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KAM ENERJI URETIM
TICARET VE SANAYI A.S.

TORLAR REGULATOR AND HYDROELECTRIC POWER PLANT (HEPP)

(14.834 MW_e - 15.294 MW_m)

KAHRAMANMARAS PROVINCE, CENTRAL DISTRICT,
SARIMOLLAALI VILLAGE-BULUTLU QUARTER,
CINARPINAR VILLAGE-KARBASAN QUARTER;
KURTBEKIRLI BAGLARI LOCATION,
OVER KORSULU RIVER

mavi YEŞiL
MÜHENDİSLİK ARITIM ÇEVRE TEKNOLOJİLERİ
DANIŞMANLIK SANAYİ VE TİCARET LTD. ŞTİ.

■ **ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT**

KAHRAMANMARAS - 2014

NAME OF PROJECT OWNER	KAM ENERJİ ÜRETİM TİC. VE SAN. A.Ş.
ADDRESS	Gaziantep Yolu Üzeri 5. km P.K. 17 Kahramanmaraş
TELEPHONE AND FAX NUMBERS	T: 0090 344 236 44 80 F: 0090 344 236 44 83
PROJECT TITLE	Torlar Regulator and HEPP (14.834 MW_e - 15.294 MW_m), Ready Mixed Concrete Plant and Power Transmission Line
PROJECT COST	44.956.722 TL
EXPLICIT ADDRESS OF THE PLACE SELECTED FOR THE PROJECT (PROVINCE, DISTRICT, POSITION)	Kahramanmaras Province, Central District, Sarımolla Ali Village – Bulutlu Quarter and Cinarpinar Village - Karbasan Quarter; Kurtbekirli Bağları Location
COORDINATES, ZONE OF THE PLACE SELECTED FOR THE PROJECT	This information is given in the next page because there are many points.
PLACE (SECTOR AND SUB-SECTOR) OF THE PROJECT UNDER EIA REGULATION	Annex 2, Energy-Tourism-House, 28: River type plants having power of 0,5 MW and more than 0,5 MW 24.b) Projects deemed appropriate by the Ministry upon request of project owner to obtain credit for the projects not being subject to Environmental Impact Assessment Regulation and being subject to Eligibility Criteria and due to similar financial reasons
NAME OF THE INSTITUTION/WORKING GROUP PREPARING PIF/EIA REPORT/FINAL EIA REPORT	**MAVİ YEŞİL** Mühendislik Arıtım Çevre Teknolojileri Danışmanlık San. ve Tic. Ltd. Şti.
ADDRESS, TELEPHONE AND FAX NUMBERS OF THE INSTITUTION/WORKING GROUP PREPARING PIF/EIA REPORT/FINAL EIA REPORT	Şehit Abdullah Çavuş Mahallesi, 32. Sokak, Yıldız Apt. Kahramanmaraş T:0 344 215 77 61 F:0 344 215 77 62
PRESENTATION DATE FOR PIF/EIA REPORT/FINAL EIA REPORT (DAY, MONTH, YEAR)	2013

1) UTM COORDINATES

FOREBAY
290153.551:4168292.800
290171.047:4168337.445
290217.804:4168302.151
290172.555:4168273.192

HEPP
290208.242:4168367.508
290240.760:4168399.605
290292.706:4168360.751
290260.187:4168326.543

SWITCHYARD
290242.874:4168384.988
290260.515:4168374.278
290245.394:4168360.417
290229.013:4168369.867

STORAGE AREA II
289822.481:4168302.373
289945.327:4168303.646
289944.690:4168268.639
289819.298:4168269.912

TRANSMISSION TUNNEL
287718.923:4167416.633
287746.676:4167466.709
290118.304:4168261.312
290149.978:4168292.987
290172.362:4168268.492
290131.396:4168231.750
287767.420:4167435.755
287742.382:4167402.874

REGULATOR
287561.333:4167349.601
287610.407:4167409.317
287680.766:4167374.434
287713.285:4167417.595
287749.351:4167396.310
287670.715:4167307.031
287708.555:4167250.862
287691.408:4167240.220
287586.166:4167273.330

PENSTOCK
290200.610:4168316.932
290240.127:4168344.082

PTL MAST FOUNDATION
290270.381:4168400.392
306844.424:4163939.292
290672.300:4168335.071
292718.358:4166932.243
294410.475:4166827.045
297410.237:4166642.893
297928.273:4166098.058
299545.662:4165205.529
302660.188:4165429.217
304849.987:4165158.272
305418.630:4165047.924
305949.584:4165024.723
306236.306:4164385.396

STORAGE AREA I
288339.841: 4167597.918
288370.253: 4167597.918
288370.253: 4167564.126
288339.841: 4167564.126

STORAGE AREA III
290246.777:4168531.680
290240.044:4168553.766
290249.900:4168579.940
290268.852:4168558.777
290269.763:4168532.688

STORAGE AREA IV
290042.904:4168560.216
290095.305:4168666.251
290171.748:4168702.007
290207.504:4168681.046
290189.010:4168639.126
290203.805:4168549.736

2) GEOGRAPHICAL COORDINATES

DATUM	:	WGS-84
TYPE	:	DEGREE.FRACTION
ORDER OF ELEMENTS	:	LATITUDE LONGITUDE
BRACKET	:	:
EASTING VALUE	:	DEGREE.FRACTION (FRACTION CAN BE WRITTEN UP TO 8 DIGITS)
NORTHING VALUE	:	DEGREE.FRACTION (FRACTION CAN BE WRITTEN UP TO 8 DIGITS)

LOADING POND
37.6362558:36.6215242
37.6366618:36.6217095
37.6363547:36.6222491
37.6360835:36.6217451

HEPP
37.6369410:36.6221221
37.6372375:36.6224811
37.6368995:36.6230805
37.6365840:36.6227221

SWITCHYARD
37.6371064:36.6225093
37.6370140:36.6227121
37.6368857:36.6225449
37.6369670:36.6223566

STORAGE AREA II
37.6362663:36.6177724
37.6363059:36.6191631
37.6359905:36.6191660
37.6359732:36.6177456

TRANSMISSION TUNNEL
37.6278062:36.5942088
37.6282635:36.5945085
37.6359641:36.6211341
37.6362566:36.6214837
37.6360412:36.6217442
37.6357009:36.6212909
37.6279896:36.5947523
37.6276877:36.5944784

REGULATOR
37.6271661:36.5924439
37.6277152:36.5929822
37.6274173:36.5937890
37.6278135:36.5941447
37.6276302:36.5945592
37.6268080:36.5936948
37.6263109:36.5941395
37.6262111:36.5939485
37.6264850:36.5927473

PTL MAST FOUNDATION
37.6372514:36.6228163
37.6007058:36.8117034
37.6367548:36.6273866
37.6245851:36.6509551
37.6240178:36.6701442
37.6230255:36.7041615
37.6182326:36.7101778
37.6105483:36.7287350
37.6132367:36.7639355
37.6112638:36.7888007
37.6103904:36.7952682
37.6102937:36.8012856
37.6045958:36.8047012

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I. DESCRIPTION AND OBJECTIVE OF THE PROJECT

I.1 Description, life cycle, service purposes of the project's activity, Market or Service Areas and Importance and Requirements within the scope of the Country, Region and/or City in terms of Economy and Social Life within These Areas

I.1.i. Description, life cycle, service purposes of the project's activity, Market or Service Areas and Importance and Requirements within the scope of the Country, Region and/or City in terms of Economy and Social Life within These Areas

Torlar Regulator and HEPP Ready-Made Concrete Power Plant and Energy Conveyance Project is located in the city of Kahramanmaraş, the Central County, Sarımolla Ali Village – Bulutlu Neighborhood and Çınarpınar Village – Karbasan Neihborhood – Kurtbekirli Bağları Location. The purpose of this project is only to generate electric power and it doesn't aim to irrigate or to make flood control.

Within the scope of this project, we suggest to build the following facilities: Torlar regulator and settling pond, conveyance tunnel, forebay pond, penstock pipe, power plant house, tailwater channel and switchyard. It is projected that the water collected by Torlar Regulator on 502.40 m thalweg elevation on Körsulu River is brought firstly to a forebay by a 2574.50 m long conveyance channel and then to the power plant house which is located on 444.00 m tailwater elevation by using a 105.00 m long penstock pipe. Along with these facilities, 18,60 km long Energy Conveyance Line with 31,5 kV is built in order to connect the electricity to the interconnected system.

Within the scope of this project, an application was made to Kahramanmaraş Provincial Environment and Urbanization Office for the HEPP (8.1 MW) project by preparing a Project Presentation Document and a "EIA is not necessary" decree dated on 29/10/2009 No:722-7039 was granted. Then, as widely discussed in "Section VII Project's Alternatives", Torlar Regulatior and HEPP and Tavşantepe Dam were incorporated and as a result of the fact that the installed power of 8.1 MW was increased to 15.03 MW, an updated project presentation document was prepared within the scope of the EIA Regulation; Kahramanmaraş Provincial Environment and Urbanization Office was granted an **"EIA is not necessary" decree dated on 29/10/2009 No:722-7039**. Within the scope of the Electricity Market Code No: 4628, the Electricity Production License was granted by Energy Regulation Authority (EPDK) for **44 years, 9 months, 4 days** along with an **EP/2564-2/1626 license on 20/05/2010** for the project. In addition, Water Usage Right Convention was signed with the General Directorate for State Hydraulic Works ***on 21/04/2011*** for an installed power of ***16,86 MWm/16,35 MWe***. Then, as the installed power of Torlar Reg. and HEPP Project was changed to ***17,193 Mwm/16, 743 Mwe*** with the Decree of EPDK on 17/11/2011 No:3500-3, the Additional Agreement of the Convention Concerning the Water Usage Right of Torlar Hydroelectric Power Production Plant and Operating Rules was issued.

As a result of the optimization studies, Torlar Reg. and HEPP will generate 34.38 GWh power per year with 0.00 Gwh firm power and 34.38 Gwh secondary power; and in case of spring expansion, they will generate 31.11 GWh per year with 0.00 GWh firm power and 31.11 GWh secondary power.

Torlar HEPP project lies within the Mediterranean Region, the city of Kahramanmaraş, the central county, on Körsulu River. The project field is located on the maps No: M37-c3 and M37-c4 with 1/25000 scale. Access to the project field can be realized via Kahramanmaraş-Andırın road which is open all year.

Within the scope of Torlar Reg. and HEPP project, storage is not present and therefore there is no optimization study nor a reservoir operation policy as the project is a river type power plant and the water to be used in energy generation will be turned by the Regulator.

It is estimated to start operating Torlar Reg. and HEPP facilities within 2,5 years after construction and assembly. In the current case, 2 years have been completed and the project's construction will be over in 6 moths. 90% of the regulator construction, %60 of the conveyance system, 90% of the forebay, %70 of the penstock pipe, 100% of the power house and 80% of the energy transmission line (conductives are left to be laid down) are completed. The estimated economic project life cycle of Torlar Reg. and HEPP project is 50 years.

In below sections, the importance and the necessity of this project are examined in terms of (i) Turkey's increasing power need and (ii) procurability and diversity of power sources.

i) Turkey's Increasing Power Need

The objective of Turkey's energy policies is “to procure safe, affordable, quality, clean energy in ways which can support our estimated development rate and upgrowth.” These policies principles are to increase productivity in power generation, to use more clean power sources and to try to obtain power source diversity by using domectic sources.

As happens all around the world, need for power increases every day depending on the development of the Turkish industry and our enery generation should increase accordingly. It is important to provide on-time, permanent and sufficient amounts of electric power which is one of the most vital inputs of the socio-economic development by considering economic conditions and its impacts on environment.

In accordance with the R.T Ministry of Energy and Natural Sources, if there are no investments in the future and problems of the industry are not resolved, electricity gap in Turkey will increase by multiplying and it will reach to 25 billion kWhours in 2011, 45,5 billion kWhours in 2012 and 144,7 billion kWhours in 2016. (www.euas.gov.tr/_EUAS/Images/Birimler/apk/2007_yillikrapor.pdf).

ii) Procurability and Diversity of Power Sources

Increasing diversity of resources to be used in energy generation is one of the most important principles of our energy policy and use of local resources is supported as much as possible. Main local resources used in generation of electricity energy in Turkey are hydroelectric energy resources, wind energy and fossil fuels. Turkey has a great potential especially in terms of hydroelectric power, and it is important to exploit this local potential as soon as possible.

To actualize the suggested project will play an important role in resolving Turkey's energy gap problem by providing source varity in the Turkish energy market. In addition, the project will not have directly greenhouse gas emission, therefore is a carbon neutral project.

Depending upon Turkey's development, the share of hydroelectric energy potantial and its consumption is decreasing within the total energy consumption. However, due to the fact that hydroelectric energy is clean; causes source loss if not utilized because of rivers naturally discharging into seas; is cheaper, more practical and has advantages such as instant operation and deliver to needed zones comparing to its alternatives that are mostly imported in order to meet peak needs of our country, it is imperative to improve our hydroelectric potantial.

Operating Torlar Reg. and HEPP project will contribute to the Turkish economy and energy market; with its geographic location and closeness to transportation roads it will create energy possibilities in the region with high development potantials; and bring new employment opportunities in both construction and operation periods.

In addition, it will contribute to Turkey's "green energy" amount by exporting energy to European countries which according to Kyoto Convention declarations, have to consume 22% of their total used energies as green energy.

Constructing such power plants by using mostly domestic capital will enable to use state sources more productively, decrease in the least the need for energy sources that are paidwith foreign currency in exhange and help utilizing our renewable energy sources that are not utilized.

I.1.ii. Table Showing Characteristic Data Concerning the Facilities to be Built within the scope of the Project

Torlar Reg. and HEPP energy project are comprised of the following facilities whose characteristics are stated below: the regulator, the settling basin, the conveyance tunnel, the forebay, the penstock pipe, the power plant, the tail water channel, the switchyard and the energy transmission line.

PROJECT CHARACTERISTICS

HYDROLOGY

Precipitation Area	: 404.70 km^2
Project Flood Discharge(Q2)	: 94.80 m^3/s
(Q_5)	: 176.80 m^3/s
(Q_{10})	: 250.30 m^3/s
(Q_{25})	: 362.60 m^3/s
(Q_{50})	: 458.90 m^3/s
(Q_{100})	: 565.20 m^3/s

TORLAR REGULATOR AND WATER INTAKE STRUCTURE

The Regulator will be built as concrete filled on Körsulu River which is located on 502,40 m thalweg elevation, will be sized according to Q_{100} pike and its crest elevation is designed as 514.00 m.

Alluvium thickness of the stream bed where the Regulator will be built is about 3 ~ 5 m. Due to the big slope of Körsulu stream bed and the over flood in water flow regime, in order not to have any piping in front of the regulator body, a 10.00 m long and 0.50 m wide concrete coating will be built in the stream bed. A 4.00 m wide scouring sluice is designed within the Regulator and a billet guide cover is added in front of the scouring sluice. Regulator's plug entrance has a cap and 3 rough grills to prevent floating matters to enter the settling basin passing through the plug. Plunge covers that are designed to be built in front of the frontal intake will prevent floating matters to enter the settling basin in case of an over flood. In addition, there will be a fish passage of 4.00 widths.

Reasons of choosing a concrete filled bodied regulator are that there are no facilities that the regulator pond may harm at the spring in case of back water and flood discharge and that the operation is rather easy.

Type **:** Concrete Filled Bodied
Thalweg Elevation **:** 502.40 m
Foundation Elevation **:** 492.90 m
Height from the Thalweg **:** 11.60 m
Height from the Foundation **:** 21.10 m
Scouring Sluice Entrance Elevation **:** 502.40 m
Amount of Revolving Water **:** 211.66 hm^3
Flood Discharge (Q_{100}) **:** 565.20 m^3/s
Water Intake Base Elevation **:** 509.80 m
Water Intake Structure Design Flow **:** 25.00 m^3/s
Regulator Crest Elevation **:** 514.00 m
Maximum Water Level **:** 517.00 m
Body Length **:** 56.00 m (including piers)
Regulation Ratio **:** 0.73%

SETTLING BASIN

The settling basin to be built next to the Regulator is designed with minimum charge loss and as a result of calculations according to particle diameter to be settled, average water depth is found 5.50 m while its net width is 21.30 m and its length is 64.70 m.

Average speed in the settling basin is calculated as V=0.21 m/s and this speed fulfils the condition of <0.30 m/s. The settling basin is designed with three sections. A washing channel with 0.02 slope and 0.80 × 0.60 m dimensions is planned to be built at the end of the pond; and the washing tunnel will be commanded by 3 lids. The elevation of the

lateral water sluice to be built on the left side at then of the settling basin is 513.95 m. After the settling basin, the water will be taken to the water conveyance channel.

It is planned to keep the bed loads coming from Körsulu Stream bed in the settling basin as much as possible. A discharge channel is constructed at the end of the settling basin. The sedimentation is discharged to the stream at least once a year.

Location	**:** Right Coast
Settling Basin Type	**:** Vertical Walled with Multiple Chambers
Chamber Quantity	**:** Three (3)
Chamber Width	**:** 7.10 m
Length of Settling Basin	**:** 64.70 m
Height of Settling Basin	**:** 6.60 ~ 7.90 m
Width of Settling Basin	**:** 22.30 m (orta ayaklar dahil)
Settling Basin Water Surface Elevation	**:** 513.95 m
Design Flow	**:** 25.00 m^3/s

FISHWAY

Type	**:** Denil	
	Fish pass location	**:** Left Coast
	Fish pass width	**:** 4.00 m

At the costruction stage, Provicial diractorate of Food Agricultural and Livestock (PDoFAL) has asked for a revision on the existing fishway.Denil Type Fishway has been chosen and the fishway has been re-built in accordance to PDoFAL request. After the design of new fishway, a scientific study including detailed site studies has been done and reported by Assoc. Prof. Dr. Mehmet KOCABAŞ (Karadeniz Technical University, Head Of Facultyof Forestry Departmentof Wildlife Ecology and Management). As a result of this study (see Appendix -29), Denil Type fishway is reported as more suitable for the local fish species, especially for Brown trout and also it was observed that it was currently functioning well.

During the design, 13 fish species identified if EIA studies have been considered. These fish species are Salmo trutta macrostigma, Barbus capito pectoralis, Capoeta capoeta angorea, Chondrostoma Regium, Alburnus orontis, Leuciscus cephalus, Lucioperca lucioperca, Garra rufa obtuse, Nemachelus angore, Nemachelus tigris, Cobitis sp, Silirus triostegus and Aphanius cypris. One of these species is Alburnus orontis which is under IUCN- EN category, while two species Barbus capito pectoralis and Leuciscus cephalus are under LC (low risk) category. Among these fish species one species have economic value, Salmo trutta magrostigm, brown trout. “Rectangular Cross Section” has been choosen as the design base of fishway structure for easy movement of critical fish species. The chamber have a width of 4 m.

Denil type fishway consists of rectangular hallow and tightly spaced chambers. These chambers reduce the speed of water by turning the flow back and generate spiral flows that damps the energy of water. As a result of this the fish are moved up as water speed decreases. Five resting fishponds are designed and. the slope of the chambers are 45 degrees. The

designof fishway is given in Figure 1. Location of fishway is also identified during site studies. Fishway contains a pond structured with natural materials in front of the dam waterfall. This parallel positioned structure created smaller waterfalls for fish movement. Water flow directions are planned according to needs of fish species. Additionally, isolation of fishway, far distance from shore, and exit leading of pond to lake (Figure 15) are main characteristics of the structure. Water will be rested at the entrance of fishway. With this design, fish would be motivated to use that area in their breeding season. Aperantly, fishway is under operation and the fishway is found to be suitable for local (native) fish species, especially for Brown trout and also it was observed that the fishway was currently functioning well.

The design of fishway is also approved by the Provincial Directorate of Food, Agriculture and Livestock on 22/02/2012 and the related letter of approval and drawings are found in Appendix-6.

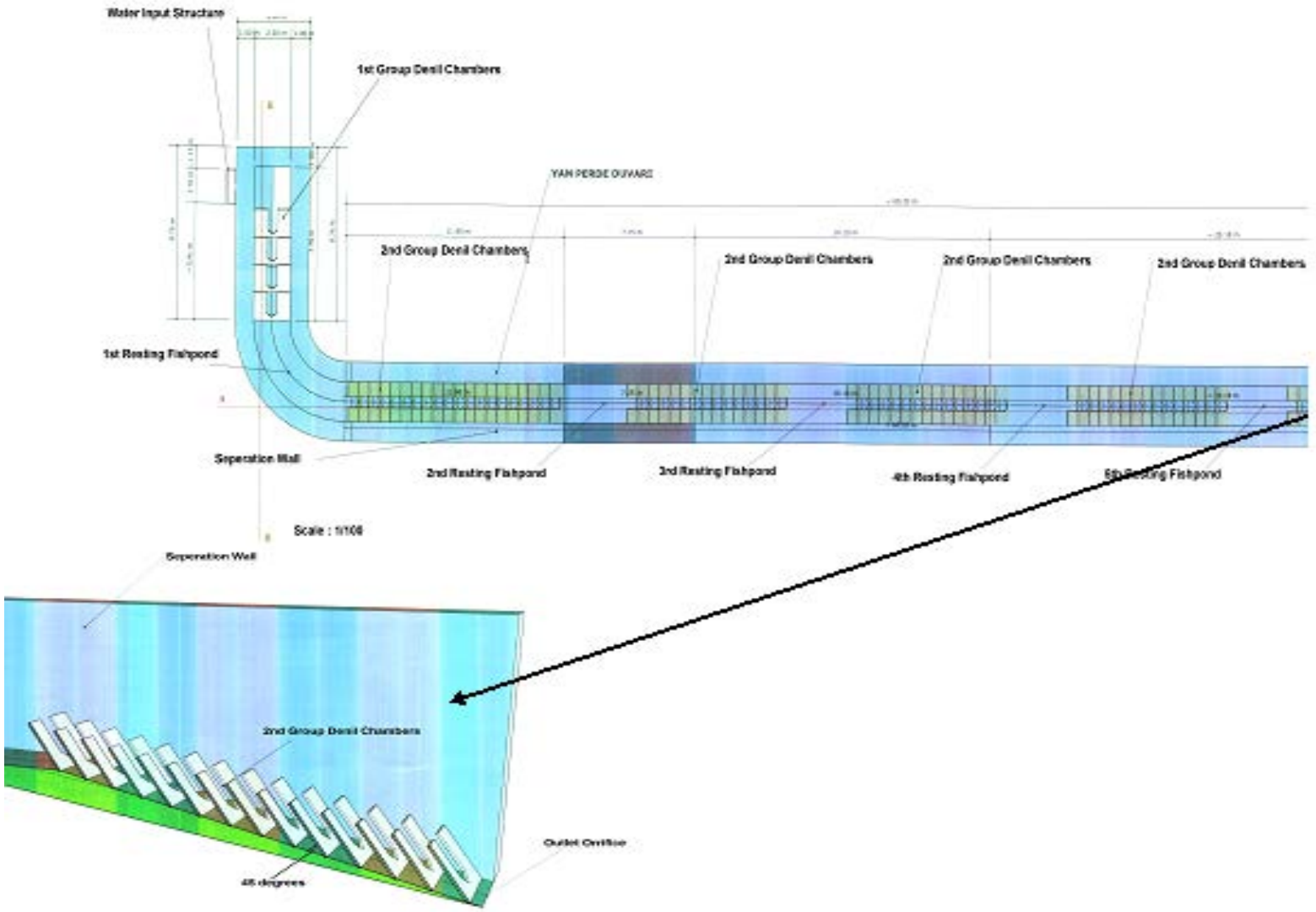


Figure 1 Display of the Fishway

Derivation Tunnel and Cofferdams

During construction, firstly it is planned to derivate the water on the left slope and to build the regulator, water intake structure and scouring sluice on the right slope; then to complete the rest of the regulator after taking the water to the already completed part.

WATER CONVEYANCE TUNNEL

The water will be taken from the settling basin and brought to the conveyance tunnel through water transition structure. The conveyance tunnel is circular; its diameter is Φ= 3.90 m and its length is 2575.50 m. Project flow chosen for the tunnel is 25.00 m^3/s.

Type	**:** Circular Cross-Sectional Tunnel
Location	**:** Right Bank
Tunnel Diameter	**:** Φ 3.90 m
Tunnel Wall Thickness	**:** 0.40 m
Tunnel Length	**:** 2574.50 m
Tunnel's Project Flow	**:** 25.00 m^3/s
Tunnel's Slope	**:** 0.001 m/m

FOREBAY

With the forebay located at the end of the conveyance tunnel, pressure waves that may occur when the turbines' sudden closing and the water need that is required when turbines take the first charge will be fulfilled. Capacity of the forebay is 4500.00 m^3. Additionally, the forebay will serve as the second settling basin to ensure the turbines don't get harmed by the sediments that cannot be kept in the settling basin.

Volume	**:** 4500 m^3
Length	**:** 45.00m
Width	**:** 17.00m
Depth	**:** 6.34~14.32 m

PENSTOCK PIPE

The route of the penstock pipe in Torlar HEPP project will be located on the most appropriate place in terms of topography and geology. Slope wash at the end of this route will be completely removed and the penstock pipe will be passed through a foundation as solid as possible by leveling the ground in some parts. In fracture points due to the land structure, anchoring blocks will be built and expansion joints will be placed in between. This portion of the penstock pipe which will be split into three parts before entering the power plant, will be embedded into mass concrete. Speed of water in the penstock pipe should be 3-5 m/s. For penstock pipe optimization, diameters that will deliver these speed limits were used. As a result of such calculations, wall thickness of the penstock pipe is designed as 10.00~12.00 mm, diameter Φ2750 mm and length 105.00 m.

Penstock Pipe Diameter	**:** Φ 2.75 mm
Penstock Pipe Wall Thickness	**:** 10 ~12 mm
Penstock Pipe Length	**:** 105.00 m
Project Flow	**:** 25.00 m3/s
Branch Quantity	**:** 2+1
Branch Diameter	**:** 2 x Φ 1850 mm, Φ970 mm
Branch Wall Thickness	**:** 8.00 mm

POWER HOUSE

Torlar HEPP is located on the right coast of Körsulu River and equipped with 3 horizontal Francis turbines. Waters to be turbined from the power plant will be connected to Körsulu River after a short tailwater channel. Power plant tailwater elevation is 444.00 m.
As seen on the detailed drawings taken from the approved feasibility report, the power house is placed on the stream bed. For construction of power house, a channel is constructed on Korsulu river for derivation. This channel is designed according to flood discharge rate. For the protection of surrounding land from flows, the surrounding elevation is hightned by filling. However, all these works were already in the approved report by the authorized institution (State Hydraulic Works - DSİ) and is not a spontaneous necessity during construction. DSİ approved situation plan taken from the approved feasibility report can be found attached. Since alteration of the river bed and construction of the power plnat on the stream bed were already realized according to the approved feasibility report, no additional licenses were granted.

Having 15.294 MWm/14.834 MWe installed power, Torlar HEPP will generate 34.38 GWh/year (0 GWh/year firm energy and 34.38 GWh/year secondary energy) and be transmitted to the interconnected system by a 18.6 km long 477 MCM Conductor Galvanic Mast Bolted Iron Mast connection line.

According to the Environmetal Impact Assessment Regulation that came into force on 17.07.2008 by being published in the Official Journal no:26939, Power Transmittance Lines with a voltage of 154 kV and above and a length between 5-15 km are subject to the Article 32 of the Appendix-II List of the Regulation; and Power Transmittance Lines with a voltage of 154 kV and above and a length above 15 km. are subject to theArticle 32 of the Appendix-I List of the Regulation. Electric energy to be generated within the scope of Torlar Regulator and HEPP project will be transmitted to the interconnected system by a 18.6 km long and with a voltage of 31,5 kV, thus it is out out of coverage of the Environmetal Impact Assessment Regulation.

Power plant type	**:** On the ground
Installed Power	**:** 15.03 MW
Tailwater Elevation	**:** 444.00 m

POWER GENERATION

Current Situation

Firm Energy	**:** 0.00 GWh / year
Secondary Energy	**:** 34.38 GWh / year
Total Energy Generation	**:** 34.38 GWh / year

In Case of Spring Growth

Firm Energy	**:** 0.00 GWh / year
Secondary Energy	**:** 31.11 GWh / year
Total Energy Generation	**:** 31.11 GWh / year

TURBINE

Quantity	**:** 2+1 suit
Type	**:** Horizontal Axis Francis
Regular Power	**:** 2 x 6.61 +1.81 MW (Total:15.03 MW)
Project flow	**:** 2 x 11.00 + 3.00 m3/s (Tot: 25.00 m3/s)
Gross Head	**:** 70.00m
Project net head	**:** 66.25 m
Synchron speed	**:** 2 x 500 + 1000 d/min
Performance	**:** 0.925

GENERATOR

Quantity	**:** 2+1
Type	**:** Horizontal Axis synchron generator
Operation Type	**:** Continous
Regular Power	**:** 2 x 7550 +2070 kVA
Terminal Voltage	**:** 6.3 kV
Power Factor	**:** 0.85 (inductive)
Frequency	**:** 50 Hz
Rotation speed	**:** 2 x 500 + 1000 d/min
Drive type	**:** Directly coupled to the Francis turbine mile
Warning Type	**:** Brushless rotating diodes
Short Circuit Ratio	**:** more than 0.75
Isolation Class, Performance	**:** F, 0.98

TRANSFORMATOR

Unit Transformators

Quantity	**:** 2+1
Type	**:** External type, three phase, oil isolated
Regular Power	**:** 2 x 7550 +2070 kVA
Nominal Voltage	**:** 6.3/31.5
Frequency	**:** 50 Hz
Linkage Group	**:** YNd5
Cooling Type	**:** ONAN
Neutral Connection	**:** Earhted over 20 Ohm resistance
Performance	**:** 0.99

Internal Requirement Transformators

Quantity	**:** One (1)
Regular Power	**:** 120 kVA
Nominal Voltage	**:** 31.5/0.4 kV
Frequency	**:** 50 Hz
Linkage Group	**:** Dzn5
Cooling Type	**:** AN
Neutral Connection	**:** Directly earthed

Emergency Diesel-Generator Group:

Quantity	**:** One (1)
Type	**:** Vertical cylinder four-stroke
Regular Power	**:** 60 kVA at sea level
Nominal Voltage	**:** 400/231 V
Frequency	**:** 50 Hz

Power factor **:** 0.8 (inductive)
Rotation Number **:** 1500 d/d
Cooling Type **:** Radiator, closed-loop water-cooled
Warning Type **:** Rotating diode warning

Energy Transmittance Line

Profile **:** 477 MCM
Length (km) **:** 18.60
Voltage **:** 31.5 kV

II. LOCATION OF THE PROJECT AREA

II.1 Location of Project

Torlar Regulator and HEPP Energy Project is located in the city of Kahramanmaraş, the Central County, Sarımolla Ali Village – Bulutlu Neighborhood and Çınarpınar Village – Karbasan Neihborhood –Kurtbekirli Bağları Location on Körsulu River. Torlar Regulator and HEPP Project is located 40 km from the city of Kahramanmaraş.

In the environment master plan, the HEPP location is defined as hydro-electric power plant zone and locations of other units are defined as forest land (Figure 2, Appendix-15).

Within the scope of this project, a total working area of 715,946.43 m^2 (71.5 da) (+12,500 m^2 temporary land for worksite facilities) are determined for the construction stage. 186,061 m^2 (18.60 da.) of this area is farmland, 388,691.43 m^2 (38.8 da) is forest land and the remaining part is treasury land. The necessary permissions have been taken for non-agricultural usage of these agricultural lands from Ministry of Food, Agriculture and Livestock (See App. 22).

There are partly little plains forming irrigable land sources. The most important river of the precipitation area of the project is Körsulu River. There are lots of little streams feeding this river. Majority of Körsulu valley is covered by forests. Therefore sediment movements of Körsulu river is low while its flood discharge level is high. Most parts of the project area and its surroundings are declivitous, forested areas (planted forests). Agricultural activities are realized in small lands created due to parting of the afforested area in patches.

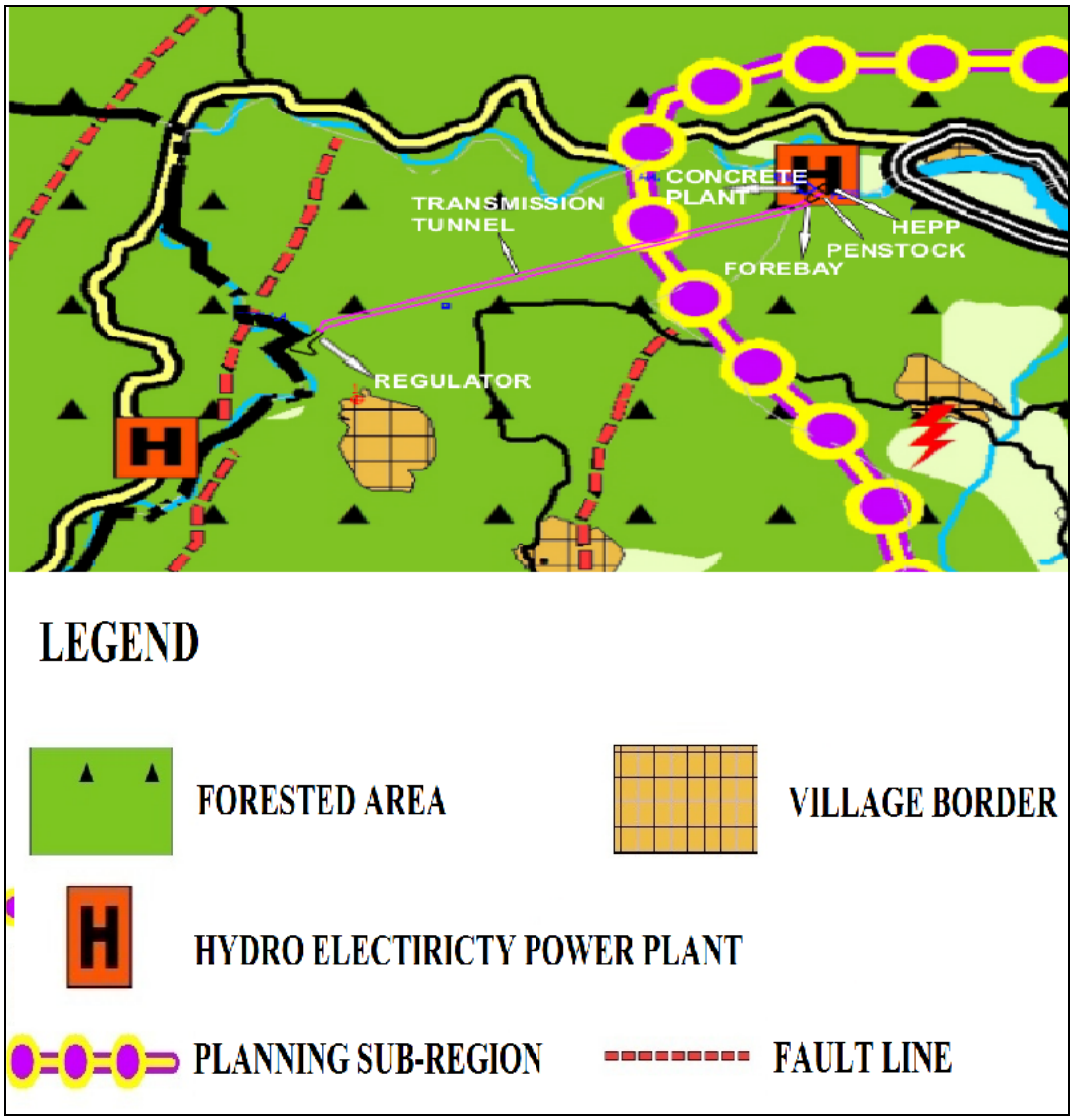


Figure 2 Display of the Project Area on Environment Master Plan

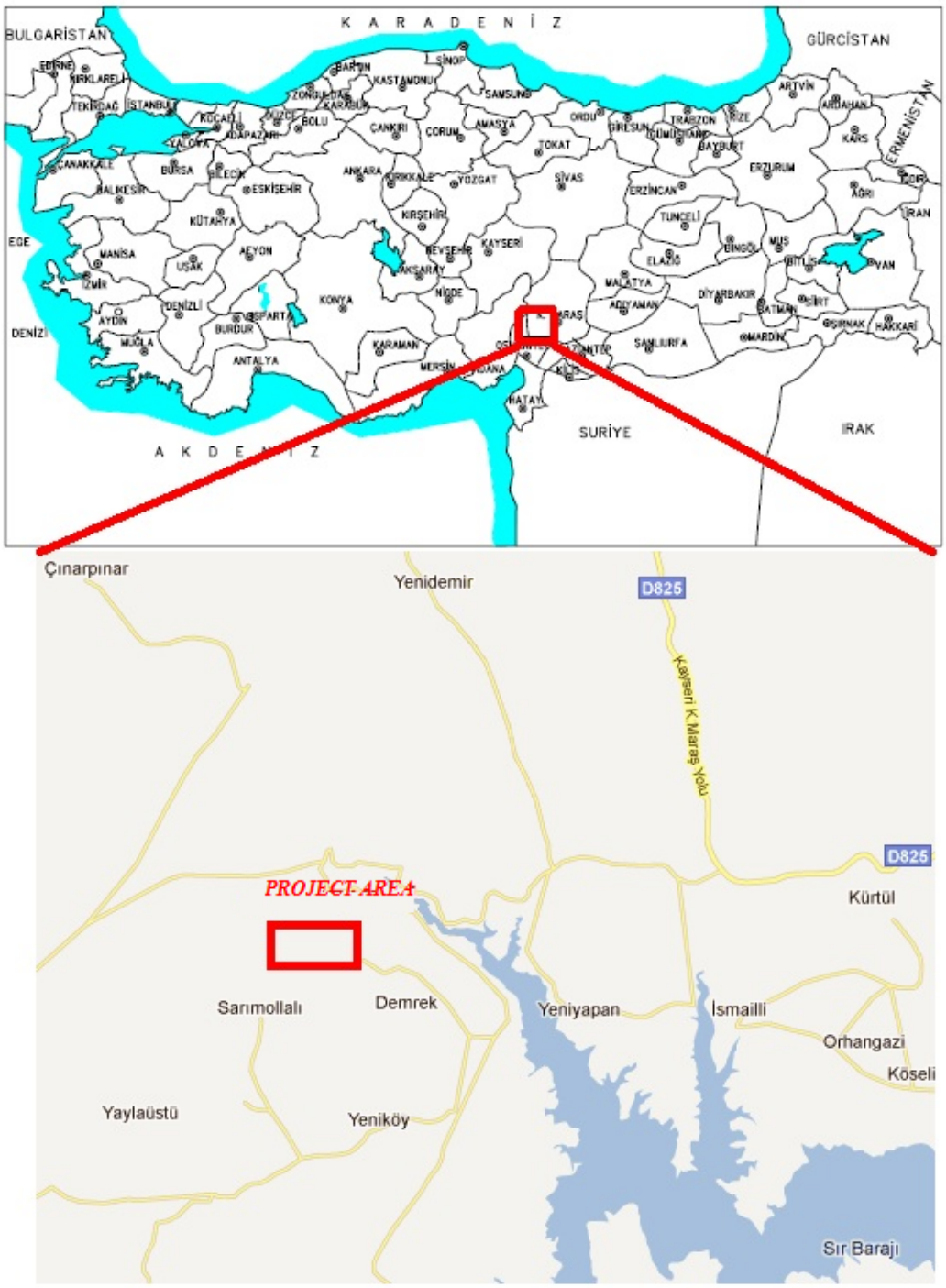


Figure 3 Site Location Map

Torlar Energy Project's area is a mountainous zone. The closest settlement is located 485 m southwest of the Regulator. The area is mostly afforested with brown soil group. There are Kübalı mountain (1450 m) and Karbasan Neighborhood on the east; Başkonuş Mountain (1785 m), Sarımollaali and Yaylaüstü Neighborhoods on the south; Yeniköy (Yenicekale) Region on the southeast; Köşürge Mountain (2060 m) and Elma Mountain on the west; Çınarpınar Village and Karadağ (1846m) on the North. These mountains on the west side of Ceyhan River form the eastern part of Middle Taurus Mountains. Project units and distances to settlements are summarized in Table-1.

Table 1 Distance of Unit to Residential Areas (Distances are in rough meter from top view)

	BULUTLU QUARTER	SARIMOLLAALI VILLAGE	DEMREK VILLAGE	KARBASAN QUARTER
REGULATOR	485	1670	2945	3590
TRANSMISSION TUNNEL	610	1780	1270	1020
FOREBAY	2465	2520	1290	970
PENSTOCK	2605	2800	1320	920
POWER HOUSE	2630	2620	1310	920
STORAGE AREA	790	1670	2315	2925

II.2 Location, technical infrastructure units, administrative and social units, other units

Facilities to be built within the scope of the project are the regulator, the settling basin, the conveyance tunnel, the forebay, the penstock pipe, the power house and the energy transmittance line. 1 ready-to-use concrete plant is used to provide the required amount of concrete. 4 storage sites seen on the following satellite image (Figure 4) and whose coordinates are given in the Table 7,8,9 and 10 are used to be able to store excavations during the construction stage. 1 construction site will be built for meeting the workers' needs. Storage sites are located on forest area (planted forests) and accordingly the required permit is granted by the Regional Directory of Forestry.

Figure 4 Satellite Image Showing Units and Their Positions

Figure 5 Satellite Image Showing Units and Their Positions

Figure 6 Satellite Image Showing Units and Their Positions

Figure 7 Sattelite View Showing Energy Transmittance Route

Materials required for this project are purchased from the borrow pits located in the project site and for concrete material need, ready-to-use concrete plant is used. The stone pit where the project's required materials have been provided belongs to Mehti Taylan ÇETİN who is a private investor. He is free off Kam Energy and its subscontractor İlci Construciton Company. The Mining License taken from Ministry of Energy and Natural Resources that shows the ownership and EIA Certificate taken from Ministry of Environment and Urbanisation are given in annex 26. Therefore, there was no need to build borrow pits or crushing-screening facilities in the scope of the project. Moreover the project has been completed in 2012, therefore there is no need for any further assessment.The stone pit, project units and storage sites are displayed on a 1/25000 scale map and plans and detailed drawings of regulator, tunnel, forebay, penstock pipe, power house etc. can be found in the appendicies. Approximate x and y coordinates of the units of Torlar Regulator and HEPP and distances between the closest settlements are displayed in tables below.

At the source of Torlar Regulator and HEPP project, there are Değirmenüstü Reg. and HEPP (installed power: 40 MW), Kale HEPP (installed power 35.33 MW), Gökgedik Reg. and HEPP (installed power 24.29 MW) which are governed by private companies and Karasu HEPP (installed power 2.135 MW) which is governed by Kahramanmaraş Municipality (see Figure 6). The water used in Karasu HEPP is being obtained from a natural spring and conveyed by a pipe line through Kahramanmaraş. This HEPP is located on this line therefore it is not on the Körsulu River and has no interaction with the river and Torlar HEPP (App. 33).

At the downstream of this project lies Sır Dam. The map showing its association to Körsulu River and other facilities is in the Appendix-16 and 33; the map showing meteorology stations located in the basin is in the Appendix-17; and the map showing the river's branches is in the Appendix-18. Distances between these projects are given in the Table-51.

