat reproduction period. In this period, it is considered that the aquatic habitat will require more water as compared to the subsequent low flow (growth) period. For this reason, it has been considered to be proper to keep the environmental current flowrate at during the high flow (reproduction) period and the low flow period of the water retaining duration at Q_sap= 27.0 m^3/sec and Q_sap= 18.5 m^3/sec, respectively. Since the HEPP is planned as a skirt type power plant, it will be suitable to release the above mentioned environmental flowrates to downstream at the quoted periods of the operation phase as well. When the HEPP is operated at peak flowrate, it is considered that it would be appropriate to release the above mentioned environmental flowrates to the downstream. The distribution of the proposed environmental flowrates at high and low flow periods as per the months is provided at Table V.50. The hydro-geological evaluations made in the scope of the project and the details of the analysis for the identification of the environmental flow amounts are shown at App-18.

Table V.50. Environmental Flowrates Suggested for the Low and High Flow Periods of Alpaslan II Dam Location (Q_Sap, m^3/sec)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AN. AVG.
Flow Period	Low	Low	Low	Low	Low	High	High	High	High	Low	Low	Low	
Aquatic period	Growth	Winter	Winter	Winter	Winter	Reprod	Reprod	Reprod	Reprod	Growth	Growth	Growth	
Q_sap (suggested)	18.5	18.5	18.5	18.5	18.5	27.0	27.0	27.0	27.0	18.5	18.5	18.5	21.33
Q_sap/AOA (%)	41.7%	29.1%	31.2%	37.3%	33.2%	17.4%	5.1%	6.4%	17.2%	32.9%	54.2%	60.6%	
Q_sap/YOA (%)	13.4%	13.4%	13.4%	13.4%	13.4%	19.6%	19.6%	19.6%	19.6%	13.4%	13.4%	13.4%	15.5%

In the scope of the project, the downstream sap shall be discharged from the bottom outlet at the first water retaining phase of the dam. The dam shall be constructed as a skirt type power plant and after the water coming from the operation phase of the dam is passed from the turbines, it shall be released to the downstream. However, in cases where water has to be retained at the operation phase, the downstream sap shall be released from the two sap turbines (small turbines) present at the power plant building. The drawings for the bottom outlet and power plant building from where the downstream sap shall be released are presented in App-21.

When it is passed on to the energy generation phase, SHW 17th Regional Directorate shall be contacted regarding the determination of the measurement station locations and the FMS stations shall be connected on-line to SHW 17th Regional Directorate.

The information on the fish species under protection at and around the project activity area is presented at Section IV.2.12. Furthermore, the relation of these species with the hydrological system and their possible needs is analyzed in the scope of the "Ecosystem Evaluation Report" in App-18. Regarding the mentioned environmental flow amounts, the measures stated at the Ecosystem Evaluation Report shall be taken. The details of the fish passages are provided at Section V.2.3.

V.2.5. Use of the Resource from where Water shall be Supplied, The Possible Changes at the Downstream as a Result of Water Retaining, The Impact of these Changes on the Water Quality and the Aquatic Fauna, Impacts on the Natural Life (Landslide, Erosion, River Hydrology, Aquatic Live, Sediment Accumulation, etc.)

Alpaslan II Dam shall be constructed for energy generation, irrigation and flood protection purposes. Dam and HEPP units are systems that will not create a pollution in terms of operation system. Therefore, they will not pose a pollution threat for the water resources. The residential wastes to occur due to the personnel to work during the operation phase of the project shall be collected in impermeable septic tanks, taken by sewage pumps and transmitted to the wastewater system of Mus Municipality. Furthermore, there will be no intervention to the river bed outside the information and permit of SHW General Directorate, no material shall be discharged to the river bed, the bed cross section shall not be narrowed and suitable flow conditions shall be provided at the river bed.

During the feasibility studies, the amount of sediment to come to Alpaslan II Dam location in the scope of Alpaslan II Dam and HEPP Project has been calculated. In the calculations, the data at the publication called “2005 Almanac of Suspended Sediment Observations in Turkey’s Rivers” prepared by EIE General Directorate has been used. The data of Murat River – Akkonak Sediment Observation Station no. 2174 operated by EIE has been taken into consideration. 200 sedimentation samples were taken at the station in the dates of 1987-2005, analyzed and the results are provided with the equation $Y= 0,1926\ X^{19657}$.

In this equation:

Y = Suspended sediment (Ton/day)
X = Average flowrate (m^3/sec).

At the analysis results of SOS (Sediment Observation Station) no. 2174, the sediment efficiency at the observation spot with a net precipitation area of 17.105,9 km^2, has been given as 250 ton/year/km^2.

Alpaslan I Dam with a precipitation area of 15,460.00 km^2 is under construction. Since the sediment to come to Alpaslan II Dam with a precipitation area of 15,505.00 km^2 will be kept at 88% by Alpaslan I Dam, sediment shall come to Alpaslan II dam from 2,045.00 km^2 being the interim basin of Alpaslan II - Alpaslan I Dams.

Literature states that the bed load’s suspended sediment amount changes from 15% up to 4-fold. Considering the vegetal cover of the project area, topographical status, river slope, forested areas, land use and other hydrological features of the basin, the bed load’s suspended sediment is assumed to be 50%.

In these assumptions, 2174 Murat River - Akkonak SOS. Total Sediment Efficiency:

= [250 ton/year/km^2 + (250 x 0,5 ton/year/km^2)] /1.25 ton/m^3 = 375,00 m^3/year/km^2'dir. *[(suspended sediment) + (bed load)] / (density)*

The overall sediment equation for Turkey (new):

$Q_s = 4.5899\ X\ A^{1\ 3702}$

Q_s= Sediment Amount (ton/year)

A= Drainage Area (km^2)

A2174 = 17,105.9 km^2

$Qs_{(2174)}$ = 2,897,742.4 ton/year = 169.40 ton/year/km^2

$A_{\text{Alpaslan II-I Interim Basin}}$ = 2,045.00 km^2

$Qs_{\text{(Interim Basin)}}$ = 157,802.98 ton/year= 77,17 ton/year/km^2

Bearing coefficient for Alpaslan II Dam has been found as (as per 2,174) = 77.17 /169.40 = 0.456. By multiplying the station location total sediment efficiency with this ratio, the total sediment efficiency of Alpaslan II Dam can be obtained.

375.00 m^3/year/km^{2}x 0.456 = 171.00 m^3/year/km^2

171.00 m^3/year/km^2 x 2,045.00 km^2 = 349,695.00 m^3/year

Considering the project life to be 50 years, the total sediment volume has been determined as 349,695.00 m^3/year x 50 years = 17,485 hm^3/year.

The possible impacts of the project on the aquatic flora and fauna, and the impact mitigating measures are put forth in detail at Section V.2.16.

V.2.6. Statement of Other Projects if any (Dam, Regulator, HEPP, etc.) at the Downstream and Upstream of the Project, Evaluation of the Impacts on the Ecosystem

At Murat River Basin, there are many projects for irrigation, energy and drinking-utilization water supply at the upstream and downstream of Alpaslan II Dam. Since water uses shall affect energy generation of Alpaslan II Dam, the upstream projects have been examined one by one, the developed status where all the upstream projects have started operation has been considered and a water supply chart has been prepared for Alpaslan II Dam. In this respect, Alpaslan I Dam present at the upstream of Alpaslan II Dam has also been taken into consideration in the present state evaluations.

According to the Water Use Rights Report (2011) prepared according to the State Hydraulic Works (SHW) General Directorate standards and approved by SHW 17th Regional Directorate, Arincik Regulator irrigation channels were detected serving irrigation at the current status within the project site. Furthermore, it has been determined that irrigation is being performed via the water supplied with motopump from Murat River at Akpinar and Kiyibasi Villages located at the downstream of Alpaslan II Dam. However, the establishment of Alpaslan II Dam shall not negatively impact these irrigation activities. Actually, Alpaslan II Dam is a skirt type power plant and will not retain water. The incoming water after energy generation shall be released to the river bed.

According to the evaluations at the Feasibility Report, the waters turbined for energy at the dam, shall be sufficient to meet the irrigation requirements of Mus Plan at the downstream. However, in case Alpaslan II Dam is operated at peak flowrate, lesser water shall be released to downstream at the accumulation periods. At the feasibility report, it has been stated that sufficient amount of environmental flow and irrigation water shall be released to the downstream independent of the operation flowrate. In this feasibility report, the environmental flowrate has been foreseen as 13.00 m^3/sec corresponding to 105 of the average flow of the last decade. In the project, it has been planned to use two big and two small - each of the two are equal – turbine units by considering the environmental flow and irrigation water requirement. The project flowrates shall be 136 m^3/sec and 36 m^3/sec for the big and small units, respectively.

Since drinking-utilization water requirements of the residential areas in the project area are supplied from local sources, the planned project will not have a negative impact. With the application of the project, the agricultural fields downstream shall have regular irrigation water, thus a problem is not expected in this regard either. When the project is implemented, it will be necessary to discharge necessary level of sap along the river bed downstream of the dam to prevent the aquatic habitat being negatively influenced from the activity.

The impacts of the project on the terrestrial and aquatic flora and fauna elements are put forth in Section IV.2.13 and V.2.16, respectively. Moreover, the impacts of the changes to occur due to the project activities on the hydraulic and ecologic system is analyzed in detail at the “Ecosystem Evaluation Report” in App-18.

V.2.7. Other Means of Use for the Water Resource if any (Water Rights Related to the Residential Areas in the Downstream, Drinking-Utilization, Irrigation, Agricultural Activities, Fish Cultivation Facilities, etc.) and their Impacts

The project area is located at the Middle Euphrates basin. There are many facilities planned in the upstream of the project for irrigation, drinking – utilization water supply and energy generation; some are in the planning, some are in the construction and some are in operation phase. These projects take place on the main and side branches of Murat River. Figure IV.21 provides the position of the project area at Section IV.2.5 within the basin.

At the study performed, it has been accepted that all the facilities planned at the upstream of Alpaslan I shall be constructed and opened for operation by the end of 2025. Therefore, the amount of water that has been operated by all the dams in the upstream and to be given to irrigation from these facilities and to drinking water from Yazici dam has been determined. Furthermore, the waters to be turned to irrigation from the regulator locations have also been calculated. The properties and irrigation water requirements of the irrigation projects upstream of Alpaslan I dam has been described in detail at Section IV.2.5.

- Upper Murat Project
- Agri Yazici Project
- Agri Patnos Project
- Agri Eleskirt Project
- Agri Tutak Project
- Hinis Project
- Kopal Project
- Kazan Lake Project
- Mus-Adalar Watering
- Hinis Ulusu Regulator
- Karakaya Dam Watering
- Kara Hasan Dam Watering

- Uctepe Dam Watering
- Kadir Dam Watering
- Kustepe Dam Watering
- Arincik Watering

At the feasibility studies, it has been assumed that at the upstream irrigations, 15% of the used waters and for the water taken for drinking-utilization water, 80% there shall be returned back to the river bed after being used.

At the downstream, there is the Mus Plain irrigation with 78,210 ha surface area whose water requirements have to be met. The waters turbined for energy purposes at the dam shall be sufficient to meet the water needs of this irrigation activity. However, when Alpaslan II Dam is operated at peak, it can be considered to release less amount of water to the downstream. In this case, the amount necessary for sap of Murat River bed and the requirement of the irrigation water shall be released to the downstream.

Water Use Rights Report has been prepared for Alpaslan II Dam and HEPP Project and this report has been approved with the letter of SHW 17th Regional Directorate no. 391570 of 18.10.2011. The mentioned approved report is given at App-12.

V.2.8. Possible Impacts on the Groundwater and Surface Water Sources (Evaluation of Parameters such as the Water Use, Project Flowrate, Length of the Transmission Channel, Width of the River Bed, Deep Alluvial Structure, etc.)

At the geological-geotechnical survey studies performed, it was found out that the basic rocks at the dam area are Zırnak and Adilcevaz formations. With the drills made, the permeability parameters of the formations were investigated via pressurized water tests (BST). According to the groundwater level measurements taken at the drill wells, the groundwater levels are above the river level and feed the river at both hillsides. With the water retaining at the dam, it can be said that there will not be an increase at the river level considering that the units at the area are impermeable.

According to the present data on the tests; although the there are occasional low permeable-permeable levels at Zırnak formation, Zırnak and Adilcevaz formations are found to be generally impermeable. When the dam height, blocked structure of Zırnak formation and the occasional low permeability-permeable levels of Zırnak Formation are considered, an injection web shall be built at approximately 50 m at thalweg along the dam axis and at the right hillside, and at gradually decreasing depths in the left hillside.

The project area is located at the Orta Firat basin. At the upstream of Alpaslan I dam, there are, from the upstream to the downstream, Murat, Yazici, Aydintepe, Nadirseyh, Karahalit, Patnos, Sekerova, Baskoy, Agacli, Sancaktar, Kustepe and Uctepe dams and irrigations, Eleskirt, Gulluova, Bulanik, Mus - Adalar, Hinis, Karahasan, Karakaya regulator irrigations and Kadir pond irrigation. Detailed information on water uses is provided at Section IV.2.5.

If a road passage will be built over the surface water resources at the mentioned project area, an art structure shall be built for passage and the opinion of SHW 17th Regional Directorate shall be taken.

Since Alpaslan II Dam is a skirt type dam, there is no transmission channel.

V.2.9. Place and Method of Meeting the Accommodation and Other Technical/Social Infrastructural Needs of the Dependants of the Personnel and the Personnel Themselves to Work During the Operation of the Project

The number of personnel to work during the operation phase of the project is 10 persons. Since the number of personnel is low, accommodation structure construction is not planned at the dam area at the operation phase. The accommodation, social/technical infrastructural needs of the personnel and their dependents shall be met from Mus city center.

V.2.10. The Characteristics of the Treatment Plant to be Employed for the Treatment of the Wastewaters to Occur After the Use of the Drinking and Utilization Waters at the Administrative and Social Unit, Elaboration of the Processes, the Receiving Bodies to Where the Treated Waters will be Discharged, the Quantity and Method of Discharge

It is considered to employ 10 persons at the operation phase. Based on the assumption that the per capita daily water requirement would be maximum 200 liters per day at the operation phase, it is estimated that the daily residential water requirement would be 10 persons x 200 L/day-person = 2 m^3. This water shall be obtained from the nearby residential areas and shall be controlled and verified for compliance with the criteria indicated at the Regulation on Human Consumption-Purposed Waters enacted by being published at the Official Gazette no. 25730 of 17.02.2005.

Considering that the daily water requirement of the workers of the operation phase will transform completely into residential type wastewater, the daily amount of wastewater to be formed will be 2 m^3. This wastewater shall be collected at septic tanks, pumped out with sewage pumps and given to the wastewater system of Mus Municipality.

V.2.11. The Solid waste Amount and Properties to Occur at the Accommodations, Social and Administrative Facilities, Where and How these Wastes will be Transported or How and for which Purposes these Wastes Shall be Utilized

The solid waste to occur in the operation period shall be residential type and caused by the personnel to work at the operation phase. It is considered to employ totally 10 persons during the operation phase. Assuming that the per capita daily sold waste amount would be 1.34 kg/day, the residential type sold waste amount due to the workers of the operation phase would be daily 10 persons x 1.34 kg/person-day =13.4 kg. These wastes shall be collected in suitable containers and disposed off at the solid waste disposal site of Mus Municipality. Recyclable wastes such as plastic, glass, paper, etc. shall be collected at separate containers and given to the companies that collect these wastes for recycling.

The following regulation provisions shall be complied with related to the solid waste management at the operation phase of the project:

- ✓ “Solid Wastes Control Regulation” enacted by being published at the Official Gazette no. 20814 of 14/03/1991,
- ✓ “Hazardous Wastes Control Regulation” enacted by being published at the Official Gazette no. 25755 of 14/03/2005 and “Regulation on Amending the

Hazardous Wastes Control Regulation" enacted by being published at the Official Gazette no. 27339 of 04/09/2009,

- ✓ "Packaging Wastes Control Regulation" enacted by being published at the Official Gazette no. 28035 of 24/08/2011,
- ✓ "Vegetal Waste Oils Control Regulation" enacted by being published at the Official Gazette no. 25791 of 19/04/2005,
- ✓ "Waste Oils Control Regulation" enacted by being published at the Official Gazette no. 26952 of 30/07/2008,
- ✓ "Regulation on the Control of Excavations Soil, Construction and Debris Wastes" enacted by being published at the Official Gazette no. 25406 of 18/03/2004,
- ✓ "Waste Batteries and Accumulators Control Regulation" enacted by being published at the Official Gazette no. 25569 of 31/08/2004,
- ✓ "Regulation for the Control of the Tires that have Outlived their Useful Life" enacted by being published at the Official Gazette no. 26357 of 25/11/2006,
- ✓ "Medical Wastes Control Regulation" enacted by being published at the Official Gazette no. 25883 of 22/07/2005,
- ✓ "Regulation on the Regular Storage of Wastes" enacted by being published at the Official Gazette no. 27533 of 26/03/2010.

V.2.12. The Sources of the Noise to Occur During the Operation of the Project Units and the Measures to be Taken for their Control

The only source of noise foreseen at the operation phase of Alpaslan II Dam and HEPP Project will be the generator and turbines located inside the HEPP building. However, since the HEPP building to be installed shall have insulation, it will be ensured that the noise and vibration remains inside the building.