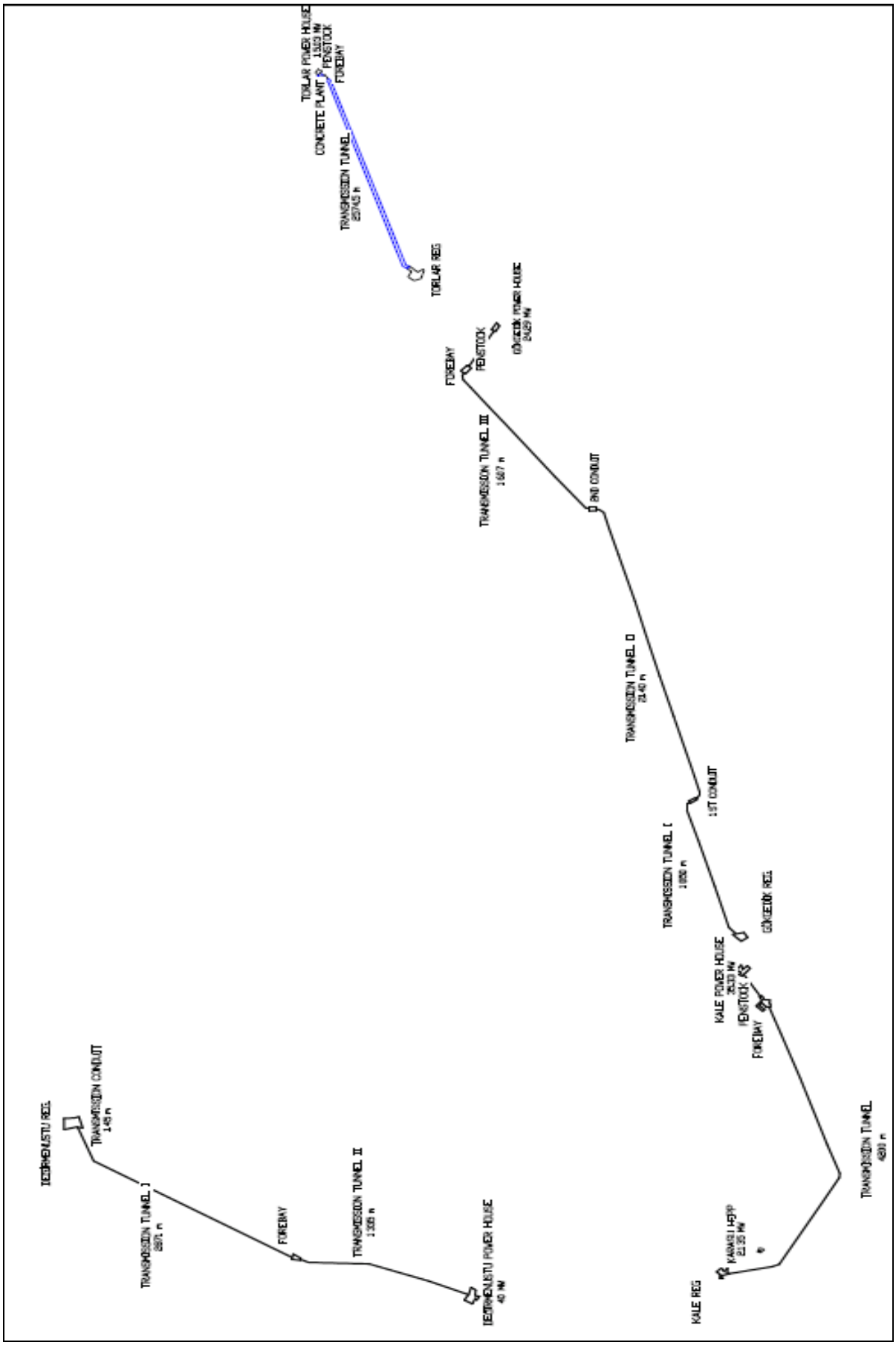


Figure 8 HEPP Projects Over Korsulu River

Table 2 Coordinates and Position of Torlar Regulator

Point No	Y	X	The Closest Residential Area	Direction	Distance
R1	287561.33	4167349.6	Bulutlu Quarter	Southeast	485 m
R2	287610.41	4167409.32			
R3	287680.77	4167374.43			
R4	287713.29	4167417.6			
R5	287749.35	4167396.31			
R6	287670.72	4167307.03			
R7	287708.56	4167250.86			
R8	287691.41	4167240.22			
R9	287586.17	4167273.33			

Table 3 Coordinates and Position of Transmission Tunnel

Point No	Y	X	The Closest Residential Area	Direction	Distance
IL1	287718.92	4167416.63	Bulutlu Quarter	South Southwest	610 m
IL2	287746.68	4167466.71			
IL3	290118.3	4168261.31			
IL4	290149.98	4168292.99			
IL5	290172.36	4168268.49			
IL6	290131.4	4168231.75			
IL7	287767.42	4167435.76			
IL8	287742.38	4167402.87			

Table 4 Coordinates and Position of Forebay

Point No	Y	X	The Closest Residential Area	Direction	Distance
LOAD1	290153.55	4168292.8	Karbasan Quarter	Southeast	970 m
LOAD2	290171.05	4168337.45			
LOAD3	290217.8	4168302.15			
LOAD4	290172.56	4168273.19			

Table 5 Start-Finish Coordinates and Position of Penstock

Point No	Y	X	The Closest Residential Area	Direction	Distance
PS1	290200.61	4168316.93	Karbasan Quarter	Southeast	920 m
PS2	290240.13	4168344.08			

Table 6 Coordinates and Position of Powerhouse

Point No	Y	X	The Closest Residential Area	Direction	Distance
HEPP1	290208.24	4168367.51	Karbasan Quarter	Southeast	920 m
HEPP2	290240.76	4168399.61			
HEPP3	290292.71	4168360.75			
HEPP4	290260.19	4168326.54			

Table 7 Coordinates and Position of Storage 1

Point No	Y	X	The Closest Residential Area	Direction	Distance
SA1-1	288314.824	4167616.659	Bulutlu Quarter	Southwest	790 m
SA1-2	288436.748	4167617.027			
SA1-3	288436.748	4167583.507			
SA1-4	288311.878	4167583.876			

Table 8 Coordinates and Position of Storage 2

Point No	Y	X	The Closest Residential Area	Direction	Distance
SA2-1	289822.481	4168302.373	Karbasan Quarter	Southeast	890 m
SA2-2	289945.327	4168303.646			
SA2-3	289944.690	4168268.639			
SA2-4	289819.298	4168269.912			

Table 9 Coordinates and Position of Storage 3

Point No	Y	X	The Closest Residential Area	Direction	Distance
SA3-1	290246.777	4168531.680	Karbasan Quarter	Northeast	590 m
SA3-2	290240.044	4168553.766			
SA3-3	290249.900	4168579.940			
SA3-4	290268.852	4168558.777			
SA3-5	290269.763	4168532.688			

Table 10 Coordinates and Position of Storage 4

Point No	Y	X	The Closest Residential Area	Direction	Distance
SA4-1	290042.904	4168560.216	Karbasan Quarter	Northeast	665 m
SA4-2	290095.305	4168666.251			
SA4-3	290171.748	4168702.007			
SA4-4	290207.504	4168681.046			
SA4-5	290189.010	4168639.126			
SA4-6	290203.805	4168549.736			

III. ECONOMIC AND SOCIAL ASPECTS OF THE PROJECT

III.1 Investment Program and Finance Sources Related to the Realization of the Project, Where to Obtain These Sources

Estimated costs of the facilities within Torlar HEPP project were prepared for the proposed facilities and detailed projects included in the Appendice were used in doing so; quantities and estimated costs of all facilities were separately determined depending on these projects. Investment amount and annual distribution of this amount regarding the project are given in Table 11 below. As seen in Table 11 the total amount of estimated cost for the project is 44956722 Turkish Liras.

Table 11 Cost of Investment (TL)

TYPE OF WORK	INVESTMENT YEARS		TOTAL
	1	2	
OPERATION, WORKSITE FACILITIES	500,000		500,000
ACCESS ROADS	350,00		350,000
REGULATOR (Scouring Sluice)	9,131,763		9,131,763
TRANSMISSION TUNNEL	5,176,469	7,764,704	12,941,174
FOREBAY	569,149	5,122,338	5,691,487
POWERHOUSE AND TAILRACE CHANNEL		2,016,607	2,016,607
PENSTOCK PIPE		1,123,035	1,123,035
SUM OF CONSTRUCTION	**15,727,381**	**16,026,685**	**31,754,066**
TURBINES AND GENERATORS		2,892,333	2,892,333
AUXILIARY EQUIPMENT		1,682,812	1,682,812
OTHER EQUIPMENT		683,642	683,642
TRANSFORMER AND SWITCHYARD		100,000	100,000
POWER TRANSMISSION LINE		525,000	525,000
SUM OF ELECTROMECHANICAL EQUIPMENT		5,883,788	5,883,788
ESTIMATED GRAND TOTAL	**15,727,381**	**21,910,473**	**37,637,854**
UNEXPECTED EXPENSES CONSTRUCTION (15%)	2,359,107	2,404,003	4,763,110
TOTAL INSTALLATION PRICE (^{0})	**18,086,488**	**24,314,475**	**42,400,964**
SURVEY, PROJECT, CONTROL EXPENSES [1]	904,324	921,354	1,825,859
EXPROPRIATION [2]	547,425	182,475	729,900
SUBTOTAL – 1 (^{1}+^{2})	**1,451,749**	**1,104,009**	**2,555,759**
PROJECT COST (^{0}+^{1}+^{2})	**19,538,238**	**25,418,485**	**44,956,722**
TOTAL COST OF PROJECT	**19,538,238**	**25,418,485**	**44,956,722**

It is planned that a part of the total investment is financed by the equity capital and another part by the credit.

III.2 Work Flow Diagram or Time Schedule related to Execution of Project in case of Natural Disaster and Earthquake

Work schedule prepared at the feasibility stage in order to finish the project as scheduled is presented in **Table 12**. 90% of the regulator's construction, 60% of the water conveyance system's construction, 90% of the forebay's construction, 70% of the penstock's construction, 100% of the power plant's construction and 80% of the energy transmission line's construction (remaining only laying down the conductors) is completed. In this regard, it is anticipated that the remaining construction will be completed in 6 months.

Table 12 Estimated Investment Programme

N	INVESTMENT ITEMS	PREPARATION PERIOD						ESTABLISHMENT PERIOD																								
		1	2	3	4	5	6	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
00	REPORTING WORKS																														
01	Preparing detailed feasibility report																														
02	Preparing Research Report																														
10	PREPARING FINAL PROJECTS																														
11	Preparing construction projects																														
12	Preparing hydromechanical projects																														
13	Preparing electromechanical projects																														
20	PREPARING SPECIFICATION & TENDER DOCUMENTATION																														
21	Preparing Hydromechanical Specifications																														
22	Preparing Electromechanical Specifications																														
23	Preparing Construction Tender Documentation																														
30	PREPARING INCENTIVE (Global) LIST																														
40	SUBMISSION OF BIDS																														
41	Submission of Hydromechanical Bids																														
42	Submission of Electromechanical Bids																														
43	Submission of Construction Bids																														
50	EVALUATION OF BIDS & CONTRACTS																														
51	Hydromechanical Bid Evaluation & Contracts																														
52	Electromechanical Bid Evaluation & Contracts																														
53	Construction Bid Evaluation & Contracts																														
60	PREPARING CREDIT REPORT & APPLICATIONS																														
61	Completion of Credit Report																														
62	Credit Application & Completion of Procedure																														

III.3 Cost Benefit Analysis of the Project

In order to calculate estimated costs for construction works of Torlar HEPP facilities, projects were drawn on the existing maps for the proposed facilities and quantity and estimated cost of each unit were separately determined via these project drawnings. These quantities were evaluated according to 2009 unit prices of General Directorate of State Hydraulic Works (DSI) and General Directorate of Highways and then these prices were exchanged into USD dollar by using the average USD dollar parity for 2009.

According to the calculations, the proposed Torlar HEPP project will generate 34.38 GWh/year (0 GWh/year firm energy and 34.38 GWh/year secondary energy); and in case of will carry out 34.38 GWh energy generation, 0.00 GWh as firm energy and 34.38 GWh as secondary energy and, in case of upstream, will carry out 31.11 GWh energy generation in total, 0.00 GWh as firm energy and 31.11 GWh as secondary energy. In cas of source development, 31.11 Gwh energy will be generated per year (0.00 Gwh being firm energy and 31.11 Gwh being secondary energy).

In calculation of benefits, DSI criteria and 6.0 cents/kWh value for firm energy and 3.3 cents/kWh value for secondary energy were based on for calculations made in terms of national economy. In energy calculations made in terms of company, 6.0 cents/kWh value was taken for both firm and secondary energy. In calculating for renewable energy, 8.5 cents/kWh value was taken for both firm and secondary energy.

In calculating economic analysis of the hydroelectric plant to be built, the memorandum called “Criteria to Be Used in Economic Comparisons” published by Ministry of Energy and Natural Resources were considered. Pursuant to the criteria specified in the above-mentioned memorandum; project’s life cycle and social discount rate were taken as 50 years and 9.5%, respectively, and it was accepted that the electromechanical equipment will be renewed within 35th year following commissioning of the facility.

Interest and depreciation rates were taken as 0.09603 in calculations for interest + depreciation + renewal expenses constituting annual expenses. Operation and maintenance expenses consist of maintenance-repair, spare parts, insurance, personnel and general expenses, and it was calculated by multiplying each item with its own multiplier. Annual expenses calculated depending on facility costs in Torlar HEPP project are given in Table 13. Due to the fact that income rate of Torlar HEPP project is below 1 according to DSI criteria, calculation of its internal rate of return and its sensitivity analysis were not performed.

The wastewater treatment expenses (plant installation, management, treated wastewater analysis), the environmental engineering fees (EIA reporting, environmental consulting, etc.), irrigation expenses to prevent dust emission, waste oil disposal expenses, etc. are the construction phase environmental costs. Landcape restoration, afforestation, environmental flow remote monitoring, etc are the expenses at construction phase. These expenses are calculated in unknown and Survey-Project-Supervision costs in table 13.

When the floristic structure of the area is examined, pine and oaks are found to be appropriate for the region. But acacia, also appropriate for the region and itis chosen for forestation because of its rapid growth resistance to erosion and to various weather conditions. Cost of a two year old acacia tree is considered to be TRY 5, the total cost of trees within the

scope of the project is found to be TRY 2500. When it is considered that a person can dig holes and plant 10 trees per day, landscaping works shall be completed in a duration of average 1 month. In this context, personnel cost is found to be TRY 2500. Total landscaping cost is calculated as: 2500+2500= TRY 5000.

Table 13 Investment Amount Annual Income-Expense Rate

TYPE OF WORK	**Cost (TL)**	**Interest+Depreciation (TL)**	**Trans.+Residue (TL)**	**TOTAL (TL)**
	1	2= (1)X0,09603	3=(1)*Coefficient	4=2+3
CONSTRUCTION WORKS				
Operation and worksite facilities	500,000	48,015	5,000	
Access road	350,00	33,611	3,500	
Regulator (Bat., Der., Scouring sluice, sediment. pond)	9,131,763	876,923	91,318	
Transmıssıon tunnel	12,941,174	1,242,741	64,706	
Forebay	5,691,487	546,553	56,915	
Powerhouse	2,016,607	193,655	20,166	
Penstock	1,123,035	107,845	11,230	
Construction Works Total Estimated Price	31,754,066	3,049,343	252,835	
Unknowns (Construction) (15%)	4,763,110	457,401	37,925	
		1,682,812		
Construction Works Installation Price	36,517,176	3,506,744	290,760	3,797,504
ELECTRO-MECHANICAL WORKS				
Electro-mechanical Equipment and Assembly	5,358,788	514,604	107,176	
Power Transmission Line	525,000	50,416	10,500	
Electro-mechanical Works Installation Cost	5,883,788	565,020	117,676	682,696
TOTAL INSTALLATION COST	42,400,964	4,071,765	408,436	4,480,200
Survey-Project-Supervision	1,825,859	175,337		175,337
Expropriation	729,900	70,092		70,092
TOTAL COST OF PROJECT	44,956,722	4,317,194	408,436	4,725,630
TOTAL INVESTMENT PRICE	**44,956,722**	**4,317,194**	**408,436**	**4,725,630**

FIRM ENERGY INCOME ($/Kwh)	0.06	0.06	0.085
SECONDARY ENERGY INCOME ($/Kwh)	0.033	0.06	0.085
CURRENT STATE			
ANNUAL FIRM GENERATION (GWh)	0.00	0.00	0.00
ANNUAL SECONDARY GENERATION (GWh)	34,38	34.38	34.38
ANNUAL INCOME (TL)	1,588,390	2,887,982	4,091,307
ANNUAL EXPENDITURE (TL)	4,725,630	4,725,630	4,725,630
INCOME/EXPENDITURE RATIO	**0.34**	**0.61**	**0.87**
UPSTREAM DEVELOPMENT STATE			
ANNUAL FIRM GENERATION (GWh)	0.00	0.00	0.00
ANNUAL SECONDARY GENERATION (GWh)	31.11	31.11	31.11
ANNUAL INCOME (TL)	1,437,252	2,613,185	3,702,012
ANNUAL EXPENDITURE (TL)	4,725,630	4,725,630	4,725,630
INCOME/EXPENDITURE RATIO	**0.30**	**0.55**	**0.78**

III.4 Other Activities Which Are Not Within The Scope of the Main Project But Are Designed To Be Realized by The Project's Owner or Other Investors Depending on the Realiziation of the Project

III.4.a. Water Supply and Waste Water Treatment

Drinking water required at the project's construction stage will be purchased as demijohns and usage water will be brought to the construction site by carrying with tankers from Körsulu River.

Domestic wastewater occurring during the construction of the project is treated in wastewater treatment plant (seen in figure 7) and discharged to the receiving environment in accordance with the "Regulation on Water Pollution Control" that came into force after being published in the Official Gazette dated on 31/12/2004 No:25687. The wastewater analysis reports results are given in annex 27. This regulation's 32nd Article "Discharging Standards For Domestic Wastewater" contains the provision that dictates that "for settlements with no septics; in areas required by the Governorship to be protected for pollution, if the population is below 84 habitants, domestic wastewater is collected in watertight septics to be built in accordance with the 'Regulation Regarding the Holes that Will be built where septic construction is not possible.'" In this regard, wastewater treatment facility built by the activity owner is not within the discharge of such legislation nor environmental permit. However, outlet water of wastewater treatment facility built by the activity owner should be controlled by the Ministry of Environment and Urbanization twice a year via an authorized environmental analysis lab. During operation stage, wastewater originated from the personnel will be collected in watertight septic and pulled out by the Municipality's vacuum trucks and removed.

Figure 9 Domestic Wastewater Treatment Plant

III.4.b. Fire Protection System

A proper fire system will be established in order to prevent a possible fire taking place in Torlar Regulator and HEPP project. Fire alarm system equipped with heat, smoke and flame detectors will be used within plants building and the following fire extinguishing systems will be available;

Fire hydrants,

- Fire extinguishers filled with carbon dioxide,
- Hand-held fire extinguishers,
- Fire blankets,
- Fire extinguishing powder generator,
- Fire extinguishing foam generator,
- Carbon dioxide tank,
- Sand buckets,
- Foam system,
- Fire hoses.

III.4.c. Lighting

Project's owner will provide all internal and external lighting required for the project area. In this regard, external lighting will be performed particularly in hydraulic structures and HEPP buildings.

III.5 Other Economic, Social and Infrastructural Projects Which Are Not Within The Scope of the Main Project But Are Indispensable For The Project And Designed To Be Realized by The Project's Owner or Other Investors Depending On The Realization of The Project

Kahramanmaraş drinking water distribution pipe line is located at the ***one kilometer*** upstream of Torlar Regulator and HEPP. Before begining the construction of Torlar Reg. and HEPP, ***a wall (height: 3 meters, length: 5 meters) had been constructed i***n order to prevent any potential impact (i.e. possible soil weakening under the pipe line) to the pipe line due to the increase in water level in the reservoir area .

III.6 Ownership Status, Expropriation, Ways of Re-Settlement, Information in Relation with Briefing the Public within the Scope of Expropriation of the Places Chosen for the Project

Total working area for construction is 715,946.43 m^2 (71.5 da) (+12,500 m2 worksite facilities). 186,061 m^2 (18.60 da.) of this working area is agricultural area, 388,691 (38.86 da) m^2 is forest area and the remaining part is treasury land. The calabrian pines, oak trees, grove, degraded grove, and some areas without trees exist in the project area.. The forest land is generally degraded. 186,061 m^2 (18.6 da) was expropriated for the transmission line corridor and poles. 21,473 m^2 (2.15 da) was expropriated for the regulator area, power station

area, diversion channel and other facilities. The lands that are expropriated for the transmission line are mostly farmlands used for agricultural production. But expropriation doesn't affect the agricultural activity because the landowners continue to plant at the expropriated lands. Only the areas where the poles are placed (25 m^2 each) can't be used, in remaining parts of the expropriated land the agricultural activity is going on if any. In the figure below, there is a map showing the project's area, expropriation boundaries, land ownership status and project's units. Also the sizes of areas covered by the units can be seen in Table 14.

Table 14 Total Used Areas for the Units

Units	Area (da)
Pond Area (at 514 m)	16.3
Regulator	0.64
Sedimentation Pool and Tunnel Entrance	0.62
Conduit	0.48
Forebay	0.47
Penstock	0.21
Power Station and Tail water	0.36
Forebay and Passageway	0.17
Transmission Line Poles (total number 64)	0.16
Transmission Line (Air Easment)	18.44

Since the project is a river type project, there is no water storage in the scope. Behind the regulator type structures, generally a water level adjustment must be done, in order to reach the project design flow. Therefore some water accumulation occurs before the regulator structure, but it is not used for energy production. At 514 m elevation, the calculated reservoir area is 163,123 m^2 (App. 31).

Land owners were informed by a debriefing meeting. Within the scope of expropriation studies in the project, most of the private land owners were convinced to sell their properties willingly. The expropriation was only made for the land owners who were not known or could not be reached.

All the compansations were paid by the company, but there are still ongoing cases because the landowners couldn't be found as they are not living in Turkey or they were dead and their inheritors could not be determined. Also their payments were deposited to the bank by the company as a necessity of Turkish Expropriation Legislation.

All information on expropriation process and results are given in the land aqusition report and sent to WB.

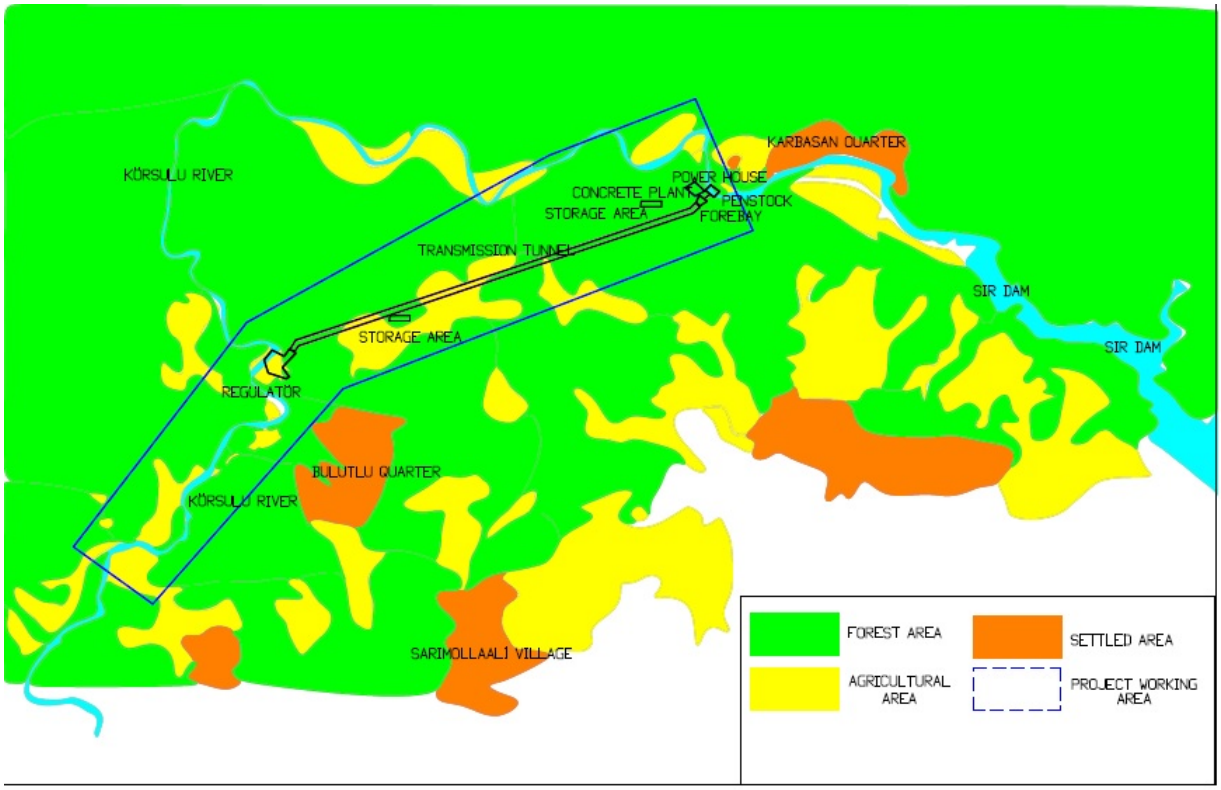


Figure 10 Map of Land Presence in Project Area

III.7 Other Matters

There is not any other matter to be conveyed in this section related to economic and social dimensions of the project.

IV. Determination of the Affected Area within the Scope of the Project and Explanation of the Extant Environmental Characteristics Within This Area (*)

(*) *In this part, impact area must be considered while giving environmental characteristics of the area selected for the project. While the matters listed in this section are explained, sources of the information obtained from the related public institutions and organizations, research institutions, universities or other similar institutions are expressed in the Notes section or written on the related map, document etc. If the project owner wants to provide information based on his/her own researches, a certificate documenting accuracy of this information is obtained for those that are under the authority of public institutions and organizations from the respective institutions and organizations and is attached to the report.*

IV.1 Areas Effected from the Project

Torlar Regulator and HEPP, Ready-to-Use Concrete Plant and Power Transmission Line project planned to be built by the operator is a project intended for only energy generation.

Within the scope of project for the determination of affected areas and affect degrees have been evaluated in three groups; "1 Low degreed affected areas", 2 Secondary Degreed affected areas", 3 Highly affected areas".

In consideration of these impacts, the areas within project's impact area can be classified as follows:

a) Areas being continuously affected by activities of the project; in other words, the areas losing its natural characteristic due to the project (lands in the route of regulator site, transmission tunnel entrance and exit region, forebay site, lands on the penstock's route, plant site, areas of river downstream of regulator (until tail water) and areas in which masts of power transmission line is placed).

Bed of Körsulu River remaining within borders of the project.

b) Areas which are affected by construction activities of the project but are not subject to these impacts after completion of such construction activities (storage areas 1–2–3–4, ready mixed concrete plant site). These areas can be restored at the end of the construction works. The effects seen in these areas are not permanent.

c) Areas affected in social and economic aspects due to activities of the project (Bulutlu Neigborhood, Karbasan Neigborhood, Sarımollaali Village and city of Kahramanmaras)

a) Areas to be continuously affected by activities of the project

Natural ecosystem –will be destroyed by excavations in the area in which units and construction works planned to be performed under the project. Thus construction of the units will also destroy natural vegetation of these areas. However, this impact will emerge in local areas in which the structures will be built (lands in the route of regulator site, transmission tunnel , forebay site, penstock, plant site and areas in which masts of power transmission line is placed). Sizes of these areas are presented in Section III.

Bed of Korsulu River remaining within borders of the project:

A partial muddiness occurred at the construction stage of regulator structures. But this negative effect will be removed after the water will be derivated. In this context, water samples were taken from Körsulu River HEPP spring and river mouth and analyzed to determine the current quality values. In the controls to be performed by Provincial Directorate of Environment and Urbanization, spring and river mouth analysis will be reperformed and the effects of construction stages will be controlled.

Another important continious impact of the project is a substantial decrease in water flow of Korsulu stream. The length of the river section in between regulator and power house is 6.43 km. During operation stage, flow regime of Körsulu River between regulator structure and the tailwater of hydroelectric plant changes. The aquatic habitat is affected negatively depending on the change in flow regime of Körsulu River in between regulators and hydroelectric plants. Througout the corresponding river section, there are considerable stream contrubitions of the side branches.

b) Areas which are affected by construction activities of the project but are not subject to these impacts after completion of such construction activities

When environmental impacts (dust-noise-vibration-traffic etc.) at construction stage of the project is considered, calculations for project impact area showed a 100 m of impact area. The areas to be temporarily influenced by project activities are marked as working area and protection area in the map given in Figure 8 above.

In order to construct energy transmission line, totally 1600 m^2 ($25m^2$x64 poles) has been expropriated for 64 poles and an amount of 184.461 m^2 (18.44 da) has been granted an easement for the line itself.

c) Areas affected in social and economic aspects due to activities of the project

Project implementation will not result in significant negative socio economic impact on the surrounding area since most of the lands utilized for the project are forestlands. There are small amount of agricultural areas as small individual lands. As its explained in the previous section, only 1600 m^2 land which the poles have been placed on cannot be used for agricultural activity, the remaining expropriated land can be used for agricultural activities so there will only be a small amount of income loss. To compensate the small income losses, company has paid to the owners the twice of the values of the lands decided by the court. **All the information of lands those are expropriated are given in the land aqusition report and sent to WB.**

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

IV.2.1. Meteorological and Climatic Characteristics

When examining climatic characteristics of the region where Torlar Regulator and

HEPP will be constructed under the project, 1975-2010 Meteorological Bulletin data based on long-term observation data of General Directorate of State Meteorology Affairs Kahramanmaras Meteorology Station presenting the best climatic characteristics of the region were used. Data obtained from DMI-TUMAS (General Directorate of State Meteorology Affairs – Turkey Meteorology Archiving System) is presented in the Appendice section (See Appendix-7).

Meteorological records coming from all stations within the city of Kahramanmaras from their establishment to 2010 were examined and general climatic state of the province was revealed.

The city of Kahramanmaraş is located on the junction point of three geographical regions (Mediterannean Region, Eastern Anatolia Region and Southeastern Anatolia Region). Its climate is closer to the "Degenerated Mediterannean Climate." In the central station, summers are hot and dry while winters are warm and rainy which is a typical Mediterannean Climate characteristic. But when one moves to north, continental climate takes over due to increase of height. Continental climate is influential in regions away from the sea and in the middle of continents. Summers are hot and dry while winters are cold and snowy. Where continental climate is influential, winters start earlier and the snow cover duration is about 90 days. Summers start early as well and are hot but since the humidity is low, this heat is not sensible much. The difference between day and night and that of during the year is elevated.

Pressure Distribution of the Region

According to 36-year (1975-2010) observation data of Kahramanmaras Meteorology Station, annual average pressure value is 948.6 hPa. Maximum annual pressure was determined in September with the value of 964.8 hPa.; on the other hand minimum annual pressure was measured as 924.7 hPa in March. Pressure measurement (mean pressure, maximum pressure, and minimum pressure) values obtained according to 36-year observation data are given in Table 15 and Figure 9.

Table 15 Pressure Distribution of Kahramanmaras according to 36-Year Long-Term Observation Data (hPa)

MONTHS	Mean Pressure (hPa)	Maximum Pressure (hPa)	Minimum Pressure (hPa)
January	950.9	964.3	928.5
February	949.2	963.3	929.5
March	947.7	962.6	924.7
April	946.2	957.7	925.0
May	945.6	955.5	929.4
June	942.9	950.7	928.6
July	940.2	947.5	931.9
August	941.4	951.4	931.9
September	945.6	964.8	936.6
October	949.3	959.1	937.7
November	951.2	964.6	933.1
December	951.6	963.4	931.9

ANNUAL	**946.8**	**964.8**	**924.7**

Source: DMI-TUMAS (Kahramanmaras Central Station 1975-2010 Observation Data)

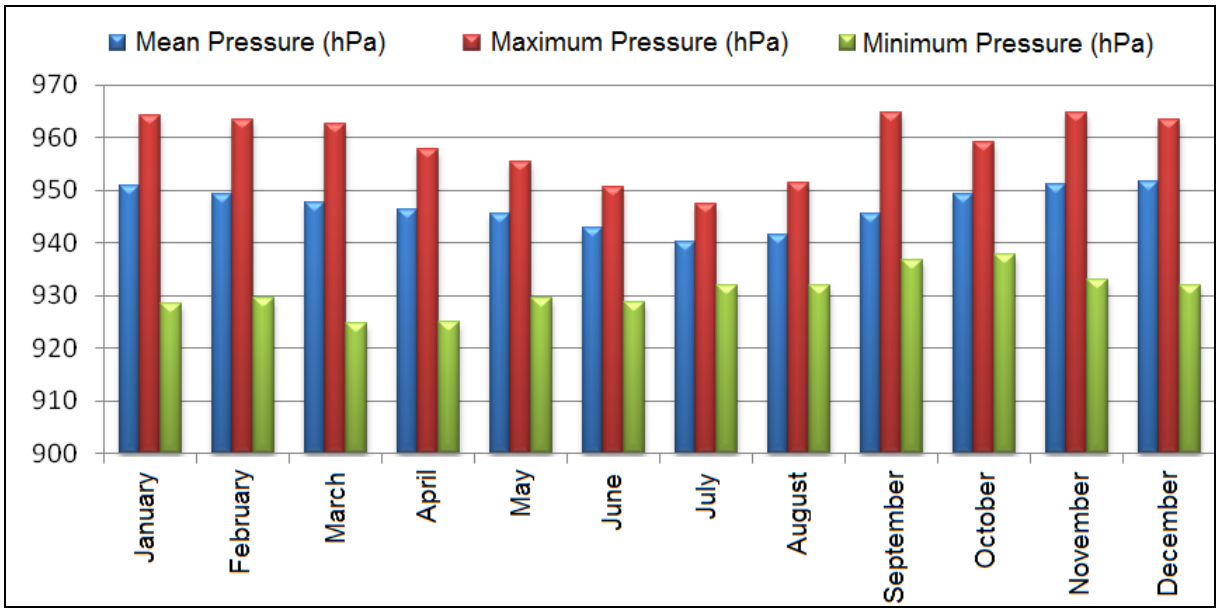


Figure 11 Graphic of Monthly Pressure Values (hPa) of Kahramanmaras according to 36-Year Long-Term Observation Data.

Temperature Distribution of the Region

According to 36-year observation data of Kahramanmaras Meteorology Station, annual average temperature of the city is ***16.8 °C*** . According to the observation results (between 1975 and 2010), maximum temperature is measured as ***45.2°C*** in July; on the other hand minimum temperature is recorded as ***– 9.6 °C*** in February. Monthly temperature values of Kahramanmaras obtained according to the 36-year observation results are summarized in Table 16 and displayed in the graphic given in Figure 12.

Table 16 Temperature Distribution of Kahramanmaras according to 36-Year Long-Term Observation Data (°C)

MONTHS	Mean Temperature (°C)	Maximum Temperature (°C)	Minimum Temperature (°C)
January	4.9	17.4	-7.8
February	6.3	21.8	-9.6
March	10.6	29.2	-7.6
April	15.4	36.0	-0.6
May	20.4	38.0	5.0
June	25.2	42.0	11.0
July	28.4	45.2	15.6
August	28.4	44.4	16.0
September	25.1	41.3	8.6
October	19.0	37.2	2.2
November	11.5	27.2	-4.4
December	6.6	20.9	-7.6
ANNUAL	**16.8**	**45.2**	**-9.6**

Source: DMI-TUMAS (Kahramanmaras Central Station 1975-2010 Observation Data)

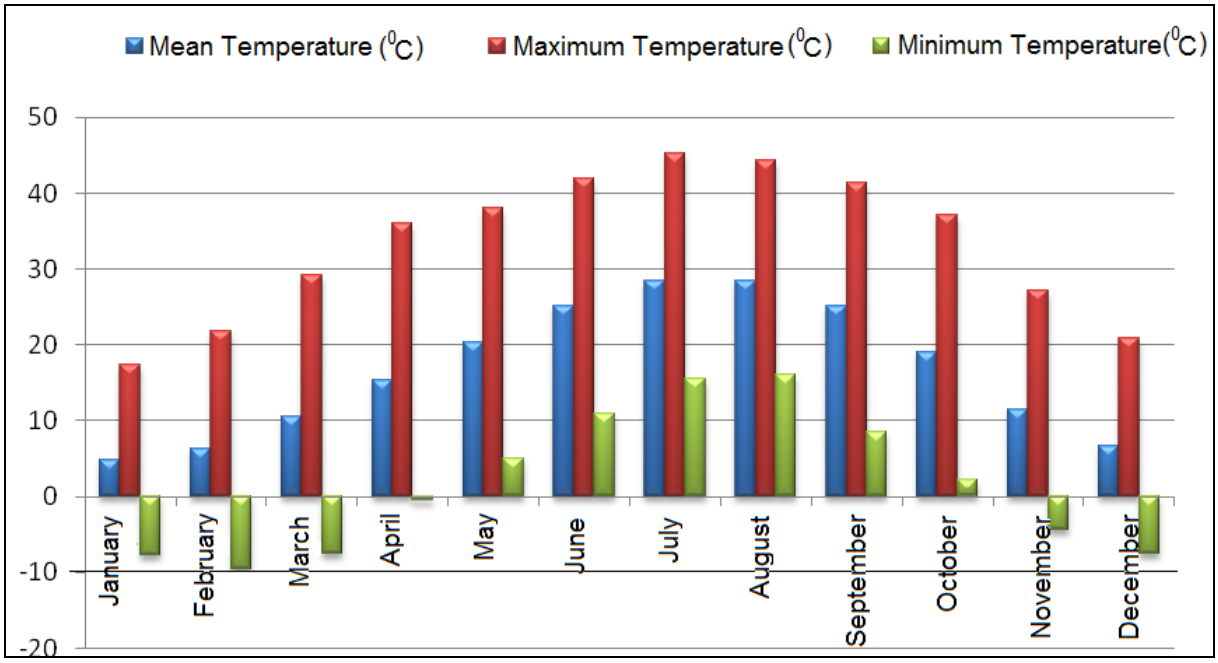


Figure 12 Distribution of Monthly Temperature Values (°C) of Kahramanmaras according to 36-Year Long-Term Observation Data

Precipitation Distribution of the Region

Average annual total precipitation determined in Kahramanmaras Observation Station has been measured as **735.8 mm**. Maximum daily amount of precipitation is **98.2 mm** and recorded in December. Characteristic precipitation values of Kahramanmaras between 1975 and 2010 are given in the following tables and graphics.

Table 17 Precipitation Distribution of Kahramanmaras according to 36-Year Long-Term Observation Data

MONTHS	Average Total Precipitation (mm)	Daily Maximum Precipitation (mm)
January	125.4	52.9
February	112.3	64.0
March	94.8	53.5
April	76.1	66.5
May	39.3	50.0
June	5.9	22.3
July	1.0	7.9
August	0.5	5.0
September	7.3	18.7
October	53.1	56.8
November	90.9	72.0
December	129.2	98.2
ANNUAL	**735.8**	**98.2**

Source: DMI-TUMAS (Kahramanmaras Central Station 1975-2010 Observation Data)

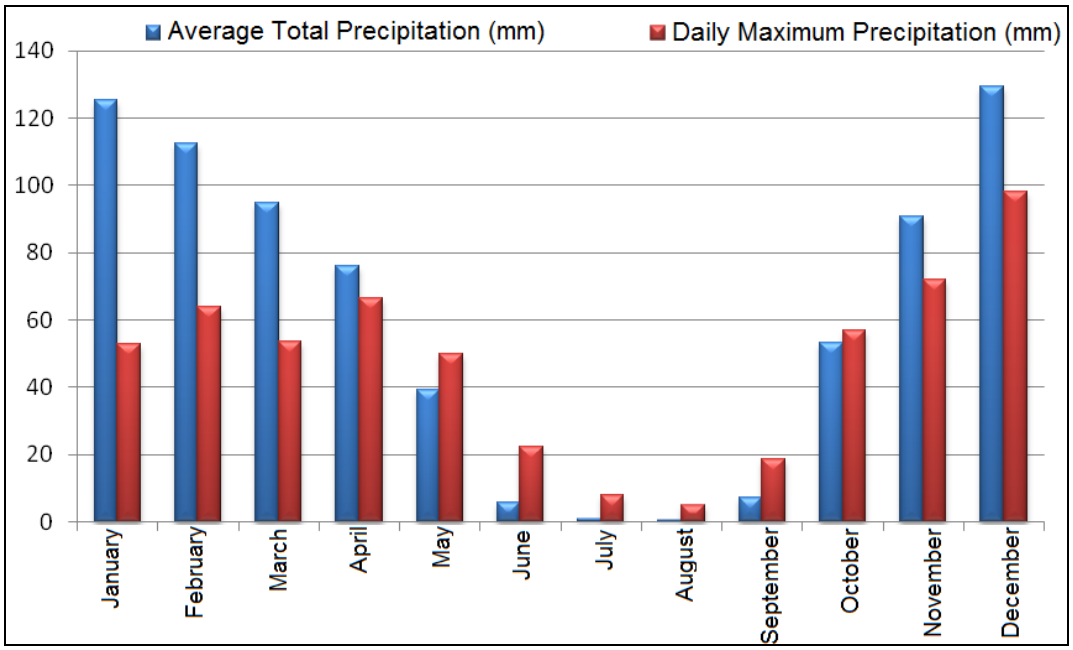


Figure 13 Graphic of Average Total Precipitation and Maximum Precipitation Distribution of Kahramanmaras according to 36-Year Long-Term Observation Data

Maximum Precipitation Values Observed in Standard Times and Frequency Graphics

Maximum precipitation values and precipitation-heaviness-time frequency values observed in standard times between 1966-2005 are presented in Appendice section (See Appendix-10).

When 24 hours precipitaion values are taken into consideration in precipitation-heaviness-frequency curves of Kahramanmaraş Meteorology Station, total precipitation amount is determined as ***70,31 mm***.

At the installation stage of Torlar Regulator and HEPP facility, this value will be taken into consideration and the construction will be performed accordingly.

Humidity Distribution of the Region

According to 36-year observation data of Kahramanmaras Meteorology Station, annual average relative humidity determined in the city is ***59.2%***. Minimum relative humidity in the region is ***1%*** and observed in July. Humidity measurements obtained according to 36 – year observation data are given in Table 18 and displayed in the graphic given in Figure 12.

Table 18 Relative Humidity Distribution of Kahramanmaras according to 36-Year Long-Term Observation Data

MONTHS	Mean Relative Humidity (%)	Minimum Relative Humidity (%)
January	70.0	8.0
February	66.0	7.0
March	60.5	5.0
April	58.4	4.0
May	54.7	4.0
June	50.7	2.0

July	52.6	1.0
August	54.3	3.0
September	51.6	4.0
October	55.2	4.0
November	64.7	2.0
December	71.3	13.0
ANNUAL	**59.2**	**1.0**

Source: DMI-TUMAS (Kahramanmaras Central Station 1975-2010 Observation Data)

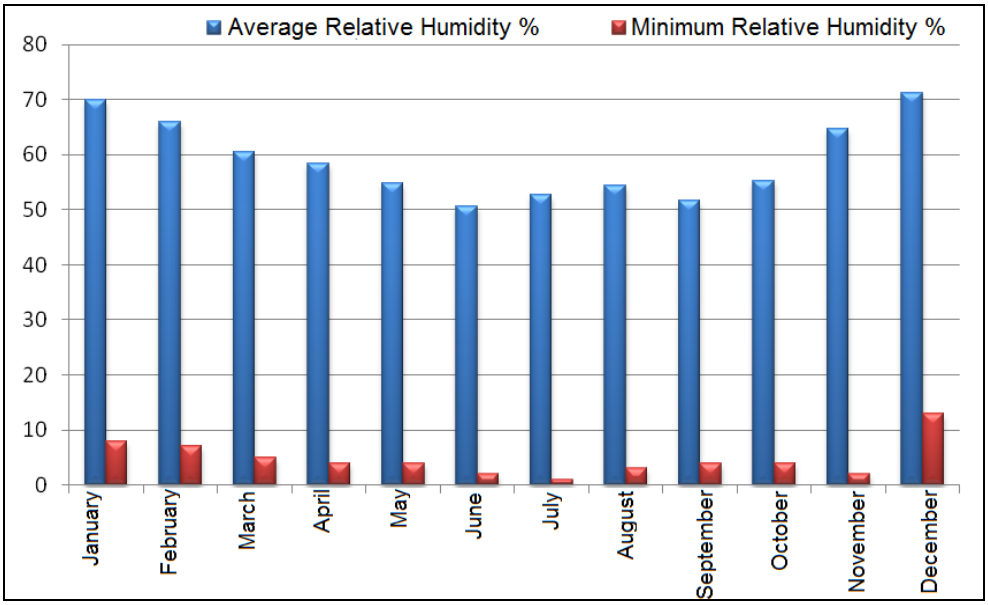


Figure 14 Distribution of Relative Humidity of Kahramanmaras by Months according to 36-Year Long-Term Observation Data

Evaporation state of the region

According to data obtained from Kahramanmaras Meteorology Station between 1975 and 2010, annual average open surface evaporation value determined in Kahramanmaras is ***1529.9 mm***, and maximum daily open surface evaporation value is ***21.0 mm*** and recorded in July.

Table 19 Evaporation Distribution of Kahramanmaras according to 36-Year Long-Term Observation Data

MONTHS	Average Open Surface Evaporation (mm)	Daily Maximum Open Surface Evaporation (mm)
January	-	-
February	-	-
March	11.3	7.7
April	108.3	10.5
May	173.3	13.0
June	266.3	16.8
July	319.9	21.0
August	301.2	19.9
September	212.6	16.0
October	114.0	10.5
November	22.3	6.8
December	0.7	8.9
ANNUAL	**1529.9**	**21.0**

Source: DMI-TUMAS (Kahramanmaras Central Station 1975-2010 Observation Data)

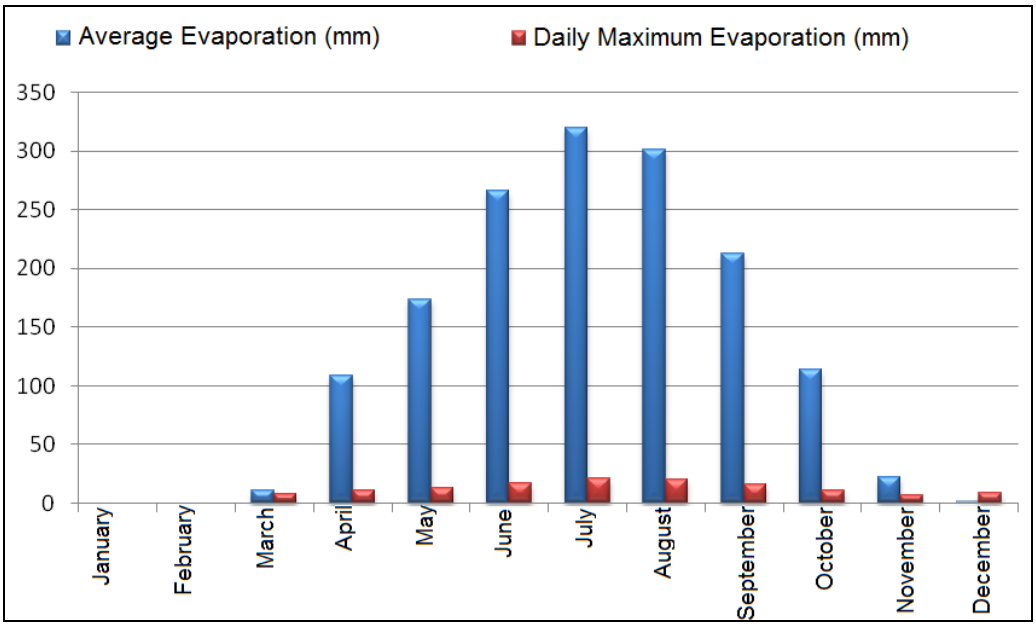


Figure 15 Monthly Evaporation Distribution of Kahramanmaras according to 36-Year Long-Term Observation Data

Range of Counted Days and Number of Foggy, Snowy, Snow Covered Days, Maximum Snow Depth

Range of counted days by months is presented in Table 20 and graphical illustration of the counted days is presented in Figure 14.

According to data obtained from Kahramanmaras Meteorology Station between 1975 and 2010, it is observed that average number of snowy days is 7.2 days in total, average number of days with snow cover is 4,7 days in total, average number of foggy days is 13.1 days in total, average number of hailing days is 0.9 days, average number of frosty days is 28.2 days in total and average number of days with thunderstorm is 19.9 days.

Table 20 Monthly Counted Days Distribution of Kahramanmaras according to 36-Year Long-Term Observation Data

MONTHS	Average number of snowy days	Average number of days with snow cover	Average number of foggy days	Average number of hailing days	Average number of frosty days	Average number of thunderstorm days
January	2.9	2.2	3.4	-	9.9	0.3
February	2.3	1.9	2.8	0.1	5.5	0.6
March	0.5	0.1	0.8	0.1	2.4	1.3
April	-	-	0.1	0.2	-	3.0
May	-	-	0.1	0.2	-	4.8
June	-	-	-	0.1	-	2.1
July	-	-	-	-	-	0.7
August	-	-	-	-	-	0.8
September	-	-	-	-	-	1.9
October	-	-	0.3	0.1	-	2.8
November	0.2	0.1	2.2	0.1	2.3	1.1
December	1.3	0.4	3.4	-	8.1	0.5
ANNUAL	**7.2**	**4.7**	**13.1**	**0.9**	**28.2**	**19.9**

Source: DMI-TUMAS (Kahramanmaras Central Station 1975-2010 Observation Data)

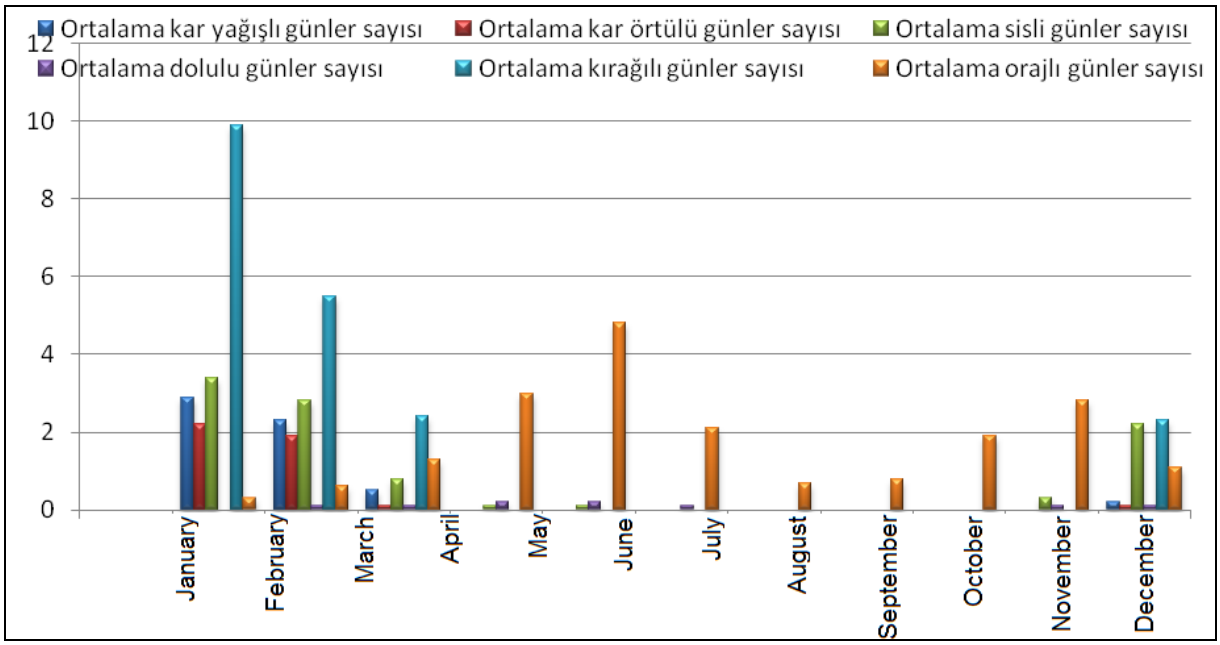


Figure 16 Graphic of Counted Days of Kahramanmaras according to 36-Year Long-Term Observation Data

Maximum Snow Depth

According to meteorological data of the city of Kahramanmaraş, it is observed that the annual total snow depth is 37 cm which is recorded in February.

Table 21 Monthly Counted Days Distribution of Kahramanmaras according to 36-Year Long-Term Observation Data

MONTHS	Maximum snow depth (cm)
January	26
February	37
March	7
April	-
May	-
June	-
July	-
August	-
September	-
October	-
November	6
December	17
ANNUAL	**93**

Source: DMI-TUMAS (Kahramanmaras Central Station 1975-2010 Observation Data)

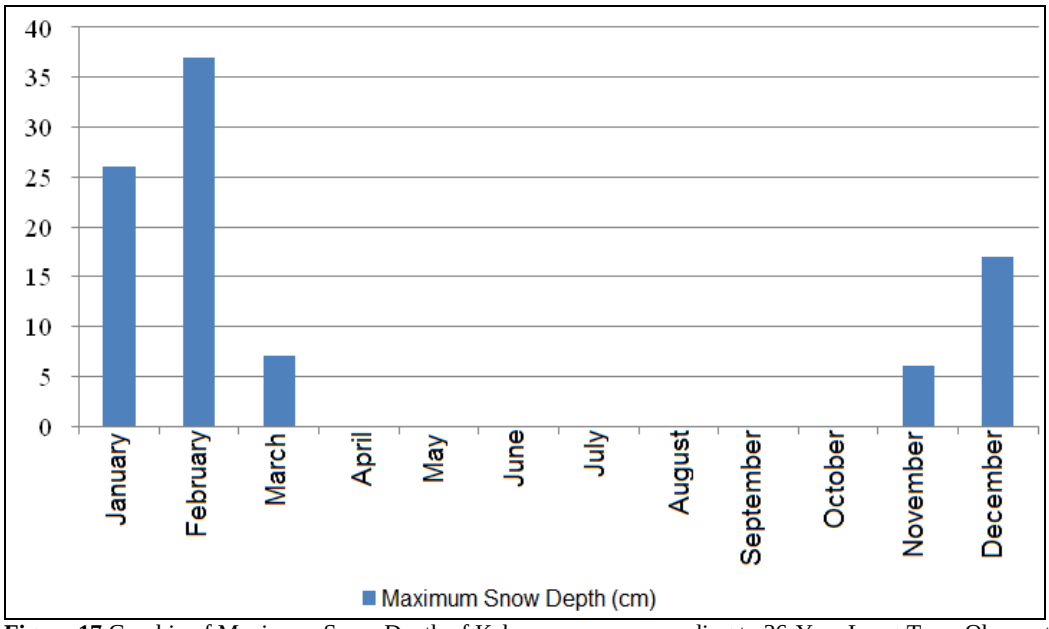


Figure 17 Graphic of Maximum Snow Depth of Kahramanmaras according to 36-Year Long-Term Observation Data

Wind Distribution of the Region (Annual, Seasonal, Monthly Wind Direction Distribution; Wind Speeds According to Directions; Distribution Graphic of Monthly Average Wind Speeds; Direction and Speed of the Fastest Wind, Number of Stormy and Gusty Days)

According to data obtained from the Kahramanmaras Meteorology Station, monthly and annual number of blows and their speed range are given in the following tables. As shown in the tables, the dominant wind direction in the city blows in West – Northwest (WNW) direction. When the other dominant wind directions were examined, it was determined from DMI data that the second dominant wind direction is West (W) and the third one is West – Southwest (WSW).

Tables and graphics for wind range of the region are given below.

Table 22 Distributions of Monthly and Annual Blow Numbers of Kahramanmaras by Directions

SUM OF BLOW NUMBERS													
Wind Direction	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**ANNUAL**
N	1651	1535	1748	1402	1557	2069	2121	1781	1974	2291	1924	1369	21422
NNE	754	796	881	687	723	666	576	671	615	805	864	712	8750
NE	678	629	754	674	521	401	369	519	649	889	879	830	7792
ENE	1654	1392	1576	1270	1050	698	614	700	851	1108	1029	1280	13222
E	1527	1600	1456	1121	948	781	694	857	922	1007	1153	1637	13703
ESE	1622	1774	1940	1590	1187	688	662	650	708	1026	1060	1719	14626
SE	1010	989	941	899	768	474	504	706	808	1075	1013	1221	10408
SSE	1248	1167	1475	1366	1164	561	571	807	967	1176	1066	1075	12643
S	2515	2050	2103	1980	1708	798	868	969	1721	1950	1827	2257	20746
SSW	1655	1240	1583	1303	1355	766	760	790	1010	1357	1299	1233	14351
SW	1303	993	829	707	676	402	379	398	598	1034	1315	1640	10274

WSW	2299	2147	2221	1914	1947	1943	2028	1931	1402	1653	1797	1990	23272
W	2581	2074	2233	2479	2662	3635	4439	4098	2812	2278	2593	2697	34581
WNW	1581	1681	3306	4842	6219	7844	8086	7807	6291	3662	1641	1648	54608
NW	825	887	1119	1628	2089	1898	1877	1964	2111	2215	1670	1040	19323
NNW	1025	1054	1388	1196	1412	1951	1981	1681	1738	1768	1308	1069	17571

Source: DMI-TUMAS (Kahramanmaras Central Station 1975-2010 Observation Data)

AVERAGE WIND SPEEDS													
Wind Direction	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**ANNUAL**
N	1.4	1.7	1.6	1.3	1.5	2.4	2.5	2.0	1.4	1.1	1.2	1.2	1.6
NNE	1.2	1.4	1.3	1.1	1.2	2.0	2.1	1.7	1.2	1.1	1.2	1.0	1.4
NE	0.7	0.8	0.8	0.7	0.6	0.8	0.8	0.7	0.7	0.7	0.8	0.6	0.7
ENE	1.1	1.0	1.1	1.0	0.9	0.8	0.9	0.9	0.8	0.8	1.0	1.0	0.9
E	1.0	1.0	1.1	0.9	0.7	0.7	0.7	0.7	0.7	0.7	0.8	1.0	0.8
ESE	1.1	1.1	1.2	1.2	0.9	0.7	0.8	0.7	0.7	0.7	0.9	1.0	0.9
SE	0.6	0.8	0.8	0.8	0.6	0.6	0.7	0.7	0.7	0.6	0.6	0.6	0.7
SSE	0.7	0.8	1.0	0.9	0.8	0.8	0.9	0.9	0.8	0.7	0.6	0.6	0.8
S	0.5	0.6	0.7	0.7	0.7	0.7	0.9	0.8	0.7	0.5	0.5	0.5	0.7
SSW	0.7	0.7	0.9	0.9	0.9	1.1	1.2	1.2	1.0	0.7	0.5	0.6	0.9
SW	0.5	0.5	0.6	0.7	0.8	1.1	1.3	1.2	0.8	0.6	0.5	0.5	0.8
WSW	0.8	0.8	1.0	1.2	1.5	2.2	2.5	2.4	1.7	0.9	0.6	0.7	1.4
W	0.8	0.8	1.2	1.5	1.8	2.7	3.3	3.2	2.3	1.0	0.6	0.7	1.7
WNW	1.0	1.3	1.9	2.4	2.8	3.7	4.2	4.0	3.2	1.7	1.0	1.0	2.4
NW	0.9	1.0	1.4	1.9	2.2	2.8	2.9	2.8	2.1	1.3	0.7	0.7	1.7
NNW	1.5	1.8	1.8	1.6	1.9	2.5	2.7	2.4	2.0	1.4	1.2	1.3	1.8

Source: DMI-TUMAS (Kahramanmaras Central Station 1975-2010 Observation Data)

Table 23 Distributions of Seasonal and Annual Blow Numbers of Kahramanmaras by Directions

Wind Direction	Sum of Blow Numbers Spring	Sum of Blow Numbers Summer	Sum of Blow Numbers Autumn	Sum of Blow Numbers Winter
N	4707	5971	6189	4555
NNE	2291	1913	2284	2262
NE	1949	1289	2417	2137
ENE	3896	2012	2988	4326
E	3525	2332	3082	4764
ESE	4717	2000	2794	5115
SE	2608	1684	2896	3220
SSE	4005	1939	3209	3490
S	5791	2635	5498	6822
SSW	4241	2316	3666	4128
SW	2212	1179	2947	3936
WSW	6082	5902	4852	6436
W	7374	12172	7683	7352
WNW	14367	23737	11594	4910
NW	4836	5739	5996	2752
NNW	3996	5613	4814	3148

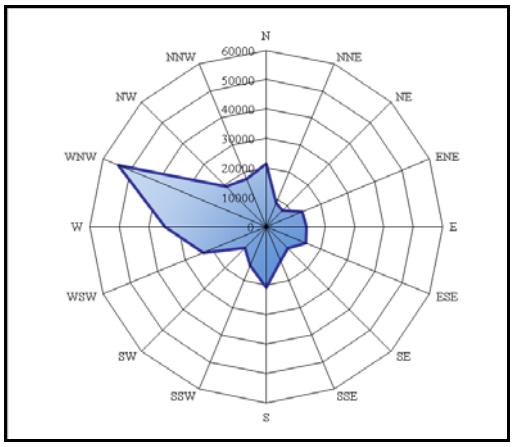


Figure 18 Annual Wind Diagram by Blow Numbers

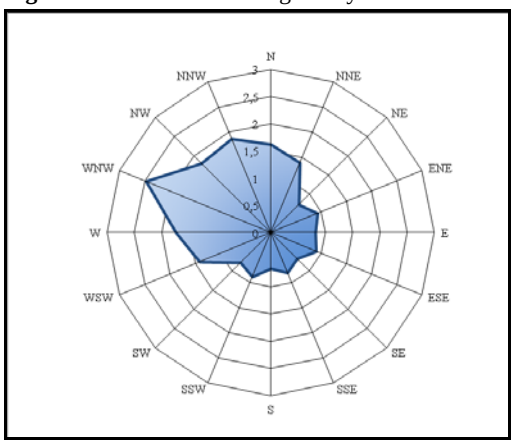


Figure 19 Annual Wind Diagram by Blow Speeds

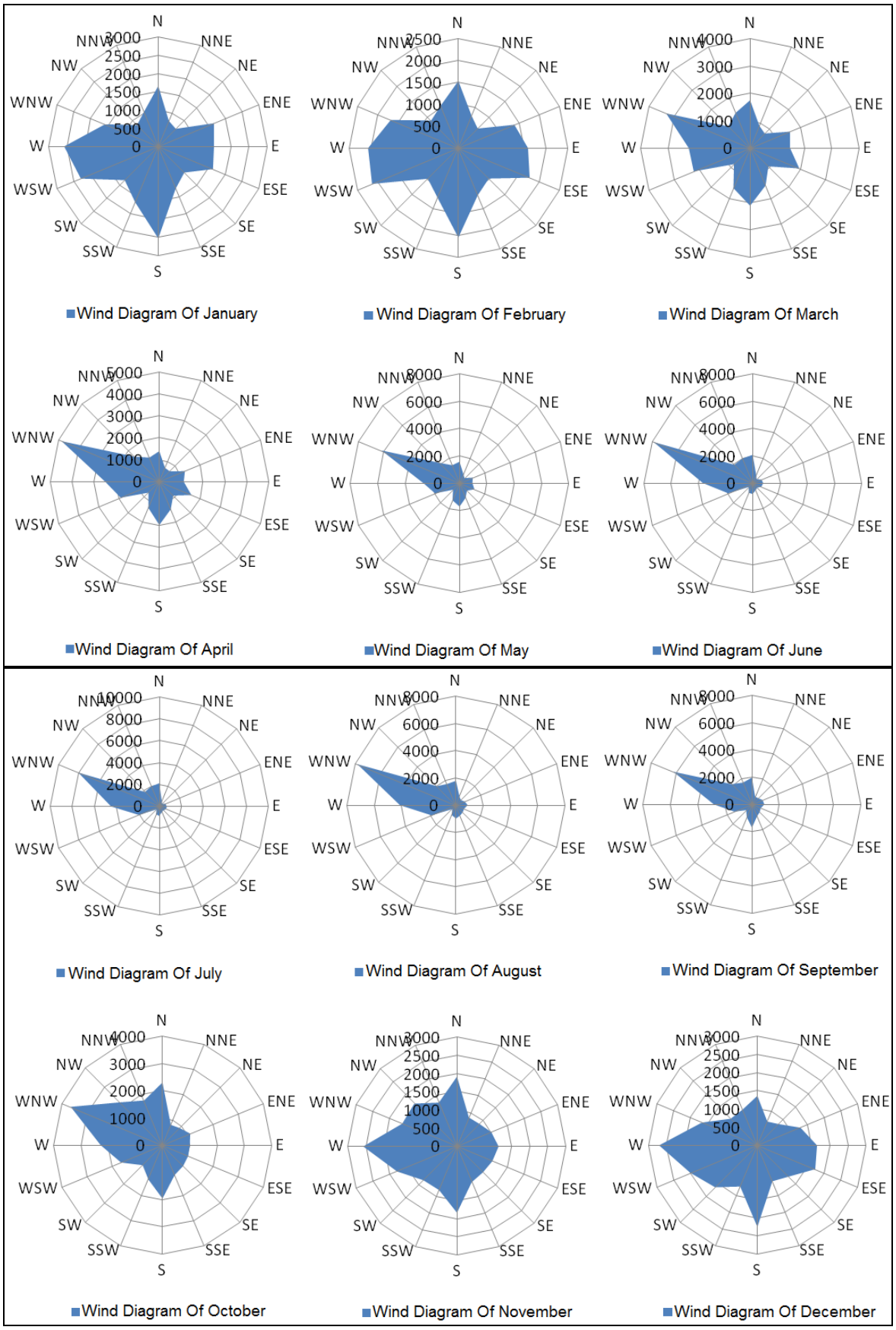


Figure 20 Monthly Wind Diagrams by Blow Numbers

Diagrams for seasonal blow numbers are presented below.

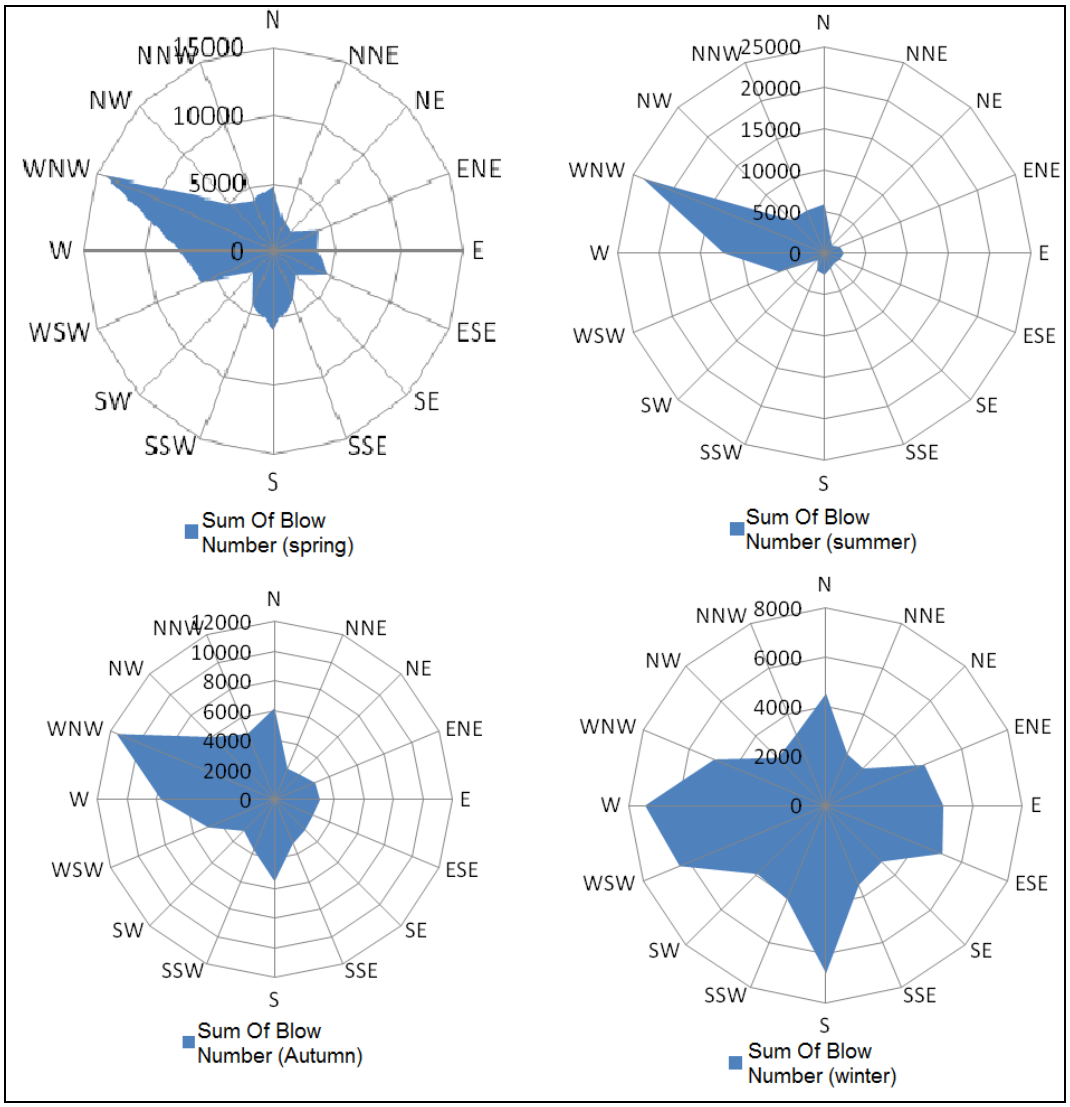


Figure 21 Seasonal Wind Diagram for Blow Numbers

Distribution of Gusty and Stormy Days

According to the data obtained from the Kahramanmaras Meteorology Station between 1975 and 2010, it was determined that the fastest wind during the observation period was blowing from North and its speed reached up to 39.3 m/sec in February. Annual average wind speed is 1.7 m/sec. during the observation period, it was determined that 15.8 days in a year are “stormy” and 99.1 days are “gusty”.

The above-mentioned data is described in the following tables and graphics.

Table 24 Table of Wind Data and Stormy and Gusty Days of Kahramanmaras according to 36-Year Long-Term Observation Data

	Average Wind Speeds	Maximum Wind Direction	Maximum Wind Speed	Average Number of Stormy Days	Average Number of Gusty Days
January	0.9	N	31.2	1.2	3.0
February	1.1	N	39.3	1.3	3.0
March	1.4	N	35.9	1.4	5.1
April	1.6	N	30.7	0.8	5.4
May	1.9	NNE	31.4	0.6	9.0
June	2.9	N	26.6	1.9	16.6
July	3.2	NNW	26.8	3.0	20.3
August	2.9	NE	29.4	2.4	19.5
September	2.0	NNW	33.7	0.9	10.6
October	1.0	N	25.6	0.6	3.4
November	0.7	N	36.8	0.9	1.3
December	0.7	NE	38.2	0.8	1.9
Annual	**1.7**	**N**	**39.3**	**15.8**	**99.1**

Source: DMI-TUMAS (Kahramanmaras Central Station 1975-2010 Observation Data)

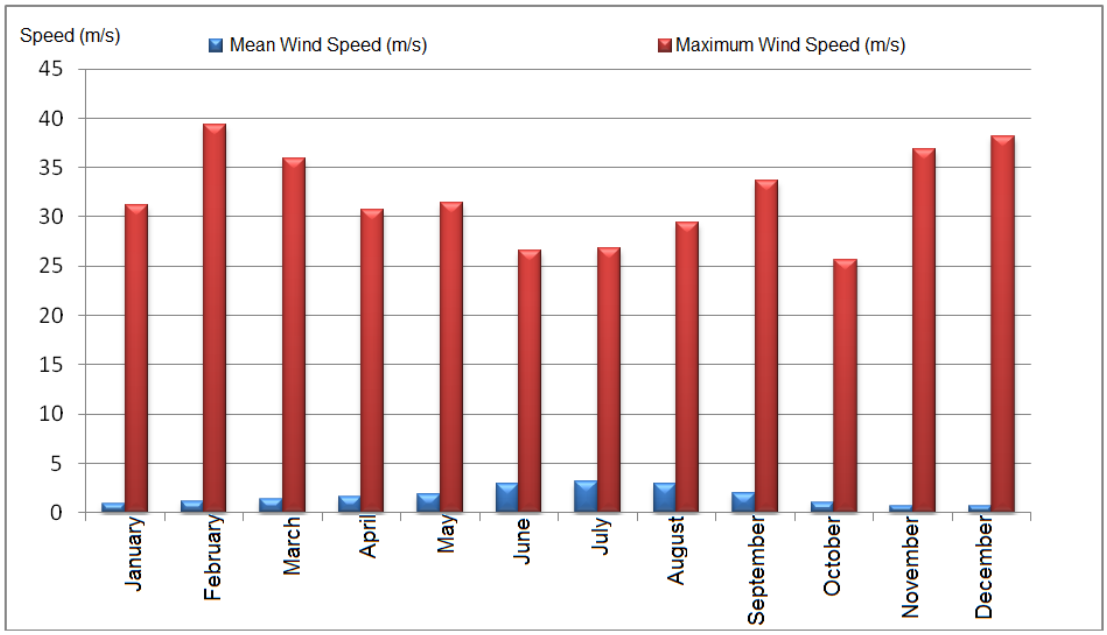


Figure 22 Average and Maximum Wind Speeds of Kahramanmaras by Months

Annual and seasonal wind directions and forces obtained from monthly measurements recorded in Kahramanmaras meteorology station are shown with wind diagrams given in the figures. West winds are dominant in Kahramanmaras.

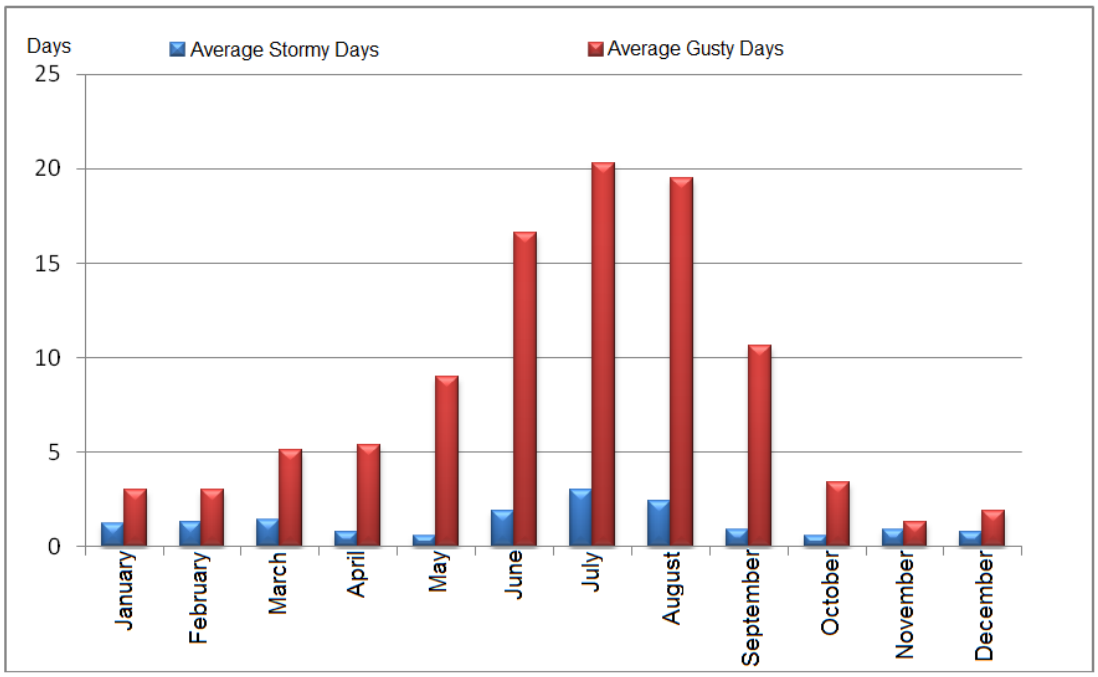


Figure 23 Distribution of Average Gusty and Stormy Days

IV.2.2. Geological Characteristics

IV.2.2.1. Regional Geology, 1/25,000 Scaled General Geology Map of the Site, Stratigraphic Column Sections

Rock units that are found in general stratigraphy of the examination area and its neighborhood are aligned from the older to the younger as follows.

Andırın Limestone (Mza)	Mesozoic
Flysh (Mfls)	Miocene
Alluvium (Qal)	Quaternary
Slope Wash (Qym)	Quaternary
Soil Cover (S.C.)	Quaternary

Andırın Limestone (Mza) (Mesozoic)

They are only found on the upper elevations of Yelligedik Crest. Andirin limestones contain cherty limestone at the bottom and as going upwards, they turn to grey and light grey limestone. Andırın limestones are hard, durable, recrystallized, medium thick layered and jointed. The limestone becoming allochtonous in the area presents a shale structure from place to place due to light metamorphism. It is common to see in Andırın limestone, karst landforms are formed and developed as a result of meltdown. Karstification developed into impermeable units at the bottom and large fusion cones and caves were formed. Andirin limestone was developed as overlap on flyshes with a thrust after Miocene.

Flysh (Mfls) (Miocene)

The complete bedrock of the project area is composed of Miocene aged flyshes. Flysh is formed as a result of alternation of sandstone, siltstone, pebble and carbonate claystone, being horizontally and vertically transitional with each other.

Carbonate claystone and siltstone levels of the unit are particularly dominant in the project area and are generally grey, blackish grey and from to place place light green and bluish color presenting alternation. The unit generally has a folded-faulted structure and its bedding directions and inclination frequently change. It has generally thin layer and has a medium thick layer from place to place; in 20-25 m heights of the unit, usually claystone levels are dominant and there are sandstone levels between them. Therefore, it was observed that upper parts of the unit are softer and more dispersible and have a structure being prone to weathering. They have a dispersible structure and present an appearance of slope wash when their surfaces touching with atmosphere are dehydrated. Towards the bottom, sandstone having medium thick layer and hard and sound structure are more dominant; thin bands of claystone levels appear. Pebble levels are observed from place to place in the region, and they are grey, have many faults and cracks and generally originate from ophiolite and limestone.

Base of Miocene aged flyshes is not encountered in the examination area, and they are covered by Mesozoic aged Andirin limestone by overlapping. Their upper part is covered by current covering units.

Alluvium (Qal) (Quaternary)

It consists of deposits brought by Körsulu River during the flood in the examination area. In general, it consists of poorly graded materials in the size of sand, pebble and block. It has a high block ratio and is generally flat and originates from polygenic. Its grains have been derived from claystone and sandstone. Its maximum thickness is 4 m in the regulator site and 2,5-3 m in the power plant site.

Slope Wash (Qym) (Quaternary)

In the examination area, quaternary aged slope wash is generally formed as a result of dehydration and thus weathering and dispersion of flysh under atmospheric conditions. Its thickness ranges between 0.5 m and 4 m.

Soil Cover (S.C.) (Quaternary)

It is yellowish brown, reddish, grizzlyish and contains small amount of clay-silt and large amount of pebble. It does not have homogenous characteristic and does not have the formation characteristics underneath itself. Thickness of the unit which is generally seen in plain areas being close to bed of Körsulu River ranges between 0.50 m and 1.50 m.

Structural Geology

In the examination area, there is not any structural formation which is capable of affecting construction of the project units. However, reverse faults resulting from tectonism occurring at the end of Miocene, overlaps and several foldings and faultings of all sizes took place in the region.

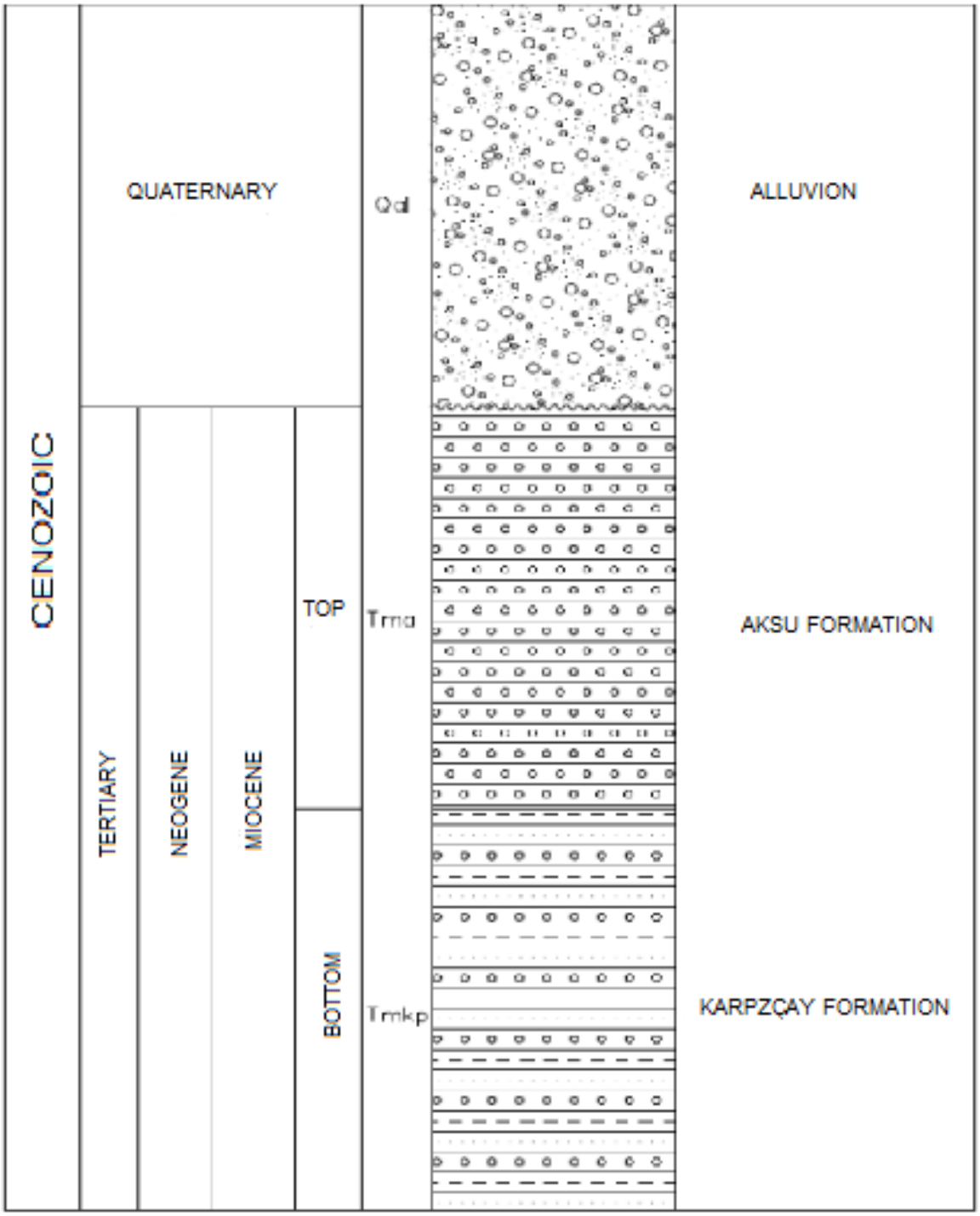


Figure 24 Stratigraphic Section

In the examination area, Mesozoic aged Andirin limestone was formed by overlapping on aged flyshes. Moreover, there are several large and small faults in the flyshes and one of them is a reverse fault extending in the direction of Kuyuluk Hill, Tavsan Hill and Mount Kocadağ.

IV.2.2.2. Geology of the Project Area

The examination area and its surroundings are very stiff and rough and Trias-Jura-Cretaceous aged Andirin limestones contain Upper Cretaceous aged ophiolite complex, Mid-Miocene aged flysh, Quaternary aged slope wash and alluvion exposure.

Regulator

It will be built as mostly concrete uncontrolled frontal intake at the southwest of the hill, 250 m upstream of KHGM bridge. In the construction area of the regulator, slope wash, alluvion, limestone and Miocene aged flysh character unit present silty sandstone, silty claystone and carbonate cement conglomerate exposure. In terms of unit structure, it is located just below Andirin limestones which were resulted from overthrust movements. Because of the overthrust, the unit has a disaggregated and clayed character with indurable, soft, hard loose rock and soft loose rock features.

Water Intake Structure

In the area where the water intake structure is planned to be built on right coast of Torlar regulator in 473,00m elevation, Jura – Cretaceous aged limestone, Miocene aged flysh and Quaternary aged slope wash ecposure are presented. The limestone is grizzly, has large amount of faults, melting cavity, calcite fill and is hard and durable; the Flysh is grey, brindle, incompetent to alter and has characteristic of soft rock.

Penstock Pipe

70 m penstock pipe starts in 150 m downstream of General Directorate of Rural Services (KHGM) bridge which is located on its north and at end point of the forebay; finishes by the electricity power plant to be built at 450,00 m elevation on left hillside of Körsulu River. Along the route where the penstock pipes will be mounted, slope wash with large limestone block, Middle Miocene aged conglomerate, sandstone, claystone and flysh-characterized unit that was formed as a result of siltstone alternation crop out. Carbonate cementitous conglomeratic levels located within the unit have soft and medium-hard rock characteristics and pebbles are generally derived from limestone and ophiolite. Sandstone, claystone and siltstone levels have soft and hard loose rock characteristics.

Electricity Power Plant

The structure will be built in 450,00 m elevation in left coast of Korsulu River where soil cover and alluvium outcrop at the top and Miocene period flysh-characterized unit, sandstone and claystone outcrop in the lower parts. In terms of structure, the unit has hard loose and soft rock characteristics.

Forebay

The forebay will be built in the North of Torlar Neighborhood, at 150 m downstream of KHGM bridge at 471,60 m elevation. On the construction area, grey and white color hard Andirin limestones and filled claystone block crop out. In terms of structure, the unit has hard, durable rock characteristic. The unit’s bearing capacity is high and it has no problem in terms of stability.

Water Distribution Line

The conduit will completely pass through levels which constitute upper levels of Andirin limestone and which are weathered in some places, have a view of slope rubble in

some places and in which the unit has robust structure, faults, melting cavities and in which melting cavities are filled with secondary calcite minerals. The unit has a hard and robust structure.

Tunnel

The tunnel will completely pass through levels which constitute upper levels of Andirin limestone and which are weathered in some places, have a view of slope rubble in some places and in which the unit has robust structure, faults, melting cavities and in which melting cavities are filled with secondary calcite minerals. Geological maps of the units under Torlar Regulator and HEPP project are included in Appendix-4.

IV.2.2.3. Seismicity and Natural Disaster Potential

According to Seismic Zones Map of Turkey prepared by Ministry of Public Works and Settlement, the examination area and its surroundings are included within Degree 2 seismic zone. Therefore, maximum ground acceleration (a_{max}) value must be considered as 0.30 g.

A risk analysis study has been performed according to earthquake probability method. By considering the advanced earthquake data occurred between 1900-1987 and techtonic features, we concluded that the magnitude of earthquakes already occurred in the region ranges from 5.0 to 5.1. Maximum horizontal ground movement accelerations that may be influential on the construction units to be built in accordance with possible earthquakes to be realized in 100 years period are calculated as 146 cm/s^2 by 5% probability and 142 cm/s^2 by 10% probability. As a result, we calculated seismic design coefficient for the region as $0.10 < K \leq 0.12$. T**his value is used as a parameter in the statical analysis of the project componets (Power house, tunnel, forebay, etc).**

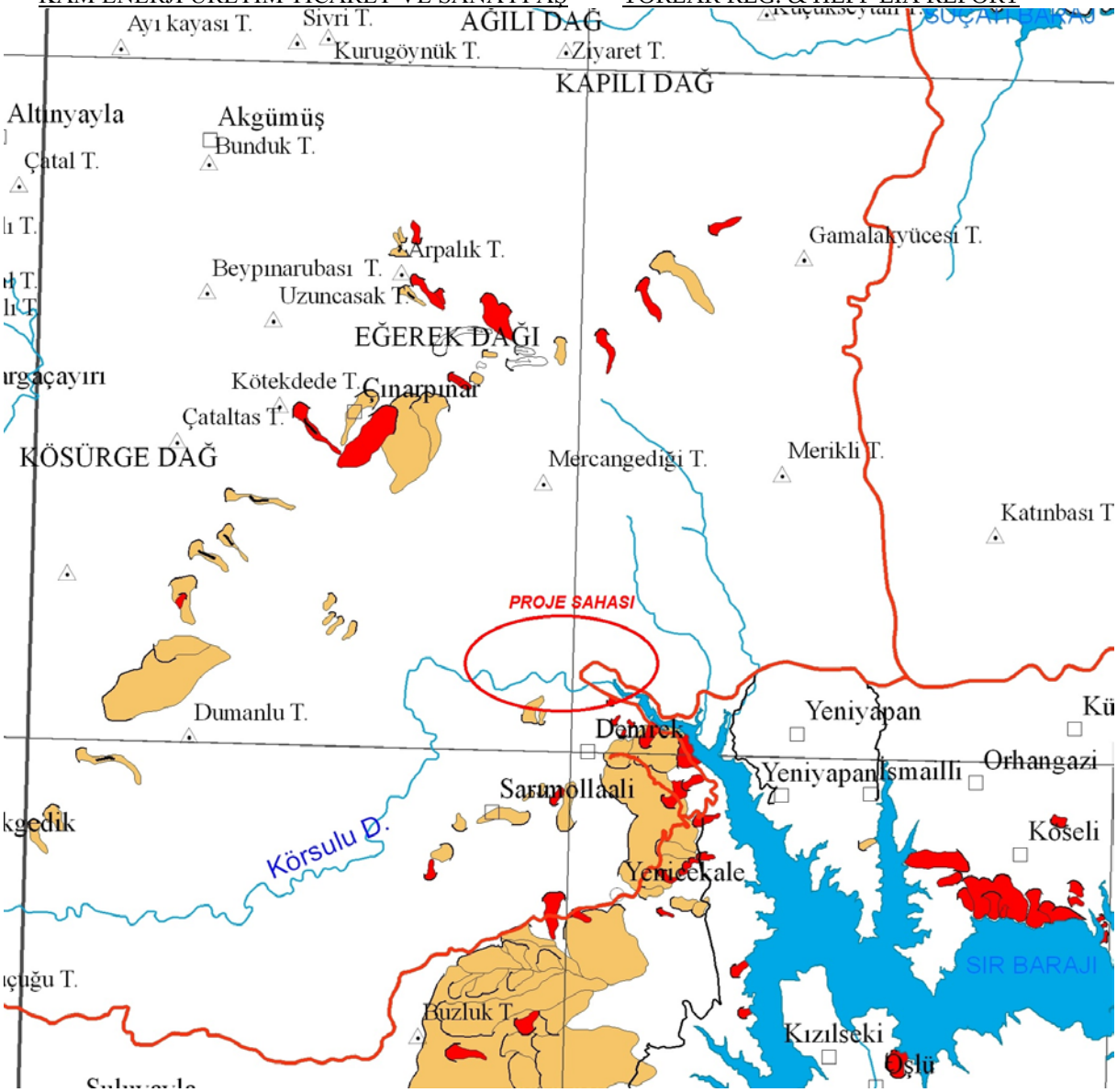


Figure 25 Region's Landslide Inventory Map

Earthquake map for the project area is included in Appendix-3 and region's landslide inventory map is displayed in Figure 23.