V.2.13. The Possible Impacts on the Forest Areas and Description of the Measures that can be Taken Against these Impacts

According to the information obtained from Mus Province Land Assets data, there are 126 hectares of brushwood in the scope of Alpaslan II Dam and HEPP Project, and there is about 55 ha area deemed as forest within the project area according to the data obtained from the stand map. As indicated at Section IV.2.9, within the area with the operation type of coppice forest, oaks are present at tree species, the stand types are unforested forest soil-very distorted oak coppice forest stand (OT-CBMBt), very distorted oak coppice forest stand (CBMBt), very distorted oak coppice forest stand, and unforested forest soil (CBMBt-OT). For these types of stands, the hill closure is provided in the range of 1-10%.

During the operation phase of the project, there will be no activity that can create an impact on the forest areas other than these lands. However, necessary precautions shall be taken against forest fires. Necessary equipment, devices and tools against a possible fire inside the HEPP buildings shall be kept ready, in case of any fire at the surrounding forests, these equipment and devices shall be used for fire extinguishing.

As mentioned at Section V.1.23, after the construction works, terraces shall be formed at high slope and land slide areas, thereby flatter surfaces shall be obtained and these regions shall be vegetated. While doing the forestation activities, the dominant plant cover of the region shall be considered and the tree species to be used at forestation shall be selected accordingly. In addition to the tree species, owing to their ability to spread on the surface much rapidly and holding the soil surface together, seeding studies shall be performed (before the forestation works) especially as of the construction phase and thus it shall be ensured that the herbaceous texture quickly covers the surface.

V.2.14. The Possible Impacts on the Agricultural Areas and Description of the Measures that can be Taken Against these Impacts

As mentioned in the former sections, in line with the information obtained from the 1/25,000 scaled Turkey soil data, it is anticipated that 632.5 hectares of dry and irrigated agricultural land will be affected from the reservoir and 60.65 hectares of dry and irrigated agricultural land will be affected at the areas outside the dame lake in the scope Alpaslan II Project.

In the framework of a study prepared for the reservoir area in the scope of the project, an application has been made to the Turkish Ministry of Agriculture and Village Affairs in 2003 for land use permit of non-agricultural areas and in the framework of the Agricultural Survey Report prepared by the Provincial Agricultural Directorate, the land use permit of non-agricultural areas has been granted with the 22.02.2003 dated and TSD/250.11.11.11-2844/9803 referenced letter of the Agricultural Production and Development General Directorate of the Turkish Ministry of Agriculture and Village Affairs. The mentioned letter is presented in App-2. In the framework of the project modification made, the dam location was moved 4 km towards the upstream with the new formulation in this report. Thereby, the reservoir formed in this new formulation covers a smaller area that the lake area for which a land use permit of non-agricultural areas had been obtained. Therefore, the land use permit of non-agricultural areas that had been granted covers the whole reservoir.

For the areas outside the reservoir, necessary applications shall be made if necessary, after EIA studies, to obtain a land use permit of non-agricultural areas in line with the provisions of the Soil Protection and Land Use Law no. 5403 and Soil Protection and Land Use Application Regulation no. 26024.

With the project starting to operate, it will have a positive impact on the agricultural fields. If the project is realized, there will be groups benefiting from Alpaslan II Dam at differing magnitude. Alpaslan II Dam is a dam that has irrigation purpose in addition to flood protection. With the project, the water requirement of 68,060 ha agricultural field that needs irrigation at the Mus Plain shall be met and there will be flood prevention benefit. Therefore the project will have a significant role in the irrigation of the soils, consequent increate in agricultural productivity and contribution to the region and the country as a whole.

It is anticipated that income increase and the subsequent transformation and evolutions will create opportunities for new investments. The traditional agricultural methods can be abandoned and new agricultural training and dissemination can be observed. In this way, the agricultural lands shall be utilized and the migration of the farmer having subsistence troubles will be prevented.

Furthermore the right owners to obtain expropriation benefits from the project might make investments outside agriculture and this may create new employment areas in the region. The similar situation has been experienced at the impacts of Ataturk Dam at GAP zone on the agricultural areas. The former migrations to other cities were reversed and it has received seasonal migrations just as in cotton production.

V.2.15. The Possible Impacts on the Grassland Areas and Description of the Measures that can be Taken Against these Impacts

As explained at Section IV.2.7, the total surface area of the province is 819,600 ha as per the Provincial Environmental Status Report and 278,673 ha (34%) of this land is grassland. Most of the area (71.01%) foreseen to be impacted from the dam is grassland. This is followed by watered agriculture and meadow fields at about 10% ratios each.

An application shall be made to the Provincial Food, Agriculture and Stockbreeding Directorate to obtain the necessary permits for the grasslands located in the project area as per the Grassland Law no. 4342.

At the operation phase of the project, it is not anticipated to have any impact on the grasslands. Furthermore, with the flood prevention benefit, it will be enabled to provide flood protection at these grasslands.

V.2.16. The Possible Impacts on the Terrestrial and Aquatic Flora/Fauna and the Measures that will be Taken

V.2.16.1. The Possible Impacts on the Terrestrial Flora & Fauna and the Impact Mitigating Measures

Construction Phase

Due to the intense construction activities at the construction phase and since the facilities to be installed will destroy the habitats, it is inevitable for the plant and animal species in the area to be negatively impacted from the project. However, the existence of alternative areas in the vicinity for the animal species determined at the site, the movement ability of the mammals, reptiles and bird species, the area being used my most fauna types only as a wandering and subsistence area, displays that the scale of the negative impacts will be low.

During the construction and operation phase, permanent habitat loss shall be observed at the places of permanent structures and hard surfaces. Noise and light formation shall occur at the intensity that will cause permanent impact on the terrestrial ecosystem. With the establishment of the facilities, some rocky areas shall also be lost in addition to agricultural areas. However, these habitats display a widespread and intense distribution at the areas of the project site with no structure/units and also in the near vicinity outside the project site. This situation gives the idea that the possible impacts on the fauna communities will be low.

Due to intense human activities at the project site, the animals might abandon the site. In order to minimize the negative impact especially on the species that nest at the ground and under the soil during the construction phase, in case these species are detected, they will be ensured to be transferred to the nearby alternative areas.

Although some of the animal species detected at the project site are included in the IUCN categories, these are species widely distributed in our country and the west pale-arctic zone. When the findings of the fauna studies are evaluated, it has been considered that the negative impact of the activities on the fauna will be low and at a local scale since the vicinity of activity site display similar habitat variety, the threatened fauna species being widely distributed species and there is no endemic species.

Moreover, it can be considered that the terrestrial fauna members might temporarily draw away from the site due to the noise levels to occur during the construction activities. There are alternative habitats in the vicinity of the project site for the mammals and bird species that might be expected to be affected from the noise levels of the construction activities. In order to ensure that the fauna species with low mobility are not harmed by being crushed under the work machinery to be operated during the construction activities, the personnel to operate the work machinery shall be trained and informed in this regard.

Operation Phase

With the formation of the reservoir, a part of terrestrial life shall be substituted by aquatic life and thus, there will be some change in land use, water and food chain. Some of the groves providing a habitat for the terrestrial fauna at the area to be inundated by the reservoir are areas that have been formerly destroyed due to land clearing for farms, illegal tree cutting, etc. However, since these areas shall be inundated, the habitats of the mammals, reptiles and bird species living here will contract. Alternative habitats that can be used by small mammals (mice, etc.), reptiles (turtles, lizards, etc.) and bird species expected to be affected from the change to occur at the operation phase of the project in terms of their living and subsistence habitats are present both at the top parts of the reservoir level and in the vicinity of the project area.

At the flora determination studies at the project site, 257 species from 51 families have been detected. 13 of these detected species are endemic. When it is considered that 34% of the Turkish Flora is endemic, it can be seen that the endemism rate of the plants detected at the work site is very low. However, when the endemism rate of the species spread at the East Anatolia Region is considered, this result can be deemed as normal, since East Anatolia region has low habitat diversity and the resultant number of endemic species is low. The endemic species are mostly concentrated at high mountains at the East Anatolia Region. The endemism rate is very low at the species distributed at steppe habitats. 4 species with regional distribution has been detected in the region. These are; *Ferula huber-morathii* Pesmen (EN), *Cirsium yildizianum* Arabacı & Dirmanci (EN), *Centaurea fenzlii* Reichardt (VU) and *Verbascum macrosepalum* Boiss & Kotschy ex Murb. (VU). These species are mostly distributed over the steppe habitat at the project site. However, when the vertical distribution of these species within the site is examined, although some populations shall be inundated, some will be left above the maximum water level. The other endemics detected at the site are very widespread and their IUCN threat category is “LC: Low Concern”.

The seeds of especially the regionally endemic species shall be collected from the populations within the project area before the formation of the reservoir. These gathered seed shall both be transferred to the gene bank and planted to the high locations above the water fill elevation. Thereby, the population to be lost due to habitat contraction shall be recovered in short term. At the habitats to be inundated by the dam filling system, *Cirsium yildizianum* species is well distributed with high population. However, this species to be newly published has also been detected at the steppe habitats above the dam filling system.

Since the project area is located in the East Anatolian Region, it is suitable for the tree species widely distributed over the Iran-Turan phyto-geographical zone. When Alpaslan II Dam project is completed, there will be a big reservoir at the valley base. Provided that the surrounding of the reservoir is forested with trees conforming to the regional climate, a beautiful nature can be obtained much better than the present state. For this aim, the pedunculate oak species (*Quercus robur* sups. *pedunculiflora*) found to be widespread at the project site shall be used during the landscaping studies.

Concurrently with the construction commencement, the oak acorns should be collected, sufficient quantity of saplings should be grown and these shall be planted in the form of a line around the reservoir after the completion of construction. Again, the use of ashen (*Fraxinus angustifolia)* species shall be appropriate for this purpose. In addition to the tree species, owing to their ability to spread on the surface much rapidly and holding the soil surface together, seeding studies shall be performed (before the forestation works) especially as of the construction phase and thus it shall be ensured that the herbaceous texture quickly covers the surface. When the trees reach a certain height, they both contribute to the organic richness of the soil and minimize the erosion that can occur due to precipitation, and a visually beautiful nature view shall be created. When the organic matter in the soil reaches a sufficient level, the *Tulipa sintenisii* species, named after this region, can also be planted in the gaps within the forestation area. With the landscaping projects to be prepared in the scope of the project, the areas influenced by the project shall be reclaimed.

While the terrestrial fauna will abandon the area inundated by the reservoir, the fauna living in the aquatic environment shall flourish. The fauna species living in still waters and in the vicinity (frogs, aquatic snakes, etc.) shall be positively influenced by the reservoir formation. Furthermore, the reservoir shall create suitable feeding, sheltering and reproduction niches of many bird species in time. In this case it shall be possible for especially the migrating water birds and wild bird species to use this area as a layover site. In the migration season, the suitable still water areas to be created thanks to the dam, the ornito-ecologic importance of the region might increase. The similar situation was observed at the other reservoirs of our country. One of the positive impacts of the dam is the increase of fish population at the reservoir and this will create a nutrient source for the people living nearby.

V.2.16.2. The Possible Impacts on the Aquatic Flora & Fauna and the Impact Mitigating Measures

In terms of creating environmental problems, hydroelectric power plants are energy generation plants with the least negative impact. These plants do not create air, water pollution, solid waste or radioactive leak threat. Therefore, the impacts of not the plants themselves, but the impacts on the basin where water is retained are analyzed.

The hydroelectric power plants can have, in general, positive and negative impacts on the fish populations and fish diversity depending on the changes in the water regime, the surface and groundwater quality and changing of the vegetation structure. The transformation of a habitat with high current into a still environment (as a result of the dam construction) generally has an impact on the growth of some fish rather than the species composition. Detailed information on the aquatic fauna and flora composition of the project area and the vicinity is provided at Section IV.2.12. The possible impacts on the aquatic flora and fauna groups are listed below.

Phytoplankton Organisms

The actual areas where phytoplankton species are spread are still waters or lotic habitats with low current. The current speed causes drifting of the freely moving phytoplankton organisms therefore they are either not present or have a very low population at fast flowing brooks and rivers and the actual dominant algae species in these types of areas are *Bound algae*. The bound algae attach themselves to plants, rocks and sediments to overcome or minimize this physical impact of current and do not drift away. Therefore, fast current systems are not suitable habitats for phytoplankton and the fact that the phytoplankton species collected in the project area being low proves this point. In general, all the detected fresh water algae species are cosmopolite and there is no species specific to the region, endemic, rare or endangered.

Zooplankton Organisms

The zooplankton organisms generally relocate depending on the movement of the water and live in still water habitats. Their existence in the fast flowing parts of the rivers is very limited. Thus, their species diversity in river systems is low. According to Bern Convention (2002) and CITES (2004), no protected and/or endangered species has been encountered.

Benthic Organisms

In general, within the benthic organisms detected, there is no endangered or protected species. Therefore, it is expected for the project to have a low level of impacts on the benthic organisms.

Fish

It is considered that the changes to occur at the aquatic ecosystem due to the project activities will have an impact on the growth of the fish population rather than the species composition. The possible impacts of the project on the aquatic species and the measures to be taken to mitigate these impacts are presented in detail at Chapter B.4. In this respect, the possible impacts of the project on the detected fish species has been listed down one by one.

*Acanthobrama marmid (*Heckel, 1843): The production period of the species with a very ‘high’ population density is the April-June months. It does not have any protection status as per IUCN Red List (2011), Bern Convention (2002) and CITES (2004). When the issues mentioned at the suggestions part are considered in terms of the population density and continuity of the species, it is contemplated that it will not be affected in a negative way due to the planned project.

Alburnoides bipunctatus (Bloch, 1782): This species, determined to have a very ‘high’ population density, is among the protected species at App III of the Bern Convention*, however no protection status was determined related to its population in Turkey.* When the issues mentioned at the suggestions part are considered in terms of the population density and continuity of the species, it is contemplated that the species will not be affected in a negative way from the planned HEPP.

Alburnus mossulensis (Heckel, 1843): This species, determined to have a ‘high’ population density, is not preferred as a nutrition due to its high amounts of fishbone. When the issues mentioned at the suggestions part are considered in terms of the population density and continuity of the species, it is contemplated that the species will not be affected in a negative way from the planned HEPP.

Barbus lacerta: This species is determined to have a ‘high’ population density When the issues mentioned at the suggestions part are considered in terms of the population density and continuity of the species, it is contemplated that the species will not be affected in a negative way from the planned HEPP.

Capoeta trutta: This species is determined to have a ‘high’ population density When the issues mentioned at the suggestions part are considered in terms of the population density and continuity of the species, it is contemplated that the species will not be affected in a negative way from the planned HEPP.

Capoeta umbla: This species is not located within IUCN Red List (2011) and Bern Convention (2002) as an endangered or protected species. This species has a high population in the project area and widely consumed by the regional community. When the issues mentioned in Chapter B.2.2 are considered in terms of the population density and continuity of the species, it is contemplated that the species will not be affected in a negative way from the planned project.

Chondagitoma regium: This species, with a ‘medium’ level of population density, is not located within IUCN Red List (2011) and Bern Convention (2002) as an endangered or protected species. When the issues mentioned in Chapter B.2.2 are considered in terms of the population density and continuity of the species, it is contemplated that the species will not be affected in a negative way from the planned project.

Garra rufa: The production period of the species with a ‘high’ population density in the project area is the April-July months. When the issues mentioned in Chapter B.2.2 are considered in terms of the population density and continuity of the species, it is contemplated that it will not be affected in a negative way due to the planned project.

Squalius cephalus: The species has ‘medium’ population density in the project site, located in “LC” category according to IUCN 2011 and is not endangered. When the issues mentioned at Chapter B.2.2 are considered in terms of the population density and continuity of the species, it is contemplated that it will not be affected in a negative way due to the planned project.

Luciobarbus mystaceus (Pallas, 1814): The species has ‘medium’ population density in the project site and has been encountered at the deep water system. It does not have a protection status as per IUCN Red List (2011), Bern Convention (2002) and CITES (2004). When the issues mentioned at Chapter B.2.2 are considered in terms of the population density and continuity of the species, it is contemplated that it will not be affected in a negative way due to the planned project.

Oxynemacheilus argyrogramma: It has been determined that this species has a ‘high’ population density in the project site. It is not an endangered or protected species as per IUCN Red List (2011) and Bern Convention (2002). When the issues mentioned at Chapter B.2.2 are considered in terms of the population density and continuity of the species, found to be highly populated at the zone where Murat River joins with Bingol Brook, it is contemplated that it will not be affected in a negative way due to the planned project.

Oxynemacheilus euphraticus: This species with a high ecologic tolerance and has a ‘High’ population density at Alpaslan II Dam and HEPP area and at the side branches of Murat River. There is no protection status mentioned for this species at IUCN Red List (2011). When the issues mentioned at Chapter B.2.2 are considered in terms of the population density and continuity of the species, found to be highly populated at the zone where Murat River joins with Bingol Brook, it is contemplated that it will not be affected in a negative way due to the planned project.

Glyptothorax kurdistanicus: It is not an endangered or protected species as per IUCN Red List (2011) and Bern Convention (2002). When the issues mentioned at Chapter B.2.2 are considered in terms of the population density and continuity of the species, found to be highly populated at the zone where Murat River joins with Bingol Brook, it is contemplated that it will not be affected in a negative way due to the planned project.

The following measures shall be taken to minimize the possible impacts of Alpaslan II Dam and HEPP Project on the aquatic ecosystem and species:

- In order to prevent the negative impact on the species present in the area, necessary measures shall be taken during the HEPP construction and operation phases. In this scope, the water will not be polluted during the construction phase by considering the biological and ecologic properties of the fish and the flow of the water shall not be interrupted especially during the reproduction season of the fish detected at the area (the reproduction season of the fish species of the area is April-July).

- During the construction activities at the river system, the works shall be minimized at the April-July months being the larva laying season of the aquatic fauna at the river bed, especially the loosening explosions at the river bed shall not be practiced that can have high noise, dust, etc. impacts.