IV.2.2.4. Geotechnical Examination Report (Detailed Geotechnical Examinations of All Units under the Project)

Regulator

56.00 m long Torlar Regulator was planned to be built with no cover, a filled body, and an 11.60 m height from the thalweg. In order to determine permeability, stability and bearing capacity of the outcropping units in the regulator area, 3 basic boreholes (RBH-1, RBH-2 and RBH-3) with 60 m depth in total were drilled. In basic boreholes drilled in the regulator area, pressurized water tests were conducted at rubber attachable levels in order to determine impermeability of regulator site. According to pressurized water tests conducted;

According to the pressurized water tests conducted in basic borehole RBH-1 drilled in the left coast, it was determined that the flyshes located in the left coast were generally impermeable – low-permeable (0.87 – 2.36 Lu).

According to the permeability tests conducted in basic borehole RBH-2 drilled in the thalweg (inside the river), it was calculated that the alluvium's permeability coefficient was K= 1.2 – 3.7 x 10^{-3} cm/s. As a result of pressurized water tests conducted on flyshes located underneath the alluvium, it was determined that the unit was generally impermeable – low-permeable (0.84 – 1.87 Lu).

According to the permeability tests conducted in basic borehole RBH-3 drilled in the right coast, it was calculated that the alluvium's permeability coefficient was K= 1.2 x 10^{-3} – 5.1 x 10^{-4} cm/s. Flyshes located underneath the alluvium was determined as generally low-permeable (1.23–3.55 Lu).

As a result of pressuremeter tests conducted in basic borehole RBH-1 drilled in the regulator site, it was found that safe (safety coefficient is taken as 3) bearing capacities were 7.7 kg/cm^2 at 4.50 m, 7.8 kg/cm^2 at 6.00 m, 8.0 kg/cm^2 at 9.00 m, 8.2 kg/cm^2 at 12.00, 8.4 kg/cm^2 at 15.00 m. As a result of pressuremeter tests conducted in basic borehole RBH-2, it was found that safe (safety coefficient is taken as 3) bearing capacities were 7.7 kg/cm^2 at 4.50 m, 7.8 kg/cm^2 at 6.00 m, 8.0 kg/cm^2 at 9.00 m, 8.2 kg/cm^2 at 12.00, 8.4 kg/cm^2 at 15.00 m, 8.6 kg/cm^2 at 18.00 m, 8.7 kg/cm^2 at 20.00 m.

As a result of pressuremeter tests conducted in basic borehole RBH-3, it was found that safe (safety coefficient is taken as 3) bearing capacities were 7.7 kg/cm^2 at 4.50 m, 7.8 kg/cm^2 at 6.00 m, 8.0 kg/cm^2 at 9.00 m, 8.2 kg/cm^2 at 12.00, 8,5 kg/cm^2 at 15.00 m, 8.7 kg/cm^2 at 18.00 m.

Moreover, as a result of tests conducted in laboratory on core samples obtained from basic boreholes RBH-1, RBH-2 and RBH-3 drilled in the regulator site, it was found that uniaxial compression strength (q_u) ranged between 375.10 kg/cm^2 and 423.50 kg/cm^2.

Accordingly, in terms of bearing capacity at the regulator's foundation and therefore of sitting, a 0,5 – 1,00 m stripping excavation was performed after current alluvion with 3,00-4,00 m thickness that was conditional for the impermeability of the regulator and was located in the thalweg, was removed.

Settling Basin

In the settling basin site, 2 basic boreholes (SBH-1 and SBH-2) were drilled in order to determine the stability, the status of underground water and the bearing capacity. As a result of the basic boreholes drilled, it was determined in the settling basin site that there is a soil cover with 0.50-1.50 m thickness; alluvium layer with 2.00-3.00 m thickness underneath the soil cover and Miocene period flyshes at the bottom. Excavation for settling basin will be performed in this unit. Miocene period flyshes are generally formed as a result of horizontal and vertical alternation of claystone and siltstone and, in some places, sandstone and pebble.

As a result of basic boreholes drilled in the settling basin site, it was measured that underground water in basic borehole SBH-1 is 3 m and underground water in basic borehole SBH-2 is 4.50 m. But these water sources remaining within the formation are the water sources which are located in the ground and they depend on seasonal precipitation, therefore do not have the characteristics of underground waters. Thus, it is expected that underground water problem will arise during the excavation.

Transmission Route

Transmission tunnel to be placed under the Torlar HEPP project starts at 510.90 m elevation, extends along 2+239 km and ends at the start of conduit at 507.99 m elevation. The tunnel will be entirely excavated in Miocene period flyshes which are particularly represented by claystone and siltstone in the project area. The unit generally has a thin and, in some places, medium-thick layer, and has a softer structure in the zones where clay ratio increases and has a hard and robust structure in the other sections.

In order to determine geotechnical parameters of the unit to be passed in the tunnel route and state of the underground water, 2 basic boreholes (TBH-1, TBH-3) with a depth of 130 m in total were drilled. Basic borehole TBH-1 (100 m) was drilled at the tunnel entrance and basic borehole TBH-3 (30 m) was drilled at the tunnel exit.

Conduit

The conduit is located in Tributary River, between 2 + 329 km (End of tunnel) and 2 + 452 km (Start of tunnel) of the transmission route. Main rock of the conduit generally consists of weathered, dispersible carbonate claystone levels of flyshes. Any problem concerning the bearing capacity was not arise.

Tunnel

It starts in 2+452 km of the transmission route at 507.84 m elevation and ends in 2+547 km of the forebay at 507.72 m elevation. The tunnel will be entirely excavated in Miocene period flyshes which are particularly represented by carbonate claystone and siltstone in the project area. The unit generally has a thin and, in some places, medium-thick layer, and has a softer structure in the zones where ratio of the clay increases and has a hard and robust structure in the other sections.

In order to determine geotechnical parameters of the unit to be passed in the tunnel route and state of the underground water, 1 basic borehole (TBH-2) with a depth of 50 m in total was drilled.

In entrance portal of the tunnel, robust and, in some places, weathered carbonate claystone and siltstone levels of flyshes are dominant and portal excavation slopes were taken as 2/1 (2 vertical / 1 horizontal) scale. In addition, excavation slope supports (bolt and wire mesh) were provided.

In exit portal of the tunnel, weathered, dispersible carbonate claystone and siltstone levels of flyshes are dominant in upper zones and harder and robust carbonate claystones and siltstones are dominant in lower zones. Therefore, in excavations that are being carried out in the portal, excavation slope to use was taken as 1.5/1 (1.5 vertical / 1 horizontal) scale in the upper slopes and as 2/1 (2 vertical / 1 horizontal) scale in the lower slopes.

Forebay

In order to determine stability, status of underground water and bearing capacity in the forebay site, 1 basic borehole (LBH-1) was drilled. As a result of basic borehole drilled, it was revealed that there was slope rubble with 4.00 m thickness and Miocene period flyshes underneath the slope rubble in the forebay site. No underground water was found in the basic borehole LBH-1 drilled in forebay site. Therefore, underground water problem did not arise during the excavation.

Weathered, dispersible carbonate claystone and siltstone levels of flyshes are dominant in upper zones a slope was layer of 4 m thickness, and harder and robust carbonate claystones and siltstones are dominant in lower zones in the forebay site. Therefore, in portal excavations, excavation slope to use was taken as 1.5/1 (1.5 vertical / 1 horizontal) scale in the upper slopes and as 2/1 (2 vertical / 1 horizontal) scale in the lower slopes. There is not any problem in accordancewith the bearing capacity and the sitting in the forebay foundation.

Penstock Pipe Route

In order to determine stability, status of underground water and bearing capacity in the penstock route, 1 basic borehole (PBH-1) was drilled. As a result of the basic borehole drilled, it was revealed that Miocene period flyshes were located along the penstock route.

In the basic borehole PBH-1 drilled in the penstock route, level of the underground water was measured as 13 m. Therefore, in consideration of depth of the excavation, any problem concerning the underground water did not arise during the excavation.

Power Plant Location

In order to determine stability, status of underground water and bearing capacity in the powerhouse site of the Torlar Regulator and HEPP project, 3 basic boreholes (BH-1, BH-2, BH-3) were drilled. An alluvium layer with nearly 2.00 – 2.50 m thickness was cut in the basic boreholes drilled. Miocene period flyshes are located underneath the alluvium. Power plant excavation will be performed in this unit. Upper zones of the levels constituting formation have an altered and dispersible structure and gain density and become more robust structured towards the bottom.

As a result of pressuremeter tests conducted in basic borehole PHBH-1 drilled in the power plant site, safe (safety coefficient is taken as 3) bearing capacities were calculated as 7.8 kg/cm^2 at 6.00 m, 8.0 kg/cm^2 at 9.00 m, 8.2 kg/cm^2 at 12.00, 8.4 kg/cm^2 at 15.00 m, 8.7 kg/cm^2 at 18.00 m, 8.8 kg/cm^2 at 20.00 m.

As a result of pressuremeter tests conducted in basic borehole PHBH-2, safe (safety coefficient is taken as 3) bearing capacities were calculated as 7,5 kg/cm^2 at 4.50 m, 7.8 kg/cm^2 at 6.00 m, 8.0 kg/cm^2 at 9.00 m, 8.2 kg/cm^2 at 12.00, 8.4 kg/cm^2 at 15.00 m, 8.6 kg/cm^2 at 18.00 m, 8.7 kg/cm^2 at 20.00 m.

As a result of pressuremeter tests conducted in basic borehole PHBH-3, safe (safety coefficient is taken as 3) bearing capacities were calculated as 7.7 kg/cm^2 at 4.50 m, 7.8 kg/cm^2 at 6.00 m, 8.0 kg/cm^2 at 9.00 m, 8,3 kg/cm^2 at 12.00, 8.4 kg/cm^2 at 15.00 m, 8.7 kg/cm^2 at 18.00 m, 8.8 kg/cm^2 at 20.00 m.

In addition, as a result of tests conducted in the laboratory on core samples obtained from basic boreholes PHBH-1 and PHBH-2 drilled in the powerhouse site, uniaxial compression strength (q_u) was found to range between 195.10 kg/cm^2 and 411.60 kg/cm^2.

According to these data, alluvium with maximum 2.00-2.50 m thickness is located within the powerhouse site, and hard and robust carbonate claystones and siltstones of flyshes is located below the alluvium. There are no problems regarding the bearing capacity and the sitting.

IV.2.3. Hydrogeological Characteristics (Underground Water Levels; Currently Existing Caisson Well, Deep Well, Artesian Well, etc.; Safe Drawing Value; Physical, Chemical, Bacteriological Characteristics of Water; Existing and Planned Usage, Flowrates, Distances to the Project Area of the Underground Water)

There are many water sources having about 3 m^3/sec flowrate in total in Maras-Central Plain. These sources mainly stream through Paleozoic marbles and Middle-Eocene period limestone. Ahallow wells are rarely observed in the plain.

There are totally 57 boreholes drilled by DSI in Maras plains. 6 boreholes of them are located within Maras-Central Plain. Depth of these boreholes ranges between 35 m and 302 m.

Base of Maras-Central Plain where the plant area is located is generally covered with Quaternary period large materials. In the east section aquifer thickness in the plain ranges between 200 m and 150-170 m in the middle and west section. The levels having abundant underground water are sandy and pebble levels with 60-70 m thickness beginning from the base. In the lower levels, aquifer loses its efficiency due to the involvement of clay. Underground water supply in the plain was formed by percolation during precipitation, percolation from the surface runoff coming from the drainage area, percolation from sources and streams and underground water flow from Turkoglu Plain. Underground water discharge happens as a result of evaporation, sweating, sources and flowing into Aksu River.

Usage of underground water in the province is 343.5 hm^3/year. Underground water resources are still utilized in the center of Kahramanmaras Province. Regular deep well usage was started with facilities established according to a project carried out in 1978.

Sources within the examination area include the water emerging from discharging a free aquifer into Degirmenustu and Karasu Rivers and the water arising as a result of rain in the winter and surface runoff and percolation under the ground of snow water. In the aforesaid area, in the lower part, Miocene period flyshes and Late Cretaceous ophiolite complex outcrop and the karstic limestone dragged as a result of tectonism overlaps on these two units.

Carbonate rocks consisting of limestone and dolomite rocks covers an area of nearly one-third (1/3) of Turkey’s surface area. Karstic rocks are carbonate rocks. It was determined by studies that 25% of the world population substantially meet their water need from karst spring water. Potable water and irrigation water of City, Town, Township, Village and Hamlet are supplied from these types of sources.

Large cities of our country such as Izmir, Antalya, Antakya, Kahramanmaras, Burdur meet their potable water need from karstic sources streaming through limestone and having high flowrate. Mesozoic period limestone exposing in the working area has the same structure and has characteristic of a free aquifer drawing water from all directions. The aforementioned aquifer does not have an impermeable layer preventing water percolation and is contact with atmosphere. Half-permeable and impermeable layers are located beneath the unit.

Ophiolite complex and flysh units do not have an economic underground water potential due to their general structures and lithology. But, in the levels where sandstone and pebble levels of flysh unit and serpentinized peridotites are dominant, discharges in the form of small sources are observed from place to place, depending on seasonal precipitations.

IV.2.4. Hydrologic Characteristics (Physical, Chemical, Bacteriological and Ecological Characteristics of Surface Water Sources such as Sea, Lake, Fishpond, Stream and Other Wetlands; Flowrate and Seasonal Changes of Streams

The closest stream to the project site is Korsulu River over which the HEPP will be built. Sır Dam is located nearly 915 m far away from the project site in top view.

Körsulu River was formed when Köprüağzı River rising from Göksun Plain with Karapınar River rising in-between Mazgaçdağı Hill and Kayranlıziyareti Hill within Geben Plain join together. This 40 km long river flows into Ceyhan River around Karbasan Neighborhood. Körsulu River is fed by karstic sources discharging from Triassic-Jura period limestone mainly leveled in a large area between Andırın County and Göksun County. The sources meeting potable water need of the city of Kahramanmaras today are Değirmenözü and Obaönü karst sources which were flowing into Körsulu River before. Reception basin of the river is a topographically high and mountainous region where Mediterranean climate changes into continental climate. Therefore, after the winter time where it snows in high amounts, karstic sources and thus Körsulu River are fed by the melting snow by March. While flowrate of the river is high in March-July period, it starts to decrease by August and reaches its minimum level in February. Average flow of the river is 4.65 m^3/sec.

Körsulu River over which Torlar HEPP project has been carried out reaches Ceyhan River around Karbasan Neighborhood. There is a dam called Sır Dam, located in downstream of the project and was established on Ceyhan River. Sır Dam, ~~installed~~ ***located*** 33 km west of Kahramanmaras Province on Ceyhan River, generates 725 GWh energy per year. Average annual energy production is 725 million Kilowatt-hours. Sır Dam and HEPP plants were constructed and commissioned by Çukurova Elektrik A.Ş in 1991 and now they are operated by the State.

IV.2.5. Providing Monthly Maximum, Monthly Minimum and Monthly Average Flowrates of Körsulu River for At Least 10 Years Concerning the Water Collection Basin of the Regulator to be Established

Torlar Regulator is located on Körsulu River. Precipitation area of HEPP is 404.70 km^2. In order to calculate potential of water of the Torlar HEPP, Körsulu River long term flow measurements in between 1972 and 2002 are used. Flow measurement data of AGI No. 20-36 (DSI) was used for calculation of project flows (App. 32). Calculations are performed by using common Q = C x An (n = 1.0) equation.

AGI No. 20-36 (DSI) is located in upstream of the project site over The AGI have a basin of 174.20 km^2 - In order to extend the flow observation values and fill the missing data of AGI No. 20-36, the data of AGI No. 20-53 (DSI) was used (App. 32). A correlation and regression analysis was performed in between. – As a result of the regression analysis, the data taken in the years between 1984 and 1996 which is found as the most suitable time interval to use their data for both hydraulic calculations were used. The operations were carried out by removing several values that deviate from the sequence in correlation analysis.

The following significant correlation equation between AGI Station No. 20-36 (DSI) and AGI Station No. 20-53 (DSI) was found:

y= 0.8739*X, correlation coefficient R = 0.85

With this equation, 1972 – 2002 daily flow observation values were obtained for AGI No. 20-36 (DSI).

On the regulator the sponsor have been set up a new AGI (App. 32) and DSI controls and observes it. Therefore the environmental water amount released is being measured instantaneously by DSI.

Table 25 Torlar Regulator Site Natural State Monthly Average Flowrates (m^3/s)

YEAR	OKT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	AVERAGE
1972	3.69	0.91	1.08	0.40	0.06	9.29	21.44	27.89	5.94	1.66	1.34	0.41	6.18
1973	1.27	1.15	0.75	0.19	0.30	7.59	20.62	13.41	2.82	0.82	0.03	0.00	4.08
1974	0.05	0.80	1.68	0.12	1.19	16.91	21.73	10.83	4.79	2.62	1.44	4.82	5.58
1975	7.15	2.80	3.75	5.22	5.55	21.05	14.37	21.90	8.29	2.63	0.68	0.22	7.80
1976	0.51	0.51	0.51	4.74	0.74	9.70	62.49	42.69	6.50	2.97	0.50	0.36	11.02
1977	2.49	2.98	14.17	4.39	16.05	26.36	45.92	30.65	6.46	2.02	0.63	0.45	12.71
1978	0.81	0.82	3.37	6.88	15.32	25.02	42.39	31.06	9.61	2.83	1.42	0.70	11.69
1980	7.66	2.36	5.14	2.99	4.58	54.20	80.03	53.37	8.75	3.03	1.56	0.72	18.70
1981	0.94	0.88	3.21	5.00	6.82	52.65	35.65	27.56	10.28	3.23	1.44	0.80	12.37
1982	1.50	1.96	25.02	23.43	5.59	9.96	43.40	23.29	6.33	2.47	1.05	0.85	12.07
1983	1.03	0.83	0.38	0.36	0.47	16.11	37.91	20.71	6.40	2.15	0.99	0.57	7.33
1984	0.96	10.25	7.50	4.50	16.50	19.95	27.87	18.80	4.64	1.77	0.78	0.31	9.49
1985	0.39	0.78	0.38	1.33	8.54	14.36	27.65	10.55	2.71	0.34	0.02	0.00	5.59
1986	2.52	2.64	2.32	14.17	6.43	12.32	16.35	8.96	5.04	1.65	0.82	0.28	6.13
1987	0.53	1.66	3.42	14.66	20.74	14.07	72.22	70.26	19.50	4.71	2.06	0.60	18.70
1988	0.87	2.68	29.53	5.30	10.91	38.42	61.56	41.02	10.69	3.68	1.12	0.63	17.20
1989	9.23	9.25	10.39	7.91	8.84	13.97	13.60	10.32	6.06	4.63	4.10	3.75	8.51
1990	4.62	24.80	13.25	5.01	4.77	10.15	28.27	16.82	5.92	2.33	1.14	4.18	10.11
1991	2.69	4.00	4.67	1.59	2.06	18.56	31.41	13.03	5.05	1.58	0.67	0.27	7.13
1992	1.03	4.10	4.86	3.51	4.97	13.46	61.54	41.63	10.85	2.83	0.85	0.27	12.49
1993	0.33	1.60	2.60	1.68	3.66	14.49	49.28	32.97	10.91	2.15	0.71	0.12	10.04
1994	0.19	0.43	0.69	4.80	4.08	15.38	17.39	10.70	2.58	0.61	0.10	0.00	4.75
1995	0.31	9.10	4.67	14.94	9.78	17.66	41.85	24.39	7.31	2.59	0.62	0.06	11.11
1996	0.86	18.55	6.84	16.26	14.24	34.38	60.21	41.24	9.22	2.02	0.77	2.12	17.23
1997	6.48	5.44	17.06	17.00	10.10	9.07	31.05	23.11	8.53	4.87	3.95	3.45	11.68
1998	3.14	4.62	12.37	7.79	11.72	18.27	35.35	25.50	10.46	6.26	4.47	3.42	11.95
1999	3.09	3.53	18.35	11.54	20.47	20.03	26.97	12.92	6.62	5.18	3.72	3.45	11.32
2000	2.50	2.37	2.49	4.79	7.23	16.54	45.85	20.95	7.88	4.79	4.05	3.52	10.25
2001	3.30	2.94	2.85	2.82	3.61	16.02	13.49	11.98	6.01	4.25	3.62	3.30	6.18
2002	3.00	2.71	15.59	10.98	8.97	31.56	52.07	29.94	10.58	7.18	5.64	4.50	15.23
TOTAL	73.15	127.50	218.91	204.30	234.31	597.54	1139.95	768.46	226.73	89.85	50.32	44.11	314.59
AVERAGE	2.44	4.25	7.30	6.81	7.81	19.92	38.00	25.62	7.56	3.00	1.68	1.47	10.49

IV.2.6. Water usage rights at the project area

Karasu HEPP, which is a water source of Kahramanmaras city, is located at an upper elevation of Torlar Regulator and HEPP but is not located on the Körsulu River. It is on the dirinking water pipe line having an 2,135 MW installed power capacity.

Torlar Reg. and HEPP precipitation area is 404.70 km^2. In the ecosystem assessment report environmental water is calculated as 950 lt/s (corresponding ***10.3%*** of average 10-year flowrate of the regulator site) this amount of flow will be kept for maintaining natural life. Also, there are contrubitions to the river from the side rivers.

The region of the river bed remaining in between regulator and power house will be fed by the environmental water and the contrubition of the side branches. In this region there isn't any stated water usage in terms of agriculture or drinking. There is no specific water usage on the river bed in between the regulator and the powerhouse.

IV.2.7. Existing and Planned Usage and, if any, Basin Characteristics of Surface Water Sources

Karasu HEPP is located on an upper elevation of the Torlar Regulator and HEPP. Karasu HEPP is a plant which was established to meet water needs of the city of Kahramanmaras but it is not on the Körsulu river, and Torlar HEPP structures were located outside the strict and short-distance preservation areas of the Karasu HEPP. apart from Karasu HEPP, Değirmenüstü Reg. and HEPP (in operation), Kale Reg. and HEPP (in operation), Gökgedik Reg. and HEPP in acceptance stage and Sır Dam (in operation), which are built by private sector for energy generation, are located on Körsulu River which does not supply any potable water source and there is no building established for the purpose of utility water over the river (App. 32). Moreover there are not any planned projects on the river.

IV.2.7.1. Characteristics and usage status of soil (soil structure, land usage capability, classification, bearing capacity, slope stability, slickness, erosion, use for soil works, pasture, meadow used as natural vegetation, etc.)

Brown forest soil with a gradient degree of 6 and an erosion degree of 4 is observed in the project area. Around the area, colluvial soil is observed in some places as well as brown forest soil. A map showing characteristics of soil in and around the project area is given below.

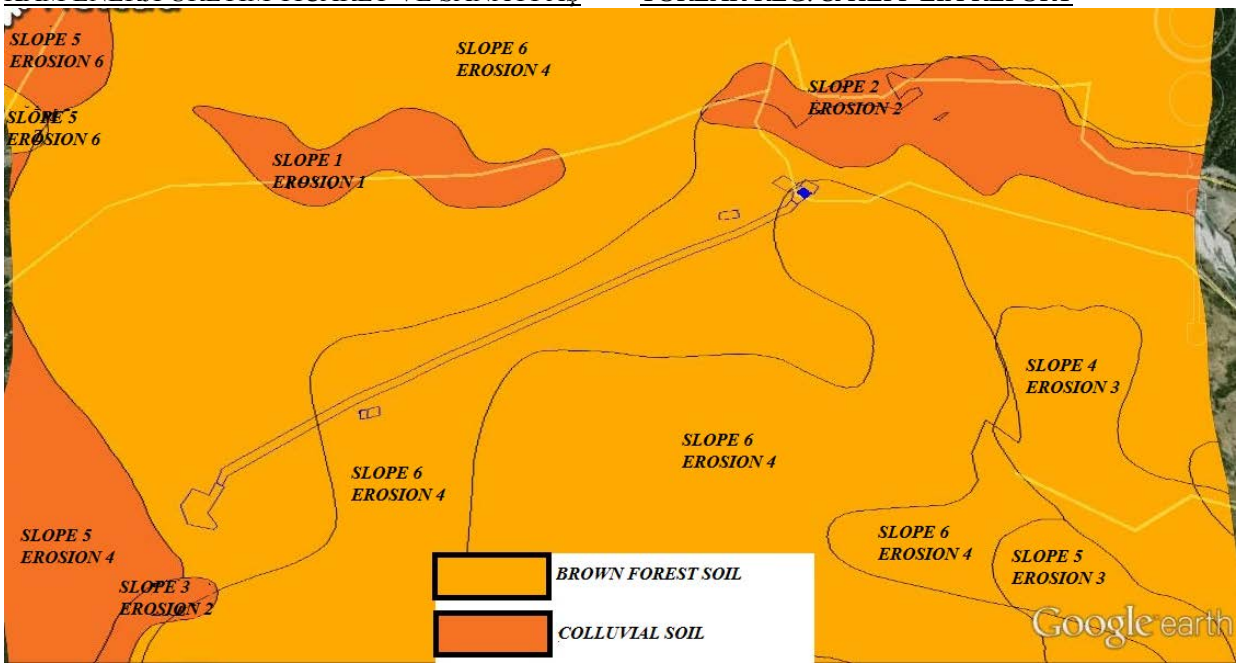


Figure 26 Characteristics of Soil In and Around the Project Area,

IV.2.7.2. Agricultural Areas

186,061 m^2 (18.60 da.) area has quality of agricultural land which was expropriated for the construction of energy transmission line poles and the corridor, only 1600 m^2 of this area looses its availability for agricultural activity. On the rest of the land agricultural activities could still go on. The type of the agricultural lands can be seen below table. Land presence map for the area is given Figure 8 above. Areas in the project site are evaluated as marginal agricultural land and planted agricultural land according to criteria of agricultural land standards.

Type of Farmland (As defined on the title deeds)	Area (m^2)	Area (da)
Irrigated Farmland	58,774	5.88
Dry Farmland	11,217	1.12
Vineyard	10,068	1.01
TOTAL	186,061	18.60

There will only be a small amount of income loss due to decrease in these lands . It has been observed that wheat and barley, are currently cultivated in these lands. But these agricultural activities are not made for commercial, they are made for personel needs. To compensate this small income losses, company has paid to the owners the twice of the values of the lands decided by the court. Therefore it is possible to buy a new land for the agricultural activities.

IV.2.7.3. Forest Areas

Total forest area to be-used is 388,691.43 m^2 (38.86 ha.). These forest areas are not natural forest, they are all planted. The regulator area, some transmission tunnel route, storage area and impoundment area takes part in these forest lands. ***According to ecosystem evaluation report, there is no important habitat for birds and other species.*** There are

commonly calabrian pines and oak trees in the form of degraded grove. Stand map for the project is included in the Appendice of the report. There is no protected areas (natural habitats), seed orchard, seed stand and gene protection forest in project area.

Dominant vegetation of the region is calabrian pines and oak trees. In the project, 176 trees would be cut off during the construction of power house (App-34) and 346 trees would be cut off for the impoundment area and regulator (App-35).

Although it is officially qualified as forest land, the land has lost its forest characteristic due to the decrease in the number of trees. Therefore regarding the project activites a few number of trees will be cut off. Moreover , size of the project components are relatively small compared to an average HEPP Project and it has a tunnel as a water conveyance structure being a river type HEPP. In the light of foregoing, there will not be expected severe impacts to the forest land.

IV.2.7.4. Protected Areas

1. Areas required to be protected pursuant to legislation of our country

a) "National Parks", "Nature Parks", "Natural Monuments", "Nature Conservation Zones" defined in the article 2 of the Law On National Park dated on 09/08/1983 No.2873 and determined in accordance with the article 3 of this Law.

In and around the activity area and in the considered basin, there are not any national parks, natural parks, natural monuments and natural conservation areas defined in Article 2 of 9/8/1983 dated National Parks Law No. 2873 and determined in accordance with the article 3 of this Law.

b) "Wild Life Conservation Sites and Wild Animal Placement Sites" determined by the Ministry of Environment and Urbanization in accordance with the Law On Land Hunting dated on 01/07/2003 No.4915

In and around the activity area and in the considered basin, there are not any Wild Life Conservation Sites and Wild Animal Placement Sites.

c) Areas defined as "Cultural Assets", "Natural Assets", "Archeological Zone" and "Conservation Zone" by the subclauses 1,2,3 and 5 of the (a) clause entitled "Definitions" of the 1st paragraph of the article 3 of the Law On Protection of The Cultural and National Assets dated on 21/07/1983 no.2863 and the Law On Amendments on Some Articles and Additions of Some Articles of the Law On Protection of The Cultural and National Assets No.2863, dated on 17/06/1987 No.3386.

There are no such areas in and around the project area.

ç) Fisheries Production and Breeding Areas under the Law On Fisheries dated on 22/03/1971 No.1380.

There are no such areas in and around the project area.

d) Areas defined in the articles 17, 18, 19 and 20 of the Regulation On Control of Water Pollution dated 31/12/2004 No.25687

Since there is not any activity resulting in polluting the underground, no waste and wastewater formation possible to pollute underground and surface water sources in the region will take place. Therefore, polluting elements relating to Strict Protection Area, Short-Distance Protection Area, Medium-Distance Protection Area, Long-Distance Protection Area will not take place.

e) Areas defined as "Vulnerable Pollution Zones" in the article 49 of the Regulation On Protection of the Air Quality that was published in the official gazette dated on 02/11/1986 No.19269

There is not such area in and around the project area. According to calculations made, air quality values of construction equipment to be operated in the project area will reach up to limit values given in Article 6.

f) Areas determined as "Special Environmental Protection Zones" by the Council of Ministers in accordance with the article 9 of the Environmental Law dated on 09/08/1983 No.2872.

There is no such area within the boundaries of the project site which is determined and declared as "Special Environmental Protection Zones" by Council of Ministers in accordance with the article 9 of the Environmental Law dated on 09/08/1983 No.2872.

g) Areas that were pun under protection by the Bosphorus Law dated on 18/11/1983 No.2960.

There is not any interaction between the area whose coordinates are given in the related law and the project area.

ğ) Forestland determined by the Law on Forests dated on 31/08/1956 No.6831.

A large part of the area where Torlar Regulator and HEPP project is located is degraded forestland. There are commonly calabrian pines (closure 2) and oak trees (closure 0) in the form of degraded grove. Majority of the sections turned into farms and cultivated includes the lands obtained as a result of clear-cut of forest area. Related permissions were obtained for forest areas located within the scope of the project as per Article 17 of Forestry Law No.6831. No official protected areas and/or critical natural habitats were determined in project area.

h) Areas on which building restrictions are applied in accordance with the Coastal Law dated on 04/04/1990 No.3621

There are no such areas in and around the project area.

ı) Areas that are specified in the Regulation On The Regeneration of the Olive Cultivation and Inoculation of the Wild Olives dated on 26/01/1939 No.3573.

There are no such areas in and around the project area.

i) Areas that are specified in the Pasture Law dated on 25/02/1998 No.4342

The project areas are not located within pasture areas.

j) Areas that are specified in the Regulation On Protection of Wetlands that came into force by being published in the official gazette dated on 17/05/2005 No.25818

The project is located in Körsulu River buffer zone . In this regulation; 2500 meters away from wetland is identified as buffer zone in order to protect wetland ecosystem. This is common for all rivers in Turkey and as known, HEPP Projects must be located on the rivers. The Wetland permit of the project is given in Annex 28.

2. Areas to be protected in accordance with international conventions that Turkey is a part of:

a) Conservation Zones No. I and II stated in "Important Areas for Sea Turtle Breeding" and "Habitat and Breeding Areas For the Mediterranean Monk Seal" that are put under protection in accordance with BERN Convention that came into force by being published on the official gazette dated on 20/02/1984 No.18318

There are no such areas in and around the project area.

b) Areas put under protection by the Convention for the Protection of the Mediterranean Sea Against Pollution (Barcelona Convention) that came into force by being published on the official gazette dated on 16/06/1981 No.17368

The project area and its neighborhood have no concern with the areas taken under protection in accordance with the "Convention for Protection of the Mediterranean Sea against Pollution" (Barcelona Convention).

ı) In Turkey, there are no "Special Conservation Zones" determined by the "Protocol Regarding The Protection of The Mediterranean Special Conservation Zones" that came into force by being published on the official gazette dated on 23/10/1988 No.19968.

ıı) In Turkey, there are no areas chosen by the United Nations Environment Program in accordance with the Genoa Declaration dated on 13/09/1985 for the list of the "100 Coastal Historical Sites in the Mediterranean Region With Common Importance."

ııı) In Turkey, there are no areas in the coastal zones that are habitat and breeding areas of the "Endangered Sea Species Specific to the Mediterranean Sea" specified in the article 17 of the Genoa Declaration.

c) Cultural, historical and natural areas having "Cultural Heritage" or "Natural Heritage" status which are put under protection by the Ministry of Culture in accordance with the articles 1 and 2 of the Convention for the Protection of World Cultural and Natural Heritage that came into force by being published on the official gazette dated on 14/02/1983 No.17959

There are no such areas in and around the project area.

ç) Areas that are put under protection by the RAMSAR Convention that came into force by being published on the official gazette dated on 17/05/1994 No.21937

There are no such areas in and around the project area.

d) Areas stated in the European Landscape Convention that came into force by being published on the official gazette dated on 27/07/2003 No.25181

There are no such areas in and around the project area.

3. Areas to be protected

a) Areas that are determined as such areas whose current features are to be protected and on which it is forbidden to built in the Certified Environmental Plans (areas whose natural features are to be protected, biogenetical reservation zones, geothermal zones etc.)

The project site is not located in the areas determined as the area whose existing characteristics will be protected and in which construction is forbidden in environmental plan.

b) Agricultural zones: Agricultural development zones; zones that are watered, likely to be watered and whose capacity classes are I, II, III and IV; I and II class zones that are used in the agriculture depending on rainfall; and specific crop areas for plantation

There are no such areas in and around the project area.

c) Wetlands: Natural or artificial, temporary or permanent, still or running, fresh, brackish or salty all waters, including sea water zones with a low tide depth no higher than 6 meters, all waters forming habitats for especially water birds and other creatures, ecologically wetlands from the coast line of marshes, reeds, wet meadows and peat beds to the mainland.

There are no such areas in and around the project area.

ç) Lakes, streams, groundwater operation areas

The project itself is a hydroelectric power plant operation and is located in Korsulu River buffer zones.

IV.2.7.5. Detailed researches and land studies for determination of flora, fauna and biodiversity characteristics of the activity area

IV.2.7.5.1. Flora

Flora fauna studies of Torlar Reg. and HEPP project has been carried out with site visits and literature reviews by Prof. Dr. Lokman ALTUN (Blacksea Technical Univercity, Faculty of Forestry, Forestry Engineering, Forest Soils and Ecology, Director of the Section), Prof. Dr. Bilal KUTRUP (Blacksea Technical Univercity, Faculty of Science, Biology, Hydrobiology, Director of the Section), Assc. Prof. Fatma GÜLTEKİN (Blacksea Technical Univercity, Faculty of Engineering, Geological Engineering, Hydrogeology), Veli YORGALI (Forest Engineer, Mavi Yeşil Engineering Company, Coordinator of the EIA), Süleyman SAĞLAM (Agricultural Engineer, Mavi Yeşil Engineering Company) and Ahmet YARDIMCIOĞLU (Environmental Engineer, Mavi Yeşil Engineering Company). The flora-fauna information given below are as a result of these site visits and literature reviews.

The activity area is located in C6 square according to Davis's grid system (1965). The region is also located in Anatolia Diagonal and between Mediterranean-Southeast-Central Anatolia intersection points. Vegetation of the region has been substantially damaged due to anthropogenic factors (grazing, clearing agricultural lands, illegal cutting, fire) in the recent years.

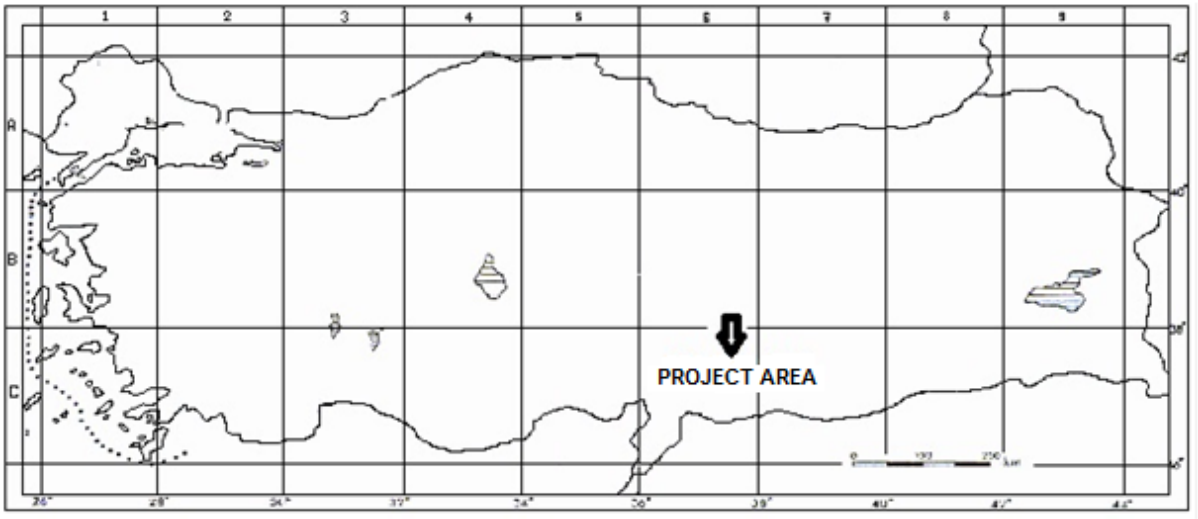


Figure 27 Illustration of the Project Area on Davis Grid System

Agricultural area clearing efforts continuing in regional impact area of the project for long years and the continuing agricultural-cultural industry activities caused extinction of natural flora and fauna substantially in the course of time and biotopes completely changed. In the presence of these problems, it is not possible to provide accurate information about population level for flora and fauna of the region. As a matter of fact, during site visits, almost all of plant samples collected from the area consists of ruderal – cosmopolite (detritus – common) plants and farm weeds. There are no endemic species and habitats preferred by these species. Like plant species, animal species constituting the fauna consist of species with wide expansion, which are not local and have expansion not only in Turkey but also in the other countries. Existing animal species survive in the spaces between farms or in rocky areas that are inappropriate for settlement. Although the project area is located in Anatolia Diagonal defined as endemism center of Turkey, main reasons for absence of the endemic species are that;

- There is abundant improvement area and cultigen is grown in the region,
- The regulator area is intensely cleared for settlement and agriculture and there is abundant grazing,
- The altitude of project site with 500-800 m average altitude is not sufficient for endemic species for that endemic plant species is generally located in 2000-3500 m altitude (The Florustic Investigation of Areas between Kahramanmaraş-Gaziantep, University of Kahramanmaraş, Institute of Natural and Applied Sciences, Department of Biology, Kahramanmaraş, 2007).

Flora of the Land and its Surrounding

Literature data and site visits were used in the studies related to the Flora-fauna determinations. The most widespread family seen in the research area is Compositae. The other widespread families in the area and its near surrounding are Poaceae, Fabaceae, Caryophyllaceae and Labiate.

The list of Flora existing at far and near surrounding of the power production plant planned to be constructed is given in table 28.

According to the most up-to-date criteria and the list of IUCN (International Union for the Conservation of Nature and Natural Resources), CITES (Convention on International Trade in Endangered Types of Wild Fauna and Flora), and Bern Convention (Convention on Wildlife and Natural Habitats) globally endangered plant and animal species were specified

In addition, the national status necessary for the endemic plant species were specified according to "Red Data Book of Turkish Plants" (Türkiye Bitkileri Kırmızı Kitabı- TBKK).

Here are IUCN classifications:
EX: Extinct Species, E: Endangered Species, V: Vulnerable Species, R: Rare Species, I: Indeterminate Species, K: Insufficiently Known Species, O: Out of Danger Species, NT: Rare or Not Threatened Species

Xanthium strumarium *Papaver dubium L.* *Paliurus spina-christi Miller* *Reseda lutea L. var. lutea* *Carduus nutans*

Figure 28 Some of the Species Observed in the Area and it's near Surroundings

Table 26 Flora of the Field of Activity and its Surrounding

PLANT TYPE	ENGLISH NAME	HABITAT								ENDEMISM				RELATIVE ABUNDANCY	DANGER CATEGORY	PHYTO GEOGRAPHIC ZONE
		I	II	III	IV	V	VI	VII	VIII	L	B	Y				
COMPOSİTAE																
Xanthium strumarium	Cocklebur							+						II	NT	Widespread
Xanthium spinosum	Thorny Cocklebur				+			+						II	NT	Widespread
Carduus nutans L. ssp. nutans	Creeping Thistle					+								II	NT	Widespread
Centaurea babylonica (L.) L.	Knapweed				+		+							II	--	East Mediterranean
Senecio vernalis	Ragwort					+		+						II	NT	Widespread
POACEAE																
Phleum boisseri Bornm	-----	+					+							IV	NT	Iran-Turan
Echinops orientalis	Globe thistle					+		+						II	NT	Iran-Turan
FABACEAE																
Lotus corniculatus	Bird's foot trefoil	+				+	+		+					III	NT	Europe-Siberia
Lathyrus gongoni	Grasspea		+	+		+								III	NT	East Mediterranean
Medicago turbinata	Clover				+			+						V	NT	East Mediterranean
Medicago orbicularis	Clover				+			+						V	NT	Mediterranean El.
Onobrychis aequidenteta (Sibth. et Srn) d'urv	Trefoil				+			+						III	NT	Mediterranean El.
Onobrychis caput-calli	Trefoil				+			+						III	NT	Mediterranean El.
Trifolium purpureum Lois. var. purpureum Lois	Shamrock				+			+						III	NT	Widespread
CARYOPHYLLACEAE																
Minuartia juniperina (L.) Miare & Petitm.	Sandwort					+								I	NT	Iran-Turan

Arenaria antitaurica McNeill	Thyme-leaved sandwort					+								III	NT	-----
Gysophila libanotica Boiss.	Baby's breath					+								II	NT	Mediterranean El.
Silene ampullata Boiss.	Catchfly					+								I	NT	Iran-Turan
PTERIDOPHYTA																
Equisetum ramosissim a Desf.	Marsh horsetail				+									II	NT	Widespread
Ceterach officinarum	Fern								+						NT	-----
RANUNCULACEAE																
Adonis aleppica Boiss.	Adonis				+										NT	Iran-Turan
Adonis microcarpa	Adonis				+										NT	Mediterranean El.
Ranunculus cuneatus Boiss.	Buttercup				+										NT	Mediterranean El.
Nigella arvensis L. var. glauca Boiss.	Black sesame				+									III	NT	Widespread
Consolida schlerodada (Boiss) Schröd. var. Rigida (Freyn et Sint.) Davis	Larkspur						+								NT	East Anatolian
PAPAVERACEAE																
Papaver dubium L.	Poppy	+												II	NT	-----
Glaucium grandiflorum Boiss. et Huet var. Grandiflorum	Horned poppy				+										NT	Iran-Turan
BRASSICACEAE																
Alyssum minutum Schlecht. ex DC.	Scabiosa							+						II	NT	Widespread
Arabis verna (L.) DC.	Rockcress							+						II	NT	Mediterranean El.
Capsella bursa-pastoris (L.) Medik.	Shepherd's pouch					+								III	NT	Widespread
Boreava orientalis Jaub. et Spach	Yellow weed				+			+						III	NT	Widespread
CISTACEAE																
Fumana aciphylla Boiss.	Rock rose					+								III	NT	Iran-Turan
RESEDACEAE																
Reseda lutea L. var. lutea	Wild mignonette					+								II	NT	Widespread
Reseda lutea Linnaeus var lutea	Wild mignonette				+			+						IV	NT	Widespread
POLYGONACEAE																
Rumex patientia Linnaeus	Sorrel				+			+						IV	NT	Widespread
Polygonum arenastrum Bor.	Common knotweed								+					III	NT	Widespread
MALVACEAE																
Alcea pallida Waldst. & Kit.	Hibiscus		+	+										III	NT	Widespread
GERANIACEAE																
Pelargonium endlicheria num Fenzl	Geranium	+												III	NT	Widespread
Geranium lucidum Linnaeus	Shining cranesbill								+					III	NT	Widespread
RHAMNACEAE																
Paliurus spina-christi Miller	Black thorn						+							II	NT	Widespread
Rhamnus oleoides Linnaeus ssp.graecus	Buckthorn								+					III	NT	East Mediterranean

HABITAT CLASSIFICATIONS	
1 Forest/Woodland	5 Dry Grassland
2 Dwarf shrub heath	6 Wet Grassland
3 Frigana	7 Road side
4 Cultural Areas (vineyards and orchards etc.)	8 Rockland

ENDEMISM
L: Local Endemic
B: Regional Endemic
Y: Widespread Endemic
RELATIVE ABUNDANCE
I.Few and far between
II.Rare
III.Medium abundance
IV.High abundance

IV.2.7.5.2. **Fauna**

In the project area and its surrounding there are fauna species belonging to Protozoa (single-celled animals), Mollusca (mollusks), insecta (insects), reptilia (reptiles), Aves (birds), mammalia (mammals) classification.

Table 27 Animal Species Existing in the Project Area and its Surrounding

Genus and Species Name	Turkish Name	Bern	Red Data Book	IUCN Red List	Habitat
REPTILES					
SCINCIDAE					
Ophisops elegans subsp. *elegans*	Tarla kertenkelesi	II	Nt	-	Edges of the fields
Ablepharus kitaibellii	Yayla kertenkelesi	II	Nt	LC	short-vegetated open space
Mabuya (Trachylepis) aurata	Parlak kertenkele	III	Nt	LC	open forests and woodland
LACERTIDAE					
Lacerta (Anatololacerta) danfordi	Toros kertenkelesi	III	-	LC	forests and wooded areasr
Lacerta trilineata	Büyük yeşil kertenkele	III	Nt	LC	open forests and woodland
VIPERIDAE					
Vipera (Montivipera) xanthina	Şeritli engerek	II	Nt	LC	mountainous areas
COLUBRIDAE					
Natrix tessellata	Su yılanı	II	Nt	LC	Stony places near water
Natrix natrix	Yarı sucul yılan	III	Nt	LC	Stony places near water
AMPHIBIANS					
RANIDAE					
Rana ridibundula	Ova kurbağası	III	Nt	LC	Abundant vegetation, ponds, lakes and streams
Bufo viridis	Gece kurmağası	II	Nt	LC	Damp stone bottoms
Bufo bufo	Siğilli kurbağa	III	Nt	LC	Breeding time (March to May) the edges of the creek pond eggs. Then live on the land.
BIRDS					
ACCIPITRIDAE					
Accipiter nisus	Doğu atmacası	II	A.4	LC	closed forests, wooded steppe, divided by borders, trees and shrubs, such as agricultural land and park-garden with trees
Aquila chrysaetos	Kaya kartalı	II	A.3	LC	All kinds of high, rocky, forested mountain
Gypaetus barbatus	Sakallı akbaba	II	A.2	LC	Higher parts of the mountains, valleys, rocky, bare or sparsely wooded and rocky slopes
ALAUDIDAE					
Galerida cristata	Tepeli toygar	III	-	LC	Open, dry, treeless areas and fields
APODIDAE					
Apus apus	Ebabil, Kara sağan	III	A.4	LC	Wetlands, open areas and settlements
CICONIIDAE					
Ciconia nigra	Karaleylek	II	A.2	LC	old growth forests or the steep cliffs away from residential areas
COLUMBIDAE					
Columba palumbus	Tahtalı güvercin	-	A.4	LC	beech and oak forests
Streptopelia turtur	Üveyik	III	A.2	LC	Forest edges, tree-lined open land, agricultural areas, fertile plains
CORVIDAE					
Corvus corone cornix	Leşkargası	-	-	LC	Gardens, forest edges, swamps and marshes surrounding area, mountainous
Pica pica	Saksağan	-	-	LC	Agricultural areas and areas with sparse trees and shrubs
FALCONIDAE					
Falco tinnunculus	Kerkenez	II	A.4	LC	Mountains, valleys, forest edges, savannahs, agricultural land, sea coast
HIRUNDINIDAE					
Hirundo daurica	Kızıl kırlangıç	II	-	LC	Rock walls, bridges, buildings, caves and rock cavities
LANIIDAE					
Lanius collurio	Çekirgekuşu	II	-	LC	Open bush land
PASSERIDAE					
Passer domesticus	Ev serçesi	-	-	LC	Gardens, parks and fields
Petronia petronia	Kayalık serçesi	III	-	LC	Cliffs, rocky and sandy areas, open areas and vegetation weak
SCOLOPACIDAE					
Tringa totanus	Kızılbacak	III	A.3	LC	Fresh water side of the pastures, meadows, wetlands, grasslands
STRIGIDAE					
Athene noctua	Kukumav kuşu	II	A.3	LC	Relatives in rural areas, fields and gardens

FI	Density in the activity area and its surrounding
FD	Density outside the activity area and its surrounding
RDB	Red Data Book
EVRDB	European Vertebrate Red Data Book
BERN.	Convention on the conservation of European wildlife and natural habitats
ERL	European Red List
CITES	Convention on International Trade in Endangered Types of Wild Fauna and Flora
IUCN	International Union for the Conservation of Nature and Natural Resources
AVL.	Central Hunting Commission Decisions

IUCN/Red Data Book	
E	Evaluated
NE	Not Evaluated
DD	Data Deficient
EX	Extinct
EW	Extinct in the Wild
CR	Critically Endangered
EN	Endangered
VU	Vulnerable
NT	Near Threatened
LC	Least Concern

Conservation Status of Bird Species in Birds Of Turkey (Prof. Dr. İlhami KİZİROĞLU)	
A1	Extinct or endangered species
A1.1	Extinct
A1.2	The species which individual number is between 1 and 25 couples.
A2	The species which individual number is between 26 and 50 couples.
A3	The species which individual number is between 51 and 500 couples.
A4	The species which individual number is higher than 500 couples

Testudo graeca *Empusa pennata* *Acrida sp.* *Apis mellifera*

Figure 29 Some Fauna Samples Observed Around the Area

Table 28 Kahramanmaraş Region – Fish Species Living in Waters

Bilimsel adı	Türkçe adı(Geldiay ve Balık (1988)	Yerel adı
Cyprinus carpio	Sazan	Üretim, aynalı
Leuciscus cephalus	Tatlısu kefali	Kefal
Capoeta capoeta angorae	Siraz	Sarı balık
Capoeta barroisi	Siraz	Çapar balık
Alburnus orontis	İnci balığı	Gümüş balığı
Silurus glanis	Yayın	Et balığı
Clarias lazera	Kara balık	Kara balık, Sekiz bıyık
Salaria fluviatilis	Horozbina	
Salmo trutta macrostigma	Dağ alabalığı	Kırmızı benekli alabalık
Acanthobrama marmid	Tahta balığı	Çipura
Barbus rajanorum	Bıyıklı balık	Sivri sazan
Aphanius cyprii	Dişli azancık	
Nemachaeilus angorae	Çöpçü	
Nemachaeilus tsyhienchus	"	
Phoxinellus zeregii	Ot balığı	
Rutilus tricolar	Gördek balığı	
Garra rufa	Yağlı balık	kaya balığı
Cobitid sp.	Tatlı su kaya balığı	"

Table 29 Fish Species Living in Korsulu River

Name in Latin	**Generic Name**	**Local Name**	**Immigration**
Alburnus orontis	Bleak	Gümüş Balığı	Non-Migrant
Phoxinellus sp.	Grey wrasse	Gümüş	Non-Migrant
Leuciscus cephalus	Round chub	Kefal	Non-Migrant
Garra rufa	Doctor fish	Kaya baligi	Non-Migrant
Capoeta capoeta angorae	Goatfish	Sarı Balik	Non-Migrant
Cobitis sp.		Kaya baligi	Non-Migrant
Nemacheilus angorae	Angora loach	Copcu	Non-Migrant

8 of 17 bird species that live and likely to live in energy transmission line route because of their habitat characteristics are in the list of Bern Appendix-2 and 5 of them are in the list of Bern Appendix-3. None of the bird species observed in the examination area is in "NT" (Near Threatened) category. In fact, all of the bird species observed in the examination area is in "LC" (Least Concern) category in IUCN Red List Category Lists. Moreover, in accordance with TEIAŞ Mast Assembly Regulation, bird repellers will be placed on the energy transmission line in order to protect bird population.

Project area is located within the limits of the areas where hunting is prohibited for the 2012 hunting season as well as areas where hunting is prohibited due to settlement of wild animals.

In field observations performed during EIA and Ecosystem Evaluation Report studies, species being in the protection list prepared by the central hunting commission were not observed. Field observations are performed by Prof. Dr. Lokman ALTUN (Forest Engineer, Professor Doctor, Blacksea Technical Univercity, Faculty of Forestry, Forestry Engineering, Forest Soils and Ecology, Director of the Section), Prof. Dr. Bilal KUTRUP (Biologist, Professor Doctor, Blacksea Technical Univercity, Faculty of Science, Biology, Hydrobiology, Director of the Section), Assc. Prof. Fatma GÜLTEKİN (Hydrogeologists, Professor Doctor, Blacksea Technical Univercity, Faculty of Engineering, Geological Engineering, Hydrogeology), Veli YORGALI (Forest Engineer, Mavi Yeşil Engineering Company, Coordinator of the EIA), Süleyman SAĞLAM (Agricultural Engineer, Mavi Yeşil Engineering Company) and Ahmet YARDIMCIOĞLU (Environmental Engineer, Mavi Yeşil Engineering Company). These field studies are supported by the related litterature studies and flora-fauna section of the EIA report was prepared. Any separate reports were prepared after field observations. But, in case species which are in the conservation lists belonging to the 2012 Hunting Season prepared in accordance with the decisions of Republic of Turkey, Ministry of Forestry and Water Affairs, General Directorate of Nature Conservation and National Parks Central Hunting Commission are observed in the areas during both the construction and management stages, compliance with MAK decisions and the conservation precautions determined by the decisions of this commission will be necessary.

Species found in the activity area and its near surrounding are the ones that can be seen in any place of Turkey and that do not need private habitats. None of the endemic and endangered species are seen in the construction areas and its surrounding, conserved under Bern Convention. 2012 Central Hunting Commission Decisions and Bern Convention decisions shall be observed within the scope of the Project.

IV.2.7.6. Livestock (species, nutrition areas, annual production amount, place and value of these goods in the economy of country)

Project area is located within the boundaries of Sarımollaali and Demrek villages. Although livestock depends mostly on small cattle raising in both villages, great cattle breeding is also performed in small quantities. Apiculture is performed by few families in villages having a rich flora for such activity.

IV.2.7.7. Valuable Areas in terms of Landscape and Recreation Areas

Although a majority of the Project area is located in the forestry land there are no other places of value in terms of landscape and recreation areas (convention-fair centers, amusement center, sports ground, picnic sites, religious formations, monuments, etc.) in the project area and its near surrounding except the forestry land.

IV.2.7.8. Lands in the government and possession of competent bodies of the State

Within the scope of the project, only the forestry lands are in the government and possession of competent bodies of the State. Except the forestry land, within the project area and the impact area, there are no Military Restricted Areas, Areas Allocated to Public Bodies and Institutions for Certain Purposes which are in the government and possession of competent bodies of the State, "Restricted Areas" under the decision of the Committee of Ministers no:7/16349, etc.

Forestry permit will be granted from the Ministry of Forest and Water Affairs for the forestry lands that will be used as a part of the project in accordance with Article No:17/3 of the Forestry Law No:6831 amended under the Law No:5191.

IV.2.7.9. Current Pollution Load of the Project Area and the Impact Area

Evaluation in terms of Soil Pollution

Soil pollution can be described as the distortion of the nature of the soil as a result of human activities, negative shift of physical, chemical and biological composition and reduction or inappropriate use of the effective usability as a matter of the characteristics of the soil. Resources that are polluting the soil features the factors such as, disposal of solid wastes of the municipality and the other institutes into the soil, pouring of the mud coming out in the waste treatment facilities into the soil, disposal of liquid wastes by releasing them into the soil, air polluters like particles and aerosol polluting the soil by accumulating in it.

As described in the environmental impact chapter below, no soil-polluting activity is the case due to construction activities. As a result of the study of the project area and its surrounding in terms of industrial activities causing soil pollution, no factors causing pollution load have been observed impacting upon the flora and fauna species in the region by causing toxic impact in the soil.

Evaluation in terms of Water Pollution

Current water quality was determined after having tested the water samples taken from the creek of Körsulu where the project is being executed. Results can be seen in the Table below.

Table 30 Source and Downstream Water Quality Test Result for Creek of Korsulu Torlar HEPP

Parameter	*Unit*	*Source Test Result*	*SKKY TABLE 1 (CONTINENTAL WATER RESOURCES CLASSIFICATION)*	*Downstream Test Result*	*SKKY TABLE 1 (CONTINENTAL WATER RESOURCES CLASSIFICATION))*
pH		*8.05*	*1st Class*	*8.1*	*1st Class*
Chemical oxygen req.	*mg02/l*	*<10*	*1st Class*	*<10*	*1st Class*
Dissolved oxygen	*mgO2/l*	*9.35*	*1st Class*	*9.65*	*1st Class*
Oxygen saturation	*%*	*100*	*1st Class*	*103.4*	*1st Class*
Chloride	*mg/l*	*16.3*	*1st Class*	*19.9*	*1st Class*
Ammonium nitrogen	*mg/l*	*<0.5*	*1st Class*	*<0.5*	*1st Class*
Biochemical Oxygen req.	*mgO2/l*	*<5*	*1st Class*	*<5*	*2nd Class*
Phenol index	*mg/l*	*<0.01*	*1st Class*	*<0.01*	*1st Class*
Nitrite nitrogen	*mg/l*	*<0.04*	*3rd Class*	*<0.04*	*2nd Class*
Total Dissolved Solids	*mg/l*	*205*	*1st Class*	*210*	*1st Class*
*Total Organic Carbon**	*mg/l*	*3.91*	*1st Class*	*4.71*	*1st Class*
Total Kjeldahl Nitrogen	*mg/l*	*<0.7*	*1st Class*	*<0.7*	*1st Class*
MBAS	*mg/l*	*0.04*	*1st Class*	*<0.025*	*1st Class*
Sulfate	*mg/l*	*19*	*1st Class*	*22*	*1st Class*
Color	*Pt-Co*	*<5*	*1st Class*	*5*	*1st Class*
Sulfur	*mg/l*	*<0.1*	*1st Class*	*<0.1*	*1st Class*
Total Phosphorus	*mg/l*	*0.34*	*3rd Class*	*0.26*	*3rd Class*
Nitrate Nitrogen	*mg/l*	*0.5*	*1st Class*	*0.96*	*1st Class*
*Total Pesticide**	*mg/l*	*<0.0002*	*1st Class*	*<0.0002*	*1st Class*
*Mineral Oil and its derivations**	*mg/l*	*0.22*	*3rd Class*	*0.25*	*3rd Class*
Oil and Grease	*mg/l*	*<10*	*4th Class*	*<10*	*2nd Class*
Sodium	*mg/l*	*<0.2*	*1st Class*	*9.67*	*1st Class*
Total Chrome	*mg/l*	*0.009*	*1st Class*	*<0.002*	*1st Class*

IV.2.7.10. Other Characteristics

There is no available subject matter to be described under this title.

IV.3 Characteristics of the Socio Economic Environment

IV.3.1. Economic Features

When the economic features of the settlement areas which are affected by the project are examined, it is seen that there is no industrial plant or industrial activity in the project area and it's near surrounding except the City Center, Pazarcık, Elbistan and Afşin Districts. Fundamental economic activities in the affected settlement areas in question (Demrek and Sarımollaali villages) are livestock and agriculture. Majority of the agriculture performed in these areas is irrigated agriculture. Fruits and vegetables grown for one season and are sold in the bazaars of Kahramanmaras and Andırın.

In these settlements livestock is performed in fewer amounts compared to the agriculture. Apiculture is also performed in the area though not very widespread. Usually, produced honey is either purchased by the other dwelling owners of the area who are not dealing with apiculture or marketed in city center of Kahramanmaras and in Andırın. Products of agriculture and livestock not only contribute to subsistence economy of the dwellings but also form a great majority of the dwellings' financial budget. Since there are no economic

activities in the said settlements other than agriculture and livestock, there are villagers who migrate to big cities such as Kahramanmaras, Andirin, Elbistan, Afsin, Ankara and İstanbul for some periods of the year as seasonal workers.

IV.3.2. Population

In Demrek and Sarimollali villages that remain within the limits of project area, people are continuously migrating due to either the uneven land forms or the very low income obtained through agriculture. Old people usually form the great majority of village population. Young people prefer to migrate to big cities due to financial problems. Below are the population movements belonging to villages:

Table 31 Population Change as of 2000, 2007 and 2011 Years (TUIK, 2011)

	2011			2007			2000		
	Women	**Men**	**Total**	**Women**	**Men**	**Total**	**Women**	**Men**	**Total**
Demrek	129	136	265	136	140	276	135	138	273
Sarimollali	117	124	241	133	134	267	159	145	304

IV.3.3. Income

In settlements affected by the project, resident population lives on agriculture and livestock. In these settlements, villagers both generate revenue from agriculture and livestock and contribute heavily to their subsistence economy. In other words, these villagers consume some of the goods produced through agriculture and livestock and they make money by the rest of it in the bazaars set up in the city centers and districts. Another resource of income is seasonal workers (Agriculture labor, common labor, construction labor) who go to work in the city center, in Andırın, Elbistan and Afşin districts or big cities like Adana, Ankara, Antalya and Istanbul in certain seasons of the year. During the last 20 years, young population living in the region have migrated to the city center of Kahramanmaras in the first place and then to Elbistan and Afşin districts or to big cities like Adana, Antalya, Ankara and Istanbul because of unemployment.

IV.3.4. Social Infrastructure Services in the Region (Education, Health, Cultural Services and Utilization of these Services)

Education;

There is one primary school in Demrek Village which was affected by the project. But, this school was classified as damaged by the Ministry of Public Works and Settlement. Therefore, mobile education was started in the village and the new school in Yenicekale village was used for this purpose. Although there is a primary school in Sarimollaali village it is not used either and mobile education is performed in this village as well.

Health;

Considering the villages affected by the project, there is not any health center or village clinic in Demrek and Sarımollaali villages. The villagers usually use the existing health units in the central district or Andırın district for health services.

IV.3.5. Unemployment (Unemployed Population in the Region and its Rate Compared to the Employed population)

In villages affected by the project, people are continuously migrating due to either the uneven land forms or the very low income obtained through agriculture. Old people usually form the great majority of villages' population. Young people prefer to migrate to big cities due to financial problems. Young people form the great majority of unemployed population as is the case in Kahramanmaras province generally.

IV.3.6. Utilization of Urban and Rural Areas (Distribution of Settlements, Existing and Intended Utilization Areas, Industrial Zones, Dwelling Houses, Tourism Areas, etc. within this context)

There are no industrial establishments in the project area and its near surroundings. Scattered villages and quarters take place in the region. Since there is no urban settlement, rural area utilization is prevalent.

IV.3.7. Other

There is no available subject matter to be described under this title.

V. IMPACT OF THE PROJECT ON THE AREA DESCRIBED IN SECTION IV AND THE MEASURES TO BE TAKEN

Impacts resulting from the project include potential impacts on physical – biological environment, impacts on natural geography and geological structure, meteorological and climate changes, impacts on water ecosystem, impacts on land ecosystem, impacts on soil sources, impacts on flood hydrology, impacts on land usage, impacts on air quality, noise and vibration impacts and impacts on infrastructure services as well as impacts on socio-economic environment, expropriation impacts, impacts on water rights, social structure and impacts on economic structure.

V.1. Preparation of the land, projects at the stage of construction and installation, their impact on the physical and biological environment and the measures to be taken

V.1.1. Preparation of the land, projects at the stage of construction and installation, their impact on the physical and biological environment and the measures to be taken

Facilities that are projected to be installed are; regulator, settling pond, transmission tunnel, forebay, penstock pipe, power plant building, tail-water channel, switchyard and power transmission line. Access to Torlar HEPP Project is provided through asphalt-paved road until Körsulu Bridge which is 8 km far from Andırın intersection of Kahramanmaras-Kayseri highway. A new road of approx. 250 m was constructed after the Körsulu Bridge in order to reach the power plant area. 4.1 km of the existing Kahramanmaras potable water transmission line was improved beginning from the Körsulu bridge and in addition a new road of app. 400 m was constructed in order to reach the regulator area. The power generated in the power plant building shall be wired up to the national network via the transmission line of app. 18.6 km (34.5 kV).

Regulator body, Aggregates for concretes used for concrete construction of tunnel and power plant are purchased from a Borrow pit, Washing, Crushing and Screening Plant run by a private company designated in Appendix-13. These aggregates are used in the establishment of ready-mixed concrete power plant.

Within the scope of this project, excavations of the regulator, power plant, forebay, energy transmission line are completed; 60% of those of the penstock is completed and the construction of its 40% section is continued. During excavations, 151,925 m^3 excavations were performed. In the water conveyance tunnel, approx. 27,720 m^3 excavations were performed. For the remaining part, it is estimated that 18,480 m^3 excavations will be performed. During excavations, in order not to contaminate the upper soil, this section of the soil was stripped and stored in a way that it maintains its productivity. Lower soil providing the formation of the upper soil layer was piled so that it wouldn't lose its horizons. This vetegal soil will be used for landscaping of the area and the recreation areas.

Remaining excavation process will be performed either by work machines or blastings. During such process, 3 excavators, 2 loaders, 4 trucks, 2 sprinklers, 2 compressors, 1 tunnel boring machine, ANFO, Powergel Magnum 365 and 1 tunnel ventilation fan are used. Material coming out of the excavations are used as filler to fill the openings in the excavation area and as laying material in revision of the roads. Blasting pattern and plan are explained under V.I.22.

V.1.2. Hazardous and risky processes in terms of human health and the environment from the preparation of the area to works that will go on until the opening of the units, dimensions of health protection zone, type and quantity of the explosives, the equipment and machines to be used during the area preparation.

As stated above, majority of excavations are completed and only remaining job is to complete 40% of the water conveyance tunnel. 300,028 kg explosives are used in such tunnel's excavations and these explosives are stored in 4 mobile stores, 2 tonnes each. Stores are surrounded by fences. Blastings are performed under the surveillance of Gendarmerie and before blastings, local people are informed. Devices and machines that are used in blastings:

- Jumbo drill machine,
- Hand operated table drill machine,
- Powergel magnum explosive,
- Exel capsule igniter,
- Detonating cord,
- Ampere-meter,
- Ignition magneto

Moreover, fuel such as diesel oil and gasoline that are used by the construction machines during the construction stage of the project are supplied from a gas station in Kahramanmaraş. A deal was made with the gas station enabling them to distribute fuel to the machines by their own distribution means periodically (daily or once in two days, etc.) according to the amounts used by the construction machines. In this way, no storing is done in the construction site.

For heating, stove and air conditioning are used. Considering the explosives mentioned above, the articles belonging to “Bylaw regarding the Principles and Procedures of Production, Imports, Transportation, Maintenance, Storing, Sales, Use, Disposal, Control of de-monopolized Explosives and Hunting Materials and the like,” which was put into force by decision of the Council of Ministers dated 29th September 1987 and no 12028, amended by decision of the Council of Ministers dated 28th October 2004 and no 8057; and “Bylaw on the Measures to be taken in works and workplaces which use Inflammable, Explosive, Hazardous and Harmful Materials” dated November 1973 and no 7551 are abided.

V.1.3. Transportation infrastructure plan covered by the project, measures to be taken with respect to the distance between the project area and the highways, access roads to the highway, mapping

Torlar HEPP Project takes place in central district of the city of Kahramanmaras, on the Korsulu River. Torlar Regulator is located in the city of Kahramanmaraş, in the location of Kurtbekirlibağlari, Bulutlu Neighborhood, Sarimollaali Village. Access to Torlar HEPP Project is provided through asphalt-paved road until Korsulu Bridge which is 8 km far from Andırın turnout of Kahramanmaras-Kayseri highway. A new road of app. 750 m was constructed after the Korsulu Bridge in order to reach the power station area. Besides, 4.1 km of the existing Kahramanmaras potable water transmission line was improved beginning from the Körsulu Bridge, in addition a new road of app. 480 m was constructed in order to reach the regulator area and app. 480 m was constructed in order to reach the forebay. The map regarding the project area transportation infrastructure is given below.

Within the scope of the project, road construction was performed in accordance with the Highways Technical Specifications. All kinds of expenses occured during the road construction was financed by the investor company.

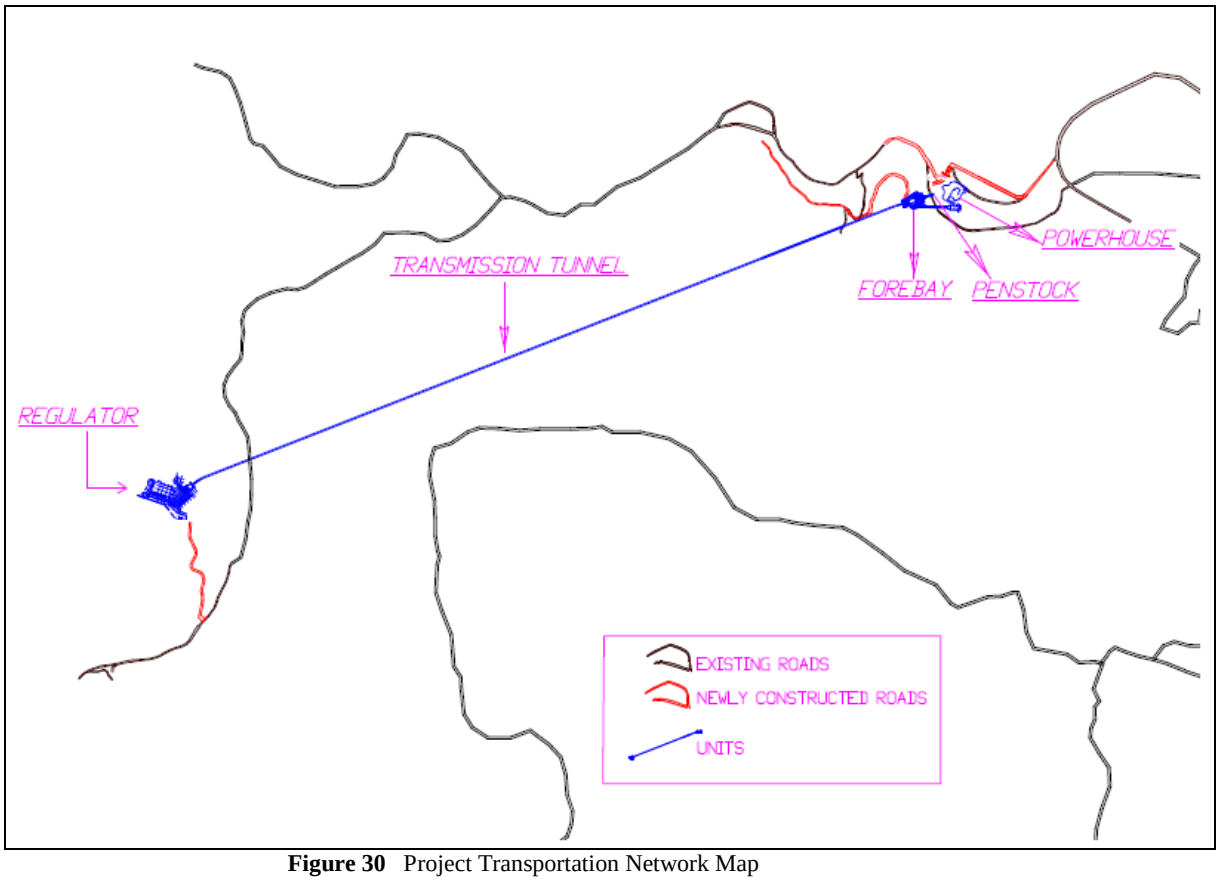


Figure 30 Project Transportation Network Map

The Road Construction plays an important role to transport and construction of process units. However, on the other hand, a road project without an environmental planning it may lead to degradation of the forest ecosystem. This degradation results from the excessive felling of forest land, the erosion of soil, the over- use of natural resources and the pollution of the atmosphere. The environmental planning that has done before construction has provided results and conclusions which explain that an environmental-friendly design for the opening-

up, construction and operation of a road project may reduce the above negative effects and protect the forest ecosystems.

A basic step towards the protection of the environment is the definition of the lower road density and is to minimize the total length of roads. This is the most effective way to prevent watershed disturbance and increased soil erosion rates. It has to be kept in mind that even the best developed drainage system established during the road construction process will only reduce rather than avoid impacts on natural watersheds.

The hydraulic excavator and advanced drilling and blasting techniques are used in construction of new roads and improving of existing roads. However, in the first phase of opening-up, a dominant role plays the machinery which will produce the least damage on the ecosystem and on the remaining stand. The construction of road by use of hydraulic excavators and advanced rock drilling and blasting techniques are superior than road construction by the traditional use of bulldozers on steep slopes. There are short-term economic benefits from the use of bulldozers in road construction; however, in the long-term, dozer construction in mountainous terrain is likely to create considerable environmental damage. The advantages of road construction by means of hydraulic excavator and advanced drilling and blasting techniques are listed below:

- Subgrade width can be kept to the absolute minimum determined by safety and anticipated use.
- Excellent control can be applied the placement of excavated material. Excavated material can be separated and temporarily stockpiled by the excavator in anticipation of its best use in building the road.
- Total construction width is minimized since subgrade width and length of ill slope are minimized. The use of a hydraulic hammer results in less need for blasting.
- Drainage and erosion control can be installed immediately and function satisfactorily during the entire project.

Generally: excavators with well trained operators often proved to be a cheaper and much more environmentally sound alternative than bulldozers on road construction work.

The protection by the overuse of the aggregates is also obtained by the creation of surface layers with industrial side-products. There have been used fly ash and slag which were stabilized with lime and cement.

In Torlar HEPP Project, on newly constructed roads at borrow and spoil sites, rock lining is used for stabilizing slopes as shown below;

Figure 31 Satalite View Of Newly Constructed Roads 1

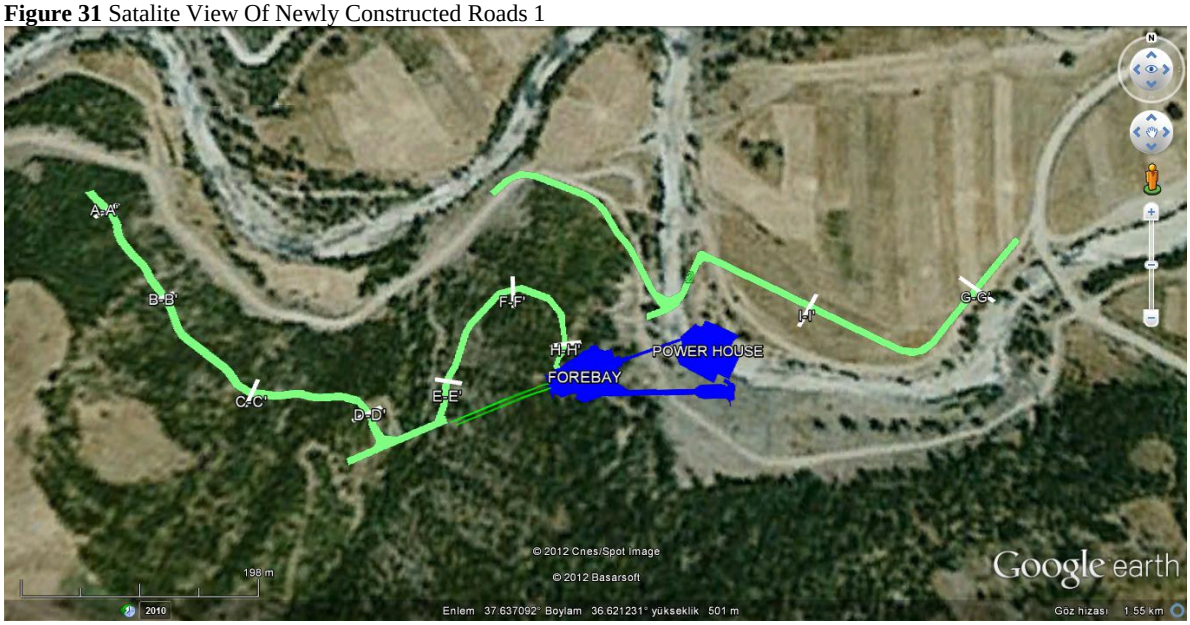
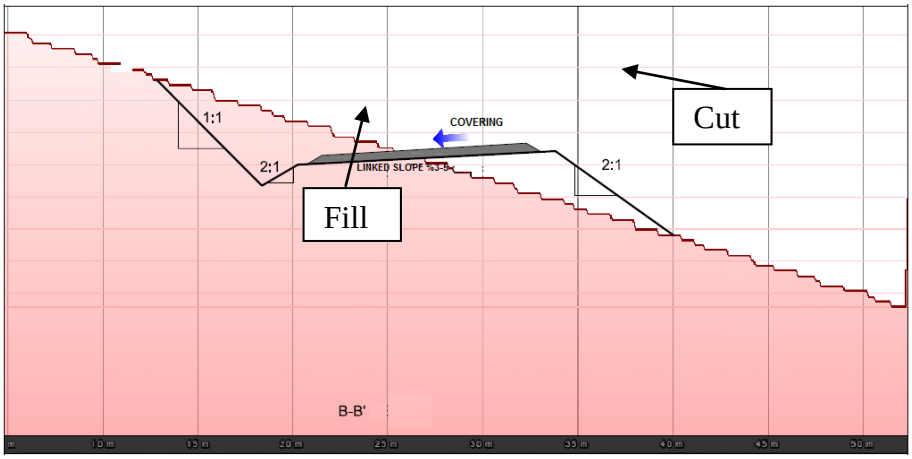
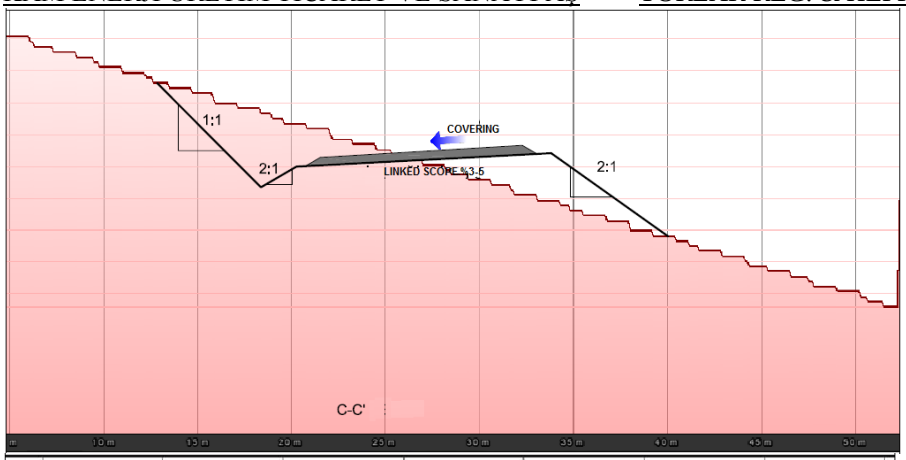
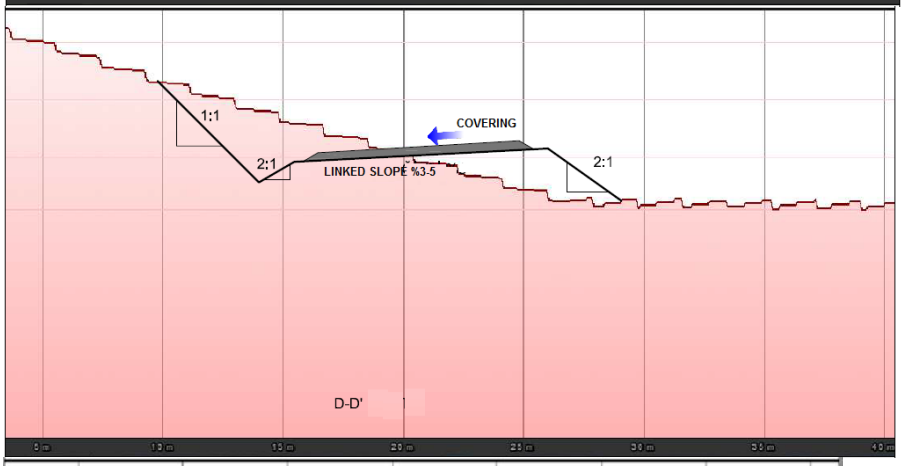
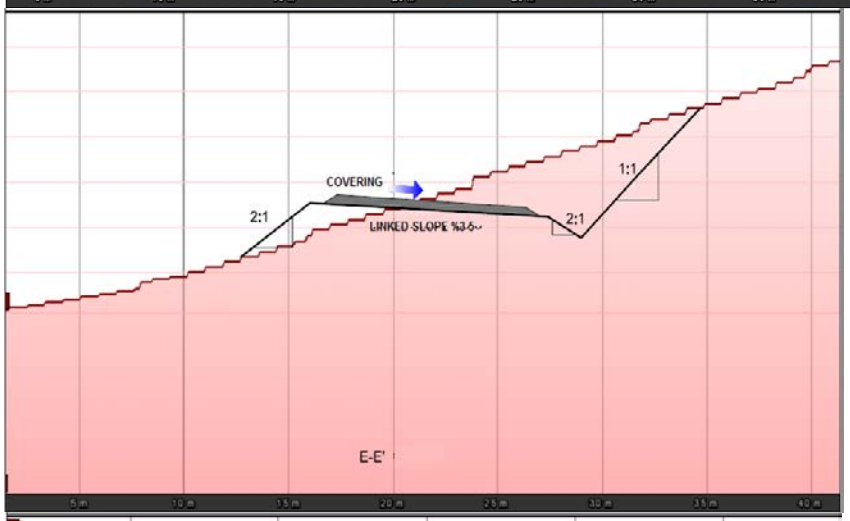


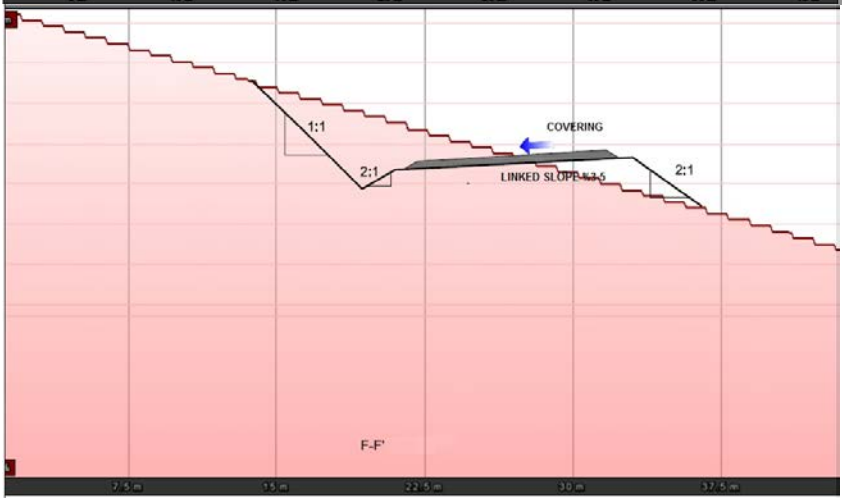
Figure 32 Newly Constructed Roads 1 Sections




1:1
2:1
COVERING
LINKED SCORE %3-5
2:1
C-C'


1:1
2:1
COVERING
LINKED SLOPE %3-5
2:1
D-D'


COVERING
2:1
LINKED SLOPE %3-5
2:1
1:1
E-E'


1:1
2:1
COVERING
LINKED SLOPE %3-5
2:1
F-F'

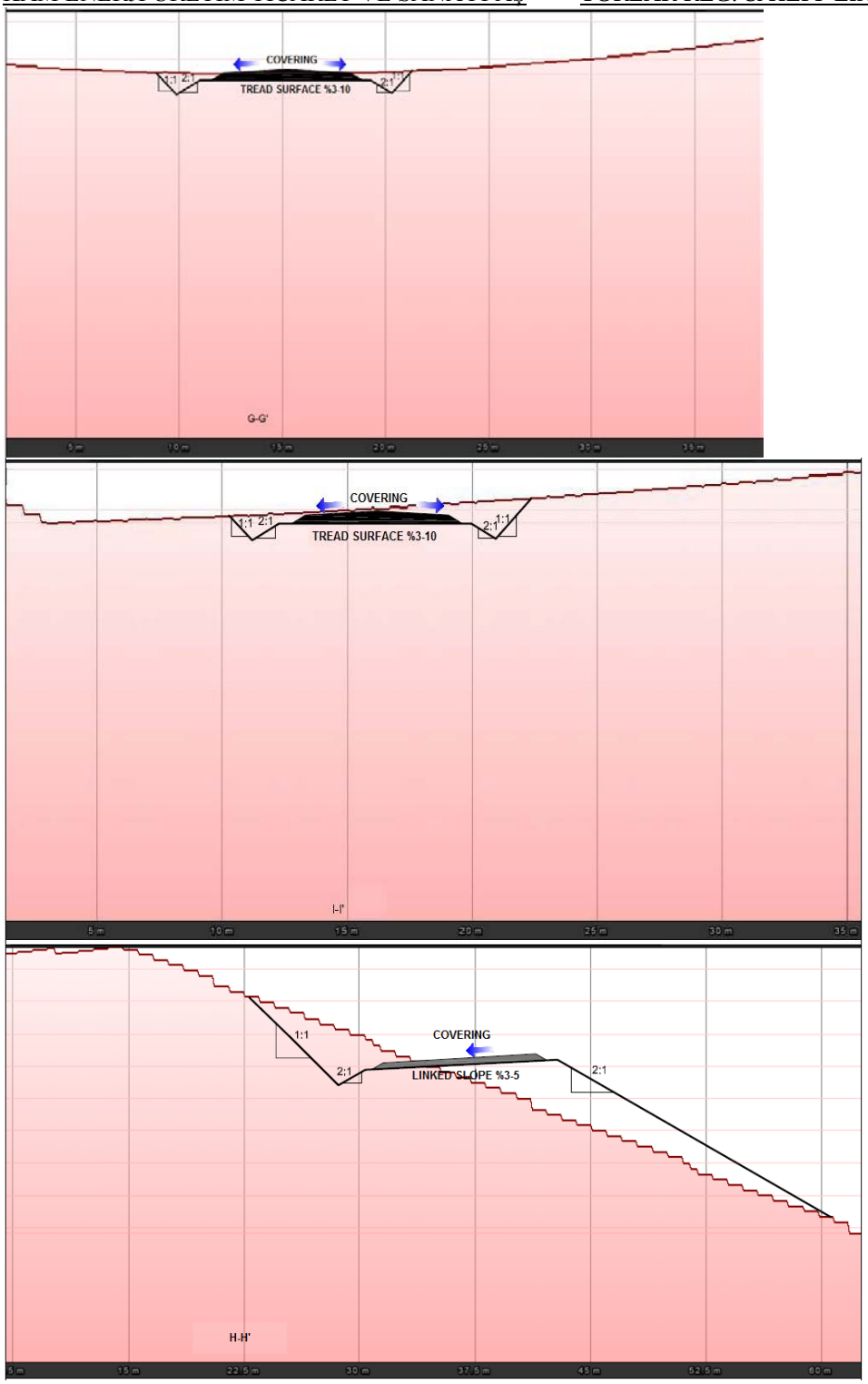


Figure 33 Satalite View Of Newly Constructed Roads 2

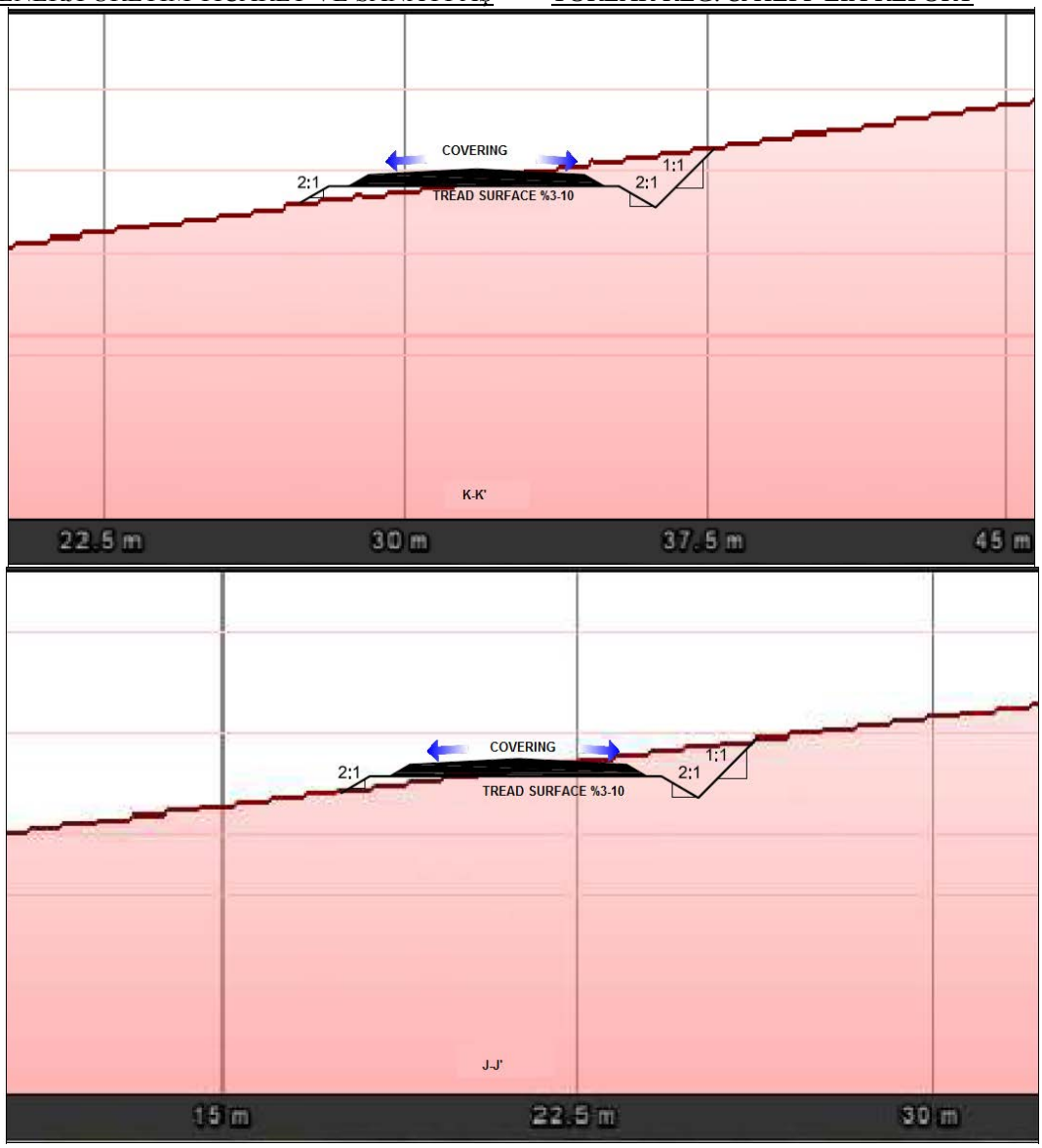


Figure 34 Newly Constructed Roads 2 Sections

As a result the environmental planning that has done before construction has provided results and conclusions which explain that an environmental-friendly design for the opening-up, construction and operation of a road project. Within the scope of this plan;

- total length of roads newly constructed are minimized to prevent watershed disturbance and increased soil erosion rates,
- the hydraulic excavator and advanced drilling and blasting techniques are used in construction of new roads and improving of existing roads to reduce damage on the ecosystem and on the remaining stand,
- the protection by the overuse of the aggregates is also obtained by with industrial side-products. There have been used fly ash and slag which were stabilized with lime and cement.
- at borrow and spoil sites, rock lining is used for stabilizing slopes and minimize soil erosion.