- The physical conditions necessary for the species present in the waters to be released after the reservoir shall be met (minimum values for the species of the Cyprinidae family: water depth 15 cm, flowrate 0.20m/sec; $DO_2 < 5$ mg/l) (Cows and Welcomme, 1998).

- Temperature, among the physical properties of water, is one of the most important factors affecting life in aquatic ecosystems. Due to temperature increase, the metabolism of fish increases, the age of reaching sexual maturity lowers. Moreover, temperature affects the distribution, feeding, spawning and behavior of fish species. Most of the species within the Cyprinidae (Carps) family, stop feeding activity when the water temperature lowers below 8-10ºC and start reproduction at water temperatures above 15ºC (Nikolskii, 1963).

- pH, being one of the water quality parameters to be periodically monitored, is an indication of the acidity and alkalinity of the water and it is very important in terms of the life and productivity of fish. Fresh water fish generally prefer a pH level of 6.5-8.5.

- Dissolved oxygen amount (DO_2) being one of the most important factors for the aquatic beings and that is proposed to be monitored both at the construction phase and at the operation phase, is highly important for the living beings dependent upon aerobic metabolism and has great significance in terms of the life and development of the aquatic beings. The amount of dissolved oxygen decreases with the increase in temperature and organic matter, increases with the increase in air pressure (Yaramaz, 1992). However, factors such as salinity and current flowrate also affect the dissolved oxygen amount (Wetzel, 1983). Bremond and Vuichard (1973) has stated that the dissolved oxygen amount should be at least 5 mg/l for the Cyprinids to continue their livelihood.

- Electrical conductivity (EC) value which is the power of the ions in water to conduct electrical current, varies depending on the concentration of all the salts present in the water in dissolved form. Any increase in the electrical conductivity, being one of the parameters that need to be periodically followed especially at the HEPP construction phase, depends on the increase of salinity rate in the water (Wetzel, 1989). However, Bremond and Vuichard (1973), stated that electrical conductivity is an indicator of the dissolved matter amount and that the proper inland water level for the fish should be in the range of 150-750 µS/cm and that the ecological balance would be disrupted if the value reaches up to 3,000 µS/cm.

- Monitoring studies shall be conducted twice a year at the construction and operation periods of the project in order to monitor the possible impact of the project activities on the aquatic ecosystem.

Since HEPPs cause changes in the flow structure of the region, there will also be some habitat changes as well. When we evaluate all these from the perspective of the aquatic beings:

- This means that the existing habitats of algae among the aquatic beings shall decrease and a new habitat will be formed. Instead of the algae species living as dependent at the river bed, the free-living phytoplankton species shall become more dominant with the formation of the lake and pond. In the still zones, again the forms living dependent on sediments, rocks and plants shall continue their existence. The increasing phytoplankton organism (freely moving algae) shall become a nutrient source for the zooplankton species in the lake area. In general, there will not be situation that negatively influences the fresh water algae flora of the region since the fresh water algae shall be able to continue their living within the lake system as well.

- The still water body to form at the reservoir area shall form suitable niches for the zooplankton organisms. The increase of the phytoplankton organisms at the regulator site shall create a positive situation for the zooplankton and there will be an increase thereof both in terms of density and species diversity. The zooplankton organisms, currently at a low level of species diversity and population density at the river and stream systems in the region, shall be started to be represented with abundant species and density after the formation of the regulator lake. As a result, optimum conditions shall be created for the zooplankton organisms after the planned activity takes place.

- Some of the benthic beings can distance away from the reservoir area where the current water transforms into still water. However, other benthic species will become prevalent at the section that has become still. These species prefer to live in deep environments with a bottom structure comprised of intense silt and sedimentation. Thereby, in addition to the benthic species living at the current environment at the downstream part of the HEPP, the presence of species adapting to the still water system at the reservoir area shall be positive in terms of biological diversity.

- The increase of the plankton species forming a nutrient for the fish at the reservoir area shall have a positive impact in the growth of fish species that can live at the still water system as well.

- Another factor that will enable the increase of the biological diversity in the region shall be the still water habitat to be formed after the creation of the reservoir area and the environments with current at the downstream. Consequently, the species composition accommodated by the two habitats will be different.

Considering the fact that Alpaslan II Dam and HEPP is a skirt type power plant, at the water retaining process of the environmental flowrate covering the reproductive period of the fish with high flow period Q_sap= 27.0 m^3/sec (Q_sap/YOA (%)=19.6), and at the low flow period Q_sap= 18.5 m^3/sec (Q_sap/YOA (%)=13.4) (See App-18).

In general, the fish living at the river, brooks and/or streams migrate from the downstream to the upstream at certain periods to reproduce, feed and overwinter. In order not to prevent the reproduction of the fish species present in the area, it is foreseen to establish a ‘Carriage Station’ to build fish passages at the mentioned dam and HEPP or to ensure that sub populations are not created.

Fish Passages

Although the species detected at the project site are with ecologic tolerance and can well-adapt to the still water system, they have reproduction migration behavior during their reproduction period to the upper parts and/or side branches of the rivers.

When a fish passage is constructed to a hydroelectric power plant, the water entrance (exit to the upstream) should be positioned as away from the bank or turbine, in a manner to prevent drifting of the fish exiting the fish towards the turbine with current.

Alpaslan II Dam has been planned as a skirt type power plant and its height from the foundation has been determined as 116 m. Fish passage implementation is generally not found suitable on technological and economical terms at dams with such height. However, according to the provision at Article 8, Part 4 of the Water Production Regulation no. 22223 of 10.03.1995 of the Ministry of Agriculture and Village Affairs, “While building facilities such as reservoir, pond, sets, etc., it is obligatory to build fish passages, elevators and fish webs”.

In the world, ‘Fish Elevator’ is rarely recommended for this high dams. However, a ‘Carriage System’ is contemplated for the species migrating between the downstream and upstream for reproduction and wintering in the river, considering the dam’s height, land status (slope), the state when migration of fish species from the sea to the river and/or from the river to the sea is not present, and also to ensure that sub populations are not formed.

‘Elevator Type Fish Passage’ deemed fit for Alpaslan II Dam and HEPP project has been prepared by considering the source “Fish Passages: Design, Dimensioning and Monitoring” published by SHW in 2009.

A boat is used as a carriage vehicle at the elevator type fish passage, a discharge hatch that can be opened and closed can be installed on this boat or the boat can be unloaded by inclining. When the boat is at the bottom level, it is buried under the foundation. The fish have to be oriented towards the fish elevator with a guiding current. Furthermore the foldable latched screen hatch placed in from of the elevator aids in directing the fish to the elevator, and then to the carriage boat. The bottom hatch of the elevator closes at regular intervals. The fish collected in the boat cannot go anywhere from here and carried upstream with the elevating boar. A waterproof connection can be made between the boat at the upper water elevation or the boat is emptied directly to the inlet mouth upstream. The water and fish in the boat reach the top channel and from here, there again needs to be an orienting stream. The operation mechanism of the elevator is determined according to the migration periods and this system is generally operated automatically (SHW, 2009). An overall evaluation of the fish elevators is provided below:

- Very less space is required and excess height in very high dams can be easily overcome with fish elevators.
- Since the fish are carried passively to the upstream, the fish elevators are very suitable for both the big fish and the species with weak swimming performance.

- The fish elevators are not suitable for the upstream migration of the invertebrates.
- The maintenance expenses and construction cost of the fish elevators are very high.

The schematic structure and operation principle of the fish elevator is provided at Figure V.18. Figure V.19' shows a sample fish elevator built in France.

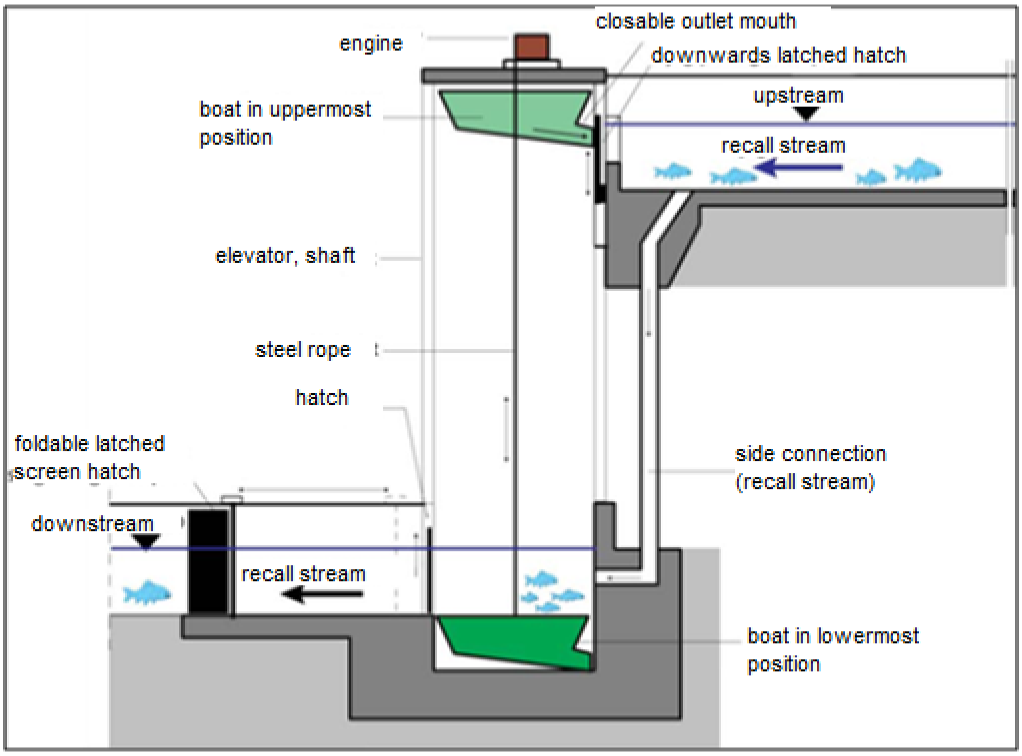

Figure V.18. Schematic Structure of the Fish Elevator

Figure V.19. Tuilieres Fish Elevator, France

When it is considered that there is no reproduction aimed fish species in the area between the sea and the river and/or the river and the sea and the problem created by the fish passages with a height above 100 meters, at a “Transport Station” to be installed at the downstream part of the dam, the fish species downstream shall be caught at certain periods and carried upstream. Thereby, the formation of sub populations will be avoided and the species migrating to the upper zones of the rivers for reproduction shall be carried upstream. The fish catching and transport system to be installed in the scope of the project shall be realized by selecting one of the below two methods:

- By considering the migration period of the fish, this is simple and manual system where the fish will be caught by professional fishermen with proper methods (catching the fish by creating a barrier with nets on the migration route of the fish), placed inside an oxygenated container and carried upstream of the dam. A group selected from regional fishermen can be trained concerning the catching and transport of the fish without killing.
- A boat is used at the dam downstream as a transport vehicle similar to a fish elevator. At the migration time of the fish, the fish transported to this boat or oxygenated containers can be carried to the dam upstream, a waterproof connection can be made between the boat and the upper water elevation or the boat can be discharged to the inlet mouth at the upstream.

V.2.17. Other Properties

There are no other issues to be addressed in this section.

V.3. The Impacts of the Project on the Socio-Economic Environment

V.3.1. The Income Rise Expected with the Project; the Employment Opportunities to be Created, Population Movements, Migrations, Education, Health, Culture, Other Social and Technical Infrastructural Services and the Changes in the Benefiting Status from these Services, etc.

The possible socioeconomic impacts of the project at the construction and operation phases have been determined depending on the activity and socioeconomic studies in the framework of the properties of the project site and surrounding and the information on similar investments formerly undertaken. The benefits and costs to arise from the activity are also included to the mentioned potential impacts. Every kind of possible benefits and costs are time- and place-dependent and the impact groups can be perceived in different forms depending on age, financial status, gender or ethnic origin.

With the realization of Alpaslan II Dam, contribution shall be provided both to the regional economy and the national economy. Especially thanks to the employment opportunities to be provided to the Villages within the impact area of the project during the project’s course, it is expected to provide a solution to the unemployment problem in the region and also to provide an improvement in the local community’s economy. It is also evident that contribution will be made to the national economy due to the fact that the project is an energy project in its nature.

As a result of the socioeconomic site study conducted at the region, it was found out that the region gives out seasonal emigration[1] and it is foreseen that emigration movements for employment opportunities will decrease with the employment to be provided with this project. It should be mentioned that the seasonal emigrants of the region work at construction works in big cities, therefore it is considered that many personnel experienced in the construction field can be employed at the construction phase.

The activities to be realized by Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S. during the construction and operation phases of the planned Alpaslan II Dam shall contribute to the resolution of the infrastructural problems of the region such as education, health and roads. The improvement of the roads during the construction phase of the project can also cause a betterment in the transportation means of the region. During the course of the project, necessary actions shall be taken in providing a solution to the visible education problems in the region, meeting the needs of the schools and students, ensuring that education can be realized in the most optimum conditions and thereby supporting the economic and social improvement of the local community. With the realization of the project, among the Village roads located within the Village roads network of Mus Provincial Private Administration and that will be inundated by the reservoir (Ozenc, Kusluk, Kayalıkale, between Aligedik–Asagifindikli, Ulusirt, Kayalik, up to Asagihacibey–Yukarihacibey road separation and the road of Kom Field) the roads that have a connection to the province roads shall be connected to the province road from the optimum route after the re-building of the province road, and the ones that do not have a connection shall be reopened as per the optimum route. When the drinking water or sewerage lines of the Villages near the dam are inundated, the mentioned drinking water and sewerage lines shall be made operative again to prevent any negativities to be experienced.

Concerning the impacts of the project on the socioeconomic environment, it will be fundamental to ensure the continuity of the two-way communication between the project owner and the local community and to display a sensitive attitude during this process. With a healthy and continual improvement of this communication, it will be possible to keep the public informed concerning the developments in the project and the existing concerns and expectations of the public can be known and met.

V.3.2. Environmental Cost Benefit Analysis

As explained in detail at Chapter III.3, when the project is considered in terms of income/expense ratio and in terms of internal profitability, it has been determined that Alpaslan II Dam and HEPP Project is an economically feasible project. The cost benefit analysis results of the Project from an environmental perspective is provided at Table V.51.

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[1] As a result of the socio-economic site study conducted at the Villages located within the project impact area, it has been learned that the local community would migrate to big cities like Izmir, Istanbul and Bursa to work at construction jobs.

Table V.51. The Environmental Cost Benefit Analysis of the Project

Impacts	Construction Phase	Operation Phase
Annual 733.80 GWh power generation	-	+
Environmentally clean production as compared to the other power generation methods	-	+
Selection of the workers from the regional community, providing employment opportunities to the personnel employed from the region, meeting the needs of the personnel from out of town via local means, thereby contributing to the local economy	+	+
Flood Prevention	-	+
Agricultural Irrigation	-	+
Residential areas, agricultural fields and grasslands inundated	-	-
Treatment of residential type wastewaters	+	+
Disposal of the residential type solid wastes at the storage site of the Municipality	+	+
The rehabilitation of the roads to be used at the construction phase	+	+
Impacts on the aquatic ecosystem	-	-
Discomfort caused at the regional community at the construction phase due to the dust and noise caused with the increasing traffic	-	-

- : No environmental benefit
+ :There is an environmental benefit

As stated at the former sections, besides flood protection benefit, an annual energy of 733.80 GWh shall be generated at Alpaslan II Dam and HEPP Project, the water requirement of 68,060 ha area at the Mus Plain requiring irrigation will be met. Again, the project will provide job opportunity for about 1,126 persons, thereby providing an economic development in the region.

V.3.3. Evaluation of the Social Impacts Depending on the Realization of the Project

In the scope of the site study conducted for Alpaslan II Dam and HEPP Project, meetings were held with the mukhtars of the Villages located in the impact area of the project and information was obtained during these meetings regarding the knowledge level and expectations of the local community regarding the project impacts. This section provides an evaluation of the questions asked at the questionnaire regarding this topic.

During the meetings, first of all, it was talked about the expectations of the community from the project. It has been observed that the Villages located in the impact area displayed a negative attitude towards the project, however, this was mostly caused by the concerns due to the former experiences at Alpaslan I Dam and HEPP Project realized before in the region. Although the regional community is not against the project in the overall, they request suitable compensation during the expropriation process and just treatment in the determination of the land worth. The first expectation from the project is using the Village residents located in the impact area while meeting the employment requirement to emerge at the construction phase of the project and thereby providing a solution to the unemployment problem in the region. Support is also expected during the project regarding the deficiencies of the Villages in terms of infrastructure (schools, computer equipped Village rooms, health clinics, roads, sewerage, etc.)

Certain questions were asked in the questionnaire (question sheet) to determine the groups that will be positively and negatively affected from the project. Accordingly, it was determined that the local community would be affected in all of the interviewed

Villages. The groups/persons considered to be positively affected from the project are the ones that live in other provinces but have lands in the region and therefore be subject to expropriation. Other than that, only one of the Village headmen talked indicated that Mus Plain would become more productive and usable as a result of the Project and that the persons to benefit from the project would the ones to use the Mus Plain after the project.

The persons being affected from the project and that will receive the land price after expropriation need to be provided a support in helping them to decide how they can use the money. The local community mostly lives on agriculture and stockbreeding and has no knowledge, experience or occupational ability on another income-generating economic activity other than the two mentioned. In this scope it has been requested to propose alternatives to these people as economic activities or provide occupational training courses.

At the public participation meeting held on 08.08.2011, the most intensely discussed subject was the expropriation prices. It has been requested for the expropriation values to be determined separately for each land type and that the value determination should conform to the real market values.

The studies commenced by SHW first in 1967 for Alpaslan II Project , has been revised with the changing conditions at different times and finally, the Revised Feasibility Report prepared by Alpaslan II Enerji Uretim and Madencilik San. Tic. A.S. has been submitted to SHW and the submitted Revised Feasibility Report was found appropriate with the 24.05.2011 dated letter of SHW no. 183825. Since the project has a long history and the public is aware of this process, the community has lost its trust towards the realization of the project.

It has been seen that the local community obtained its information on the project, not through official channel, but from the television, newspapers or the nearby Villages. In only one of the interviewed Villages, information was obtained through a letter coming to the headmen’s office related to land appreciation. In order to minimize the concerns and ambiguities of the regional community on the project, continuous information shall be provided to the Villages located in the impact area. This situation shall be beneficial both in terms of decreasing the possible problems that can be encountered in the future phases of the project and to establish a more healthy relationship between the regional community and the Project owner.

CHAPTER VI

POTENTIAL AND RESIDUAL IMPACTS AFTER OPERATION PHASE AND MITIGATION MEASURES TO BE TAKEN

CHAPTER VI. POTENTIAL AND RESIDUAL IMPACTS AFTER OPERATION PHASE AND MITIGATION MEASURES TO BE TAKEN

VI.1. Land Reclamation and Reclamation Studies

Alpaslan II Project will be operated by Alpaslan II Enerji Uretim A.S. according to the Production License agreement signed with EMRA. The operation phase for the Alpaslan II Dam and HEPP is planned to be 50 years. Alpaslan II Dam reservoir area is anticipated to be filled with sediment and there is not any satisfactory mitigation measure to eliminate this adverse effect that will occur after dam construction. Availability of equipment through economic life of the plant will be provided by means of continuous maintenance. When electromechanical equipments complete their economic life, they will be renewed in accordance with the technology of period and continuous operation of the plant will be provided.

After the construction period, land reclamation will be carried out in the area where temporary structures such as construction buildings were located. These buildings will be dismantled and the area will be rehabilitated. The required soil for landscaping will be provided with topsoil generated during excavation activities, which will be stored in appropriate conditions.

Concrete plant and crushing-screening washing facilities will only be used during the construction phase, therefore these plants will be dismantled and removed with the completion of the construction studies.

VI.2. Impacts on Existing Water Resources

Alpaslan II Dam will be established on Murat River, and constructed for purposes of energy production, irrigation and flood control. Dam and HEPP Units do not create pollution in terms of the operating system. Therefore, any impact of Dam and HEPP on water resources is not anticipated after closure period of the plants.

Within the scope of the project there will not be any domestic and industrial wastes reaching the reservoir and nearby streams. In addition, no wastewater generation or discharge after closure period would occur.

As it explained in related sections, in operation phase, minimum water level will be provided in order to protect habitats of aquatic organisms during the filling of the reservoir. Any adverse impact on aquatic ecosystem would not be expected as a result of the operations after completion of operation phase.

CHAPTER VII

ALTERNATIVES OF PROJECT

CHAPTER VII. ALTERNATIVES OF PROJECT

(In this chaper site selection, technology, actions that will be taken, comparison of alternatives and order of preference will be studied)

The construction of Alpaslan II DAM, HEPP, Material Borrow Areas, Crushing-Screening-Washing Facilities, Concrete Plants, Relocation Road Project (Alpaslan II Dam and HEPP Project) is planned to be realized by Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S. Project will be located on Murat River which is sub-basin of Firat River Basin in Mus province, at 1,265.00 m thalweg elevation of this river and approximately 34.00 km away from Mus city center.

As a result of Alpaslan II Project studies which was started in 1967 by "*General Directorate of the State Hydraulic Works the Directorate of Firat Planning"* and revised according to the developing and changing conditions, *"Mus Alpaslan II Project Planning Report"* was prepared in September, 1994. In the scope of this report, the aim of the Project was estimated as "Irrigation, Power Generation and Flood Control and Prevention".

In this chapter, for Alpaslan II Dam and HEPP Project, three alternatives were studied under three main topics:

- Alternative Projects
- Alternative Project Locations
- No Action Alternative

Alternative Projects

In this chapter, environmental impacts of other energy systems and thermal power plant as an alternative to Alpaslan II Dam and HEPP Project were studied.

Water power is a primary source of energy since it is;

- a renewable source of energy as a result of hydrological cycle rotated by one third of the solar energy that reaches the earth,
- a clean source of energy in terms of preventing environmental pollution,
- and a substantial source for Turkey with a special place in meeting the demand for electrical energy

Dam and hydroelectric plant investment cost is high, however; using investment through long years is an economic advantage. Hydropower is important ecologically in terms of less environmental pollutions, when it is compared with the fossil fuel.

A comparison made at the Energy Report that was prepared by Union of Chambers of Turkish Engineers and Architects (UCTEA) in 2006, is given at Table VII.1. As it can be seen from the table, solar energy, wind energy and hydraulic power have negligible or limited environmental effects when they are compared with the primary energy sources.

Table VII.1. The Comparison of the Energy Generation Systems in the aspect of Their Environmental Impacts

	Climate Change	Acid Rain	Water Pollution	Soil Pollution	Noise	Radiation
Petroleum	√	√	√	√	√	-
Coal	√	√	√	√	√	√
Natural gas	√	√	√	-	√	-
Nuclear	-	-	√	√	-	√
Hydraulic	√	-	-	-	-	-
Wind	-	-	-	-	√	-
Solar	-	-	-	-	-	-
Geothermal	-	-	√	√	-	-

Hydroelectric has been confirmed as renewable energy technology in World Summit on Sustainable Development - United Nations. As a result of this decision, hydroelectric energy and dams acquire much more importance.

When environmental impacts of a power plant which is an alternative to Alpaslan II Dam and Hydroelectric Power Plant are investigated, potential environmental impact of these two projects is compared in Table VII.2. As it can be seen in the table, some environmental impacts (like impacts of air emission, impacts of cooling systems to the aquatic systems, etc.) which are present in thermal power plant projects (but not in HEPP Projects) draw the attention. Also, operating costs of power plant is much more than the hydroelectric power plants due to their process. In addition to this, fuel costs of power plants and operation costs of flue gas purification facilities should be considered.

Table VII.2. Comparison of the Main Potential Environmental Impacts of Alternative Power Plant and Alpaslan II Project

Probable Adverse Impacts	Thermal Power Plant	Alpaslan II Hydroelectric Power Plant
Impacts of air emissions on the environment	Yes	No
Noise and vibration	Yes	Yes [1]
Impacts on surface and groundwater quality	Yes	No [2]
Toxic effects of chemical discharges and spills	Yes	No
Thermal shock to aquatic organisms	Yes	No
Change in surface water flow and discharge	Yes	Yes
Impacts on traffic	Yes	No
Worker exposure to dust from ash and coal	Yes	No
Worker exposure to toxic gases leaking from boilers	Yes	No
Worker exposure to excessive noise during operation	Yes	No
Impacts generated due to power transmission lines	Yes	Yes
Loss of soil	No	Yes [3]
Loss of habitat	No [4]	Yes [3]
Sedimentation of reservoir and loss of storage capacity	No	Yes [5]
Loss of vegetation	Yes [6]	Yes [3]
Impacts on aquatic life	Yes	Yes

1 Only in construction phase.
2 Minor impacts on downstream river water.
3 In a limited area due to the scale of Aplaslan II Dam Project.
4 Except indirect effects because of air emissions and water discharge
5 Sedimentation will not cause any problem in Alpaslan II Dam economic life.
6 Relatively minor loss when compared with hydroelectric projects with large reservoirs

Alternative Project Locations

In line with the principles of the planning report, Alpaslan II Dam and HEPP project was prepared and it was approved by General Directorate of State Hydraulic Works (SHW). However, with changing conditions and within the framework of research, inspection and evaluations about the project, it has been concluded that Alpaslan II Dam and energy facilities are required to be revised in terms of location and size. These studies have been carried out in order to realize the project under more appropriate conditions and improve its economic feasibility. As a result, the proposed location of the Alpaslan II dam axis in the Planning Report of September, 1994 has been decided to be located at the downstream. Also, it has been determined that it would be more favorable to increase the installed capacity of the project in terms of its feasibility.

The first researches about Alpaslan II Project was started in 1982 by General Directorate of the State Hydraulic Works (SHW) and three different axis which named Zorova, Arincik and Mercimekkale (respectively from upstream to downstream) was investigated for dam construction. Mercimekkale axis was found infeasible due to the social reasons and length of the dam axis, while Zorova was found infeasible due to the landslip that has occurred at the right bank of the downstream. Detailed studies were also carried out at Arincik axis and Feasibility Report was prepared in September, 1994, Final Project was designed by Alpaslan II Consortium in 2004.

Drawbacks about geology of Arincik axis was expressed in Alpaslan II Dam and HEPP Project Geology and Equipment Report which was prepared for Alpaslan II Dam location. For this reason, in April, 2009, a technical visit have been arranged to the current axis (which was investigated before by General Directorate of SHW) and to Zorova axis which is located approximately 4.00 km away from current axis and the reports were revised accordingly.

In Zorova axis, it is reported that there is not a major problem except the upstream landslide and a detailed geological survey would be appropriate in this axis which is closer to material areas. Therefore, basic research and pre-project studies was started in October, 2009.

In Zorova axis, within the scope of geological studies, which were carried out in October 2009 - February 2010, total depth of 1,116 m., 19 bore holes were drilled and laboratory experiments were conducted on core samples which taken from wells. As a result of these studies, “Zorova Axis Geotechnical Survey Report” was prepared, and the feasibility of the dam at this axis was proved technically.

No Action Alternative

When the no action alternative is considered, it can be said that this alternative is generally not preferred for energy production projects, which generate public benefits to the country. When the no-action alternative is considered, the following consequences may take place:

- The energy demand of the country increases continually. For this reason, thermal and nuclear power plants will be considered as alternative of hydroelectric power plants. These alternatives would be less economic, have other adverse impacts on the environment, and are not as sustainable as using a renewable source for energy production.

- From a broader perspective, failure to make full use of the available low cost and peaking hydropower energy sources may ultimately limit social and economic development in the country.
- Problems which could occur in construction and operation phases will be prevented.
- In case of Alpaslan II Dam Project would not be implemented, 878.11 GWh energy and 280 MW installed power which acquisition is targeted will not be realized.
- Employment opportunities for 1,126 people in construction and operation phase would not be provided and expected improvement in the economy of the region, especially starting with the construction phase, would not be realized.
- Flood protection that would be supplied with the implementation of the project will not be realized for Mus Plain. Thousands of decare of cultivated area and houses would be flooded and financial damage might occur.
- Irrigation from the Alpaslan II Dam will not be implemented. That will cause inefficient use of agricultural areas.

CHAPTER VIII

MONITORING PROGRAM

CHAPTER VIII. MONITORING PROGRAM

VIII.1. Proposed Monitoring Program for Construction of Facility, Proposed Monitoring Program for Operation and Post-Operation of Facility and Emergency Action Program

Monitoring program is implemented in order to control studies which will be carried out in construction or operating phases, whether they reached their targets or not. In this regard, monitoring activities provide some information about changes in the environmental conditions, the actual level of impacts that are previously estimated, adaptation for developed measures and impact minimizing success of these measures.

Monitoring activities provide the followings,

a) Technical and specific definitions, measurement methods, sampling points, measurement frequencies, threshold determinations which are needed as an indicator to perform the correct actions (status that indicate requiring corrective actions) including measurement parameters

b) Monitoring plan and their reporting procedures provide information; i) to determine the situations that require specific precautions as soon as possible ii) the results and development of these precautions

In this section, the monitoring activities to be performed during all phases are described in table format. The monitoring plan (which is given in Table VII.2) includes the followings;

- In which phase of the project, monitoring actions will be implemented
- Parameters that will be measured
- The relevant impact type and mitigation precautions (why parameters are measured)
- Measurement locations and frequencies (where, when and how often the parameters measured),
- Methods that will used (how parameters are measured),
- Monitoring cost (Total monitoring cost is included in the project budget),
- Agency responsible from monitoring

While impact assessment attempts to encompass all relevant potential impacts to identify their significance and include appropriate measures for these impacts, still unanticipated impacts may arise, which can be managed or mitigated before they become a problem using the information obtained through monitoring.

Emergency Action Plan

Emergency Action Plan is intended to minimize the unexpected risks and damage which will occur in construction and operation phases of the project. Also, in emergency action plans responsibility of labor and necessary studies in case of possible accidents is defined.

An outline emergency action plan has been prepared for unexpected emergency situations which will occur in construction and operation phases of the project. According to this plan, Rapid Response Team will be constituted; authority and responsibility of team and procedures which will be implemented in emergency case will be determined by

Rapid Response Planning Coordinator. Rapid Response Plan which is given in App-22, will be developed and reviewed by Rapid Response Planning Coordinator and Team.

VIII.2. Program related with implementation of subjects, that will be implemented in the event of EIA positive decision is made, indicated in second paragraph of Communiqué on Competency Certificate under the heading of "Provisions of Institutions which has obtained Competency Certificate"

Within the scope of Communiqué on Competency Certificate dated December 18, 2009, following the EIA positive decision, commitments indicated in EIA with regard to operation and construction periods will be verified by the institution, which has certificate of competency and entitled by the Project owner, filling the "Final EIA Report Monitoring Report Forms given in App-4 of Communiqué on Competency Certificate" and delivering to Ministry in line with the monitoring periods to be identified by Ministry of Environment and Urbanization.

Table VIII.1. Monitoring Plan

PHASE	**What** parameter is to be monitored?	**Where** is the parameter to be monitored?	**How** is the parameter to be monitored/ type of monitoring equipment?	**When** is the parameter to be monitored- frequency of measurement or continuous?	**Why** is the parameter to be monitored?	**Source of Funding**	**Institutional Responsibility**
CONSTRUCTION PHASE	On-Site Erosion and Runoff	Construction sites, equipment sites	Visual observation	Daily	To reduce the risk of erosion and control the erosion interception construction To reduce the risk of sedimentation in river bed	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S.
	Proper storage and utilization of topsoil and excavation materials	Construction sites and storage areas	Visual observation Recording	Daily	Meeting the environmental Health and safety conditions To control the effectiveness of the relevant mitigation measures and ensure landscaping and formation of natural habitats Protection of natural properties of soil Excavation Soil, Construction and Demolition Waste Control Regulation	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S..
	Air Quality	Settlements near the construction area, transportation, concrete plant, crushing-screening plant and Storage area	Dust sampler or dust measurement By institutions accredited by Ministry of Environment and Urban Planning	Once in 3 Months In case of complaint	To ensure compliance with Health Protection of Environment and Employees, Regulations of Air Quality Assessment and Management, Industrial Air Pollution Control and Occupational Health and Safety Management	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S. Ministry of Environment and Urban Planning of Mus
	Air Quality	Trucks and machinery exhausts	Inspection with exhaust measurement devices	Annually	To ensure compliance with Regulations of Exhaust Gas Emissions Control and Air Quality Protection	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S..
	Aquatic Ecosystem	Pre-determined points on Murat River and Bingol Stream	Visual observation Sampling	Biannual	To ensure protection continuity of Aquatic Ecosystem	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S..

Table VIII.1. Monitoring Plan (continued)

PHASE	**What** parameter is to be monitored?	**Where** is the parameter to be monitored?	**How** is the parameter to be monitored/ type of monitoring equipment?	**When** is the parameter to be monitored- frequency of measurement or continuous?	**Why** is the parameter to be monitored?	**Source of Funding**	**Institutional Responsibility**
CONSTRUCTION PHASE	Noise	Settlements near the construction area, truck route, material borrow area and blasting area	Measuring noise levels via portable sound level meters	Once in 3 months In case of complaint	To ensure compliance with Regulations of Environmental Noise Assessment and Management and Occupational Health and Safety Management	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S. Ministry of Environment and Urban Planning of Mus
	Vibration	Settlements near the blasting area	Measuring noise levels via portable vibration level meters	During the first blasting to be carried out in each blasting area In case of complaint	To ensure occupational health and safety, To reduce the risk of blasting and keep it under control, To ensure compliance with Regulations of Vibration and Environmental Noise Assessment	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S. Ministry of Environment and Urban Planning of Mus
	Physical, chemical and biological (treated waste water before discharged) water quality parameters	Discharge water of domestic wastewater treatment facility and wastewater generated in material borrow areas In case of an accident, as a result of spilling waste oil, paint etc. to surface water and groundwater	Analysis will be done by laboratories accredited by Ministry of Environment and Urban Planning	Once in a mount for Discharge water as a result of biological treatment (domestic discharge), Once in 3 months for discharge water as a result of physical and chemical treatment (concrete discharge) When an accident such as spill and leakage is reported	To ensure compliance with Water Pollution Control Regulations	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S. Ministry of Environment and Urban Planning of Mus
	Water Quality	At predetermined points before the union of Murat River and Bingol Stream, Near dam axis	Analysis will be done by laboratories accredited by Ministry of Environment and Urban Planning	Once in 3 months	To determine construction facilities impact to current water quality According to Water Pollution Control Regulations Table 1, determination of water quality classification (Basic Pollution Parameters selected from Table 1)	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S..