V.1.4. Securing the Ground, Procedures to Prevent Occurrence of Water Leakage in the Regulator and the Channel Structures

Precautions to be taken at the project site in order to secure the ground and to prevent water leakage are determined according to the geological studies carried out in the dam site.

A total of 385 meters long foundation bore holes have been drilled in 13 bore holes, within the scope of Torlar Regulator and HEPP Project. In order to determine permeability, sensitivity and bearing capacity of the foundation bore holes, permeability, pressurized water tests and pressure meter tests have been carried out, and laboratory tests have been carried out on the core samples taken.

In order to determine the permeability of the regulator location, pressurized water tests were carried out in such levels of foundation bore holes where rubber could be attached.The results of the pressurized water tests indicated that the flyshes have been generally impermeable-slightly permeable (0.84-3.55 Lu). The results of the non-pressurized water tests carried out on the existing thalweg in the regulator location indicated that the permeability coefficient has been = $1.2 – 3.7 \times 10^{-3}$. Therefore alluvium is permeable-high permeable. Accordingly, in order to provide impermeability at the regulator location, current alluvium within the thalweg which is of 3.00-4.00 meter thickness and has permeable characteristics, was removed.

According to NGI (Q) rock classification method conducted in the conveyance tunnel's route, during the tunnel's excavation, 2-3 cm thick jetcrete and systematic bolting with 1 m intervals are used.

V.1.5. Flood investigation of the project site, where and how the procedures relating to flood prevention and drainage will be carried out

In order to carry out basin work in the river basin no:20, annual maximum flow values of the AGIs (Flow Measurement Stations) which are operated by DSI (General Directorate of State Hydraulic Works) and EIEI (Electrical Works Study Administration) have been determined using the Flow Observation Yearbooks that were officially published by the mentioned institutions. Recurrent flow rate values for the closed AGI (Flow Measurement Station) were taken from “Frequency Analysis of Maximum Flows of River Basins in Turkey – 1994”. Recurrent precipitation values for the closed meteorological stations were taken from the “Frequency Atlas of Maximum Precipitation in Turkey - Volume I (Point Precipitation Frequency Atlas)-1990”, published by DSI (General Directorate of State Hydraulic Works).

By utilizing point flood recurrence values which were calculated using the probability distribution function that is the most appropriate one for the annual instant peak flow rare series for the Flow Measurement Stations located within the river basin no:20; Q_2 annual flow rate values were pointed on the log-log graphic sheets against the precipitation areas of the station location. By multiplying the Q_2 annual flow rate value which is read from the graphic as the value corresponding to the precipitation areas of the cross section axis location with the average dimensionless regional flood recurrence value; flood recurrence flow rate values for cross section axis locations were obtained.

By applying DSI (General Directorate of State Hydraulic Works) synthetic and Mockus methods depending on the criteria of the method applied, flood recurrence flow rates were calculated via synthetic methods, from the precipitation. Since synthetically calculated values via unit hydrograph optimization are accepted as the project's flood flow rates, calculations which were made utilizing unit hydrograph optimization are described in detail in this section.

Thiessen polygons method was utilized for determining the precipitation stations that represent the project site. Recurrent precipitation amount of the basin within the regulator location was determined according to the effects with varying ratios, of values of the station that represents this basin. Recurrent precipitation values which were obtained as a result of probability distribution and density function of maximum daily precipitation of the representative precipitation stations are given for each meteorological station in the table in Appendix-14. The distribution of precipitation over area was determined utilizing values which were read corresponding to time from the Precipitation-Area duration curves of the US Soil Conservation Service for various durations.

For calculating the distribution of precipitation over time, curve for region (B), which was obtained by utilizing series that gave the maximum amount of precipitation within any 24 hour period for each observation year, and hourly values for which are known for each observation year in the "Distribution of Precipitation Over Time In Turkey" brochure published by DSI (General Directorate of State Hydraulic Works) has been used. Precipitation – Flow connection was calculated with the following formula developed by the US Soil Conservation Service;

$S = (25400 / CN) – 254$
$h(mm) = (P - 0.20 \times S)2 / (P + 0.80 \times S)$

As described above, the weighted average, and the recurrent precipitation of the drainage area were calculated by multiplying the recurrent precipitation of meteorological stations by Thiessen ratios. Recurrent precipitation of the Kahramanmaras (DMI) meteorological station which has a pluviograph, was calculated utilizing the hourly pluviograph ratios. For calculating recurrent flood flow rates that were selected according to the hydraulic conditions of the drainage area from these precipitation, the flow and the residual flows were calculated by the curve number in the CNII specification and recurrent flood hydrographs were calculated by superposing with unit hydrograph. Base flow was added to the flood hydrographs that are accepted as the project's flood hydrographs.

Unit hydrograph for Torlar Regulator was created according to the values obtained; the unit hydrograph analysis, the unit hydrograph coordinates and the unit hydrograph graphic is given in Appendix 14. Recurrent precipitation for Torlar Regulator drainage area was calculated and it is given in Annex 14. Furthermore, recurrent flood flow rates were calculated utilizing the DSI synthetic, Mockus and regional flood frequency analysis methods. The calculated recurrent flood flow rates, flood hydrographs that are obtained via the Mockus method and that are accepted as the project's flood hydrographs, the recurrent flood hydrographs that are calculated via unit hydrograph optimization of the DSI synthetic method for Torlar Regulator are given in Appendix-14.

The source of the Torlar Regulator which is planned to be established has been evaluated from AGI (Flow Measurement Station) No:20 – 36. By looking at the dates of instant flow rates of the above mentioned AGI (Flow Measurement Station) for the observation period on 1972 – 1996; the flood period was determined to be months of March, April and May. Totals were calculated utilizing average monthly daily flow rated for these months for each year, and their average in the flood period was calculated. The average flow rate of the year that gave the highest average, was accepted as the base flow.

$Q_{Torlar\ Regulator}=(A_{Torlar\ Regulator}/A_{22-49})^{n}$ x $Q_{(22-49)(}n=0.66)$

With the above given equation, base flow rate for Torlar Regulator was calculated as 47.30 m^3/s for recurrence hydrographs.

V.1.6. Amount of stones, sand, pebbles and similar materials to be removed as a result of any excavations,

Since the aggregate materials which are required within the scope of Torlar Regulator and HEPP project are obtained via procurement, no procedures such as excavations, bottom sweeps, etc. are carried out in aquatic environments.

V.1.7. Possible Effects during the construction procedures on the existing species within aquatic environments

Impacts that may affect the flora and fauna in the region during the construction activities such as dust, noise and vibration shall be eliminated upon completion of the construction activities. However, in order to minimize their effects during this period, the area is irrigated during dust generating activities and it is not permitted to have all construction equipment to be operated at the same time.

Plant species shall incur biomass loss during preparation of the field and construction phases of activities, due to scraping of the ground cover. However, complete elimination of flora species shall be out of the question.

As for the terrestrial fauna species, these shall leave their habitats and move to more appropriate alternative living areas nearby, due to the fact that their habitats within the project site shall be disturbed during preparation of the field and the construction phase. Personnel to be employed during the project shall be warned by the owner of the project in order to prevent any damage to fauna species; and trainings as well as information meetings on protection of wild life shall be carried out.

No blastings are performed in March-June period that is the breeding season for fauna species under the project. During the construction and operation phases of the activities, protection measures of the Bern Treaty regarding the fauna species listed in Annex 2 and Annex 3 of the Bern Treaty; and Article 6 and Article 7 of this Treaty shall be adhered to. Terrestrial Hunting Law No: 4915 and the related Regulations shall be adhered to, during all phases of activities.

The elevation of the regulator from the thalweg is 11.60 meters, the regulator structure shall not create a large lake area as dams do, water level will only rise and will be taken to the transmission tunnel. The regulator lake that will be formed shall be very small and shall not cause the stream to become stationary. Waters along the project flow rate shall be led to the river bed without any alterations. A short term mudiness is experienced due to activities to be carried out in aquatic environment during the construction phase. During this period, fish and coastal ecosystem, mainly the benthic invertebrates are affected unfavorably. Although there are no measures to reduce this effect, a permanent and inalterable impact shall be out of the question due to the fact that these construction works shall be carried out within a very short period of time.

V.1.8. From where, how and in which quantities the materials to be used for the construction of the facilities

Materials to be used for concrete fabrications within the scope of the project in question are obtained from the existing quarries and crushing-sieving plants within the boundaries of the district, concrete are manufactured in the readymade concrete plant to be built in the construction site.

V.1.9. The number and Size of the Quarry

As specified in Section V.1.8, no material quarries such as rock quarries, sand quarries, or clay quarries were opened within the scope of the project, materials are obtained from the existing and crushing-sieving plants within the boundaries of the district.

V.1.10. Specification of whether any material quarries will be opened or not, if yes, explanation on how the explosions will be carried out

As specified in Section V.1.8, no material quarries such as rock quarries, sand quarries, or clay quarries were opened within the scope of the project, materials are obtained from the existing and crushing-sieving plants within the boundaries of the district.

V.1.11. Duration of operation (days-months-years) for production amounts in material quarries (if any quarries are to be opened), routes for transportation

Due to the fact that no material quarries were opened within the scope of the project, information regarding production amounts, duration of operation, routes for transportation, transportation infrastructure plan, procedures regarding infrastructure construction, areas of settlement within the nearest proximity to the quarry, production map for the quarry, layout plan showing the near vicinity as well, machinery and equipment to be used is not provided.

V.1.12. Crushing-sieving Plant

Due to the fact that the materials that are required within the scope of the project are purchased there will not be expected any effects.

V.1.13. Concrete Plant

A readymade concrete plant with a capacity of 60 m^3/hour was established within the scope of the project, in order to meet the requirement for concrete during the construction phase. Production in ready-made concrete plant is realized via the wet system in terms of

mixture types; and via the bunker system in terms of types of storage. The production process shall start with laboratory tests. First, tests shall be conducted in order to examine the qualities and compatibility of the correctly selected materials (cement, aggregates, water, additives) to be used for production of readymade concrete. In order to prevent unfavorable changes to occur in time on the materials subjected to testing, quality controls must be conducted on a continuous basis.

The production process of the readymade concrete starts when the plant operator determined the formula number that describes the concrete to be produced, and enters it into the computer system. Following the initial command, the aggregate, cement and water which are stored in separate sections are weighed at the same time. Subsequently, the weighted aggregate is transferred to the mixer tank via a belt or a bucket. At this point, cement, water and chemical additive (if contained in the formula) are added into the tank and mixed. Wastewater resulting from this process is not discharged to the river. It is settled in the settling pond and then used in washing mixer and concrete plant area. Hydrous residues in the settling pond and any chemical additives are transferred to the boiler and mixed.

Volume of one batch of concrete, although it may change from one plant to another, is generally 3 m^3. Duration of mixing at the plant is also determined by standards, depending on the batch volume. Adequately mixed batch shall be transferred to the truck mixer; and this procedure shall be continued until filling is completed. A cement silo, truck mixer, compressor, power transformer, spiral conveyor, sica silo and a truck with mixer shall be used in the plant. The concrete plant shall carry out its activities throughout the time during which the construction of the project continues. A separate road construction shall not be made for the construction of the concrete plant, access road to the construction site are used.

V.1.14. Measures to be Taken Against Possible Landslides

Appropriate methods shown below figures were used in order to prevent landslide risks that may occur in excavations and road constructions under the project. Sideroad slope stability is provided as shown in the below figure.

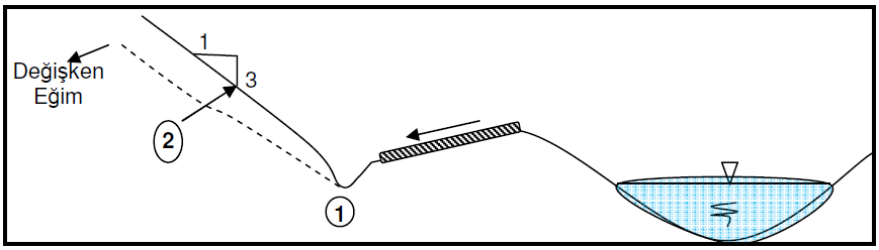


Figure 35 Providing Slope Stability on the Side of the Road

In order to prevent landslide and to ensure slope stability at tunnel entrance-exit excavations; jetcrete on steel mesh with an interval of φ6 at 15 cm; or bolting are provided.

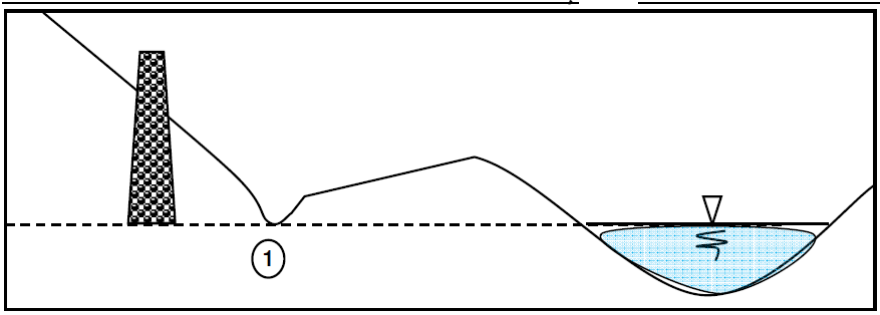


Figure 36 Rock Blocking

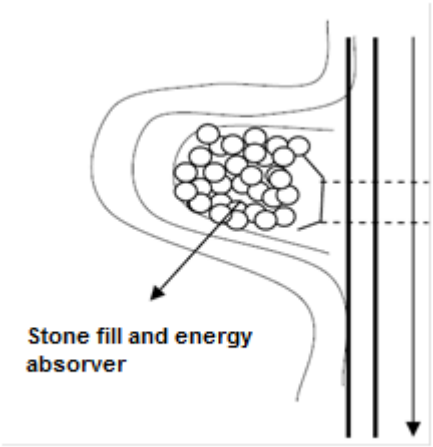


Figure 37 Prevention of Soil Erosion at River Passes

V.1.15. Effects on Ground Water

The rock structures on which the project site is located are impermeable in terms of hydrogeology and they are inefficient in terms of ground water. However, water is encountered from time to time, along the route of the tunnel. Water that is encountered along the tunnel route is natural water that falls into the basin by draining through the breaks and the cracks of rocks; this water is let to rest in sedimentation ponds and then is discharged to the appropriate receiving medium.

V.1.16. Dust emitting works such as crushing, grinding, washing-sieving, transportation and storage during construction; cumulative values

The area where Torlar Regulator and HEPP facilities are located in does not include any industry other than the rural settlements in the region. The nearest settlement unit to the project site is the Karbasan Quarter, which is located at approximately 920 meters north east of the HEPP building. There are no industries in the region, furthermore, there are no activities which can cause dust, noise, water and soil pollution, such as construction, etc.

Activities which cause dust formation during construction activities are excavation works, explosions, movement of construction equipment on the road, loading and unloading of excavation materials to and from the trucks, and storage of excavation materials. Howewer under the project, excavations are completed except that of the conveyance tunnel. In this case, tunnel excavation and ready-made concrete production are left to form dusts in the project area. The dust emission to be caused by these activities have been calculated

according to worst case scenario with the assumption that no preventive measures had been taken; and the amount of dust which shall be created as a result of all these activities have been compared with the limit values which are specified as the limit values for pollution arising from sources other than chimneys, and for which contribution values to air quality must be calculated in the event that they are exceeded; in Annex-2 of the Regulation No:27277 for Control of Air Pollution Arising from Industrial Facilities, published in the Official Gazette of 03.07.2009. Other emissions to influence air quality during the construction phase arise from the exhaust emissions of the construction machinery to be utilized.

Dust emission factors used for calculating dust emission formations:
Transportation (dust rising off the roads) =0.7 kg/km-vehicle
Loading of materials =0.01 kg/ton
Unloading of materials =0.01 kg/ton
Removal of materials =0.025 kg/ton

Dust Emission to Arise from Transmission Line Excavation Activities

The entire transmission line shall be constructed as a tunnel. Since the emissions to form inside the tunnel during the excavations shall remain inside the tunnel and nothing shall be emitted to the atmosphere, this has been excluded from the emission calculations. Formation of emission shall only occur during the transportation of materials that are removed from the transmission tunnel to the storage site and unloading of the same at the storage site. A total of 18,480 tons m^3 (18,480 tons * 1.4 = 25,872 tons) excavations shall be carried out during the excavation activities (6 remaining months) for the transmission tunnel. In this context, annual excavation shall be 4297 tons, monthly excavation shall be 143.23 tons, daily excavation shall be 17.9 tons and hourly excavation shall be 12.44 tons.

Dust Emission to be Formed During Transportation of Materials from the Transmission Tunnel to the Storage Site

Distance between the transmission tunnel to the storage site is approximately 1.000 meters. When it is considered that one truck is capable of transporting 20 tons of material at one trip, number of daily trips is calculated as: 143.23 / 20 ton/trip = 7.16 trips. Therefore, dust emission to form during transportation shall be;

0.7 kg/km-trip x 7.16 trip / 8 hour x 2 km= ***0.313kg/hour (1)***

Dust Emission to be Formed During Unloading of Materials that are Removed from the Transmission Tunnel, at the Storage Site

17.9 ton /hour x 0.01 kg/ton = ***0.179 kg/hour (2)***

Total amount of dust emission to form during excavations for the transmission tunnel is found to be: ***II = 1+2 = 0.492/hr.***

Emissions to Arise During Production Activities of the Readymade Concrete Plant

The plant produces 60tons/hour readymade concrete, annually. For production activities in the plant, a total of 96,000 tons of aggregate materials with various grain sizes shall be utilized annually. The amount of cement to be used annually shall be 12,000 tons. 3,480 tons of ash and 120 tons of chemicals shall be used as additives.

Amount of materials to be transported annually	96,000 tons
Unloading emission factor	0.01 kg/ton

Emissions to Form Suring Unloading of the Aggregate Materials at the Readymade Concrete Production Plant

Dust Emission = 60 ton/h * 0.01 kg/ton = 0.6 kg/h

Emissions to Form During Readymade Concrete Production

No emission shall occur since the release of dust particles into the environment shall be prevented using filters to be mounted on the silos while the silos are being filled within the scope of the project; therefore, this has been excluded from emission calculations. Since readymade concrete production shall be carried our using the wet system, no emission formation is expected. Silo filters shall be cleaned every 3 months. Silos are planned to be cleaned 4 times a year. 3 cement silos and 2 sica silos shall be utilized during production. Emission factors that are specified by EPA for readymade concrete production are given below.

Table 32 EPA Emission Factors for Readymade Concrete Production Plants (http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s12.pdf)

EMISSION FACTORS FOR CONCRETE BATCHING [a]

Source (SCC)	Uncontrolled				Controlled			
	Total PM	Emission Factor Rating	Total PM_{10}	Emission Factor Rating	Total PM	Emission Factor Rating	Total PM_{10}	Emission Factor Rating
Aggregate transfer [b] (3-05-011-04,-21,23)	0.0035	D	0.0017	D	ND		ND	
Sand transfer [b] (3-05-011-05,22,24)	0.0011	D	0.00051	D	ND		ND	
Cement unloading to elevated storage silo (pneumatic)[c] (3-05-011-07)	0.36	E	0.23	E	0.00050	D	0.00017	D
Cement supplement unloading to elevated storage silo (pneumatic)[d] (3-05-011-17)	1.57	E	0.65	E	0.0045	D	0.0024	E
Weigh hopper loading [e] (3-05-011-08)	0.0026	D	0.0013	D	ND		ND	
Mixer loading (central mix)[f] (3-05-011-09)	0.272 or Eqn. 11.12-1	B	0.067 or Eqn. 11.12-1	B	0.0087 or Eqn. 11.12-1	B	0.0024 or Eqn. 11.12-1	B
Truck loading (truck mix)[g] (3-05-011-10)	0.498	B	0.139	B	0.0280 or Eqn. 11.12-1	B	0.0080 or Eqn. 11.12-1	B
Vehicle traffic (paved roads)	See AP-42 Section 13.2.1							
Vehicle traffic (unpaved roads)	See AP-42 Section 13.2.2							
Wind erosion from aggregate and sand storage piles	See AP-42 Section 13.2.5							

As it can be seen from the table above, the emission factor for controlled systems during changing of silo filters is 0.0045 kg/ton. Within the scope of this project, 12,000 tons of cement and 120 tons of chemicals shall be used annually, the total amount of materials to be used in the silos shall be 132,000 tons. Monthly calculation is 11,000 tons, daily calculation is 440 tons and hourly calculation is 55 tons. Therefore, dust emission to form during cleaning of the silos shall be calculated as follows;

55 ton / h * 0.0045 kg/ton = 0.2475 kg/hr.

Total dust emission arising from the readymade concrete plant is calculated as: 0.6+0.2475= **0.8475 kg/h (IV).**

In this case, ***total dust emission*** to form during the construction phase of Torlar Regulator and HEPP project is calculated as;
0,492+0,848 = 1,34 kg/hr

According to this calculation, values given in Table 2.1 of the Regulation for of Air Pollution Arising from Industrial Facilities is exceeded; as 1,34 kg/hour > 1.0 kg/hour. Within this framework, provisions have been implemented to calculate the Air Pollution Contribution Values for emissions within the area of influence of the plant on an hourly basis; and for cases where this is not possible, to calculate the same on a daily, monthly and annual basis. Air Pollution Value and Total Pollution Value have been calculated and modeling has been conducted as below.

Environment Legislation formula – II has been used for dust modeling.
Formula II (Griffort Dispersion)

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

(ξ) : Integration variable in x direction
x,y,z : Cartesian coordinates at peak point
(x, in the direction of dispersion and perpendicular to this dispersion)
y : Horizontal (0 in the example given)
z : Vertical (has been taken as 2 for particles that are suspended in air, and 0 for settling dust)
C(x,y,z) : Value of contribution to air pollution for any dispersion at peak point (mg/m3), (*1µg = 0.001 mg*)
Q : Mass flow of emissions arising from the emission source
Z : Height of the peak point from the ground (m)
(Has been taken as 2 for particles that are suspended in air, and 0 for settling dust)
Uh : Wind speed (m/h)

Horizontal and vertical dispersion parameters (m)
$\sigma_Y = F * x^f$
$\sigma_Z = G * x^g$
Calculation of Settling Dust:

$$d(x,y) = 3600 \sum_{i=1}^{4} V_{di} * C_i(x,y,0) \qquad \text{(Çevre Mevzuatı Formül III)}$$

If the efficient chimney height is below 50 m., F, f, G, g parameters are determined based on the efficient chimney height, as below;

Dispersion Class	**F**	**f**	**G**	**g**
A (Very Unstable)	1.503	0.833	0.151	1.219
*** B (Unstable)**	0.876	0.823	0.127	*****
C/I (Neutral)	0.659	0.807	0.165	0.996

C/II (Neutral)	0.640	0.784	0.215	0.885
D (Stable)	0.801	0.754	0.264	0.774
E (Very Stable)	1.294	0.718	0.241	0.662

Determination of the dispersion class is based on the existing meteorological data and the daily overcast weather. Annual overcast ration in the province of Kahramanmaras is within the 3/8 – 5/8 range. Dispersion class that corresponds to this overcast is the B (Unstable) class. Wind speeds are determined as below.

Ua(m/sec)	**U_R(m/sec)**
1.4 or less	1
1.4-1.8	1.5
1.9-2.3	2
2.4-3.8	3
3.9-5.4	4.5
5.5-6.9	6
7-8.4	7.5
8.5-10	9
greater than 10	12

Wind speed (U_H) value is calculated using the formula below.

$U_h = U_R (h / z_a)^M$ In this formula;

Z_a = Height of the wind gauge from the ground in meters (10 m)
h = Efficient chimney height, maximum height which the dust can rise (10 m)

And the following values are taken for M.

Dispersion Class	**M**
A (Very Unstable)	0.09
B (Unstable)	0.20
C/I (Neutral)	0.22
C/II (Neutral)	0.28
D (Stable)	0.37
E (Very Stable)	0.42

Thus, dispersion classes and U_h values are calculated in the table below.

Table 33 Classification of Wind Data During HEPP Construction

DIRECTION	DISPERSION	UA (m/sec)	UR (m/sec)	UH (m/sec)
N	C/2	4.4	4.5	4.5
NNE	C/2	4.1	4.5	4.5
NE	C/2	5.4	4.5	4.5
ENE	B	3.1	3	3
E	B	1.8	1.5	1.5
ESE	B	2.5	3	3
SE	B	2.9	3	3
SSE	B	2.7	3	3
S	B	1.9	2	2
SSW	B	2.1	2	2
SW	B	2.1	2	2
WSW	B	2.4	3	3
WSW	B	1.9	2	2
WNW	B	3	3	3
NW	B	3.8	3	3
NNW	B	4.6	4.5	4.5

As a result of calculations, dispersion classes according to directions have been calculated based on the meteorological data for the province of Kahramanmaras.

Dust Dispersion Calculations;

Q = 1,34 kg/months

80% of the total dust that forms during construction (based on past experience) comprise of particles greater than 10µ.

For particles that are suspended in the air C (x,y,z)
Q = 0,268 kg
h = 10 m.
z = 2 m
Vdi = 0,01 m/s

For the amount of settling dust (di)
Q = 1,072 kg
h = 10 m.
z = 0 m
Vdi = 0,07 m/s

Table 34 Dispersion of Particles That are Suspended in the Air During Construction (µg/m3)

DIRECTION	DISPERSION	UH (m/sec)	50	100	200	300	400	500	600	700	800
N	C/2	4.5	111.88	56.69	20.84	11.17	7.13	5.02	3.77	2.96	2.40
NNE	C/2	4.5	111.88	56.69	20.84	11.17	7.13	5.02	3.77	2.96	2.40
NE	C/2	4.5	111.88	56.69	20.84	11.17	7.13	5.02	3.77	2.96	2.40
ENE	B	3	167.82	85.04	31.27	16.75	10.69	7.54	5.66	4.44	3.60
ENE	B	1.5	335.65	170.07	62.53	33.50	21.39	15.07	11.32	8.88	7.20
ESE	B	3	167.82	85.04	31.27	16.75	10.69	7.54	5.66	4.44	3.60
SE	B	3	167.82	85.04	31.27	16.75	10.69	7.54	5.66	4.44	3.60
SSE	B	3	167.82	85.04	31.27	16.75	10.69	7.54	5.66	4.44	3.60
S	B	2	251.74	127.55	46.90	25.12	16.04	11.31	8.49	6.66	5.40
SSW	B	2	251.74	127.55	46.90	25.12	16.04	11.31	8.49	6.66	5.40
SW	B	2	251.74	127.55	46.90	25.12	16.04	11.31	8.49	6.66	5.40
WSW	B	3	167.82	85.04	31.27	16.75	10.69	7.54	5.66	4.44	3.60
WSW	B	2	251.74	127.55	46.90	25.12	16.04	11.31	8.49	6.66	5.40
WNW	B	3	167.82	85.04	31.27	16.75	10.69	7.54	5.66	4.44	3.60
NW	B	3	167.82	85.04	31.27	16.75	10.69	7.54	5.66	4.44	3.60
NNW	B	4.5	111.88	56.69	20.84	11.17	7.13	5.02	3.77	2.96	2.40

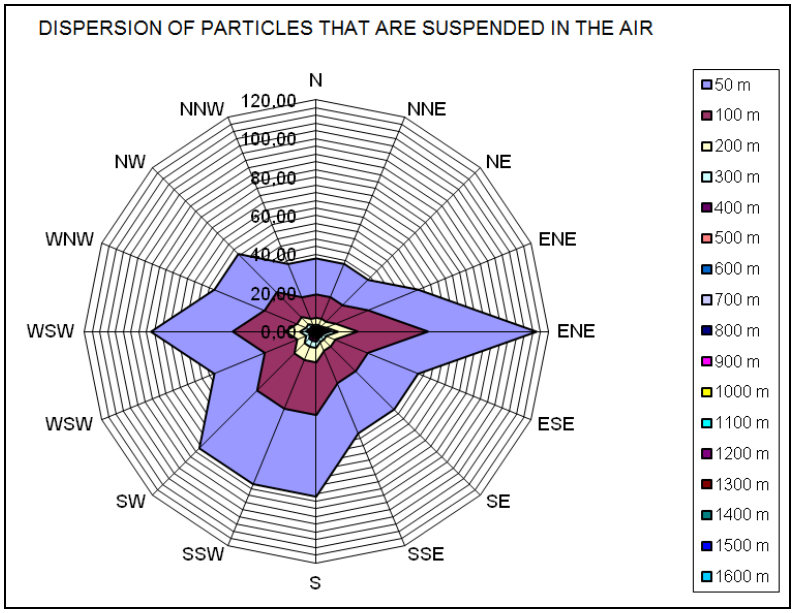


Figure 38 Graphic Showing Dispersion of Particles That are Suspended in the Air During Construction, according to Directions (µg/m^3)

Table 35 Dispersion of Particles That are Settled During Construction (mg/m^2-hour)

DIRECTION	DISPERSION	UH (m/sec)	50	100	200	300	400	500	600	700	800
N	C/2	4.5	446.70	227.42	83.40	44.65	28.50	20.09	15.08	11.84	9.59
NNE	C/2	4.5	447.25	226.62	83.32	44.63	28.50	20.09	15.08	11.84	9.59
NE	C/2	4.5	447.25	226.62	83.32	44.63	28.50	20.09	15.08	11.84	9.59
ENE	B	3	670.87	339.93	124.99	66.95	42.74	30.13	22.63	17.75	14.39
ENE	B	1.5	1341.74	679.86	249.97	133.90	85.49	60.26	45.25	35.51	28.78
ESE	B	3	670.87	339.93	124.99	66.95	42.74	30.13	22.63	17.75	14.39
SE	B	3	670.87	339.93	124.99	66.95	42.74	30.13	22.63	17.75	14.39
SSE	B	3	670.87	339.93	124.99	66.95	42.74	30.13	22.63	17.75	14.39
S	B	2	1006.31	509.89	187.48	100.43	64.11	45.19	33.94	26.63	21.58
SSW	B	2	1006.31	509.89	187.48	100.43	64.11	45.19	33.94	26.63	21.58
SW	B	2	1006.31	509.89	187.48	100.43	64.11	45.19	33.94	26.63	21.58
WSW	B	3	670.87	339.93	124.99	66.95	42.74	30.13	22.63	17.75	14.39
WSW	B	2	1006.31	509.89	187.48	100.43	64.11	45.19	33.94	26.63	21.58
WNW	B	3	670.87	339.93	124.99	66.95	42.74	30.13	22.63	17.75	14.39
NW	B	3	670.87	339.93	124.99	66.95	42.74	30.13	22.63	17.75	14.39
NNW	B	4.5	447.25	226.62	83.32	44.63	28.50	20.09	15.08	11.84	9.59

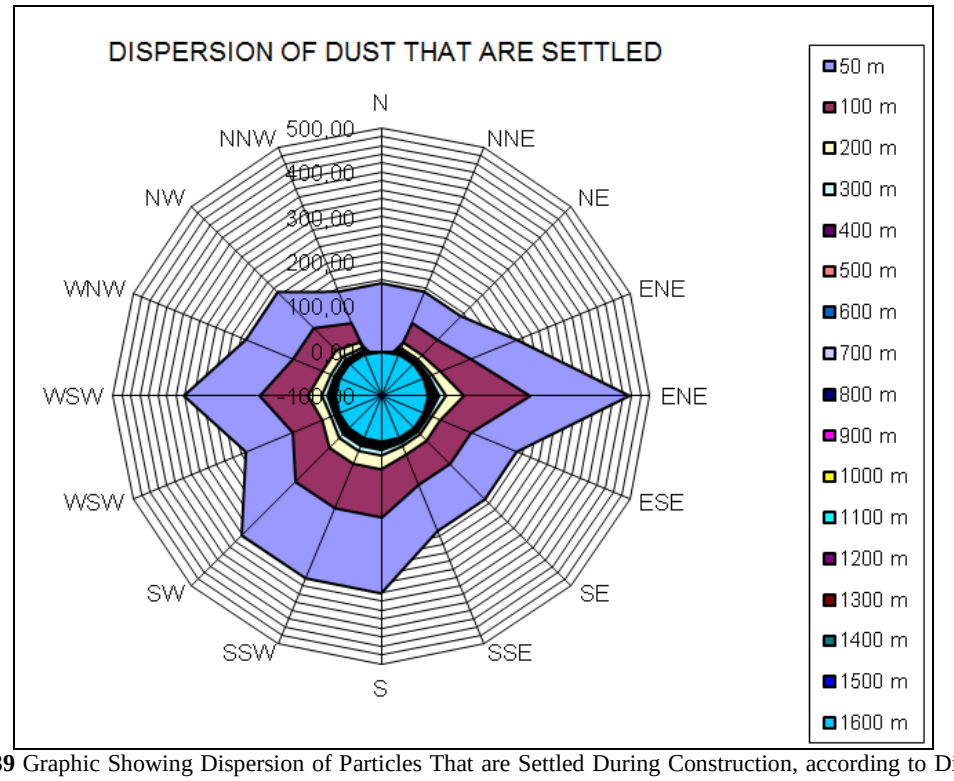


Figure 39 Graphic Showing Dispersion of Particles That are Settled During Construction, according to Directions (mg/m^2-saat)

Dust emission amounts arising from the procedures to be carried out within the scope of the project; and their dispersion based on meteorological conditions have been determined using the above given formula. Emission values obtained as the result of the calculations are assessed below, according to the limit values of the Regulation for of Air Pollution Arising from Industrial Facilities, Long Term Limit Values and Short Term Limit Values.

Table 36 Limit values of the Regulation for of Air Pollution Arising from Industrial Facilities, Long Term Limit Values and Short Term Limit Values

	Particles Suspended in the Air		**Settling Dust**	
	General (µg/m3)	Industrial Areas (µg/m3)	General (mg/m2-day)	Industrial Areas (mg/m2-day)
Long Term Limit Values	150	200	350	450
Short Term Limit Values	300	400	650	800

Total emission flow of the dust to form during the construction phase of the project is 1,34 kg/hour; all dust emission generating sources have been assumed to be operated at the same time. While this is compulsory for the purpose of modeling, this does not occur in practice. When dispersion table (Table 36) for the particles that are suspended in the air is reviewed, one can see that the dust dispersion in all directions falls below the Long Term Limit Values and the Short Term Limit Values at a distance of approximately 100 meters. When dispersion table (Table 37) for the settling particles is reviewed, one can see that the settling dust falls below the limit values at a distance of above 100 meters. The nearest area of settlement to the project site is Bulutlu Quarter. The distance of the project site to Bulutlu Quarter is approximately 485 meters. Even when wind blowing from this distance and these directions are reviewed, it is expected that the settlement area shall not be influenced from the dust formation as a result of the HEPP construction activities.

Explosions to be carried out during excavation works shall be carried out in closed areas. Explosions shall be carried out in closed areas during the excavation for the transmission tunnel.

During the excavation for the transmission tunnel, depending on the soil, approximately 2.500 m^3 excavations are expected to be carried out. A monthly excavation of 250 m^3 shall be carried out. The pattern regarding the explosions to be carried out during the excavation for the transmission tunnel is given below.

Amount of Annual Excavation : 2,500 m^3
Amount of Monthly Excavation : 250 m^3
Type of Explosive to be used : Powergel Magnum
Hole Height : 7 m
Hole Width : 3.7 m
Stemming Length : 3 m
Amount of Material to be Taken from 1 Hole (V) : B x S x K = 3 x 3.7 x 7
: 78 m^3
Number of Monthly Explosions : 1
Number of Holes to be Opened with 1 Explosion : 4
Amount of Material to be Taken with 1 Explosion : 1 explosion/month * 4 holes/1 explosion * 78 m^3 materials / 1 hole : 312 m^3 materials / month

Total Number of Annual Explosions: 2,500 / 312 : 8 explosions

Number of Explosions to be Carried Out Within the Scope of the Project: 5,000/312 = 16 explosions

Amount of Explosives to be Used at One Time	: 75 kg
Amount of Capsules to be Used at One Time	: 4 pcs
Feeding Dynamite to be Used at One Time	: 4 kg
Amount of Explosives to be Used Within the Scope of the Project	: 1,200 kg
Amount of Capsules to be Used Within the Scope of the Project	: 16 pcs.
Feeding Dynamite to be Used Within the Scope of the Project	: 16 kg

Since the explosions shall be carried out inside the tunnel, no dust emissions shall be released to the atmosphere. In this context, it is not possible to calculate the amount of dust on an hourly basis. Therefore dust calculation has been not made for the explosion procedure.

Provisions of the "Statute for Procedures and Principles regarding Production, Importing, Carrying, Keeping, Storing, Selling, Using, Destroying and Inspection of Off-Monopoly Explosive Materials, Hunting Materials and the Like" which had entered into force with the decision No: 12028 of the Council of Ministers dated September 29, 1987; and amended with the decision No: 8057 of the Council of Ministers dated October 28, 2004; shall be adhered to regarding usage, transportation and storage of the above mentioned explosive materials.

V.1.17. Types, properties of fuels to be used starting from land preparation until commissioning of the units; the emissions to be generated

Within the scope of the project, a certain amount of emission shall be released as a result of operation of construction equipment in the activity area. Construction equipment to be used on site shall use Tupras – 400 fuel; general specifications of Tupras – 400 diesel fuel are given in Table 7.

Fuel required by construction equipment that shall be operated on site shall be 50 lt/h. accordingly; the fuel requirement is calculated as follows;

Q=50 lt/h x 0.835kg/lt = 41.75kg/h = 0.04 t/h

Table 37 General Specifications of Tupras 400 Diesel Fuel

SPECIFICATIONS	GUARANTEE	METHOD
Color, ASTM	3.0 Max.	ASTM D 1500
Density, 15 C (kg/L)	0.820-0.850	ASTM D 1298
Pour Point C. (F) Winter Summer	 -6.7 (20) Max. -3.9 (25) Max.	 ASTM D 97
Distillation Regain C (F) 90% Final Point Sulfur, Weight (%)	 357 (675) Max. 355 (725) Max. 0.7 Max.	 ASTM D 86 ASTM D 129 or IP 356
Carbon residue (%, over distillation), Weight (%)	 0.2 Max.	 ASTM D 524
Viscosity, 37, B	34.45	ASTM D 88
Corrosion, copper strip 3 hours 50 C	Strip no:3 or less	ASTM D 130
Ash, Weight %	0.01 Max.	ASTM D 482
Calculated cetane index	50 Min.	ASTM D 976
Carbon residue (%)	0.03 Max.	ASTM D 2709

SOURCE: TUPRAS INC. -2004

Table 38 Dispersion Factors for Pollution Arising from Diesel Vehicles (kg/t)

POLLUTANT	DIESEL
Carbon monoxides	9.7
Hydro carbons	29
Nitrous oxides	36
Sulfur oxides	6.5
Dust	18

SOURCE: Principles of Air Pollution and Its Control, 1991

When dispersion factors given in Table 40 are taken into account, estimated values for pollutants to arise from the construction equipment are calculated as follows;

Carbon monoxides : 9.7kg/Tx0.04t/h = 0.39 kg/h
Hydro carbons : 29kg/Tx0.04t /h = 1.16 kg/h
Nitrous oxides : 36kg/Tx0.04t/h = 1.44 kg/h
Sulfur oxides : 6.5kg/Tx0.04t/h = 0.26 kg/h
Dust : 18kg/Tx0.04t/h = 0.72 kg/h

Since the mass flow values calculated for the construction equipment are very low, they shall have no unfavorable effect on the existing air quality. Fuel systems of vehicles to be operated in the project site shall be controlled continuously, and provisions of Directive No:25869 of 08.07.2005 on Motorized Vehicles Exhaust Gases, published by the Ministry of Environment and Forestry, shall be adhered to.