Table VIII.1. Monitoring Plan (continued)

PHASE	**What** parameter is to be monitored?	**Where** is the parameter to be monitored?	**How** is the parameter to be monitored/ type of monitoring equipment?	**When** is the parameter to be monitored- frequency of measurement or continuous?	**Why** is the parameter to be monitored?	**Source of Funding**	**Institutional Responsibility**
CONSTRUCTION PHASE	Domestic solid waste, packaging waste and hazardous Wastes (paint, waste oil) from project	Construction Site	Visual observation Recording Reporting	Daily/Once in 2 days	To ensure compliance with Regulations of Solid Waste Control, Packaging Waste Control and Waste Oil Control	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S. Related municipal
	Chance finds of Cultural and Historical Assets	Project area	Visual observation	In case of chance find of Cultural and historical assets	With the aim of protection of cultural properties To comply with Code of Protection of Cultural and Natural Properties	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S. Ministry of Provincial Culture and Tourism of Mus
	Health and safety, personal protective equipment use, use of warning sign in construction site	All construction sites	Observation, inspection and reporting	Daily	To ensure compliance with Labour Legislation and Regulations	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S.. Mus Province Directorate of Health
	Maintenance and examination of fire equipment, Maintenance and periodic control of emergency equipment and emergency action equipment	Locations where emergency response and first aid equipments exist	Periodic controls by supplier for necessary equipment and materials	Once in 6 months	To reduce the risks related to emergency situation To ensure compliance with Emergency Action Plan	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S.

Table VIII.1. Monitoring Plan (continued)

PHASE	**What** parameter is to be monitored?	**Where** is the parameter to be monitored?	**How** is the parameter to be monitored/ type of monitoring equipment?	**When** is the parameter to be monitored- frequency of measurement or continuous?	**Why** is the parameter to be monitored?	**Source of Funding**	**Institutional Responsibility**
OPERATION PHASE	Reservoir Sedimentation Erosion	Planting areas which are made for soil conservation and physical measures Coastal areas where reservoir water level changes could be observed which do not contain vegetation	Visual observation	Once in 3 months Monthly in heavy rain period	With the aim of soil conservation and water quality conservation	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S.
	Domestic solid waste, packaging waste and hazardous wastes (paint, waste oil) from project	HEPP Building	Visual observation Recording	Weekly	To ensure compliance with Regulations of Solid Waste Control, Packaging Waste Control and Waste Oil Control	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S.
	Health and Safety	All work places	Observation, inspection and reporting	Monthly	To ensure compliance with Labour Legislation and Regulations	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S.
	Minimum flow (sap)	Reservoir exit	Flow meter Recording	Continuous	To control the minimum flow rate which is committed	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S. General Directorate for State Hydraulic Works Ministry of Environment and Urban Planning
	Water Quality (Temperature, DO, pH etc...)	Reservoir exit	Analysis will be done by laboratories accredited by Ministry of Environment and Urban Planning	Once in 6 months	With the aim of water quality conservation and to comply with Water Pollution Control Regulations	Project Budget	Alpaslan II Enerji Uretim ve Madencilik San. Tic. A.S.

CHAPTER IX

PUBLIC PARTICIPATION

CHAPTER IX. PUBLIC PARTICIPATION

(How and in Which Way the Local People Likely to be Affected by the Project Were Informed, Opinions of People about the Project and Explanations Reflected to EIA Report)

Studies that were carried out before Public Participation Meeting, within the scope of EIA Regulations, on August 8, 2011, interviews and surveys with local people about these meetings and the results of these meetings are evaluated in following titles.

IX.1. Introducing the Local People that Likely to be Affected by the Project

Within the scope of Alpaslan II Dam and HEPP Project, total of 225 households will be inundated by the reservoir area; 25 households of Gocmenler (Muhacir Zorova) Quarter which is located on the left shore of Murat River, 45 households of Tepekoy Village, 15 households of Dogdap Quarter, 50 households of Bagici (Carbuhur) Quarter, 50 households of Asagi Hinzir Quarter of Kayalidere Village, on the right shore 25 households of Sanlica Village and 15 households of Aligedik Village.

Dumlusu Village, Akpinar Village and Akkonak Quarter are the settlements that will be partially effected by construction facilities and material borrow areas.

Also, a military zone in Dogdap Peak Area which is located between Tepekoy and Dogdap Quarters, will be inundated.

Settlements near reservoir area and construction equipment supply areas will directly be affected from the project. These are, Dogdap Quarter, Kayalidere Village, Akkonak Quarter, Dumlusu Village, Akpinar Village and Kusluk Village.

Detailed information about socio-economic status of local people is given in Section IV.3. In order to determine the project impacts on local people and socio-economic characteristics, interviews with related parties will be done and correspondences and opinions of local and central public enterprise will be received. Census data for current situation of Mus province where the project located, is presented in Section V.3.

IX.2. Recommended Methods for the Participation of Public in the EIA Study

Project studies were carried out in compliance with Environmental Impact Assessment Regulation which put into force by its publication in the Official Gazette No. 26939 on July 17, 2008. For planning and conducting of public participation and information studies, internationally accepted standards also taken into consideration.

EIA Application File which is prepared within EIA Regulation was presented to Ministry of Environment and Urbanization on June 13, 2011 and it was determined by the Ministry that the report is in line with determined format. “Scoping and Review Assessment Commission” is formed by Ministry in order to define scope and criteria of format which is specified privately for the Project and to evaluate and analyze the EIA Report. Ministry is requested to duplicate the EIA Application File dated June 17, 2011 and final report was presented to the ministry on June 27, 2011. Ministry determined the dates of “Public Participating Meeting of EIA Process” and “Informing, Scope and Special Format Determination Meeting” was notified in written to relevant institutions and organizations. Date of public participation meeting and EIA Application File was released to public in Ministry of Environment and Urbanization website.

Meeting place, date and scope information was publicized putting advertisements on the newspaper (Mus'un Sesi Gazette, July 26, 2011 in local and Star Gazette, July 26, 2011 in country-wide). Getting in contact with relevant headmen, municipalities, district governorship and governorship, was ensured participation with a large number of interested people. All village headmen were informed about the meeting and their participation to meeting with village residents were expected. Proceedings about public participation meeting are given in App-24. Village headmen publicized the information about meeting place and time via voice announcement and posting announcement text in visible places in the village. A brochure which includes characteristics and possible environmental impacts of the project and necessary measures to be taken was prepared and distributed to participants.

Within this scope, due to the 9th article of the regulation, a Public Participation Meeting was arranged on a date determined by the Ministry of Environment and Forestry for informing the public about the Project and to receive their opinions and suggestions regarding the Project. It was carried out under the presidency of Provincial Directorate of Environment and Urbanization of Mus, in Mus province Varto County, Koprubasi Facilities. 78 participant attended the meeting. Detailed list of participants and meeting records is given in App-24. Photographs from the meeting are presented in Figures IX.1-IX.4.

Fıgure IX.1. Public Participation Meeting Photographs - 1

Within EIA studies, another part of the public participation is “Socio-economic Field Surveys” which realized between June 6-8, 2011. In this study, data collected from the headmen of affected villages, were used to assess the socio-economic characteristics of affected settlements.

IX.3. Concern, Opinion and Suggestion of the Local People about the Project and Relevant Evaluation

As it mentioned in Section IX.2, for more information about the public concern, opinion and suggestion, before the scope determination meeting, villages which are likely to be affected were visited between June 6-8, 2011. The purposes of these visits were to meet village headmen and local people in order to collect information about socio-economic structure of the village, to give general information about the Project and receive opinion and suggestions of local people.

Although there are some concerns about the project, it is observed that they have positive attitude towards the Project. It is learned from the headmen that general concern of the participants about the project was expropriation areas during the Project activities more than the impacts of the project on the environment. During the public participation meeting, some information about expropriation studies, what measures will be taken in order to eliminate or minimize the adverse impacts. Detailed list of participants and meeting records is given in App-24.

Basically the questions and concerns of the participants about the Project can be summarized as below;

- In which areas the expropriation studies will be realized?
- What is the price that will be paid to expropriated areas?
- Is it the same price that will be paid to the all expropriated areas?
- How will the problems of pastures be solved?

During the meeting, simple/lean language was selected in response to the concerns of local people. After the meeting, it is considered that local people’s concern about the Project was substantially resolved. Especially, it is mentioned that, all necessary actions will be taken for the local people during the expropriation procedure. In addition, during the employment of workers in dam construction, priority will be given to the local people.

Meeting which was conducted in a friendly atmosphere, has been successful for the local people to understand the project and to eliminate the question marks. Suggestions made by local people were evaluated in EIA Report.

Figure IX.2. Public Participation Meeting Photographs - 2

Figure IX.3. Public Participation Meeting Photographs - 3

Figure IX.4. Public Participation Meeting Photographs - 4

V.4. Consulted Stakeholders and Their Opinion and Suggestions and Evaluations about the Subject

Opinions of relevant stakeholders were taken into consideration within the EIA process. Opinions of these institutions play an important role in EIA studies. Within the scope of the Project EIA studies, consulted institutions are listed below:

- General Directorate of Forestry,
- Ministry of Culture and Tourism,
- General Directorate of State Hydraulic Works,
- Mus Municipality,

Opinions of the institutions which is mentioned above is stated various chapters of the report and given in Appendices.

CHAPTER X

NON TECHNICAL SUMMARY OF THE INFORMATION PROVIDED UNDER THE ABOVE GIVEN HEADINGS

CHAPTER X. NON TECHNICAL SUMMARY OF THE INFORMATION PROVIDED UNDER THE ABOVE GIVEN HEADINGS

(All studies that planned to be carried out in construction and operation phases, all measures against the environmental impacts was elementally and popularized explicated with non-technical words)

Alpaslan II Dam and HEPP Project which is planned to be constructed by Alpaslan II Enerji Üretim Madencilik San. Tic. A.S., was designed on the Murat River which is sub-basin of Firat River Basin in Mus and approximately 34.00 km away from Mus city center.

Alpaslan II HEPP, within the scope of Alpaslan II Dam and HEPP Project, will be established with the gross head of 98.00 m and with the project flow of 344.00 m^3/s. With a total capacity of 280.00 MW, for the current situation, annually 862.26 GWh will be generated as 606.35 GWh of it is firm. For the future situation, annually 733.80 GWh will be generated as 511.46 GWh of it is firm. At the same time, irrigaiton of Mus Plain will be provided with this project. In Alpaslan II HEPP, as part of Alpaslan II Dam an HEPP Project, with 98.00 m maximum gross head and 344.00 m^3/s

In Alpaslan II Dam and HEPP Project Dam axis precipitation Area of Murat River is 17,505.00 km^2. Quite a few project which was planned to improve by General Directorate of SHW located in this basin. Some of these projects are in planning level or under construction or some parts get to the business level. However, Alparslan I Dam and HEPP Project which is the largest of them and planned for power generation and flood control, is located at upstream of Alparslan II Dam and HEPP Project and it was opened for operation.

During the operation studies, it is seen that the distribution pattern of the turbined water regulated at the dam will be sufficient for providing the water requirement of Mus Plain.

The project area is located on Murat River, route of Mus-Varto-Erzurum State Road which is used to reach the dam axis. The road is covered with asphalt and open to traffic every season.

Dam was designed impermeable core rock fill type.

Mus-Varto State Highway and Mus-Varto junction Karaagil Provincial Road pass through the reservoir. With the realization of the project, these roads have to be relocated. In this context, as a result of these studies, permission about route and details have been received from General Directorate of Highways (GDH) regarding the 3.5 km of road. Works regarding the rest of the road are still on progress. The road which will be relocated will be with 4 lanes and 24 m width. 3.5 km section of the road which approved by GDH, will be evaluated in EIA Report with the aim of providing access from right bank to the dam axis. For the remained roads, another EIA Report will be prepared after the GDH approval. Opinion article about subject from 11th District Office of Highways is given in App-2, road route which is planned to be relocated is given in App-1.

As it seen in Table I.2, reservoir area which will be formed at maximum water elevation is 54.69 km^2. The Project area mainly consists of meadow and agricultural areas. Apart from these, small amount of forests and non-cultivated areas are also present.

Total of 225 households will be inundated by the reservoir area; 25 households of Gocmenler (Muhacir Zorova) Quarter which is located on the left shore of Murat River, 45 households of Tepekoy Village, 15 households of Dogdap Quarter, 50 households of Bagici (Carbuhur) Quarter, 50 households of Asagi Hinzir Quarter of Kayalidere Village, on the right shore 25 households of Sanlica Village and 15 households of Aligedik Village. In addition to these inundated households some structures belonging to these households will also be inundated; a barn for each, a shed for each and small mosque belonging to each village, 5 mosques and 4 primary schools with their public housings.

For the private areas expropriated in construction and operation phase of the Project, consensual purchase will be preferred. Procedures for expropriation of the areas which will be inundated and used during the construction and operation phases of the planned project will be realized in accordance with the Expropriation Law No: 2942 and its amendment, Expropriation Law No: 4650, which came into force upon its publication in the Official Gazette dated on May 5, 2001.

Based on the cadastral information, it is determined that 5009,32 ha will be under dam lake and 335,40 ha will be under borrow pits. Expropriating of these private areas in Project field is discussed.

The Project area is located within the "First Degree Earthquake Zone" according to Turkey Earthquake Zones Map prepared by the Ministry of Environment and Urbanization. Alpaslan II Dam site is located near the vicinity of East Anatolian Fault Zone (EAFZ) on the southwest and North Anatolian Fault Zone (NAFZ) on the northwest. These fault zones, which are the biggest fault zones of Anatolia, are known as active fault systems. Dam site is located 50 km away from Karliova, which is junction point of these two fault zones (EAFZ and NAFZ).

These wetlands are not located within the project area. The nearest of these wetlands to the reservoir is Kucuk Hamurpet Lake and Kumlukiyi Lake. The distance between Kucuk Hamurpet Lake and the reservoir is about 8.5 km, and Kumlukiyi Lake is at a distance of about 2 km.

Within scope of Alpaslan II Dam and HEPP Project, in accordance with determination of any cultural heritage are inundated or not, Ministry of Culture and Tourism transmitted the subject to Regional Directorate of Cultural and Natural Heritage of Van with the Official Letter No. 137223 on June 29, 2011 (App-2) relying on the application to General Directorate of Cultural Heritage and Museums.

A letter dated on September 15, 2011 (No: 188765 see Appendix-2) was issued by Ministry of Culture and Tourism of General Directorate of Cultural Heritage and Museums referring to responsive letter of Van Regional Committee Directorate of Cultural and Natural Properties Conservation. The letter states that there is to be inundated cultural heritage within the dam site according to the expert report, therefore studies of inventory and documentation shall be carried out within the framework of principle decision of Supreme Committee of Natural Properties Conversation that is entitled as Conservation of Affected Immovable Cultural Heritage in Dam Site, Additionally a decision made in the letter that a committee shall be established consists of Associated Professor Hanifi Biber, who is one of the members of Archaeology Department of 100. Yil University, and experts from Van Regional Directorate Committee of Cultural Heritage Conversation.

After completion of commission's work, with the letter No. 366 on December 23, 2011 (App-2) of Ministry of Culture and Tourism, Regional Directorate of Cultural and Natural Heritage of Van;

Due to the decision of the Committee dated on December 8, 2011, with regard to Alpaslan Dam and HEPP Project that is located within the border of Central and Varto Districts of Mus Province, Tepekoy Tumulus, Dogdap and Kız Castles (located on Mescitli Village) shall be registered in accordance with the Article 7 of the Law of Cultural and Natural Properties Conservation (No: 2863) and identified as First Degree Archeological Site in order to having the characteristics indentified in the Article 6 of the same Law. Additionally, it is stated that decision is made on "Abdurrahman Pasa Bridge shall be reevaluated by the Archeological and Art Historian Experts of the Committee Directorate that is considered in the report of scientific committee that registration of it is not necessary, the studies of rescue excavations with regard to cultural heritage (to be inundated) and dam construction activities shall be carried out simultaneously, and cultural layer of to be inundated tumulus shall be unearthed and documented".

Excavation activities will be carried out about coffer-dam, dam body, switchyard and derivation constructions within Alpaslan II Dam and HEPP Project. Evaluable excavation materials will be used as concrete aggregate material, exhibition material on roadway and backfill material on construction of units. The rest of the material will be stored in deposit areas. 6 storage areas were planned for the extra excavated material storage. Above mentioned storage areas will inundated by reservoir in concurrence with project operationalized.

During the excavations activity, the top soil layer shall be stripped to prevent the pollution of the top soil and this layer shall be stored such that it shall not lose its productivity. This stripped soil will be used in field studies of landscape restoration and vegetal landscaping of recreation areas. On the other hand, these studies were carried out in compliance with Excavation Soil, Construction and Demolition Waste Control Regulation which put into force by its publication in the Official Gazette No. 25406 on March 18, 2004.

In case tough rock formations are encountered during the preparation of the land and construction of the units, explosion works shall be undertaken. If explosion is conducted, the regional community shall be informed beforehand, no one shall be permitted inside the detonation area. Sirens shall be sounded before detonation to warn the regional community. Explosive substances shall not be stored on site. The amount of the explosives necessary for the daily explosion shall be transported to the site with trucks. Also necessary permissions about exploding material utilization, storage and transport will be received with the application from Governor's Office of Mus.

No bottom sweeping or excavation activity shall be performed at any water body in the scope of the project. However, bed arrangement shall be made to regulate the water flow at the downstream of the power plant. The material extracted from here shall be used in building seawall of the tail race channel. Also, except for General Directorate of SHW knowledge and permissions, there will not be intervened to the stream bed, construction material will not be poured to the stream bed, cross section of bed will not be narrowed down, suitable flow conditions for stream bed will be provided.

For the building of the facilities in the scope of the project, impermeable, permeable and rock filling-purposed material borrow areas shall be opened. 6 units rock, 3 units impervious and 4 units pervious borrow pits are presented within the Project. The permeable and impermeable material borrow areas shall be inundated by the reservoir except for impermeable material borrow area A. Among the rock material borrow areas K-1 shall be completely and K-2 and K-5 shall be partially inundated by the reservoir. All the material borrow areas left outside the reservoir are mostly located on grassland and partially on agricultural land.

Detonation shall be made at the K1, K2, K3, K5, K6A and K6B rock borrow areas in the scope of the project. Production at the mentioned rock borrow areas shall be made via open borrow area operation. Drilling-detonation method shall be employed in production and explosive substance shall be used. For this aim, it is foreseen to utilize capsule, dynamite and ANFO as explosive substances. In the rock material borrow areas, work shall be performed only during day time and in one shift, thus the detonations shall be carried out during the day time. Explosive material will be provided by related company as required. And not be stored in project area.

While evaluating the possible impacts to be created on the air quality due to the activities to be realized in the construction phase of Alpaslan II Dam and HEPP Project, both dust and gas emissions have been examined. Emission values were calculated considering the worst case scenario which is peak period for dust emissions and a modelling study was carried out. According to the modeling study, evaluated values were determined to be below the limit values defined in RCAPSI.

Intensively forested areas are not found in and near the project field. Field is generally covered with pasture area. Forest areas that will be inundated by reservoir area comprised of thin tree populations. Surrounding areas have the same characteristic with the project area. Therefore, it is not expected that chopped trees have a negative impact on forest ecosystem.

Also it is anticipated that during the construction period, most of the terrestrial fauna will leave the area surrounding the construction site to go to similar areas for a temporary duration depending on the intensity of the construction activities. Since the mentioned habitats start right in the vicinity of the construction site and the region display a homogeneous ecosystem structure, the migration shall not be long-ranged.

The main water use in the construction phase of the project shall be for concrete production, washing of concrete aggregate material, preventing of dusting and drinking-utilization water for the workers. The water for concrete power plants, washing of concrete aggregate material and prevention of dusting shall be obtained from Murat River and the side branches that feed the river. The drinking water shall be obtained from canned water whereas utilization water shall be obtained from the residential areas in the vicinity of the worksite. Provided drinking and utilizing water will be checked in terms of their appropriateness of the qualifications that specified in “Regulation Concerning Water Intended for Human Consumption” which put into force by its publication in the Official Gazette No. 25730 on February 17, 2005. Within this scope, water cooler bottle will be purchased from companies that availability is approved by Ministry of Health.

During construction period, domestic wastewater created by staffs will be refined by package treatment system that constituted in worksite. This water will be purified to provide standard values which are stated in “Water Pollution Control Regulation” (WPCR) (Table 21.1) which put into force by its publication in the Official Gazette No. 25687 on December 31, 2004. Necessary permission about package treatment facility will be received.

Solid wastes shall occur during the land preparation, construction of the units and due to the personnel to work at these jobs in the scope of the project. Wastes like mould log wastes, construction iron and iron pipes are recyclable wastes. These wastes shall be collected at suitable regions within the project area and sent out to licensed recycling facilities. Excess concrete materials shall be used as filling material. Some of the excavations wastes shall be used as laying material for the roads to be built/rehabilitated or laid into the gaps from where aggregate was obtained.

The residential type of solid wastes caused by the personnel working at the construction and operation phases of the project shall be retained at the project site inside closed containers suitable for short term retaining and periodically unloaded to the garbage site of Mus Municipality. Domestic solid wastes will be collected and disposed in line with the relevant provisions of “Solid Wastes Control Regulation” (Official Gazette date: March 14, 1991, No: 20814), “Packaging Wastes Control Regulation” (Official Gazette date: June 24, 2007, No: 26562) and Water Pollution Control Regulation (WPCR) (Official Gazette date: December 31, 2004, No: 25687).

The packaging wastes to occur during the construction and operation and the other wastes planned to be disposed shall be collected separately and stored at temporary storage areas within the plan. The place and properties of the temporary storage area shall be according to the provisions stated at the related regulations. Additionally, it is possible for waste oils to occur in the scope of the project. For the waste oils to occur in this phase, disposal shall be realized as per the “Waste Oils Control Regulation” enacted by being published at the Official Gazette no. 26952 on July 30, 2008 and the “Hazardous Wastes Control Regulation” enacted by being published at the Official Gazette no. 25755 on March 14, 2005.

For the vibration and noise to occur at the works starting with land preparation until the units are opened for operation, necessary measurements have been taken at the residential locations within the project site on August 25-26, 2011and Acoustic Report was prepared. It should also be pointed out that due to the fact that the noise level estimations are based on a worst case scenario in which the set of machinery is assumed to operate at the same place and at the same time (that is in fact physically impossible), actual noise level are expected to be much lower.

Dam studies and recovery excavations which will be made for cultural property that remained under dam will be simultaneously conducted by order Regional Directorate of Cultural and Natural Heritage of Van. Required studies will be done within the scope of opinion, suggestion and demand of Ministry of Culture and Tourism and obligations that are specified in its resolution No. 765.

In general, the fish living at the river, brooks and/or streams migrate from the downstream to the upstream at certain periods to reproduce, feed and overwinter. In order not to prevent the reproduction of the fish species present in the area, it is foreseen to establish a ‘Carriage Station’ to build fish passages at the mentioned dam and HEPP or to ensure that sub populations are not created.

In the scope of the project, the downstream sap shall be discharged from the bottom outlet at the first water retaining phase of the dam. The dam shall be constructed as a skirt type power plant and after the water coming from the operation phase of the dam is passed from the turbines, it shall be released to the downstream. However, in cases where water has to be retained at the operation phase, the downstream sap shall be released from the two sap turbines (small turbines) present at the power plant building.

Alpaslan II Dam shall be constructed for energy generation, irrigation and flood protection purposes. Dam and HEPP units are systems that will not create a pollution in terms of operation system. Therefore, they will not pose a pollution threat for the water resources.

The residential wastes to occur due to the personnel to work during the operation phase of the project shall be collected in impermeable septic tanks, taken by sewage pumps and transmitted to the wastewater system of Mus Municipality. Furthermore, there will be no intervention to the river bed outside the information and permit of SHW General Directorate, no material shall be discharged to the river bed, the bed cross section shall not be narrowed and suitable flow conditions shall be provided at the river bed.

During the operation period, required water will be provided from nearest settlements, wastewater will be stored in watertight cesspools and then will be given to wastewater system of Mus Municipality by drawn with vacuum trucks

The solid waste to occur in the operation period shall be residential type and caused by the personnel to work at the operation phase. These wastes shall be collected in suitable containers and disposed off at the solid waste disposal site of Mus Municipality. Recyclable wastes such as plastic, glass, paper, etc. shall be collected at separate containers and given to the companies that collect these wastes for recycling.

Generators and turbines are the unique noise reasons during the operation period in Alpaslan II Dam and HEPP Project. However, due to the isolated construction of the building noise will be blocked, therefore vibrations will be keep in the building.

With the project starting to operate, it will have a positive impact on the agricultural fields. If the project is realized, there will be groups benefiting from Alpaslan II Dam at differing magnitude. Alpaslan II Dam is a dam that has irrigation purpose in addition to flood protection. With the project, the water requirement of 68,060 ha agricultural field that needs irrigation at the Mus Plain shall be met and there will be flood prevention benefit. Therefore the project will have a significant role in the irrigation of the soils, consequent increate in agricultural productivity and contribution to the region and the country as a whole.

With the formation of the reservoir, while the terrestrial fauna will abandon the area inundated by the reservoir, the fauna living in the aquatic environment will be developed. The fauna species living in standing waters will be positively affected by the reservoir formation

Also, dam reservoir would provide suitable feeding, sheltering and reproduction niches of many bird species in time. In this case it shall be possible for especially the migrating water birds and wild bird species to use this area as a layover site. One of the positive impacts of the dam is the increase of fish population at the reservoir and this will create a nutrient source for the people living nearby.

With the realization of Alpaslan II Dam, contribution shall be provided both to the regional economy and the national economy. Especially thanks to the employment opportunities to be provided to the Villages within the impact area of the project during the project’s course, it is expected to provide a solution to the unemployment problem in the region and also to provide an improvement in the local community’s economy. It is also evident that contribution will be made to the national economy due to the fact that the project is an energy project. During the activities that are carried out construction and operation phases of Alpaslan II Dam will contribute to the resolution of the infrastructural problems of the region such as education, health and roads. During the construction phase of the Project, improved roads makes transportation opportunities better. During the course of the project, necessary actions shall be taken in providing a solution to the visible education problems in the region, meeting the needs of the schools and students, ensuring that education can be realized in the most optimum conditions and thereby supporting the economic and social improvement of the local community.

Within the scope of Alpaslan II Dam and HEPP Project, As stated at the former sections, besides flood protection benefit, an annual energy of 733.80 GWh shall be generated, the water requirement of 68,060 ha area at the Mus Plain requiring irrigation will be met. Again, the project will provide job opportunity for about 1,126 persons, thereby providing an economic development in the region.

CHAPTER XI

RESULTS

CHAPTER XI. CONCLUSIONS

(Summary of the assessments, a general overview of significant environmental impacts of the Project and the level of success that could be achieved in the prevention of adverse environmental impacts in case of realization of the Project, selection of alternatives and reasons of these selections within the scope of the Project)

Alpaslan II Dam and HEPP Project, which is planned to be constructed by Alpaslan II Enerji Uretim Madencilik San. Tic. A.S, was designed on Murat River which is sub-basin of Firat River Basin in Mus, on the 1,265.00 m thalweg elevation of this river and approximately 34.00 km away to Mus city center.

The first researches about Alpaslan II Project was started in 1982 by General Directorate of the State Hydraulic Works (SHW) and three different axis which named Zorova, Arincik and Mercimekkale (respectively from upstream to downstream) was investigated for dam construction.

Mercimekkale axis was found infeasible due to the social reasons and length of the dam axis, while Zorova was found infeasible due to the landslip that has occurred at the right bank of the downstream. Detailed studies were also carried out at Arincik axis and Feasibility Report was prepared in September, 1994, Final Project was designed by Alpaslan II Consortium in 2004.

As a result of the geological surveys conducted in Alpaslan II Dam site since 1990, “Alpaslan II Dam and HEPP Project Geology and Equipment Report” was prepared. Those were emphasized on result section of this report:

- Impact of landslides to the project structures,
- Depth of strong base rock,
- Strength, swelling and stability properties of Yazla Formation, which is base rock
- Engineering properties of natural building materials and similar issues about groundwork and construction materials, which based on geological and geotechnical resources need to be taken into consideration

Drawbacks about geology of Arincik axis was expressed in Alpaslan II Dam and HEPP Project Geology and Equipment Report, which was prepared for Alpaslan II Dam location. For this reason, in April, 2009, a technical visit have been arranged to the current axis (which was investigated before by General Directorate of SHW and to Zorova axis, which is located approximately 4.00 km away from current axis and the reports were revised accordingly.

As a result of field observations, it was concluded that geotechnical issues may be more critical than stated in the report, therefore this may increase the construction cost and construction time. In Zorova axis, it is reported that there is not a major problem except the spring landslide and a detailed geological survey would be appropriate in this axis, which is closer to material areas. Therefore, basic research and pre-project studies was started in October, 2009.

Within the scope of geological studies carried out in October 2009-February 2010 at Zorova axis, total of 19 boreholes with 1,116 m total depth were drilled and laboratory analysis were conducted on core samples which were taken from these holes. As a result of these studies, “Zorova Axis Location Geotechnical Survey Report” has been prepared, and the feasibility of the dam construction at this axis was proved technically.

In this respect, it was determined that Zorova axis is more appropriate for dam construction.

With the Revised Feasibility Report, which was prepared within the scope of this project, required application was made to the General Directorate of SHW and Revised Feasibility Report was approved by SHW (official letter dated May 24, 2011, No. 183825). The above-mentioned official letter is presented in App-2.

Alpaslan II HEPP, within the scope of Alpaslan II Dam and HEPP Project, will be established with the gross head of 98.00 m and with the project flow of 344.00 m^3/s. With a total capacity of 280.00 MW, for the current situation, annually 862.26 GWh will be generated as 606.35 GWh of it is firm. For the future situation, annually 733.80 GWh will be generated as 511.46 GWh of it is firm. At the same time, irrigation of Mus Plain will be provided with this project.

In Alpaslan II Dam and HEPP Project dam axis precipitation area of Murat River is 17,505.00 km^2. In this basin, a number of projects were planned to be realized by General Directorate of SHW. Some of these projects are in planning level or under construction and some are in operation. However, Alpaslan I Dam and HEPP Project, which is the largest one planned both for power generation and flood control, is located at the upstream of Alpaslan II Dam and HEPP Project and it is in operation.

Feasibility studies showed that Alpaslan II Dam thalweg elevation is 1272.00 m; crest elevation is 1371.00 m; water elevation of normal operation is 1368.00 m and water elevation of minimum operation is 1340.00 m. The water elevation of minimum and normal operation, the crest elevation of the dam are the same with the values given in the original planning report, thalweg elevation and minimum operation elevation had to be replaced due to the transfer of the dam axis to the upstream. In original planning report, it is projected that thalweg elevation is 1265.00 m and minimum water elevation is 1328.60 m. At this stage, thalweg elevation and minimum water elevations at Zorova flow increase, 4.00 m and 13.20 m, respectively, when compared to original axis.

In the upstream of the project area, some facilities are in operation phase while the others are in planning phase. Therefore, with the realization of the projects that are in planning phase, Alpaslan II Dam flows will be reduced a little amount. In this context, Alpaslan II Dam flows and energy production was calculated in two-stage. These stages were classified “Current Situation” and “Future Situation” including the upstream structures. These issues are taken into consideration and termed as follows;

- Current Situation is defined as the year 2017, in which Alpaslan II Dam will be taken into operation
- Future Situation at the end of the year 2025 that is regarded as the date that the facilities located at upstream are taken into operation

Also, both energy generation and economic and financial conditions were determined based on these scenarios.

Within this scope, in Alpaslan II HEPP installed capacity is projected to be 280.00 MWe as a result of the operation studies, which depends on the flood control volume in original axis,

- In the current situation annual average of energy generation will be 878.11 GWh, while 639.61 GWh of this energy is firm energy.

- In the future situation, annual average of energy generation will be 738.46 GWh, while 544.94 GWh of this energy is firm energy.

Mus Plain water requirement will be met by the water, which is regulated and turbined in dam.

As it stated in planning report prepared in September, 1994, it is confirmed that 78,210 ha agricultural area will be irrigated in Mus Plain. 10,150 ha of this field is being irrigated by Arincik Regulator and Irrigation, which is located at 5.00 km upstream of Alpaslan II Dam and constructed with the aim of irrigation in 1968 by the General Directorate of SHW. 4,800 ha of this field is located on the right bank of Murat River while 5,350 ha of are located on the left bank. In addition, it is envisaged that, 1,424 ha area will be irrigated by regulators, which constituted on Karasu; then, total irrigation area will be 11,574 ha. Including Karasu Irrigation, 68,060 ha area still needed to irrigate in Mus Plain. 12,847 ha of this area is located on the right bank while 55,213 ha are located on the left bank and it is proposed to irrigate the whole area by pumping.

Previously, irrigation of these areas, after supplying the capacity increase of both right and left channels of Arincik, were proposed to be realized by pumping. Within this scope;

- At the first level 9,617 ha and at the second level 3,230 ha will be irrigated by the use of P11 pump that is located on the right coast of Arincik. (total area to be irrigated is 12,847 ha)
- At the first level 46,700 ha and at the second level 8,513 ha will be irrigated by the use of P1 pump that is located on the left coast main channel of Arincik.

Total of 55,213 ha irrigation is envisaged.

Alpaslan II Dam Zorova axis is located on Murat River, approximately 34.00 km away to Mus city center, on route of Mus-Varto-Erzurum State Highway, which is used to reach the dam axis. The road is covered with asphalt and open to traffic every season.

The dam is designed as impermeable core rock fill type.

Mus-Varto State Highway and Mus-Varto junction Karaagil Provincial Road pass through the reservoir. With the realization of the project, these roads have to be relocated. In this context, as a result of these studies, permission about route and details have been received from General Directorate of Highways (GDH) regarding the 3.5 km of road. Works regarding the rest of the road are still on progress. The road, which will be relocated, will be with 4 lanes and 24 m width. 3.5 km section of the road which approved by GDH, will be evaluated in EIA Report with the aim of providing access from right bank to the dam axis. For the remaining roads, another EIA Report will be prepared after the GDH approval.

As it seen in Table I.2, reservoir, which will be formed at maximum water elevation, is 54.69 km^2. The Project area mainly consists of meadow and agricultural areas. Apart from these, small amount of forests and non-cultivated areas are also present.

Total of 225 households will be inundated by the reservoir; 25 households of Gocmenler (Muhacir Zorova) Quarter, which is located on the left shore of Murat River, 45 households of Tepekoy Village, 15 households of Dogdap Quarter, 50 households of Bagici (Carbuhur) Quarter, 50 households of Asagi Hinzir Quarter of Kayalidere Village, on the right shore 25 households of Sanlica Village and 15 households of Aligedik Village.

In addition to these inundated households some structures belonging to these households will also be inundated; a barn for each, a shed for each and small mosque belonging to each village, 5 mosques and 4 primary schools with their public housings.

Among the areas that will be needed for construction of the dam axis, project facilities and the area to be inundated by the reservoir, private lands will be purchased from the owners. In case of a dispute or need for expropriation for other areas, expropriation process will be realized in accordance with the Expropriation Law No: 2942 and its amendment, Expropriation Law No: 4650, which came into force upon its publication in the Official Gazette dated May 5, 2001.