V.1.18. Water Supply

Areas where water shall be used during land preparation and construction phases of the project; quantities, sources for supply, amount of waste water and method for elimination of waste water is given in Table 41. Aprrox. 150 personnel were employed when construction is busy and in current situation 75 people are working because the construction works slow down.

Table 39 Locations where water shall be used during land preparation and construction phases of the project; quantities, sources for supply, amount of waste water and method for elimination of waste water

WATER USAGE	WATER QUANTITY	SOURCES FOR WATER SUPPLY	AMOUNT OF WASTE WATER	METHOD FOR ELIMINATION OF WASTE WATER
Drinking water and usage water for 75 persons during land preparation and construction phases	75 people x 150 lt/peopleday = 11,5 m^3/day	Drinking water will be purchased in gallons, usage water will be carried with tankers	11,5 m^3/day	Domestic type waste water to generate in the construction site shall be collected in the package waste water purification plant to be installed at the construction site and shall be purified. The purified water shall be discharged after purification, based on parameter values.
Dampening will be carried out in order to prevent dusting in the working site and village roads	Approx. 5,00 m^3/days	Pumping from the surface water	----------	No waste water shall be created since water will be retained by the soil after the damping procedure
Washing of readymade concrete production plant and plant units	Approx. 40,32 ton/year	Carried by tankers	----------	Settling in the settlement pond will be cleaned from its solid particles and used to wash transmixer and concrete ground. Hydrous deposits will be used again for concrete production.

Domestic waste water to be generated within the scope of the project may be characterized as being domestic waste water with intermediary pollution. Total pollution loads regarding the characteristics of the domestic waste water, based on literature information according to results of many long term studies are given in Table 42.

Table 40 Total Pollution Load Of Domestic Waste Water To Be Generated During Land Preparation And Construction Phases

PARAMETER	Unit load (mg/l)	Total load (kg/h)
BOI_5	220	0.20625
KOI	500	0.46875
AKM	220	0.20625
Oil, Grease oil	100	0.09375
Total P	8	0.0075
Total N	40	0.0375
Total Cl	50	0.046875
Total sulfur	30	0.028125
Total organic carbon	160	0.15
pH	6-9	

Source: Metcalf and Eddy. (2004). Wastewater Engineering; Treatment, Disposal and Reuse, Mc Graw Hill Book Company, New York, USA.

The waste water purification plant was established within the scope of the project shall be approved under the directive No:4343 on Waste Water Purification Plant Project Approval, dated 29.04.2005. Pursuant to provisions of "Regulation on Permissions and Licenses to be Obtained According to the Environment Law" which entered into force following its publication in the Official Gazette No: 27214 of 29.04.2009, an "Environment Permission Certificate" shall be obtained for discharging of the purified waste waters, from the Provincial Directorate of Environment and Urbanization of Kahramanmaras. The plant shall be commissioned at the same time as the project.

Furthermore, geological and hydrogeological characteristics of the route through which the transmission tunnel passes; as well as the water retaining capacities of the structures along this route are provided in detail, in the section above. As specified in this section, no significant water arising from the works to be conducted along the route of the transmission tunnel is expected to be encountered. However, waters which may be

encountered during excavation works for the transmission tunnel shall be waters with high content of suspended solid materials; therefore these shall be let stand in the sedimentation pond of the concrete structure to be built at the tunnel's exit, and then shall be used for elimination of dust which may possibly occur on roads; any excess shall be discharged to the Korsulu stream, which is the nearest receiving medium.

Torlar Regulator and HEPP Project does not cover any areas mentioned in Article 17 and Article 20 of the Regulation on Water Pollution Control which has entered into force following its publication in the Official Gazette No:25687 of 31.12.2004; provisions of this regulation as well as provisions of the Regulation on Amending of the Regulation on Water Pollution Control which has entered into force following its publication in the Official Gazette No:26786 of 13.02.2008, shall be adhered to during land preparation and construction works and operation phases of the project.

All waters to be discharged to the Korsulu Stream and its side streams within the scope of the project, shall comply with the "Regulation on Water Pollution Control" which

has entered into force following its publication in the Official Gazette No:25687 of 31.12.2004 as well as the criteria specified for receiving medium values and waste water discharge in Fisheries Law No:1380 and the relevant Regulation. In order to observe water quality change, Ministry of Environment and Urbanization twice a year via an authorized lab.

In order to suppress road dust emission on rural roads to be used in the work site, water-spraying humidification utilizing surface waters shall be carried out, and no waste waters shall be generated during this procedure, as the water will be retained within the soil.

V.1.19. Types and amount of solid wastes generated starting from land preparation until the commissioning of the units, where these waste shall be transported to, and for which purposes they shall be used

During the land preparation and construction phases of the project; excavation waste shall be generated due to the excavation works to be carried out; and domestic waste arising from the employees as well as construction waste shall be generated. Detailed information on the excavation waste to be generated during the land preparation and construction phase of the project, assessment and elimination of these waste are given in Section V.1.1. of the report. Information regarding other waste is given below.

Solid Waste Of Domestic Nature;

Domestic solid waste (organic waste, etc.) arising from 75 people to be employed in different phases of the project; and construction waste (wood, iron, cement bags, etc.) shall be generated. Since cement is supplied in bulk within the scope of operations of the readymade concrete plant, no waste arising from cement packaging shall be generated. With the assumption that the daily amount of solid waste arising from one person is 1.34 kg., 75 people x 1.34 kg/day = 100,5 kg/day domestic solid waste shall be generated.

The article No:18 “Collection of Solid Wastes” of the “The Regulation on Solid Waste Control” contains a provision that says that “it is forbidden for manufacturers or carriers to discharge solid wastes to seas, lakes and similar receiving environment, streets, forests and other places that may cause a bad effect on environment.” In addition, the article no:20 “Transporting solid wastes” of the same Regulation contain the provision that indicates “it is required to transport the collected domestic and domestic industrial solid wastes shall be transported in special closed vehicles that will not pollute the environment in terms of apparence, dusting, smell, water tightness etc.

Domestic solid waste arising from staff to be employed for the project shall be collected in closed trash bins to be located in different points within the site. This solid waste, which shall be accumulated in containers shall be transferred to the solid waste collection system of Kahramanmaras Municipality, which is the nearest municipality to the project site, on a regular basis and is eliminated.

In conclusion;

Employees are warned about the fact that it is forbidden to pour solid waste to be generated within the scope of the project (waste food, etc.) to seas, lakes and similar receiving medium, as well as to streets; pursuant to Article 18 of “Regulation on Solid Waste Control” No: 20814 of 14.03.1991; this prohibition, as well as the “Regulation on Solid Waste Control” and the following amendments to this Regulation are adhered to;

Amendment in Official Gazette No: 20834 of 03.04.1991
Amendment in Official Gazette No: 21150 of 22.02.1992
Amendment in Official Gazette No: 22099 of 02.11.1994
Amendment in Official Gazette No: 23464 of 15.09.1998
Amendment in Official Gazette No: 23790 of 18.08.1999
Amendment in Official Gazette No: 24034 of 29.04.2000
Amendment in Official Gazette No: 24736 of 25.04.2002
Amendment in Official Gazette No: 25777 of 05.04.2005

Packing materials and packing waste that can possibly be generated in all phases of the project shall be eliminated according to provisions of "Regulation on Controlling Packing Waste" which entered into force following its publication in the Official Gazette No:27046 of 06.11.2008.

Waste Oil and Batteries;

Repair and maintenance of the vehicles to be used within the scope of the project are carried out in authorized services. In this regard, there is no waste oil and used battery, accumulator occuring in the project's site.

Furthermore, in the event that repair and maintenance works for vehicles are **have to be done** within the activity site; the waste oil and any used batteries that may arise from thereof shall be stores in hazardous waste storage area.

Following the analysis performed to determine the category of waste oils, waste oils would be given to authorized recycling companies.

The used batteries and accumulators storaged in hazardous waste storage area would be given to a licensed recycling company.

Medical and Hazardous Waste;

Work hazards that may occur under the project will not require any medical intervention in the construction site; such intervention must be performed in the nearest health institution. So there wont be any medical waste.

Other Waste;

Used vehicle tires shall be encountered due to vehicles to be used during land preparation and construction works. Tires which have completed their life-cycles within the project site shall be delivered to a recycling company, and provisions of the Regulation No: 26357 for Control of the Tires which have completed their Life-Cycles of 25.11.2006 shall be adhered to, in this context.

Furthermore, provisions of Regulation No:25791 on Control of Waste Vegetable Oil of 19.04.2005 shall be complied with for elimination of any waste vegetable oil to be generated in the dining hall to be used within the scope of the project. Within the scope of the c clause of the 5th article of the related regulation, it is forbidden to store the oil in ways to harm the environment, to transport, to be directly or indirectly released to the soil through underground water, seas, sewer system. Waste vegetable oil that may occur in the site's dining hallare collected in separate cups and stored in hazardious waste temporary storage

site. But since greasy food is rarely cooked, few vegetal oil was stored and it will be eliminated by being given to licensed facilities.

Waste shall not be dumped into Korsulu River and its side streams in any way, and all regulations specified in Environment Law No:2872 shall be adhered to, during land preparation and construction phases of the project.

V.1.20. Sources, level and cumulative value for vibration and noise to be generated from works to be carried out starting from land preparation until commissioning of the units

Torlar Regulator and HEPP Project is under the scope of businesses which are not subject to Noise Control Permission Document pursuant to Article 44 of the "Regulation on Assessment and Management of Environmental Noise" which has entered into force following its publication in the Official Gazette No:26809 of 07.03.2008

In order to determine the background noise and to calculate the environmental noise within the scope of the project, measurements have been taken and an acoustic report has been prepared by a laboratory that is authorized by the Ministry of Environment and Urbanization, and accredited by TURKAK (Turkish Accreditation Agency) (See Annex 19).

Within the scope of the project, background parameters given in Table 43 have been measured on 25.02.2012 at 5 points for a period of 10 minutes; in front of the structures that are nearest to the project structures.

Table 41 Background Measurement Results

POINT NO	MEASUREMENT LOCATION	TIME TIME FRAME	MEASUREMENT RESULTS (dB)									
			DURATION (min)	PEAK	MAX	MIN	SPL	LEQ	SEL	Ld	Ltm3	Ltm5
1	BULUTLU QUARTER	MORNING	10	93.6	81.4	45.7	63.0	**63.1**	88.7	63.1	66.1	67.5
2	KARBASAN QUARTER	MORNING	10	93.1	75.3	42.2	56.8	**61.1**	86.7	61.1	66.3	67.2
3	ORHANGAZI QUARTER	MORNING	10	110.0	82.5	40.7	55.0	**55.6**	81.8	55.6	65.3	65.7
4	KOSELI QUARTER	MORNING	10	99.4	76.3	41.2	61.3	**58.2**	83.9	58.2	65.9	67.1
5	KEDEMEN QUARTER	MORNING	10	96.8	75.7	45.5	51.5	**56.4**	82.0	56.4	62.5	64.1

Comparison of Ldaytime value obtained as a result of calculations of the acoustic report for areas of settlement that are nearest to the project site, with limit values are given in the table below.

Table 42 Comparison of Values Calculated for Settlement Areas and Limit Values

	Distance (m)	NEAREST SETTLEMENT	CALCULATED VALUE (dBA)	LIMIT VALUE (dBA)
REGULATOR	485	Bulutlu Quarter	54.44	70
TRANSMISSION TUNNEL	610	Bulutlu Quarter	54.68	70
FOREBAY	970	Karbasan Quarter	38.60	70
PENSTOCK	920	Karbasan Quarter	47.70	70
POWER HOUSE	920	Karbasan Quarter	47.72	70

CONCRETE PLANT	600	Karbasan Quarter	53.18	70
ETL	65	Koseli Quarter	68.57	70

As it can be seen from Table 43, $L_{daytime}$ values which are calculated for areas of settlement that are nearest to the project units are *below the limit values* of Annex V, Table 5 of the "Regulation on Assessment and Management of Environmental Noise" which has entered into force following its publication in the Official Gazette No: 27601 of 04.06.2010 and has been amended with Official Gazette No: 27917 of 27.04.2011.

In the event that stiff rock ground is encountered in areas where excavation works will be carried out, rock shall be crushed using an excavator with crusher and excess excavation materials shall be transported to storage sites. Open field excavations are completed under the project therefore pattern and calculations for tunnel blastings are given.

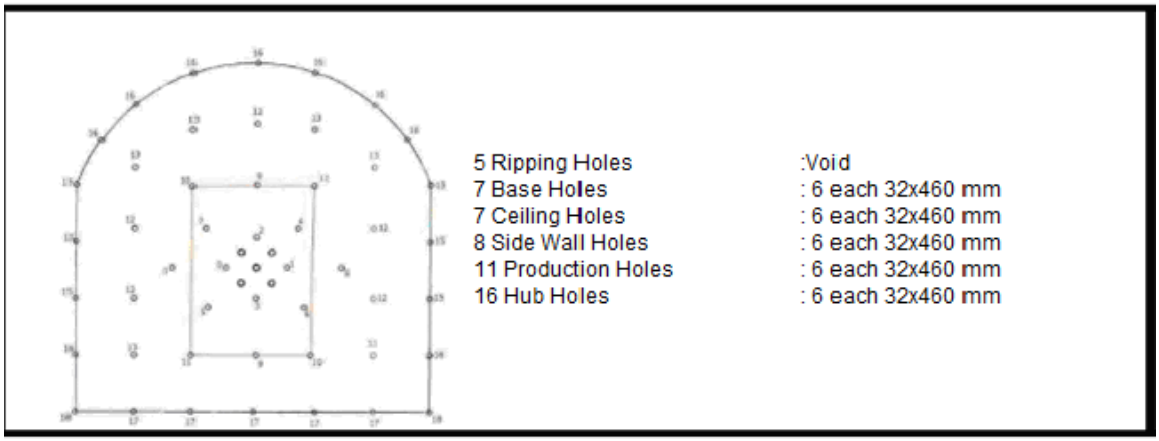


Figure 40 Explosion Pattern for Tunnels

The required explosives are stored in a mobile storage facility, far away from the construction site surrounded by wire fence in accordance with the required safety distances. rockbit drills, anfo explosives, powergel magnum cartridges, exel capsule igniter, detonating cord, current measurement device and igniter magneto are used.

ANFO that is used for explosions is an explosive material which is obtained by mixing ammonium nitrate with fuel oil (or diesel oil) in a ratio of 6%. It is used extensively all over the world and in Turkey, as it is cheap and reliable. Detonation speed can reach to 4.400 m/s in an blasting hole of 250 mm. diameter. Therefore ANFO cannot reach a fixed detonation speed in holes with a diameter less than 250 mm. Ideally, ANFO reaches maximum detonation speed in holes with medium and large sized holes (diameters of 75-250 mm). ANFO needs to be ignited with a higher primer (such as dynamite, etc.) in order to be detonated (exploded). According to information obtained from MKE BARUTSAN, characteristics of ANFO are given below.

Table 43 Characteristics of ANFO

PARAMETER	CHARACTERISTICS
Appearance	White – in prill particles
Total nitrogen ratio (min.%)	34.5

NH_4NO_3 (min.%)	98.5
Insoluble materials (max.%)	1.0
Humidity (according to Fischer method)	<0.2%
Ph (15°C)	4.5 – 6.0
Antiquate matter	Organic
Coating	Mineral
Fuel-oil absorption capacity (%)	8.0-12.0

Elastic waves that are created by the explosive material inside the rock, represent energy transfer from one point to another. Energy which is newly introduced to the medium at the initial stage changes the balance of the medium and causes displacement. If the environment does not react elastically to the newly introduced energy, the energy is absorbed and only the waves with attenuated vibration are reflected from the explosion area. If it reacts elastically to the entering energy, as a result of the disturbed medium, neighboring mediums are displaced from the balance position and create an oscillation, similar to a spring-weight mechanism. Thus, each element of the disturbed medium within the environment where the oscillation conditions occur, pass the oscillation characteristics on to other elements and create a wave motion.

No collective movement or transportation of any materials occur during the wave motion. The particles which make up the medium create the oscillation or rotation motion in balance positions and no displacement occurs within the medium. There are two types of velocities which may occur during the explosion; the first one is the wave and phase velocity, depending on the density of the disturbed medium; and the second one is the particle velocity which affects the wave velocity and creates oscillation upon deterioration of the balance position. Transfer of seismic waves, depends on various factors such as the distance traveled, the soil investigation, geology, wave type, discontinuities, frequency, angle of refraction, structure of the source, spherical propagation and elastic properties of the medium.

When the air shock to occur within the facility is calculated, the soil structure, structure of buildings (houses) in the region should be considered. Accordingly, data (assumptions) which have been taken as a basis for vibration design that may be created during production within the activity site are given above.

Air shock which is created by the explosion is calculated using the following formula (CALZIA, 1969).

High impact zone: $D < 5\sqrt{W}$
Medium impact zone: $5\sqrt{W} < D < 10\sqrt{W}$
Low impact zone: $10\sqrt{W} < D < 15\sqrt{W}$
D = Effective zone interval (m)
W = Quantity of dynamite used in a delay interval = Instantaneous change (kg)

In case of using maximum instantaneous charge (22 kg), the impact zones will be as follows.

High impact zone: 0 -39 m
Medium impact zone: 39 -78 m
Low impact zone: 78 -116 m

Impact of vibration generated by explosions, on nearby structures

The actual purpose of blasting conducted within excavation works is to break and loosen the rock within the excavation areas. During this procedure, shock waves which realize breaking travels through the rigid rock as seismic waves. It is a fact that the seismic waves will continue to diffuse until they run out of energy. There are two reasons why energy runs out. The first one is the resistance which the rock structure displays both physically and geologically; and the second one is the diffusion of the seismic waves' over a larger area, as they travel further away from the source of the wave. This energy travels through a long distance as it goes further away from the source of blasting and runs out. This process may result in damage in rock structures and buildings, and may worry the inhabitants of settlement areas. Environmental problems here, indicate that the entire energy of the explosive materials is not used for blasting. Such impacts of explosions are caused by the movements of excess portion of the energy which is released during the blast and which is not utilized to break the rock, within the rock, or in the atmosphere. When this is taken into account, a blast design which is free from environmental impacts is also a properly designed blast that utilizes the explosive energy in the best possible way.

Transmission of vibration that is generated during the explosion to distant points, is a function of the rock structure and geology between the blasted hole charge and the building. Waves travel more easily through homogenous structures, however, some of the waves bounce in broken structures or in fault layers.

The impact of vibration caused by the explosion on surrounding structures is determined using the Devine formula (Devine et al, 1966).

Devine Formula;

$$v = k\left(\frac{D}{\sqrt{W}}\right)^{-1.6}$$

Devine Formula;
V = vibration velocity traveling through the rock (inch/sec)
k = Relative parameters of rock types (26-260)
D = Distance between the blasting point and the settlement areas (feet)
W = Amount of explosives within a delay interval (pounds)

"k" parameter is defined as being the rock's capacity to transmit the vibration. Factors such as variability of units between the blasting source and the sensitive point; density of discontinuities such as breaks, faults, cracks affect the k parameter. While the k parameter is close to 260 in homogenous units; density of tectonic effects and each different units passed causes the parameter to get closer to 26. In the calculations, the k parameter has been taken as 260, under the worst conditions, with the assumption that the units are homogenous and without breaks. The instantaneous charge planned for the project is 22 kg.

Table 44 Vibration Velocity Values According to Distance Calculated for Explosions

Vibration Velocity Values According To Distance Calculated Based On The Assumption W=22 kg (Inside Tunnel)					
k	**D (m)**	**V (inç/sn)**	**V (mm/sn)**	**1/5*V (mm/sn)**	**1/2*V (mm/sn)**
260	10	21.83	554.45	110.89	277.22
260	50	1.66	42.22	8.44	21.11
260	100	0.55	13.93	2.79	6.96
260	110	0.47	11.96	2.39	5.98
260	200	0.18	4.59	0.92	2.30
260	210	0.17	4.25	0.85	2.12
260	300	0.09	2.40	0.48	1.20
260	310	0.09	2.28	0.46	1.14
260	400	0.06	1.52	0.30	0.76
260	410	0.06	1.46	0.29	0.73
260	500	0.04	1.06	0.21	0.53

The following assumptions are applicable to the table;
V = mm/sec vibration velocity which varies according to distance
Vo = Vibration velocity at the foundation of the building.
1/2 -1/5 of vibration velocity within the rock (V) is accepted as Vo value.

With the assumption that the most vulnerable buildings in the nearby villages are “b” type buildings in Table 46, Vo velocity should not exceed 5 mm/sec. When Table 45 is examined, it can be seen that the vibration velocity arising from the impact of the 22 kg. charge falls below 5 mm/sec in the open field, after a distance of 150 m from the blasting point. It is found that vibration arising from explosions made with maximum instantaneous charge (22 kg) shall not have any unfavorable impact over settlement units (“b” type buildings in Table 46), after this distance.

Table 45 Types of Buildings Which May Suffer Damage Due To Blasting, According to Vibration Velocity at Based On Foundation (Vo) Values (Forssbland, 1981)

Type of Building	Vo (mm/sec)
a- dilapidated, very old historic buildings	2
b- plastered briquette, mud-wall, brick masonry houses	5
c- concrete buildings	10
d- industrial buildings with very strong structures, such as factories	10-40

Examination of damage on buildings in terms of vibration amplitude

The vibration amplitude caused by explosions are calculated using the formula below (Armac Printing Company).

$$A = \frac{K\sqrt{W}}{D}$$

A = Maximum vibration amplitude caused by explosions (mm)
W = Amount of explosives ignited within a delay interval (kg)
D = Distance between the blasting source and the settlement areas (m)
K = Relative parameters of rock types

Table 46 Minimum and Maximum Values of Relative K Parameter Which Varies According To Blasting Rock Types and Rock Types Under the Building's Foundation (Source: Armac Printing Company)

Blasting Area	Rock Type Under the Foundation	K Parameter	
		Maximum	Minimum
Rock	Rock	0.57	1.15
Rock	Clay (Soil)	1.15	2.30
Clay (Soil)	Rock	1.15	2.30
Clay (Soil)	Clay (Soil)	2.30	3.40

Since it is known that no damage will be caused to buildings if the amplitude value is under 0,05mm (Armac Printing Company); the impact distance for blasts to be made with maximum amount of explosives (75 kg in open space and 22 kg in tunnels) is calculated as follows;

$D=(1.15\sqrt{75})/0.05 = 199.18$ m.

Therefore, the vibration to be generated as a result of blasting to be done in open space using 22 kg. of explosives shall have no unfavorable effects over the settlement area which is nearest to the Torlar HEPP (Bulutlu Quarter). Furthermore, it is foreseen that the low vibration to be generated as a result of blasting to be done in the tunnel shall not cause any discharging in surface rocks and surface cover, therefore that it will not discharge to the river side. .

Blasting to be done within the scope of the project shall comply with the provision "Impact noise L_{Cmax} to be generated from construction site activities in connection with the equipment being used cannot exceed 100 dBC", pursuant to paragraph (d) of Article 23 of the Regulation.

V.1.21. The housing and other technical/social infrastructure requirements of the personnel

During the land preparation and construction works of the Torlar Regulator and HEPP project; it is planned that a total of 150 persons will be employed. Unqualified personnel who will work in the project will be supplied from the same region as much as possible, the permanent personnel who will work in the operation phase will also be employed from the same region. This will make a contribution to the economy of the region, although small. Transportation service shall be provided for transporting the personnel to and from their houses, thus, accommodation shall not be a problem.

Technical and social requirements of the personnel who were employed in the project (housing, resting, eating, etc.) are provided at the social facilities to be made available in the construction sites to be erected within the scope of the project. Also, if needed technical or social requirements will be provided from the villages and towns around the project area.

V.1.22. Landscaping and other arrangements in the project area to form landscaping elements and for other purposes

It is necessary to restore a damaged area to environmentally stable situation in order to transfer the natural environment and natural resources to future generations. However, when left to itself, it may take a very long time for a damaged area to reach it ecological balance. There is a need for human intervention for restoring these areas to nature in a reasonable time period. The landscape restoration is the activity that aims at restoring the productivity of the damaged area, its ecological, economical and aesthetical values.

The improvement activities to be carried out within the scope of landscape restoration are not in the form of forestation only, but also include alternatives in the form of green zone arrangements, land reformation and erosion control measures. Within the scope of the activities in land preparation and construction phase of the project, the landscape character will begin to change in the regulator, the forebay, the penstock, power house, construction site, excavation storage area and the road to be built.

Although it is not necessity in Turkish Laws, the voluntary forestation will be made as described below by owner of the project. Within the scope of the project, forestation shall be carried out in front of the regulator (an area of approximately 240 m^2), in front of the forebay – power house (an area of approximately 195 m), and along the route of the penstock (an area of approximately 105m, two rows). When it is considered that the trees shall be planted at an interval of 3 meters, 240 m / 3 m/1 tree = 80 trees shall be required for the area around the regulator; 195 m/ 3 m/tree = 65 trees shall be required for the area around the forebay – power house, (105 m/ 3 m/tree)*2 = 70 trees shall be required for the area along the route of the penstock; thus, a total of 215 trees shall be required. The remaining number of the trees cut down before will be planted on other suitable locations.

V.1.23. Determining the possible impacts on cultural and natural assets under and over the ground

Within the region where the project units are located, there are no areas as defined in Environment Law No: 2872, under the heading of “Special Environment Preservation Areas”; or “National Parks”, “Nature Preservation Areas”, “Natural Monuments”, “Natural Parks” or similar places under the scope of the National Parks Law No:2873. In addition to these there are no biosphere reserve areas, biogenetical reserve areas, tourism, archeological, historical and cultural site areas.

However, in case a cultural or natural asset is encountered during the implementation phase (land preparation and construction) of the project, the nearest Museum Directorate or civilian authority will be informed pursuant to Law No: 2863.

V.1.24. Other Characteristics

There are no issues to be reported in this section.

V.2. Projects in the operation phase of the project, impacts on physical and biological environment and precautions to be taken

In this section of the report, the impacts of the activities to be performed in the operation phase of the project on the project area and its environs have been described and the precautions to minimize these impacts have been explained in detail.

V.2.1. Properties of all units within the scope of the project

Torlar Regulator and HEPP project has been planned to benefit from Korsulu River's 542.40-444 m elevations, located at approximately 40 km. to the northwest of Central district of Kahramanmaras Province; and to contribute to national development with a total of 15.03 MW 34,38 GWh energy production.

Within the scope of Torlar Regulator and HEPP project; it is planned to construct units such as regulator, fish pass, transmission tunnel, forebay, penstock, power house, tailrace channel, facilities for energy transmission, construction site and excavation storage; and to generate electric energy. Descriptions related to the facilities to be built within the scope of Torlar Regulator and HEPP project are given in I.1.ii, above.

The energy generation work flow diagram of the project is given in Figure 39.

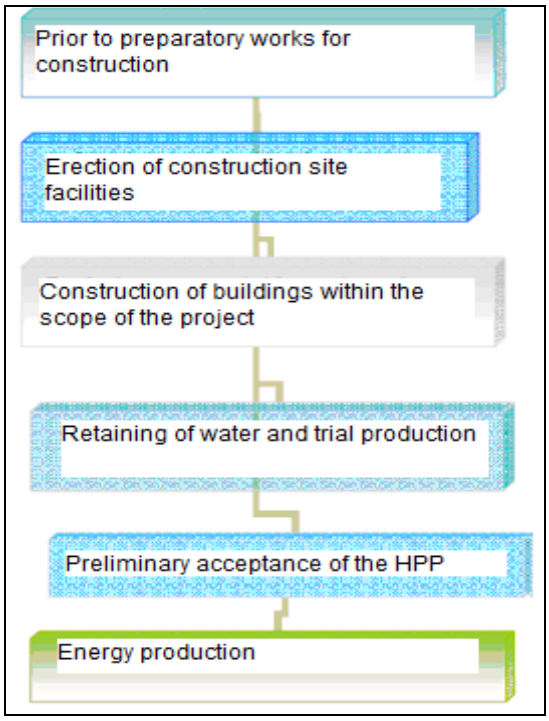


Figure 41 Energy Generation Work Flow Diagram

V.2.2. Other uses and impacts of water source

Torlar Regulator and HEPP project is a run off -type hydroelectric power plant; river type hydroelectric power plants are not facilities that consume water. Water which is turbined will be returned to the bed in the same amount. Because of non-storage regulator, there will not be any physical and chemical change caused from water held.

Karasu HEPP is located to the upstream of Torlar Regulator and HEPP. Karasu HEPP is a facility which had been built with the purpose of meeting water demand of Kahramanmaras Province; Torlar Regulator and HEPP structures are located outside of the absolute and short distance protection areas of Karasu HEPP. In addition to Karasu HEPP; Degirmenustu HEPP (in operation), Kale Regulator (in operation), Gokgedik Regulator and HEPP (approval pending) and Sir Dam (in operation), which are built by the private sector are located on Korsulu stream. Korsulu stream is not fed from any drinking water source, and no structures for the purpose of drinking water or usage water are present.

In Sır dam lake, located downstream of the project, trout farming using cage method is carried out. Factors that will create water pollution and effect trout farming is minimized as explained in section IV.2.7. As taking proposed measures, trout farming shall not be negatively influenced due to the project.

The site is located within the irrigation site of DSI (State Hydraulic Works). Within the scope of irrigation, farmers living in villages produce fruits and vegetables for their own consumption, utilizing irrigation via pumps, from the river. The size of land in the region is quite below Turkey's average. Sizes of parcels vary between 0.5 – 10 decares. In this context, no irrigation towards economic production is carried out.

V.2.3. *Calculation of Environmental Water Amount*

Torlar HEPP project is on a lower altitude compared with the Karasu Dam constructed by the municipality in order to generate electricity from potable water line of Kahramanmaraş (not on the same river). This is a 2.135 MW plant located on the corresponding line. The water is obtained from a natural spring. Therefore there is not any possible interaction in between water amount of Korsulu River and the Karasu dam or the water line.

The effects seen in river downstream of regulator which will have substantially reduced water flow are low degreed affected areas. However, calculation of environmental water flow, which is determined by ecosystem assessment report, has been performed to reduce the negative impact of this flow reduction. It is expected that terrestrial and aquatic flora and fauna elements will not be highly affected by the project with determined environmental flow..

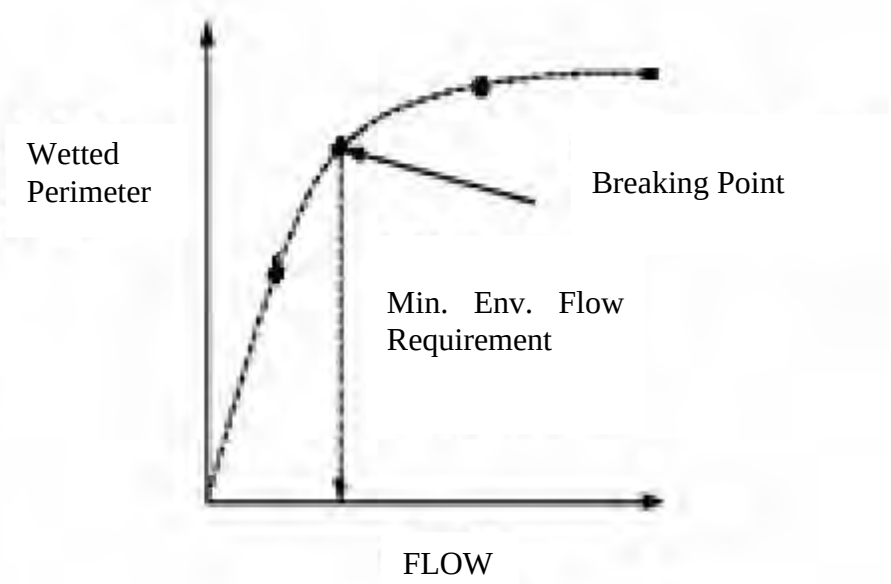
The spring water contributions located in the right and the left banks of downstream of the regulator structure, supply additional water required for preservation of natural life. In addition to this, adequate amount of water shall be released from the regulator to downstream, in order to support the protection of natural life.

The minimum/ecosystem water determination studies were prepared by *Prof. Dr. Lokman ALTUN, Head of Soil Science and Ecology Department of Karadeniz Technical University, Prof. Dr. Bilal KUTRUP, Head of Hydrobiology Department of Karadeniz Technical University, Associate Professor Fatma GÜLTEKİN, Faculty of Engineering, Department of Applied Geology, Hydrogeology Department of Karadeniz Technical University and submitted in the Assessment Report for HEPP Projects and Other Hydraulic Activity Requests* which is presented annexed to this report.

In the ecosystem evaluation report in order to calculate environmental flow, three medhots have been used. The method giving the maximum water amount was chosen as the final environmental flow.

These methods and the results are;

1.Wetted Perimeter Method: DSİ 26-30 Flow Gauging Station data were used to calculate the environmental flow:



Minimum required water for the wetted perimeter method is calculated as the flow at the breaking point shown with the arrow. Average monthly flows, cross section parameters of the gauge, dimensioless wetted perimeter and flow values are given as tables in the report. By using the equation below:

$$WP/WPmax = 0.036 (Q/Qmax)^{0.0439}$$

Q (environmental flow) was calculated as **0.950 m^3/sec** (950 lt/sec).

2. Flow Duration Curve Method: From the flow duration curve at Torlar regulator location it can be derived that at 88% of the time minimum flow is 0.750 m^3/sec, at 90% 0.600 m^3/sec, at 98% 0.020 m^3/sec and at 100 % the base flow is 0.010 m^3/sec (The minimum amount that could be observed in any time). This means that in long period of time aquatic life can naturally survive in water flows as low as **0.010 m^3/sec**.

3. Seven Days Base Flow Method: This method uses long term flow data to predict the minumum flows to be observed at the project area for seven days. However the report says that the range of years to be used for calculation was uncertain in the method. It concludes that as going further to the past, the averages became lower. For 10 years Q7 was found as **0.019 m^3/sec.** For 20 years it was 0.008 m^3/sec and for 30 years, 0.005 m^3/sec. Even the highest is chosen it would be **0.019 m^3/sec.**

Out of the three methods used for predicting the amount of minimum environmental flow, the highest one is **0.950 m^3/sec**, therefore it is chosen as the minimum environmental flow for the proejct.

The average monthly flows of the project location is given in the report and it is seen that in August and September the averages are below **0.950 m^3/sec** (0.66m3/sec and 0.71m3/sec respectively) therefore, it suggests that all of the water would be released to downstream during these months. No energy generation is expected for these months. Not

nnly specificially in August and September but also throughout the year, whenever the flow is lower than 0.950 m^3/sec, no water will be used for energy generation. In the energy assumptions in feasibility or in project evaluation studies, daily and monthly flows are worked on and environmental flow values are subtracted from all the flows and then energy calculations are done. Therefore environmental flow is taken into consideration in all times, not only in August and September. Additionally, after subtracting the environmental water from the flows, whenever the flow is below the sufficient level to operate the turbine, again no energy generation is forecasted for these levels. As a result, whenever the flow is lower than 0.950 m3/s, it is absolutely essential not to withdraw any water from the system but release all the water to downstream from the regulator.

Daily flow values for the minimum/ecological flow which is released shall be measured via the remote sensing Flow Measurement Station and monthly data shall be transferred to General Directorate of State Hydraulic Works 20th Regional Directorate as well as Kahramanmaras Provincial Directorate of Environment and Urbanization. The remote sensing Flow Measurement Station to be established shall be determined on site in cooperation with General Directorate Of State Hydraulic Works 20th Regional Directorate; and the AGI (Flow Measurement Station) to be established shall be equipped with GPRS device with modem.

Furthermore, the AGI (Flow Measurement Station) to be established shall be completed during the construction phase, and shall be in good working order before trial production is initiated. When it is considered that in addition to the flow rate values of the regulator, side streams which are connected to the river and which shall be utilized within the scope of the project shall also feed the river bed; more than the amount of water specified above shall be present in the river bed. With the help of waters to be contributed by side streams, continuity of natural life in the river bed shall be ensured in a more efficient manner.

In order to ensure continuity of fish life and to enable fish to pass back and forth to and from the stream source, a fish pass has been built (denil type). Detailed information about fish pass is given in section I.1.ii and appendix 6. The fish pass which is built at the regulator is enabled fish to conveniently pass through the water bed. Fish Species Living in Korsulu River are given above (Seen Table 31).

V.2.4. Possible impacts of use of water

The flora and fauna species in project area are listed in section IV.2.7.5. In section IX.4 the living conditions and effects of Torlar HEPP project on these species are described.

7 fish species - *Alburnus orontis*, *Phoxinellus sp.*, *Leuciscus cephalus*, *Garra rufa*, *Capoeta capoeta angorae*, *Cobitis sp.* and *Nemacheilus angorae* – are observed on Körsulu stream, on which Torlar HEPP project was built. Almost all of these species can live in 20-25 cm water depth and below 2 m/s water speed. Water depth for in between regulator and power house is above 0.33 m (See Table 52) and the average speed is 0.47 m/s (See Table 53). These values are enough for continuity of aquatic life in this stream. It can be concluded that there will be no problems with continuity of aquatic life when water budget values between regulator and power house taken into consideration.

Three amphibian species were found on the project area. None of these species are in the list of IUCN's NT (Near Threatened) or VU (Vulnerable) category. All of them are in LC (Least Concern) category.There are, also, no endemic species..Frog species that live on Project area only need stream water during spring (May – July) to lay their eggs. Only *Rana*

ridibunda species continue to live in stream water other than just to lay eggs. In order to lay eggs, these species require 5-15 cm water level. Water depth for in between regulator and power house is above 0.33 m (See Table 52). Therefore any possible impact is not expected.

On the project area 8 possible reptilian species were detected. All of these species are under IUCN's low risk (LC) category. Four species are in Bern appendix II (strictly protected fauna species), others are in Bern appendix III (protected fauna species) category. Rock viper (Vipera xanthina (Montivipera xanthina)) is an endemic to Turkey. Only water snake (Natrix natrix and Natrix taselleta) uses stream water to hunt and to drink. They prefer 1-30 cm deep puddles located side of the streams. This species doesn't have any economical or ecologocial value and they feed on the eggs and cubs of the valuable water frogs which are valuable for foreign trade. None of the other reptilians use water to hunt or breed. They use puddle on land to satisfy their needs. Determined amount of released water is enough for the reptilian species.

17 bird species were detected, by observation, literature search and by information obtain from villagers in the project area. All of the observed bird species are in LC (least concern) category. Project area isn't one of the vital places for bird species in Turkey. These bird species can use any form of water source to satisfy their needs so there will be no danger for them.

From the aquatic fauna seen in the project area, focus species were chosen by considering economic value, endemism state, preservation status and water intake points in the river. Fishes are expected to be more effected than the others. Mostly effected species are Garra rufa of fish familia, rana ridibunda of amphibians and Natrix natrix and Natrix taselleta of reptile familia.

A fish pass is built within the scope of the project in order to ensure that fish are able to pass back and forth to and from the stream source, and to ensure that natural balance is preserved. The project for the fish pass which is built within the scope of the project has been prepared and approved by the Provincial Directorate of Food, Agriculture and Livestock; the approved project can be found annexed to the report. (Annex -6).

Regarding the planned activity; all precautions and obligations set forth in Fisheries Law No: 1380, published in the Official Gazette No: 13799 of April 4, 1971; and the Fisheries Regulation, based on this law, published in the Official Gazette No: 22223 of March 10, 1995, will be undertaken. The water held in the regulator will be used directly in electric energy generation without any processing and will be returned to the river bed after being used. Thus, water will not be subjected any pollution due to the project.

The species other than fishes will be affected less. They will have adopt theirselves to the new ecology. Therefore it is not expected from the project to be risky towards the species other than fish.

As the planned investment is not a very large project involving vast areas (such as the GAP Project), and as the regulator that was built for drawing water will not be a structure which stores water as a dam lake does, no change is expected to occur on the climate. Therefore, as no climate change is expected; there will not be any adverse effects on flora, fauna and their habitats.

V.2.5. Measuring the amount of environmental water

Minimum flow to be released from Torlar Regulator, daily flow values shall be measured via the remote sensing Flow Measurement Station and monthly data shall be transferred to General Directorate Of State Hydraulic Works (DSI) XX. Regional Directorate

as well as Kahramanmaras Provincial Directorate of Environment and Urbanization. The remote sensing Flow Measurement Station to be established shall be determined on site in cooperation with General Directorate Of State Hydraulic Works XX. Regional Directorate; and the AGI (Flow Measurement Station) to be established shall be equipped with GPRS device with modem.

Furthermore, the AGI (Flow Measurement Station) to be established shall be completed during the construction phase, and shall be in good working order before trial production is initiated. When it is considered that in addition to the flow rate values of the regulator, side streams which are connected to the river and which shall be utilized within the scope of the project shall also feed the river bed; more than the amount of water specified above shall be present in the river bed. With the help of waters to be contributed by side streams, continuity of natural life in the river bed shall be ensured in a more efficient manner.

V.2.6. Impacts on areas that are under protection pursuant to national and international legislations

There are no areas that are under protection pursuant to national and international legislations, in or within near vicinity of the areas where activity units are planned to be built.

V.2.7. Possible impact on forest areas (including forest fires) and precautions to be taken against these impacts

Although it is officially qualified as forest land, the land has lost its forest characteristic due to the decrease in the number of trees. The project has a tunnel as a water conveyance structure being a river type HEPP. In the light of foregoing, there will not be expected severe impacts to the forest land.

In case of a possible fire situation during the operation phase of the project, necessary tools and equipment will be made readily available in the power house buildings and necessary precautions will be taken pursuant to the Emergency Intervention Plan presented in Annexes to extinguish the fire and prevent injury or loss of life (See Appendix 11).

After the construction works of the project are completed, forestation will be done; efforts will be made to restore land which is classified as forest land, especially those damaged during construction works, to their original conditions, in coordination with Kahramanmaras Regional Directorate of Forestry.

Following the construction works within the scope of the project, a more flat surface shall be obtained in places with a high degree of slope and land slide occurrences; and these areas shall be subject to forestation. For forestation works, the region’s prevailing natural vegetation shall be taken into account, and the trees to be used in the forestation process shall be selected accordingly. In addition to trees, starting from the construction phase, seeding will be performed in areas where landslides are densely seen since seeds spread rapidly over the surface and cover the soil surface; enabling plant tissue to rapidly cover the surface.

Since it is planned only to benefit from energy of the water during the operation phase of the project; a negative impact shall not occur concerning forest land. Following completion of construction works, reforestation and landscaping works shall be performed in suitable areas. In the event of a possible fire, all workers employed shall be readily available to intervene the fire, when required. In addition to fire extinguishers, materials which are required for initial intervention against fire, such as shovel, spade, harrow, etc., must be

available at the construction site. In the event of a fire, all construction equipment within the construction site shall be assigned for usage under the orders of the fire administrator. Furthermore, all employees shall be informed about this before starting to work.

The following precautions shall be taken in order to ensure that the existing forest land are not adversely affected within the scope of the project.

- Entrances and exits to and from the activity zone shall be kept under control,
- The facilities shall be surrounded with wire fence, entrance of domestic and wild animals into the facility shall be prevented, flying of trash to areas outside of the facility due to wind shall be prevented.
- Following completion of its operation, HEPP shall be rehabilitated, and closed in accordance with relevant techniques. Subsequently, plants and trees which comply with conditions of the region and the climate shall be planted to create green sites.
- Precautions to fight against possible forest fires, as foreseen by the business management shall be taken.

Upon demand of the business management, all available worker and construction equipment shall be utilized to fight against forest fires.

Furthermore, necessary tools and equipment will be kept readily available in the event of a forest fire, and the related authorized units shall be assisted in the event of a fire. Necessary in-service training shall be provided for the personnel to be employed; regarding precautions to be taken against possible forest fires that may occur within forest land inside the project area. Employees shall intervene to any fire which may arise, and shall inform the fire authority and the related forest management. Personnel shall not carry flammable materials on them, and shall not light a fire for any reason. Necessary penal procedures shall be carried out for personnel who disobey rules.