Based on the cadastral information, it is determined that 5,009.32 ha will be inundated by reservoir and 335.40 ha will be inundated by material borrow areas. Private land within Project area is subject to expropriation.

Switchyard will be built near dam axis, on the right coast and energy, which will be produced in Alpaslan II HEPP, will be given to transmission lines. This switchyard is planned to be 154 kV in 130.0 m x 160.0 m area. Energy produced in Alpaslan II HEPP, is connected to Alpaslan I HEPP at 26.00 km distance and alternatively transmitted to Mus Substation, which is at 28.00 km distance and then to the national network.

The project area is located within the boundaries of central district of Mus and Varto district. It is consist of rural areas, some places flat or hilly, pasture, agricultural and empty fields and some villages, which dispersedly located.

Environmental Characteristics

In the dam and reservoir area and their vicinity, volcanic rocks that are active in the same period of the Tertiary aged sedimentary rocks and volcanosedimentary units crop out. In the order from oldest to youngest, these rock units are Oligocene aged Yazla, Upper Oligocene-Lower Miocene aged Adilcevaz, Upper Miocene-Pliocene agec Zirnak and Pliocene aged Solhan formations. Two base rocks in Alpaslan II Project Zorova axis are Adilcevaz and Zirnak Formations. Dam body is located on Adilcevaz Formation on the left bank of the spillway, and Zirnak Formation on the right bank, thalweg and a part of left bank.

The Project area is located in the “First Degree Seismic Zone” according to Seismic Zonation Map of Turkey of the Ministry of Environment and Urbanization. Alpaslan II Dam site is located near positioned with East Anatolian Fault Zone (EAFZ) on southwest and North Anatolian Fault Zone (NAFZ) on northwest. These fault zones which are the longest fault zones of Anatolia are known active fault systems. Dam site is located 50 km away from Karliova which is junction point of these two fault zones (EAFZ and NAFZ).

Landslides are seen within the studied area. The obvious landslides occur at Talanyaylasi Hill and Kas Hill that are located 1 km northeastern side of Dumlusu and occur towards southwest. Another landslide can observe in Gocmenler District residential area. Results of these studies are evaluated. No problems with respect to carrying capacity and stability of the Zirnak and Adilcevaz formations are expected at Zorova dam axis, once the cover material and dissociation zones are stripped with surface excavation.

There are hydrogeological impermeable units within the Project site and its vicinity. Therefore, there is no deep ground water well or sping discharge. Drinking and irrigation water requirements of villages in the Project area and its vicinity are met from springs at higher elevations, which show limited discharge (from andesitic and basaltic lava of Solhan Formation). Gardens near river bed are irrigated from Murat River and Bingol Creek.

Alpaslan II Dam was projected at the upstream of Alpaslan I Dam 1,365.00 m thalweg elevation, and its precipitation area is about 15,460 km^2. Alpaslan I Dam was constructed for the purpose of energy production and flood control. Alpaslan II Dam was implemented for the purpose of irrigation, energy production and flood control and its precipitation area is about 17,505 km^2. Several plants were planned to be constructed for the purpose of irrigation and drinking-potable water at the upstream of the Project. Some of these plants are in planning phase, some in construction phase and the remaining part is in operation phase. For the purpose of evaluating the water potential of basin, Patnos Dam, Sekerova Dam, Yazici Dam, Nadirseyh Dam, Murat Dam, Aydintepe Dam, Karahalit Dam, Baskoy Dam, Agacli Dam and Sancaktar Dam was planned to be constructed at the upstream of the Project. Patnos Dam and Yazici Dam were taken into operation, and others are under planning and project phases. Except for that, there are Eleskirt, Gulluova, Bulanik, Mus, Adalar, Hinis, Karahasan, Karakaya regulator irrigations and Kadir lake irrigations in the area.

According to the major soil group classification given in Land Property Map of Mus Province; the reservoir is mainly located within chestnut soils (76.38% and 76.07%). The degree of the water erosion within the area including the reservoir can be 1 (slight), 2 (medium), 3 (severe), 4 (extreme). According to Slope-Depth Combination, the project area and the material borrow areas are located within the areas A (slope: 0-2%), B (slope: 2-6%) and C (slope: 6-12%) areas. According to the other classifications of soil characteristics, the project site is rocky, stony and poor drainage.

, According to the land capability classification, within the scope of Mus Province Land Asset data, 32.14% of the dam reservoir (1609.80 ha) is of Class VII, and 30.64% (1535.06 ha) is of Class VI. Class VI and VII land comprise 62.78% of the total area. Following these two classes is Class III soils with the percentage of 17.23% (863.26 ha). 51.74% of the other areas outside of the dam reservoir (173.53 ha) is of Class VI and 30.18% (101.53 ha) is of Class VII. Class VI and Class VII land comprise 81.92% of the total area. Following these two classes is Class II soils with the percentage of 17.23% (60.65 ha.

According to the data from Environmental State Report of Mus Province, it is mostly fallow agriculture that is practiced. At all dry farming land, fallowing is practiced. However, if perennial crops are planted (like clover, trefoil) fallowing is not applied. In 61% of agricultural land in the province, there is dry farming. These areas products are mostly barley, wheat, clover, trefoil, common vetch and little amounts of watermelon, chickpea and beans. In areas where there is irrigated agriculture, products like vegetables, fruits, sugar beet, corn, and sunflower are grown, and there are also vineyards. Even in areas of irrigated agriculture, due to climatic conditions and soil structure, there is only one product a year. The second product does not grow due to lack of rain, temperature, number of sunny days, and insolation.

According to the data obtained from Land Assets of Mus Province the scrub area under the reservoir generates an area of 2.52% (126.43 ha). Forest land under the reservoir is 550 ha according to the data obtained from stand map. Project site is located within the boundaries of Forestry Operation Directorate of Bitlis and Forestry Operation Directorate of Mus. Operation mode is coppice and major tree species is oak. Stand types are defined as unforested forest soil-very distorted oak coppice forest stand (OT-CBMBt), very distorted oak coppice forest stand (CBMBt), very distorted oak coppice forest stand,

and unforested forest soil (CBMBt-OT). For these types of stands, the hill closure is provided in the range of 1-10%

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Any wetlands are not located within the project area. The nearest of these wetlands to the reservoir is Kucuk Hamurpet Lake and Kumlukiyi Lake. The distance between Kucuk Hamurpet Lake and the reservoir is about 8.5 km, and Kumlukiyi Lake is at a distance of about 2 km.

Within scope of Alpaslan II Dam and HEPP Project, in accordance with determination of any cultural heritage are inundated or not, Ministry of Culture and Tourism transmitted the subject to Regional Directorate of Cultural and Natural Heritage of Van with the Official Letter No. 137223 on June 29, 2011 (App-2) relying on the application to General Directorate of Cultural Heritage and Museums.

A letter dated on September 15, 2011 (No: 188765 see App.-2) was issued by Ministry of Culture and Tourism of General Directorate of Cultural Heritage and Museums referring to responsive letter of Van Regional Committee Directorate of Cultural and Natural Properties Conservation. The letter states that there is cultural heritage to be inundated within the dam site according to the expert report, therefore studies of inventory and documentation shall be carried out within the framework of principle decision of Supreme Committee of Natural Properties Conversation that is entitled as Conservation of Affected Immovable Cultural Heritage in Dam Site. Additionally a decision made in the letter that a committee to be established shall consist of Assistant Professor Hanifi Biber, who is one of the members of Archaeology Department of 100. Yil University, and experts from Van Regional Directorate Committee of Cultural Heritage Conversation.

After completion of commission’s work, with the letter No. 366 on December 23, 2011 (App-2) of Ministry of Culture and Tourism, Regional Directorate of Cultural and Natural Heritage of Van;

Due to the decision of the Committee dated on December 8, 2011, with regard to Alpaslan Dam and HEPP Project that is located within the border of Merkez and Varto Districts of Mus Province, Tepekoy Tumulus, Dogdap and Kız Castles (located on Mescitli Village) shall be registered in accordance with the Article 7 of the Law of Cultural and Natural Properties Conservation (No: 2863) and identified as First Degree Archeological Site in order to having the characteristics indentified in the Article 6 of the same Law. Additionally, it is stated that decision is made on “Abdurrahman Pasa Bridge shall be reevaluated by the Archeological and Art Historian Experts of the Committee Directorate that is considered in the report of scientific committee that registration of it is not necessary, the studies of rescue excavations with regard to cultural heritage (to be inundated) and dam construction activities shall be carried out simultaneously, and cultural layer of to be inundated tumulus shall be excavated and documented”.

As a result of field studies carried out to identify phytoplanktonic organisms, the most dominant group at the three sampling stations is Bacillariophyceae, while Euglenophyceae and Pyrrophyceae are represented by one species each. Within the scope of the study, a total of 20 Bacillariophyceae, 5 Chlorophyceae, 4 Cyanophyceae, 1 Euglenaphyceae, and 1 Pyrrophyceae species were identified. Besides, it was determined that *Achnanthes microcephala, Cymbella affinis* and *Fragilaria ulna* from Bacillariophyceae were determined to be abundant. Cladocera, Copepoda and Rotifera are microscopic organisms, which constitute the most important groups of zooplanktons. There are a total of 6 species identified in the area; 3 species from Rotifera, 2 from Cladocera and 1 from Copepoda. Based on field studies, total of 13 species were identified, which 9 of them from family Cyprinidae, 2 of them from Balitoridae and one from Sisoridae.

In order to determine the terrestrial flora of the study area, 3 field studies were carried out. In this respect, flora in the area all through the year could be identified. Study area for terrestrial flora and fauna surveys was selected to include dam site area and material burrow sites. Since habitat diversity in the region is rather low, the flora is not rich and endemism rate is quite low as well. The study area falls within Iran-Turan phyto-geographical region in terms of its flora geographical characteristics. It is completely under the influence of terrestrial climatic conditions. As a result of field surveys carried out in the project area 1 species from a fern family, 1 species from 1 Gymnospermae family, and 255 species from 49 Angiospermae families were identified. A total of 257 plant taxa from 51 families were identified. 13 of these identified species are endemic.

The most important impact of the Alpaslan II Dam and HEPP Project on terrestrial flora and fauna elements would be in the form of habitat loss. Regional endemic species within the project area and its surroundings area found within the steppe vegetation, rather than the riparian zone. Although, some of the regional endemic species populations will be inundated, it is not expected to have any major impacts at species level since populations at higher parts of the steppe vegetation will continue to survive in the area. There are terrestrial bird species in the area, like herons, cormorants, ducks and plovers, which are dependent on water. However, these species are not expected to be affected with the transformation of the riverine water regime into a stagnant reservoir. On the other hand, since some of the terrestrial habitats will be transformed into aquatic ones, populations of water-dependent fauna elements in the area are expected to increase. As a result of field surveys, it was concluded that vulnerable fauna species in the area inhabit higher steppe vegetations. In addition, most fauna species, due to their higher mobilities, are expected to leave the project activity areas, and utilize nearby alternative areas.

Mus and its vicinity do not have richness in terms of metalic mining. In the locality, economic formations can be mentioned in terms of raw materials. These are gypsum, baryte, brick-tile, quartzite and cement. There is no any mining site within the preoject area.

Besides, there is not any source that could adversely affect the air quality between Mus province and Varto district where Murat River is located. In order to determine the existing air quality in the Project site, 24-hour measurements were performed in Kusluk and Akpinar Villages between August 25 and 26, 2011 by Cankaya Cevre Olcum ve Analiz Laboratuvari. Particulate matter (PM_{10}) measurements were carried out with micro PNS-LVS1 PM_{10} sampling device. Measurement report is presented in App-14. PM_{10} value of Kusluk Village is 0.0893 mg/Nm^3 and PM_{10} value of Akpinar Village is 0.123 mg/Nm^3.

Water samples were collected from Dam axis, Murat River and Bingol Stream by ENCON Environment Laboratory in August, 2010 and analysis were assessed. According to this, while dam axis has I Class water quality in terms of BOD and COD parameters, which are the main pollutant parameters, water quality decrease to the level of III Class in Bingol Stream and Murat River. There are no big differences between these three points in terms of other parameters. Due to the blur in the sample, which was obtained from Bingol River, suspended solid concentrations in this point were significantly higher than the other points.

The project impact area is assessed on two levels with respect to socio-economic characteristics. Firstly, data related to the Province and Districts covering the project affected settlements gathered from Turkish Statistics Institute (TurkStat), State Planning Organization (SPO) and other relevant public authorities were used to evaluate the socio-economic characteristics of Mus Province and Varto and Merkez Districts. Secondly, the data obtained from the structured surveys conducted on June 06-08, 2011 with the headmen of the villages determined to be directly affected by the project were used for evaluation of the socio-economic characteristics of the project affected settlements.

According to the results obtained from the fieldwork, in the affected villages the major means of livelihood is agriculture. In some villages, there was no population change in the last 5 years whereas the others have shown a population increase or decrease. Especially young population goes to Istanbul, Izmir and Bursa to during winter months and work in construction sector. Average household income varies depending on their economical activity. During the field survey, some households engaged in subsistence farming and were also observed.

As all of the headmen mentioned that unemployment as the major problem in their villages. Especially the young population living in the area goes seasonally to other cities and also other countries to work and some of them return to their villages. It is also stated that some of these immigrants still live in these countries.

Elementary schools in the villages are capable of giving education first 5 years, and the rest could be finished with boarding school in district center. Among the all villages surveyed, there are not any medical institution (health center, health cabinet etc.). Village people use the health care institutions in nearby district centers with rental vehicle or taxi.

Impacts of the Project and the Measures to be Taken

Construction Phase

Excavation shall be made for the cofferdams, dam body, power plant building, switchgear site and derivation constructions to be made in the scope of Alpaslan II Dam and HEPP Project. Among the material to come out from the excavation works to be undertaken in the area, the ones that can be usable shall be utilized as concrete aggregate material, laying material at the transport roads and filling material at the unit constructions. The remaining part shall be stored at the depot sites as excavations material. 6 depot sites have been planned for the storage of the excess excavations material to occur during the project. The mentioned depot areas shall be submerged under the dam lake after the operation of the project.

During the excavations activity, the top soil layer shall be stripped to prevent the pollution of the top soil and this layer shall be stored such that it shall not lose its productivity. The bottom soil providing the formation of the top soil shall also be stripped and shall be amassed such that it shall not lose its horizons. While stripping the top soil layer, all the non-soil material has to be separated from the soil. The plant parts ensuring the continuity of plant special such as seed and buds shall be separated. Furthermore, the top level of the vegetal soil shall be protected against erosion, drying and weeding, and coated with vegetal cover such as grass, meadow, grassland plants, etc. to ensure the maintaining of the soil livelihood. This stripped vegetal soil shall then be used at the landscape renovation of the area and the vegetal landscaping of the recreational areas. On the other hand, the relevant provisions at the Regulation on the Control of the Excavations Soil, Construction and Debris Wastes that has been enacted by being published at the Official Gazette no 25406 of March 18, 2004 shall be complied with.

In case tough rock formations are encountered during the preparation of the land and construction of the units, explosion works shall be undertaken. As explosives, ANFO and Powergel Magnum 365 is planned to be used. If explosion is conducted, the regional community shall be informed beforehand, no one shall be permitted inside the detonation area. Sirens shall be sounded before detonation to warn the regional community. Explosive substances shall not be stored on site. The amount of the explosives necessary for the daily explosion shall be transported to the site with trucks. Furthermore, application shall be made to and necessary permits shall be obtained from Muş Governorship in the scope of the use, storage and transport of explosive substances.

No bottom sweeping or excavation activity shall be performed at any water body in the scope of the project. However, bed arrangement shall be made to regulate the water flow at the downstream of the power plant. The material extracted from here shall be used in building seawall of the tail race channel. Furthermore, no intervention shall be made at the river bed outside the knowledge and permission of General Directorate of SHW, material shall not be spilled to the river bed, the bed cross section shall not be reduced and suitable flow conditions shall be provided at the river bed.

For the building of the facilities in the scope of the project, impermeable, permeable and rock filling-purposed material borrow areas shall be opened. Within the scope of the project, there are 6 rock, 3 impermeable and 4 permeable material borrow areas. The permeable and impermeable material borrow areas shall be submerged under the dam lake except for impermeable material borrow area A. Among the rock material borrow areas K-1 shall be completely and K-2 and K-5 shall be partially submerged under the dam lake. All the material borrow areas left outside the dam lake are mostly located on grassland and partially on agricultural land.

Detonation shall be made at the K1, K2, K3, K5, K6A and K6B rock borrow areas in the scope of the project. Production at the mentioned rock borrow areas shall be made via open borrow area operation. Drilling-detonation method shall be employed in production and explosive substance shall be used. For this aim, it is foreseen to utilize capsule, dynamite and ANFO as explosive substances. In the rock material borrow areas, work shall be performed only during day time and in one shift, thus the detonations shall be carried out during the day time. During the construction phase of the project, the explosive substance shall be supplied by the relevant firm depending on the requirement. There will be no explosive substance storage at the project area.

While evaluating the possible impacts to be created on the air quality due to the activities to be realized in the construction phase of Alpaslan II Dam and HEPP Project, both dust and gas emissions have been examined. In the calculation of the project-sourced emission, the worst case scenario has been considered and the most intense period of the project in terms of dust formation has been taken into account and a modeling study has been carried out.

When it is considered that no measure is taken, the expected PM emission value is calculated as 66,59 kg/h for the construction phase and this value is above the 1 kg/h dust emission that requires the calculation of the contribution to the air pollution as per Annex-2 of RCAPSI; thus a modeling study was performed to determine the distribution pattern of dust. Since the HC, NO_x CO, PB within PM and SO_x emission values from the exhausts of the construction equipment are below the threshold values of the regulation, it was decided that there is no need to make a model study for them. All of the values obtained from the model study were below the limit values foreseen at the RCAPSI.

There are no forest areas present at and at the near vicinity of the project site. The region is generally covered with grasslands. At the forest areas to be submerged under the dam reservoir, there are very rare tree gatherings. The areas near the project site display the same features as the project area. Therefore, it is not expected for the cut trees to have a negative impact on the forest ecosystem of the region. Furthermore, it is anticipated that during the construction period, most of the terrestrial fauna will leave the area surrounding the construction site to go to similar areas for a temporary duration depending on the intensity of the construction activities. Since the mentioned habitats start right in the vicinity of the construction site and the region display a homogeneous ecosystem structure, the migration shall not be long-ranged.

In the framework of a study prepared for the dam lake area in the scope of the project, an application has been made to the Turkish Ministry of Agriculture and Village Affairs in 2003 for land use permit of non-agricultural areas and in the framework of the Agricultural Survey Report prepared by the Provincial Agricultural Directorate, the land use permit of non-agricultural areas has been granted with the 22.02.2003 dated and TSD/250.11.11.11-2844/9803 referenced letter of the Agricultural Production and Development General Directorate of the Turkish Ministry of Agriculture and Village Affairs. The mentioned letter is presented in Annex-2. In the framework of the project modification made, the dam location was moved 4 km towards the upstream with the new formulation in this report. Thereby, the dam lake formed in this new formulation covers a smaller area that the lake area for which a land use permit of non-agricultural areas had been obtained. Therefore, the land use permit of non-agricultural areas that had been granted covers the whole dam lake.

For the areas outside the dam lake, necessary applications shall be made if necessary, after EIA studies, to obtain a land use permit of non-agricultural areas in line with the provisions of the Soil Protection and Land Use Law no. 5403 and Soil Protection and Land Use Application Regulation no. 26024. A Soil Protection Project shall be prepared for the whole project. Furthermore, application shall be made to the Provincial Food, Agriculture and Stockbreeding Directorate to obtain the necessary permits as per the Grassland Law no. 4342.

The main water use in the construction phase of the project shall be for concrete production, washing of concrete aggregate material, preventing of dusting and drinking-utilization water for the workers. The water for concrete power plants, washing of concrete aggregate material and prevention of dusting shall be obtained from Murat River and the side branches that feed the river. The drinking water shall be obtained from canned water whereas utilization water shall be obtained from the residential areas in the vicinity of the worksite. The waters to be obtained as drinking and utilization water shall be controlled and verified for compliance with the criteria indicated at the Regulation on Human Consumption-Purposed Waters enacted by being published at the Official Gazette no. 25730 of 17.02.2005. In this scope, canned waters (demijohn) shall be purchased from companies approved by the Ministry of Health in this scope.

Residential type of wastewater shall be created by the personnel working during the construction phase. The residential type of wastewater to be created during the construction phase shall be treated with the package treatment system to be installed at the worksite. The treated water to come out of this system shall be discharged to the Murat River after being treated to meet the standard values indicated at the Water Products Law no. 1380 and the Regulation thereof, plus Table 21.1 of “Water Pollution Control Regulation” (WPCR) enacted by being published at the Official Gazette no. 25687 of 31.12.2004. Necessary approvals and permits shall be obtained from the Provincial Environment and Urbanization Directorate for the package wastewater treatment plant.

The aggregate material coming out of the crushing-sieving-washing plants have to be washed before being used at concrete making. Washing drum and sedimentation tank shall be prepared for the washing process. At the washing drum, the washed aggregate material and the washing water shall be separated from each other. Then, this wash water rich in suspended solid matter shall be transferred to the sedimentation tank where the solid matter shall be made to settle with a physical separation process. The wash water of the trans-mixers shall also be kept for a duration at this sedimentation tank to settle the solid matter. The treated water can then be reused for washing process. The unused water can be discharged to Murat River. In this regard, the provisions of the Water Pollution Control Regulation enacted by being published at the Official Gazette no. 25687 of 31.12.2004 and the Water Products Law no. 1380 shall be complied with

Solid wastes shall occur during the land preparation, construction of the units and due to the personnel to work at these jobs in the scope of the project. Kalıplık kereste atıkları ile inşaat demiri, demir boru gibi atıklar yeniden değerlendirilebilir nitelikte atıklardır. Wastes like mould log wastes, construction iron and iron pipes are recyclable wastes. These wastes shall be collected at suitable regions within the project area and sent out to licensed recycling facilities. Excess concrete materials shall be used as filling material. Some of the excavations wastes shall be used as laying material for the roads to be built/rehabilitated or laid into the gaps from where aggregate was obtained.

The residential type of solid wastes caused by the personnel working at the construction and operation phases of the project shall be retained at the project site inside closed containers suitable for short term retaining and periodically unloaded to the garbage site of Muş Municipality. The residential type solid wastes occurring at the project area shall be collected and disposed of as per the “Solid Wastes Control Regulation” enacted by being published at the Official Gazette no. 20814 of March 14,1991 and the “Packaging Wastes Control Regulation” enacted by being published at the Official Gazette no. 26562 of June 24, 2007.

The packaging wastes to occur during the construction and operation and the other wastes planned to be disposed shall be collected separately and stored at temporary storage areas within the plan. The place and properties of the temporary storage area shall be according to the provisions stated at the related regulations. Additionally, it is possible for waste oils to occur in the scope of the project. For the waste oils to occur in this phase, disposal shall be realized as per the “Waste Oils Control Regulation” enacted by being published at the Official Gazette no. 26952 of July 30, 2008 and the “Hazardous Wastes Control Regulation” enacted by being published at the Official Gazette no. 25755 of March 14, 2005.

For the vibration and noise to occur at the works starting with land preparation until the units are opened for operation, necessary measurements have been taken at the residential locations within the project site on 25-26.08.2011 by Cankaya Cevre Olcum ve Analiz Laboratuvari and an Acoustic Report has been prepared. As can be seen from the table, even according to the worst case scenario, the noise levels calculated at the residential areas are below the limit values of the regulation.Furthermore, 70 dBA limit value given for the noise level being emitted to the environment from worksite activities as per Annex VII, Table 5 of the RAMEN is also met.

With a conservative approach at the calculations, it has been assumed that all the work machinery operate simultaneously. However, since the worst case scenario, being the simultaneous operation of all equipment at the same spot, shall never occur in the scope of the construction activities; the noise to be caused by the activities shall not negatively impact the residential areas. All the provisions of RAMEN in this respect shall be obeyed.

The visual character of Alpaslan II Dam Area has a character formed with the joining of two different surface waters and shaped with the impact of two different valley structure. There is no anthropogenic pressure at the project area. The biggest change to occur visually will be the transformation of the river structure into a lake structure. Since the region's landscaping features does not contain and remarkable and memorable element, in other words, since the most influencing landscaping element is the Murat and Bingöl rivers; the fact that these river structures transforming into a lake area shall create an impression for the presence of an impressive water presence and thus, create an attraction.

During the construction activities, before the commencement of the excavations activities, the top soil layer shall be stripped to prevent the pollution of the top soil and this layer shall be stored such that it shall not lose its productivity. This stripped vegetal soil shall then be used at the landscape renovation of the area and the vegetal landscaping of the recreational areas. after the construction works, terraces shall be formed at high slope and land slide areas, thereby flatter surfaces shall be obtained and these regions shall be vegetated. During the forestation works, the dominant vegetal cover of the region shall be considered and the type of trees to be used in forestation shall be selected accordingly. Thanks to the lake to be formed with the completion of the dam construction, it will be possible for the emergence of tourism and recreational activity areas.

The rescue excavations to be conducted related to the cultural assets to be submerged under the dam and the dam works shall be performed simultaneously as per the decision of the Regional Directorate of Van Cultural and Natural Assets Protection Board, and the necessary activities shall be undertaken in the framework of the opinions, suggestions and demands of the Ministry of Culture and Tourism and the liabilities stated at the decision no. 765.

Operation Phase

Layering is formed especially during the summer months, where the heated water at the lake surface cannot intermix with the underlying cold water due to the created density difference. Since there will be a continual water circulation at Alpaslan Dam, the negative impacts due to layering at the dam lake shall be limited.

High phosphorus and nitrogen levels are the major reasons for eutrophication. In general, the main parameter causing eutrophication is phosphorus. Since the water quality analysis results of Murat River demonstrate a very low level of total nitrogen and phosphorus, it can be concluded that such a problem will not be encountered at the reservoir.

In general, the fish living at the river, brooks and/or streams migrate from the downstream to the upstream at certain periods to reproduce, feed and overwinter. In order not to prevent the reproduction of the fish species present in the area, it is foreseen to establish a 'Carriage Station' to build fish passages at the mentioned dam and HEPP or to ensure that sub populations are not created. Considering the fact that Alpaslan II Dam and HEPP is a skirt type power plant, at the water retaining process of the environmental flowrate covering the reproductive period of the fish with high flow period Q_sap= 27.0 m^3/s (Q_sap/YOA (%)=19.6), and at the low flow period Q_sap= 18.5 m^3/s (Q_sap/YOA (%)=13.4). In the scope of the project, the downstream sap shall be discharged from the bottom outlet at the first water retaining phase of the dam. The dam shall be constructed as a skirt type power plant and after the water coming from the operation phase of the dam is passed from the turbines, it shall be released to the downstream. However, in cases where water has to be retained at the operation phase, the downstream sap shall be released from the two sap turbines (small turbines) present at the power plant building.

Alpaslan II Dam shall be constructed for energy generation, irrigation and flood protection purposes. Dam and HEPP units are systems that will not create a pollution in terms of operation system. Therefore, they will not pose a pollution threat for the water resources. The residential wastes to occur due to the personnel to work during the operation phase of the project shall be collected in impermeable septic tanks, taken by sewage pumps and transmitted to the wastewater system of Muş Municipality. Furthermore, there will be no intervention to the river bed outside the information and permit of DSI General Directorate, no material shall be discharged to the river bed, the bed cross section shall not be narrowed and suitable flow conditions shall be provided at the river bed.

The number of personnel to work during the operation phase of the project is 10 persons. Since the number of personnel is low, accommodation structure construction is not planned at the dam area at the operation phase. The accommodation, social/technical infrastructural needs of the personnel and their dependents shall be met from Muş city center.

The required water during the operation phase shall be obtained from the near settlements and and shall be controlled and verified for compliance with the criteria indicated at the Regulation on Human Consumption-Purposed Waters enacted by being published at the Official Gazette no. 25730 of February 17, 2005. This wastewater shall be collected at septic tanks, pumped out with sewage pumps and given to the wastewater system of Muş Municipality.

The solid waste to occur in the operation period shall be residential type and caused by the personnel to work at the operation phase. These wastes shall be collected in suitable containers and disposed off at the solid waste disposal site of Muş Municipality. Recyclable wastes such as plastic, glass, paper, etc. shall be collected at separate containers and given to the companies that collect these wastes for recycling.

The only source of noise foreseen at the operation phase of Alpaslan II Dam and HEPP Project will be the generator and turbines located inside the HEPP building. However, since the HEPP building to be installed shall have insulation, it will be ensured that the noise and vibration remains inside the building.

During the operation phase of the project, there will be no activity that can create an impact on the forest areas other than these lands. However, necessary precautions shall be taken against forest fires. Necessary equipment, devices and tools against a possible fire inside the HEPP buildings shall be kept ready, in case of any fire at the surrounding forests, these equipment and devices shall be used for fire extinguishing.

With the project starting to operate, it will have a positive impact on the agricultural fields. If the project is realized, there will be groups benefiting from Alpaslan II Dam at differing magnitude. Alpaslan II Dam is a dam that has irrigation purpose in addition to flood protection. With the project, the water requirement of 68.060 ha agricultural field that needs irrigation at the Muş Plain shall be met and there will be flood prevention benefit. Therefore the project will have a significant role in the irrigation of the soils, consequent increate in agricultural productivity and contribution to the region and the country as a whole.

It is anticipated that income increase and the subsequent transformation and evolutions will create opportunities for new investments. The traditional agricultural methods can be abandoned and new agricultural training and dissemination can be observed. In this way, the agricultural lands shall be utilized and the migration of the farmer having subsistence troubles will be prevented.

Furthermore the right owners to obtain expropriation benefits from the project might make investments outside agriculture and this may create new employment areas in the region.

An application shall be made to the Provincial Food, Agriculture and Stockbreeding Directorate to obtain the necessary permits for the grasslands located in the project area as per the Grassland Law no. 4342. At the operation phase of the project, it is not anticipated to have any impact on the grasslands. Furthermore, with the flood prevention benefit, it will be enabled to provide flood protection at these grasslands.

With the formation of the dam lake, a part of terrestrial life shall be substituted by aquatic life and thus, there will be some change in land use, water and food chain. Some of the groves providing a habitat for the terrestrial fauna at the area to be submerged under the dam lake are areas that have been formerly destroyed due to land clearing for farms, illegal tree cutting, etc. However, since these areas shall be submerged, the habitats of the mammals, reptiles and bird species living here will contract. Alternative habitats that can be used by small mammals (mice, etc.), reptiles (turtles, lizards, etc.) and bird species expected to be affected from the change to occur at the operation phase of the project in terms of their living and subsistence habitats are present both at the top parts of the dam lake level and in the vicinity of the project area.

While the terrestrial fauna will abandon the area submerged under the reservoir, the fauna living in the aquatic environment shall flourish. The fauna species living in still waters and in the vicinity (frogs, aquatic snakes, etc.) shall be positively influenced by the dam lake formation. Furthermore, the dam lake shall create suitable feeding, sheltering and reproduction niches of many bird species in time. In this case it shall be possible for especially the migrating water birds and wild bird species to use this area as a layover site. In the migration season, the suitable still water areas to be created thanks to the dam, the ornito-ecologic importance of the region might increase. The similar situation was observed at the other dam lakes of our country. One of the positive impacts of the dam is the increase of fish population at the dam lake and this will create a nutrient source for the people living nearby.

The hydroelectric power plants can have, in general, positive and negative impacts on the fish populations and fish diversity depending on the changes in the water regime, the surface and groundwater quality and changing of the vegetation structure. In general, all the detected fresh water algae species are cosmopolite and there is no species specific to the region, endemic, rare or endangered. According to Bern Treaty (2002) and CITES (2004), no protected and/or endangered species has been encountered. In general, within the benthic organisms detected, there is no endangered or protected species. Therefore, it is expected for the project to have a low level of impacts on the benthic organisms.

It is considered that the changes to occur at the aquatic ecosystem due to the project activities will have an impact on the growth of the fish population rather than the species composition. According to the fish assessments, it is contemplated that they will not be affected in a negative way due to the planned project.

The existing habitats of algae among the aquatic beings shall decrease and a new habitat will be formed. In general, there will not be situation that negatively influences the fresh water algae flora of the region since the fresh water algae shall be able to continue their living within the lake system as well. The still water body to form at the reservoir area shall form suitable niches for the zooplankton organisms. The increase of the plankton species forming a nutrient for the fish at the reservoir area shall have a positive impact in the growth of fish species that can live at the still water system as well.

In general, the fish living at the river, brooks and/or streams migrate from the downstream to the upstream at certain periods to reproduce, feed and overwinter. In order not to prevent the reproduction of the fish species present in the area, it is foreseen to establish a ‘Carriage Station’ to build fish passages at the mentioned dam and HEPP or to ensure that sub populations are not created.

With the realization of Alpaslan II Dam, contribution shall be provided both to the regional economy and the national economy. Especially thanks to the employment opportunities to be provided to the villages within the impact area of the project during the project’s course, it is expected to provide a solution to the unemployment problem in the region and also to provide an improvement in the local community’s economy. It is also evident that contribution will be made to the national economy due to the fact that the project is an energy project in its nature. During the construction and operation phases of the planned Alpaslan II Dam shall contribute to the resolution of the infrastructural problems of the region such as education, health and roads. The improvement of the roads during the construction phase of the project can also cause a betterment in the transportation means of the region. During the course of the project, necessary actions shall be taken in providing a solution to the visible education problems in the region, meeting the needs of the schools and students, ensuring that education can be realized in the most optimum conditions and thereby supporting the economic and social improvement of the local community.

As stated at the former sections, besides flood protection benefit, an annual energy of 733.80 GWh shall be generated at Alpaslan II Dam and HEPP Project, the water requirement of 68.060 ha area at the Muş Plain requiring irrigation will be met. Again, the project will provide job opportunity for about 1126 persons, thereby providing an economic development in the region.

After Operation

Service life of Alpaslan II Dam and HEPP Project is 50 years. Filling of the reservoir with sediments is expected for Alpaslan II Dam, however no mitigation measure can be taken against this adverse impact. Maintenance of the equipments will be ensured in order to be used during the Project life time. Electro-mechanic equipment will be renewed when it is required and facility continuity will be provided.

The reclamation activities will be commenced after the construction works at the construction sites. Buildings in this site will be dismantled and rehabilitated. Required soil for landscaping will be provided by vegetative soil that is stripped and stored during the excavation activities.

After the construction period, no activity will be carried out in concrete plants and crushing-screening-washing facilities. These facilities will be dismantled after completion of the construction works.

Alpaslan II Dam will be constructed on Murat River for energy generation, irrigation and flood protection purposes. The dam and HEPP units are systems that will not create any pollution in terms of operation system. Therefore, they will not pose a pollution threat for the water resources after operation phase.

After the operation phase, there will be no wastewater generation or discharge to the river bed or the reservoir.

As mentioned in the previous sections, minimum water level to preserve the aquatic habitat will be provided in the operation phase. Therefore, no adverse impact on aquatic ecosystem would be expected after the operaion phase as a result of these implementations.