V.2.8. Housing and other technical/social infrastructure requirements of the personnel who will be employed during the operation of the project, and the people who are dependent on the personnel; how and where these requirements will be provided

During the operation phase of the project; it is planned that a total of 15 persons will be employed. The personnel who will work in the project will be supplied from the same region as much as possible. This will make a contribution to the economy of the region, although small.

Social requirements of the personnel to be employed shall be met from the plant building. Technical requirements shall be met from settlement areas nearby, or, in cases where this is not possible, from town center. Service vehicle shall be provided to transport the personnel to and from the facility.

V.2.9. Detail of the characteristics of the treatment plant that will be implemented for treatment of the waste water that will be generated due to use of drinking and usage water in administrative and social units, details of the process

Drinking water and usage water requirements of the personnel who will work in the operation phase of the project will be supplied from existing surface waters, and/or by purchasing from sellers. Assuming that water needed by one person as potable and usage

water per day is 150 lt/day, the water needed by 15 persons who will work in the operation phase of the project is;

15 persons x 150 lt/person-day = 2,250 lt/day = 2.25 m3/day

With the assumption that all water to be used shall be returned as waste water; the amount of domestic waste water to be generated per day is 2.25 m^3/day. The waste water of domestic nature that will be generated in the operation phase of the project will be collected in leak-proof cesspool; it will be withdrawn by sewage truck following the filling up the cesspool and be discharged to the area determined by Kahramanmaras Municipality.

V.2.10. The types and quantities of solid wastes to be generated from houses, social and administrative facilities, where these will be transported or for what purpose and how they will be used

During the operation phase of the project, solid wastes of domestic nature will be generated from 15 workers to be employed. Assuming that the quantity of daily solid waste generated by person is 1.34 kg;

15 persons x 1.34 kg/day = 20.1 kg/day

Solid wastes of domestic nature will be generated. The waste generated during the operation phase of the project will be collected in closed trash cans that will be placed in various points within the plant areas; and will be disposed of by being regularly given to Kahramanmaras Municipality's solid waste collection sites.

No packing material waste shall be generated due to HEPP operations. However, in the event that any non-recyclable waste packing material are generated, these shall be collected separately from other solid waste within the plant area, according to provisions of "Regulation on Controlling Packing Waste" and shall be delivered periodically to a company licensed for collection of packing waste, under a contract. Furthermore, packing materials and packing waste that can possibly be generated in all phases of the project shall be eliminated according to provisions of "Regulation on Controlling Packing Waste" which entered into force following its publication in the Official Gazette No: 26562 of 24.06.2007.

Additionally, insulating oils shall be used at the transformer. If major failures occur at the plant, as a result of accidents which may happen during oil transfer, oil may be spilled on the ground. If this happens, absorbent material such as sand, gravel or saw dust will be poured over the oil to prevent seepage into the soil, then this mixture will be placed in barrels to be stored.

Service life of the insulation oil to be used is about 25-30 years. Disposal of the oil that completed its service life will be performed in licensed disposal facilities pursuant to Section 2, Article 9 of "Regulation for Controlling Waste Oil", which entered into force following its publication in the Official Gazette No:26952 of 30.07.2008. Transportation of waste oil to disposal facilities will be made by licensed carrier. Until transferred to disposal facilities, the conditions set forth in Sections 4 and 5 of the "Regulation for Controlling Waste Oil" for transportation and storage of waste oil will be complied with; it will be stored in temporary storage locations to be built within the work place, pursuant to the standards set forth in the "Regulation for Controlling Waste Oil". Subsequently, it will be sold via tendering procedure, to companies licensed by the Ministry of Environment and Forestry.

Furthermore, during the storage, transportation and disposal of the said insulation oil, "Regulation Concerning Polychlorinated Biphenyl (PCB) and Polychlorinated Terphenils (PCT)", this entered into force following its publication in the Official Gazette No: 26739 of 27.12.2007; and the "Regulation for Controlling Waste Oil" will be complied with.

V.2.11. Noise sources that will be generated during operation of the project units, distance to the nearest settlement area and measures to be taken for control purposes

The only noise sources during the operation phase of the project shall be the generator inside the plant buildings and the turbines. Since plant buildings will have noise insulation, no noise shall be dispersed to outside of the building. For personnel to be employed in the plant building; protective clothing and tools specified in Labor Law No:4857, such as headphones, ear plugs, and similar protective tools shall be provided in order to ensure that they are not effected from the noise inside the facility.

As it can be seen from the acoustic report which has been prepared within the scope of the project and presented annexed to this report; *the noise level that will be generated inside the HEPP building during energy production and that will be felt in Karbasan Quarter which is located at a distance of 920 m, is 59.81 dBA. In this context,* ***values given in Table 4*** *of the "Regulation for Assessment and Management of Environmental Noise"* ***are not exceeded.*** According to the result of the background noise measurement conducted at Karbasan Quarter (61.1 dBA), the provision stating that "the level of environmental noise released to the environment during operations of any work place, workshop, factory or similar plants shall not exceed background noise level more than 5dBA, in Leq noise indication units." is satisfied.

V.2.12. Other characteristics

There are no issues to be reported in this section.

V.3. Project's Effects Over Social-Economic Environment

V.3.1. Expected income increase, employment potential to be generated, population movement, immigrations, education, health, culture, and other social and technical infrastructure services and changing over utilization of these services etc. that will be realized with project.

In territory preparation, construction and operation phases of project, central district especially Karbasan quarter and neighborhood quarters will be affected positively in economic and social aspect.

Until starting of construction works for Torlar Regulator and Hydro Electric Power Plant (HEPP) and becoming operational of these facilities new employment possibilities will be provided in all phases for local population. Therefore person number to be included in social systems will increase by employment possibilities will be created. In addition to that, local population who are dealing with agriculture and partly livestock will recognize and learn new professions with introduction of investment.

In the project which 75 persons planned to employ in land preparation and construction phase and approximately 15 persons planned to employ in operation phase, there will be particular downfall in unemployment and trade which will develop related to this new employment will be the new income source for local population. Therefore local population will be provided to have new profession by recognizing new fields and migration movement observed recent years will be prevented even a bit. Besides, new roads restored and opened again will meet the transportation requirements of local population and partly provide contribution to region's infrastructure

900,000 TL payment will be made to workers in 30 months in Torlar HEPP project construction phase. On the other hand 34.38 GWh energy will be produced by investment will be made and almost 3000,000 TL added values will be provided to country. Migration from rural area to urban area will be prevented with this investment and local people will have chance to have employment in their home city. Therefore about 400,000 TL added values will be provided to the region in construction and operational phase of facility.

Energy which is the inseparable part of daily life has a dominant place in socio-economic structure of countries. Electric energy is composing of important part of energy in this structure. In parallel to important steps in our country regarding industrialization, agriculture and informatics; increase in electricity consumption is being observed as well. Electricity energy demands are expected to be 202.7 billion kWh in 2010 which is 193.3 billion kWh at the end of 2009 (www.teias.gov.tr). This situation requires increase in electricity energy investment in same level.

One of the qualified and economic way to meet our country's electricity energy demand is hydro-electric power. If we take into consideration that in energy policies of European Union, which our country has made important steps to be member of, decision to support to hydro-electric, wind, solar and biomass that are defined as green power has been made, it is clear that hydro- electric power should be considered and necessary to increase its share in electricity energy production. Even in the results of 10th World Energy Conference assembled in Istanbul in 1977 it is states ''Hydroelectric power plants' construction should get the primary importance in energy production.'' (Oncel, 1978:64) and if we analyze the variable global condition it can stated that this suggestion has more validity nowadays.

Considering the resource allocation of our country in electricity production in 2009; it is seen that electricity production benefited from liquid natural gas in 48.6% and from hydro-electric only 18.5% (www.teias.gov.tr). In this case it can be said that the structure relies on liquid natural gas has emerged. This situation which increases imports and therefore triggers and increase current deficit increases the cost in industry and therefore effects all economy especially export directly. All these determinations present that increasing the construction of hydroelectric power plants' which are using country resources, non-foreign-dependent, has minimum damage to environment, easily connectible to network construction's, would be beneficial and proper. Because it can be stated that, utilizing this energy source in full capacity as reliable would contribute in a big proportion to meet the electricity energy demand expected to be increased about 7.5% in ten year period (www.teias.gov.tr).

''Torlar Regulator and HEPP Project'' planned to be built on Korsulu brook in Central District borders in Kahramanmaras city by Kam Energy Production Trade and Industry INC. defines its aim as to contribution to national development with yearly about 34.38 GWh electricity production. In this context, in can be stated that this project will be an important

step to meet our country's, which aims decrease in foreign-source dependency and increase in effectiveness regionally and globally in energy field, increasing demand of high quality, reliable, low cost, environment-friendly electricity requirement in case the necessary steps taken regarding the risk may emerge regarding social and economic aspect.

Torlar Regulator and HEPP Project are planned to produce electricity with river type plant without causing schooner formation in dam lake shape. In this context, it is stated that 75 persons planned to employ in land preparation and construction phase and almost 15 persons planned to employ in operation phase. Considering the 50 years operation period of project which employment will be met by local people, it is suitable to see this project as a contribution to local economy. Because the people who are earning their living with agriculture and livestock in rough land and surrounding due to geographical location and doing these rather for family needs instead of commercial aim are struggling with unemployment problem which is social fact. Therefore it can be stated that this project is important due to possibility to introduce a partly solution for unemployment problem in the region.

It can stated that project, which says the requirements of persons' employed in scope with Torlar Regulator potable water and utility water and necessary fuel and mineral oils for heavy construction equipment and vehicles will be provided from inside of district and the vehicles', which will be used in land preparation and construction period, maintenance and repair process will be executed in the nearest authorized service or/and fuel station, and in this context project will bring an acceleration to economical businesses in the region.

V.3.2. Environmental Impact Summary

Table 47 Environmental Impact Summary Table

Assessment Elements	*Impacts On Construction Period*				*Impacts On Operation Period*			
	Actual	*Project*	*Continuity*	*Explanation*	*Actual*	*Project*	*Continuity*	*Explanation*
Water Quality	+	-	***Temporary***	***Turbidity, etc. occurs in water.***	-	+	***permanent***	***Reduction of suspended and settling ~~and~~ particles- in water as a result of water retention behind the reservoir.***
Noise	***x***	-	***Temporary***	***Noise occurs as a result of using construction vehicles and excavation operations***	***x***	***x***	***permanent***	***turbine and generator noise will occur in a closed area and dissipation is not an issue.***
Air Quality	+	-	***Temporary***	***Exhaust emissions from construction vehicles and dust emissions within the scope of excavation.***	***x***	***x***	***permanent***	***No emission occurs during operation period.***
Forests	+	-	***Temporary***	***forested land usage and tree cutting***	***x***	***x***	***permanent***	***Only project unit areas are used. Necessarry forestation will be made.***

Agricultural Areas	+	-	***Temporary***	***Agricultural land usage and agricultural production loss***	***x***	***x***	***permanent***	***Only project unit areas are used..***
Flora	+	-	***Temporary***	***Local flora loss***	***x***	***x***	***permanent***	***No negative effects on flora will ocure on operation period.***
Aquatic Ecosystem	***x***	***x***	-	***none***	-	+	***permanent***	***No negative effect will occure in case of releasing calculated environmental flow.***
Water Flow Regime	***x***	***x***	-	***none***	+	-	***permanent***	***No negative effect will occure in case of releasing calculated environmental flow.***
Climate	***x***	***x***	-	***none***	***x***	***x***	***permanent***	***Reducting carbon emissions.***
Coastal Erosion	***x***	***x***	-	***none***	-	+	***permanent***	***No negative effect is expected.***
Employment	-	+	***Temporary***	***Ensuring local employment***	-	+	***permanent***	***Ensuring local employment***
Economic Income	-	+	***Temporary***	***Income growth as a result of ensuring local employment, income growth as a result of supplying the needs of construction site from local sources.***	-	+	***permanent***	***Economic gains will be realized by employment and green energy production***
CO Emission	***x***	-	***Temporary***	***Emissions due to constructional activities***	-	+	***permanent***	***Emmission reduction due to electricity generation from renewable resource***

V.3.3. Evaluation of social impact related to realization of the project

As existing in all over our country, there are also doubts and hesitations related to HEPP constructed in this region. A serious and steady informing process was put into practice and feedback mechanisms will be created to remove these doubts and hesitations. Principle subject paving way of doubts and hesitations is opinion that region may encounter a serious landslip danger due to construction process because this region is already open to landslip. Not to encounter this kind of situation, precautionary measures will be put into practice seriously during splitting and riprap process and people will be informed regarding the process. The second hesitation subject is related to damages originated from exploding. For this reason exploding safety is a primary topic and information process will be put into practice related to this issue and municipality and interlocutors will be informed at least two or three days before regarding explosion date, time and precautions related to process. In information process, clear information regarding technical will be used and possible damages may emerge as a result of process will be transmitted to interlocutors.

Employment opportunity will be provided to local people in construction phase of facility. This chance will increase the income of local people and prevent immigration even for a while. Positive effect over economic structure will affect social life indirectly. Second affect is national. Facility will contribute to Turkey's economy by means of fulfilling energy demand's deficit and connection of surplus production to national system.

Project generally consists of dipping lands, these lands and heavy rain may cause overflow because brooks flowing uncontrolled from high slope. Planned regulator which can control the overflow danger regarding this issue may be assumed as a serious precautionary measure.

VI. Effect may be emerged after closing of project and ongoing effects and measures against these effects

VI.1. Reclamation and Recreation Works.

In order to maintain the disposability of the Torlar Regulator and HEPP project during its economic life, some measures will be taken such as regular maintenance of equipment and preventing sediment formation. According to current conditions which occur at the end of license period of the project, revisions can be made and the facility may be used for energy aim again.

If the license period of the operation is extended, or the project was transferred to government/another operator it is considered to make structure arrangement, recreation and reclamation works due to not only for safe operation but also for environmental safety (water movement, sediment transportation, fish movement etc.).

VI.2. Affects the current water resources.

Negative effect is not expected over current water resources because brook whose water diverted will flow in its own channel after the Torlar Regulator and HEPP project terminating for operation. There will be no origin-river mouth difference in quality and amount aspect of river water.

VII. ALTERNATIVES OF PROJECT

Torlar Reg and HEPP project, as seen in the following situation plan, were firstly planned in 475 m crest elevation and 444 m tailwater elevation. In this planning, Tavşantepe Dam and HEPP project was also present at the upstream of Torlar HEPP project. When alternatives were evaluated by the project owner, these two projects were discussed.As can be seen in Figure.40 Tavşanlı HEPP and Torlar HEPP would have two separate regulators, transmission canals and power houses. These two projects have been combined to a single HEPP project transmitting water with a tunnel. The final project includes one regulator and power house. This decision resulted environmental benefits as well as financials. Therefore, this alternative has been chosen.

In this regard, project renovations were performed both in DSİ and EPDK; and permits were granted again from other related institutions.

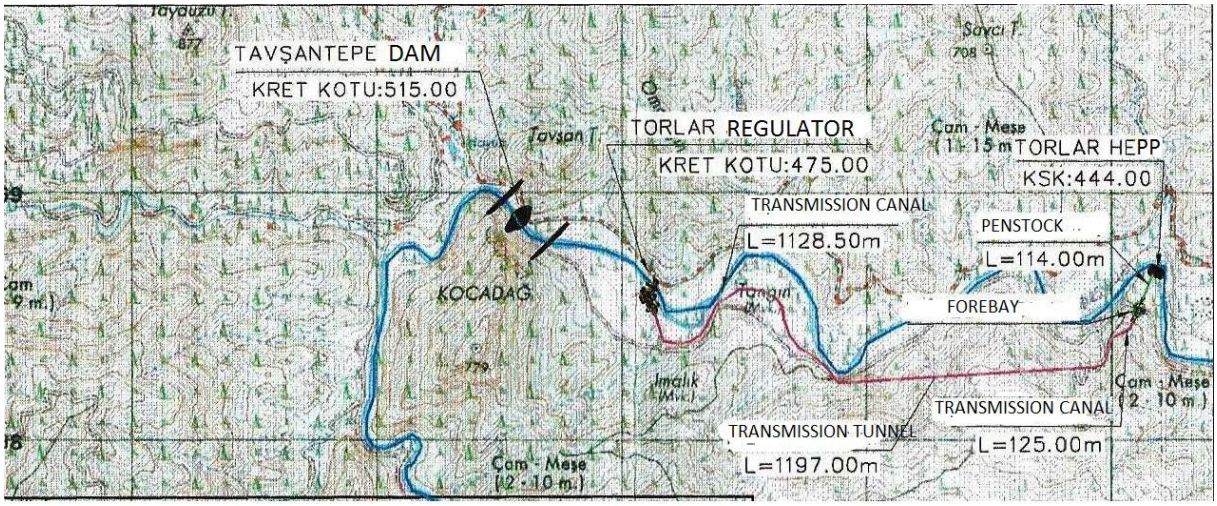


Figure 42 I. First Alternative Layout

Figure 43 II. Second Alternative

In the first Alternative, 2 distinct HEPPs will be constructed. It means to perform more construction and causing more harm to the environment. In the second Alternative, only one HEPP will be built, thus environmental harm will be minimized.

In the first Alternative, Tavşantepe dam to be built will have storage unit. In this regard, hundreds of decares lands, transportation roads and residences will be submerged. In these submerged areas, many flora and fauna species will be destroyed and ecosystem balance will be damaged. However, under the second Alternative, there will be no submerged areas.

Under the first Alternative, Tavşantepe dam to be built will cause regional climate changes due to increasing of vaporization and humidity ratios.

Because of the environmental impacts stated above, the second Alternative which is under construction at the moment is considered to be the most appropriate alternative. Location and technology alternatives were evaluated below.

Project Site Alternative

Since project units are designed and located ***as result of*** meticulous–***studies,*** the project's current location is deemed to be the most appropriate and most economic formulation and no alternative solution is available.

During determination process of project area's location; Ceyhan Basin’s stilling potential and Körsulu river's rain-flow correlation and meteorological-hydrologic features were used as baseline. Considering the topographic structure and technical, logistic and environmental factors, this site was selected for the realization of the project due to:

- Basin’s geological condition (geological formation, seismicity etc.),
- No large scaled settlement on basin,
- Land is stiff and not suitable for agriculture throughout the region,
- There are no protected areas in project area in accordance with legislation,
- Matters and limitations related to current infrastructure and other structure.

Project Technology Alternative

When considering technology alternative of this project, it is understood that there are basically two types of alternatives: reservoir type and river type plants.

The Torlar Reg. and HEPP project is licensed from Energy Market Regulatory Authorty. The feasibility report has been approved by General Directorate of State Hydraulic Works (DSI). River type plant is deemed to be the most suitable alternative when environmental, topographical, and hydrologic features unique to the area chosen for project are taken into account. Long term investigation on water flows has done when developing this project. The project area is analyzed for its availability of drop elevation.

Flooding the upper part of the river is not required as it doesn't need a reservoir. As a result, people living at or near the river don't need to be relocated and natural habitats are preserved, reducing the environmental impact as compared to reservoirs.

Other alternative for choosing plant type is turbine type to be used. Water turbines provide electricity energy as a consequence of the effect formed on turbine blades by striking of running water to turbine blades. According to working principle turbines are divided into two groups: turbojet (reaction type) and propulsive force turbine. Exact shape and design of turbine blades are determined in final design phase. Energy production can be explained by impulse-response law for turbojets (reaction type turbine). Propulsive force turbines provide change in water speed and convert kinetic energy to potential energy by means of striking water to wings shaped as hollow-pot

Nowadays reaction type turbines are being used in hydroelectric power plants and turbine shape and usage are changing according to manufacturer. As example for these type turbines, Francis, Kaplan, Propeller, Bulb, Tube, Straflo and water wheels can be presented. Considering the energy efficiency and easiness to procure turbine, Francis type turbine has been considered to be suitable to be used.

The Source Alternatives of Energy Production

Thermoelectric Power

Natural Gas

At the power plant, the burning of natural gas produces nitrogen oxides and carbon dioxide, but in lower quantities than burning coal or oil. Methane, a primary component of natural gas and a greenhouse gas, can also be emitted into the air when natural gas is not burned completely. Similarly, methane can be emitted as the result of leaks and losses during transportation. Emissions of sulfur dioxide and mercury compounds from burning natural gas are negligible. The average emissions rates in the United States from natural gas-fired generation are: 1135 lbs/MWh of carbon dioxide, 0.1 lbs/MWh of sulfur dioxide, and 1.7 lbs/MWh of nitrogen oxides (U.S. EPA, eGRID 2000). Compared to the average air emissions from coal-fired generation, natural gas produces half as much carbon dioxide, less than a third as much nitrogen oxides, and one percent as much sulfur oxides at the power plant. In addition, the process of extraction, treatment, and transport of the natural gas to the power plant generates additional emissions.

Torlar HEPP will produce 31.11 GW green energy per year. This means 35,309,850 lbs of carbondioxide, 3111 lbs of sulfur dioxide and 52,887 lbs of nitrogen oxides emissions will reduce by displacing electricity which would otherwise have been drawn primarily from a natural gas power plant.

Coal

The average emission rates in the United States from coal-fired generation are: 2,249 lbs/MWh of carbon dioxide, 13 lbs/MWh of sulfur dioxide, and 6 lbs/MWh of nitrogen oxides(U.S. EPA, eGRID 2000).

Torlar HEPP will produce 31.11 GW green energy per year. This means 69966390 lbs of carbondioxide, 404430 lbs of sulfur dioxide and 186600 lbs of nitrogen oxides emissions will reduce by displacing electricity which would otherwise have been drawn primarily from a coal power plant.

Large quantities of water are frequently needed to remove impurities from coal at the mine. In addition, coal-fired power plants use large quantities of water for producing steam and for cooling. When coal-fired power plants remove water from a lake or river, fish and other aquatic life can be affected, as well as animals and people who depend on these aquatic resources.

The burning of coal creates solid waste, called ash, which is composed primarily of metal oxides and alkali. On average, the ash content of coal is 10 percent. In Kahramanmaraş Afşin-Elbistan Thermic Power Plant 1,38 kg coal is used for producing 1 kWh energy (100 Year Univercity Publication, Fossil Fuel Arithmetic, http://biyolojiegitim.yyu.edu.tr/mkpdf/fya06.pdf). So Torlar HEPP will prevent 4569180 kg ash occurrence.

Oil

Burning oil at power plants produces nitrogen oxides, sulfur dioxide, carbon dioxide, methane, and mercury compounds. The amount of sulfur dioxide and mercury compounds can vary greatly depending on the sulfur and mercury content of the oil that is burned.

The average emissions rates in the United States from oil-fired generation are: 1672 lbs/MWh of carbon dioxide, 12 lbs/MWh of sulfur dioxide, and 4 lbs/MWh of nitrogen oxides (U.S. EPA, eGRID 2000).

Torlar HEPP will produce 31.11 GW green energy per year. This means 52015920 lbs of carbondioxide, 373320 lbs of sulfur dioxide and 124440 lbs of nitrogen oxides emissions will reduce by displacing electricity which would otherwise have been drawn primarily from an oil power plant.

Refineries release treated wastewater, which can contain pollutants, into streams and other bodies of water. Likewise, power plants release wastewater, which contains pollutants and is generally hotter than the water in nearby lakes and streams, often harming fish and plants. Drilling can also cause underground water supplies to become contaminated with oil, and runoff from the extraction process can affect surface waters. During the transportation of oil, spills can occur, damaging water quality and harming marine life and birds in oceans and coastal waterways.

Oil refining produces wastewater sludge and other solid waste that can contain high levels of metals and toxic compounds and that may require special handling, treatment, and disposal. Also, when oil is burned at power plants, residues that are not completely burned can accumulate, forming another source of solid waste that must be disposed.

The construction of large oil-fired power plants can destroy habitats for animals and plants. Waste products from refining and from power plants (such as wastewater sludge and residues) can cause land contamination if not properly disposed. In addition, when oil spills occur on land, soils are degraded.

Nuclear Energy

Nuclear energy originates from the splitting of uranium atoms in a process called fission. Fission releases energy that can be used to make steam, which is used in a turbine to generate electricity.

Uranium is a nonrenewable resource that cannot be replenished on a human time scale. Uranium is extracted from the earth through traditional mining techniques or chemical leaching. Once mined, the uranium ore is sent to a processing plant to be concentrated into enriched fuel (i.e., uranium oxide pellets). Enriched fuel is then transported to the nuclear power plant.

Nuclear power plants use large quantities of water for steam production and for cooling. Some nuclear power plants remove large quantities of water from a lake or river, which could affect fish and other aquatic life.

Heavy metals and salts build up in the water used in all power plant systems, including nuclear ones. These water pollutants, as well as the higher temperature of the water discharged from the power plant, can negatively affect water quality and aquatic life. Nuclear power plants sometimes discharge small amounts of tritium and other radioactive elements.

Waste generated from uranium mining operations and rainwater runoff can contaminate groundwater and surface water resources with heavy metals and traces of radioactive uranium.

Every 18 to 24 months, nuclear power plants must shut down to remove and replace the "spent" uranium fuel. This spent fuel has released most of its energy as a result of the fission process and has become radioactive waste.

Enrichment of uranium ore into fuel and the operation of nuclear power plants generate wastes that contain low-levels of radioactivity. These wastes are shipped to a few specially designed and licensed disposal sites. When a nuclear power plant is closed, some equipment and structural materials become radioactive wastes. This type of radioactive waste is currently being stored at the closed plants until and appropriate disposal site is opened.

The environmental impacts of the different forms of power generation is described above. In the thermoelectric power plants the burning of sources cause some emissions. To generate 1 MWh;

- a naturel gas thermal powerstation annually emits 1135 lbs of carbon dioxide, 0.1 lbs of sulfur dioxide, and 1.7 lbs of nitrogen oxides,
- a coal thermal powerstation annually emits 2,249 lbs of carbon dioxide, 13 lbs of sulfur dioxide, and 6 lbs of nitrogen oxides,
- an oil thermal powerstation annually emits 1672 lbs of carbon dioxide, 12 lbs of sulfur dioxide, and 4 lbs of nitrogen oxides,
- a municipal solid waste thermal powerstation annually emits 3685 lbs of carbon dioxide, 1.2 lbs of sulfur dioxide, and 6.7 lbs of nitrogen oxides.

It can thus be concluded that the benefits scored by hydroelectric power plants over thermal power plants and nuclear plants have environmental benefits - on account of HEP being a renewable and sustainable source of energy, negligible emissions rates, minimum land usage, financial benefits - due to low cost of generation, the developers will have an advantage especially since merchant power sales is allowed in open market, and social benefits – like development of local area, provision of electricity, along with other bundled benefits like irrigation facilities, tourism, along with rise in demand for other industries' products like cement, iron and steel, transport, etc.. and assisting in the creation of a low carbon self sustainable economy.

VIII. FOLLOW-UP PROGRAM

Positive and negative effects and biophysical and socio-economic effects in construction and operation phases of the Torlar Regulator and HEPP project which is planned to be established were analyzed in EIA works extent. In addition to that, “monitoring process” will be executed to maintain suitability of the activity to applicable law and regulations and to keep the effect of the project to environment and human health at minimum level.

In all phases of the project, all warranties stated in the report will be met by the activity's owner company and the undertaking not to cause any disturbance to local people or environment around project area will be company’s own responsibility. In this period, it is suggested to execute follow-up works by an authorized person determined by the company in such issues defined below and to carry environmental importance and limitations stated in EIA Report.

First of all, Table 49 states detailed information regarding environmental effects originated from aforementioned project’s planning, pre-construction, construction, operation and post-operation periods and measures to be taken to prevent these effects or to keep them at minimum level in order not to damage environment and responsible association/corporation. Moreover ‘’Follow-up Planning’’ (parameters to follow, location to follow parameters, how and when monitoring will be executed and responsible association/corporation) will be applied for the project is given in Table 50.

Table 48 Measurement Plan

PHASE	FOLLOW-UP SUBJECT	MEASURE	RESPONSIBLE ORGANIZATION
Land Preparation and Pre-Construction	Expropriation	Expropriation was realized by mutually agreement method with private land owners (See Appendix 24)	Kam Energy
	Forest Permits	Within the scope with project, ''Forest Permit'' was granted from Kahramanmaras Regional Forest Directorate by force of article 17/3 changed by the law registered as 5192 of Forest Law registered as 6831 to use the fields which assumed as forest. (See Appendix 23)	Kam Energy Regional Forest Directorate General Forest Directorate
	Environmental Impact Assessment	For the Torlar Reg and HEPP project (8,1 MW) necessary "EIA is not necessary" decree No:722-7039 dated on 29 / 10 / 2009 was granted. But after the installed power went up to 15.03 MW, another "EIA is not necessary" decree dated on 29/10/2009 No:722-7039 was taken	Provincial Directorate of Environment and Urbanization
	Providing Ground Safety	Before construction works under the project, ground features were determined by opening drill wells and the construction was performed by taking the necessary measures.	Kam Energy
	Permission to use agriculture lands for non-agricultural usage	To use the agriculture lands for non-agriculture aim within the scope with the project, necessary permissions was taken from Kahramanmaras Provincial Directorate of Agriculture or/and Ministry of Agriculture (See Appendix 22)	Kam Energy Kahramanmaras Provincial Directorate of Agriculture or/and Ministry of Agriculture

PHASE	FOLLOW-UP SUBJECT	MEASURE	RESPONSIBLE ORGANIZATION
Remaining Construction	Excavation Works	Under the Torlar Reg. and HEPP project, excavations are substantially completed; only remaining job is to excavate 40% of the conveyance tunnel. Part of excavation materials were used as filling materials while the other part will be used in land smoothing and landscaping. Excavation materials which are not possible to re-use will store within 25713 m^2 temporary storage area and transport to the storage area which would be determined by the Municipality. During the last works, provisions of the "Regulation on Excavation Soil, Construction and Ruin Wastes" will be complied with.	Kam Energy Contractor
	Air Emission	To reduce the dust level will be emerged in land preparation and construction phase at minimum level; irrigation will be made by sprinkler on itinerary, filling and discharging process will be made without making any tossing and during transportation of materials, vehicles will be covered with calash and top of the materials will be kept in %10 humidity.	Kam Energy Contractor
	Vehicle Emission	To reduce the emission originated from vehicles at minimum level, routine control of all vehicles and equipment will be made and the vehicles need maintenance will be taken to maintenance and another vehicles will be in service until these vehicles' maintenance completed in accordance with article 7 of ''Exhaust Fumes Emission Control Regulation'' taken effect by publishing in Official Gazette registered as 27190 and dated 04.04.2009. Besides, vehicles will be warned to work according to Traffic Regulation and especially loading process will be monitored closely to maintain compatibility to loading standards.	Kam Energy Contractor
	Waste water	Household waste water generated in construction site are collected in waste water treatment facility formed in activity site and surroundings and purified. Purified water are discharged to the closest receiving environment after providing discharge criteria given in ''Water Pollution Control Regulations'' taken effect by publishing in Official Gazette registered as 25687 and dated 31.12.2004 and ''Regulation Regarding to Make Change in Water Pollution Control Regulations'' taken effect by publishing in Official Gazette registered as 26786 and dated 13.02.2008. The household waste water generated in other construction sites aree given to package waste water treatment plant and discharged to the closest receiving environment after purifying. Since waste waters formed in ready-mixed concrete plant are used in system as closed cycle, it is not expected to have waste water generation in this unit. It is not expected significant water emergence originated from the works executed in water transmission tunnel route. However, in case of any water emergence originated from water transmission tunnel works, this water is rich in terms of suspended solids and is used after for moisturizing to prevent possible dust over the roads and surplus water is discharged to the closest receiving environment.	Kam Energy

Land Preparation and Construction	Medical Waste, Hazardous Waste and Other Waste	. Work hazards that may occur under the project will not require any medical intervention in the construction site; such intervention must be performed in the nearest health institution because no infirmary units were established in the site. Therefore there will be no medical waste in the project site. Hazardous wastes that occurred in construction stage and will occur during the remaining construction will be temporarly stored as it is stated in ''Hazardous Waste Control Regulation'' taken effect by publishing in Official Gazette registered as 25755 and dated 14.03.2005 will be stored temporarily as covered and maintain not to chemical reactions. Hazardous wastes stored temporarily will be handed over to companies which have license from Ministry of Environment and Urban Planning and removed by these companies. Within this scope, during temporary storage, licensed vehicles will be used for transportation and remove of hazardous waste generated within these activities and activities will be according to Hazardous Waste Control Regulation taken effect by publishing in Official Gazette registered as 25755 and dated 14.03.2005. In addition, during the process of removing vegetable waste oil generated in dining hall used within project activities will be according to terms of Vegetable Waste Oil Control Regulation registered as 25791 and dated 19.04.2005. Within the scope of the c clause of the 5th article of the related regulation, it is forbidden to store the oil in ways to harm the environment, to transport, to be directly or indirectly released to the soil through underground water, seas, sewer system. Waste vegetable oil that may occur in the site's dining hallare collected in separate cups and stored in hazardious waste temporary storage site. But since greasy food is rarely cooked, few vegetal oil was stored and it will be eliminated by being given to licensed facilities.	Kam Energy Contractor
	Grumble and Vibration	Under the project, construction works are mostly performed in open field therefore grumble measures are difficult to take. Grumble depends on the type of work and changes during the day. But since works are performed during the day, grumble formation was limited. Requirements for the vehicles to be used in open field specified in the Article 13 and those for road vehicles specified in the article 9 of the Regulation on Assessment and Management of Environmental Noise was considered and the vehicles to be used for the project are operated within grumble limits in order to minimize the grumble formation. In addition, vehivles with proper and regular traffic examinations, exhaust measurements and maintenance are used in the project site by complying with the provisions stated in the Article 23 regarding "noise criteria for construction sites" which is a part of Section 4 of the Regulation on Assessment and Management of Environmental Noise. During construction, in case it is necessary to protect the personnel from grumble that will occur in machinery and equipment, in accordance with "Noise Regulation" that came into force by being published in Official Gazette no.4857 dated on 23/12/2003 and was issued according to the article no 78 of the Labor Law, necessary measures were taken to protect the personnel from possible health and safety risks, especially concerning hearing, that may originate from exposure to noise. Appropriate instruments such as helmets, earlaps or ear plugs are provided for those who work with machinery and equipment in construction stages. Therefore, grumble coming from machinery and equipment are minimized so that they will not disturb the personnel who are working with them.	Kam Energy Contractor

	Accommodation and other technical/social infrastructure requirements of the personnel.	Social needs (accommodation, rest, dining hall etc.) of the personnel who work within the project are provided from the facilities located in construction site will be formed within the project.	Kam Energy Contract Packer
Operation	Waste water	Household waste water will be emerged in operational phase will be collected in leak-proof cesspool; it will be withdrawn by sewage truck following the filling up the cesspool and be discharged to the area determined by Kahramanmaras Municipality.	Kam Energy
	Solid Waste and Packaging Waste	These wastes emerged during the operational phase of the project will be collected in closed trash cans located in different places in the project area and they will be given to Kahramanmaras Municipality periodically and removed. It is out beside the point that there will be package wastes in HEPP operations. However, if package wastes emerge which recycle is possible, they will be collected separate from other solid wastes in accordance with Package Wastes Control Regulation and they will be handed over the company within the agreement with the company which has package wastes collection license.	Kam Energy Kahramanmaras Municipality
	Waste Oil	Insulation oils are being used in transformer. Absorbent such as sand, gravel or sawdust will be poured over the leaked oil in case of broad malfunction, during the oil transfer, as a result of probable accidents and this oil will be prevented to spill surrounding and this waste will be collected in cans and storage. Life span of insulation oils will be used is around 2-30 years. Removing of used insulation oils will be realized in accordance with article 9 section 2 of ‘’Waste Oils Control Regulation’’ taken effect by publishing Official Gazette registered as 26952 and dated 30.07.2008. Transportation of wastes to waste plant will be executed by licensed transporter. Terms stated in 4th and 5th section of ‘’Waste Oils Control Regulation’’ will be met during transportation to waste plant and waste in operation site will be stored in temporary storages in accordance with the terms of ‘’Waste Oils Control Regulation’’. After that waste will be valued by selling to the companies licensed by Ministry of Environment and Urban Planning with tender offer. Besides, during aforementioned insulation oils’ usage, storage, transportation and removing, terms of ‘’Waste Oils Control Regulation’’ and ‘’Polychlorinated Biphenyl (PCB) and Polychlorinated Terphenyls (PCT) Control Regulation’’ taken effect by publishing in Official Gazette registered as 26739 and dated 27.12.2007 will be obeyed.	Kam Energy
	PCB	In case of oils that are used in the transformer and contain PCB turn to waste, wastes will be temporarily stored in impermeable, close and air conditioned areas within the facility and liquids with PCB will be eliminated by being carried to licensed facilities in order to take measures against hit and impacts.	

	Grumble	Only grumble sources in operational phase of the project will be generators and turbines in plants. It is beside the point that any noise reaches to out of the buildings because plant will insulate the grumble. For the personnel who will work in plant; protective clothing such as earflap, earplug etc. which stated in Labor Law will be provided and it will maintain that these personnel will not be affected from the noise inside of the facility.	Kam Energy
Operation	Minimum Flow Rate (Ecosystem Water/Life Water) to Leave for Natural Life Persistence	To maintain the natural life persistencethe, minimum flow (ecosystem water) was determined to be 0,950 m^3/s as stated in the report. Besides, in case of a flow value ***is–lower*** than ***ecosystem flow***, all will be left to the river bed. The minimum water values will be measured by remote sensing AGI and will be continuously monitored by DSI. AGI location will be determined by DSI and the AGI station will be equipped with GPRS modem.	Kam Energy
	Natural Life Conservation	Fishway will be constructed to maintain fish life persistence, not to damage natural balance in aquatic environment and allow fish to shuttle to stream source. Through the fishway planned to be built in regulator it will be provided that fishes move on stream bed without any problem. Water will be given to stream bed after using in electricity production without being exposed to any process. Therefore it is not expected to have water pollution originated from the project.	Kam Energy DKMP General Directorate
	Landscaping	Rehabilitation/plantation works will be conducted in order to recover the natural appearance	Kam Energy
Operation and post-Operation	Reclamation Works	Top soil collected before the construction of regulator, HEPP, construction site, excavator storage area within project will be used in environment planning of facilities after construction works. In addition to planting works it will be necessary to take erosion measures. Tree planting and vegetation process will be executed also within rehabilitation works.	Kam Energy
	Water Temperature and Oxygen Level	The temperature and oxygen level of water would be monitored where water is left from regulator to stream bed.	Kam Energy

Table 49 Follow-up Plan

PHASE	PARAMETER TO BE FOLLOWED	LOCATION OF THE PARAMETER	FOLLOW-UP METHOD	FOLLOW-UP FREQUENCY	CAUSE OF THE FOLLOW-UP	RESOINSIBLE ORGANIZATION
Land Preparation and Pre-Construction	Surface Texture and Geology	Areas which regulator, forebay pool, transmitting structure and planned building will be formed	Works will be executed during ground studies and in project area	Pre-Construction	Construction Safety	Kam Energy
	Excavator Storage and Transportation Allowance	For the Excavator Storage Area	With Written Permission	Pre-Construction	In Necessity of the Regulation Related to Excavation Waste	Kam Energy
	Getting Opinion of Regional Directorate of State Hydraulic Works within scope with Premiership Memorandum Registered as 2006/27	All kind on structure will be constructed in stream beds and works of art	With Written Application	Pre-Construction	In Necessity of Premiership Memorandum Registered as 2006/27	Kam Energy
	Determination of Water Quality	In regulator place	With Analyze	One time Pre-Construction	Determination of Water Quality in Regulator Place	Kam Energy
	Air Quality	Residential Areas Close to Project Area, Construction Sites, Transportation Roads, Excavator Storage Area	Observational, dust measurement of dust sampler if necessary	Consistently and In Case of Any Complain	In Necessity of SKHKKY, Protection Health of Environment and Workers	Kam Energy
		Exhaust of Construction Equipment.	Exhaust Measurement Devices	Periodical Maintenance Periods	In Necessity of Exhaust Gas Emission Control Regulation	Kam Energy

PHASE	PARAMETER TO BE FOLLOWED	LOCATION OF THE PARAMETER	FOLLOW-UP METHOD	FOLLOW-UP FREQUENCY	CAUSE OF THE FOLLOW-UP	RESOINSIBLE ORGANIZATION
Land Preparation and construction	Storage and usage of dredgers and top soil accordingly	Construction Sites, Equipment Sites and Storage Areas	Visual survey	Weekly during construction works	Monitoring to decrease probable negative effects over natural habitat, saving vegetable soil's nature and replacement of stored top soil after completing the construction	Kam Energy
	Waste Water	In discharge point and package waste water treatment plant	Survey if waste water emerged in the project are is purified in package treatment plant and treatment plant works or not	Twice one in a year	Compliance with the Aquaculture Law and Regulation,	
	Surface Waters	Surface waters in project area and surrounding	Observation whether excavation wastes mix with surface waters	Semi annually	Maintain not to throw excavator and waste over the surface waters k	
	Solid Waste and Package Waste	Construction site or the area will be used as construction site	Observational	Daily / 1 time in 2 days	Providing harmony with Solid Waste Control Regulation, Soil Pollution Control Regulation, Package Waste Control Regulation	
	Hazardous Waste	In construction sites	Observational	Consistently	Providing harmony with Hazardous Waste Control Regulation	
	Other Wastes (Tire, Accumulator, Vegetable Oil etc.	In construction sites	Situation to give to recycle companies by registering	Consistently	Necessity of related regulations	

PHASE	PARAMETER TO BE FOLLOWED	LOCATION OF THE PARAMETER	FOLLOW-UP METHOD	FOLLOW-UP FREQUENCY	CAUSE OF THE FOLLOW-UP	RESOINSIBLE ORGANIZATION
Land Preparation and Constructio n	Grumble	In case of any complain in construction sites, truck route, residential area close to explosion area and sensitive areas	Observational and when necessary by the firm credentialed with noise level measurement device	In case of any complaint or during works executed in sensitive areas	Providing harmony with CGDY Regulation	Kam Energy
	Excavator Waste	Construction Site	Observational	Daily	Providing harmony with Excavation Soil, Construction and Wreckage Waste Control Regulation	Provincial Special Administration/Regional Forest Directorate Kam Energy
	Vibration	In residential areas close to explosion areas	Vibration level measurement device used for measuring vibration level	Initial explosions in different locations or in case of complain	Minimize probable explosion risk, providing safety of environment and workers and harmony with CGDY Regulation.	Kam Energy
	Occupational Health and Safety	All of the project area	Observational and Inspection	Daily	Providing harmony with Labor Law and Regulation	Kam Energy
Operation	Occupational Health and Safety	All of the project area	Observational and Inspection	Consistently	Providing harmony with Labor Law and Regulation	Kam Energy
	Determination of Remote Sense AGI location	Regulator Location	Location will be determined with Regional Directorate of State Hydraulic Works and donated with GPRS modem	Remote sensing AGI will be located one time and measurement result will be monitored constantly	To provide naturel life persistence and keep the records	
	Sap (Minimum Flow)	Regulator Location	Measurement and record keeping with remote sensing AGI	Consistently	To provide natural life persistence	
	Fishway	Regulator	Observational	In migration period of fish	Control if fishway is working or not	

PHASE	PARAMETER TO BE FOLLOWED	LOCATION OF THE PARAMETER	FOLLOW-UP METHOD	FOLLOW-UP FREQUENCY	CAUSE OF THE FOLLOW-UP	RESOINSIBLE ORGANIZATION
Operation	Waste Oil	On Transformer Stations	Observational	Continuously	In accordance with Directives on Control of Polychlorinated Biphenyls (PCB) and Polychlorinated Terphenyls (PCT), and Control of Waste Oil	Kam Energy
	Wastes	On Project Units	Observational	Continuously	To comply with the Directives on Control of Solid Wastes, Control of Soil Pollution, Control of Packaging Wastes	
	Waste Water	On Project site, leak-proof cesspool	Observational	Continuously	In accordance with the Directive on Control of Water Pollution	Kam Energy
	Water Temperature and Oxygen Level	On the stream bed.	Analysis	Every month	To control the temperature and oxygen level for protecting aquatic organisms life condition.	

A draft Emergency Response Plan was prepared for emergency situations which may take place on the land preparation, construction and operational phases of the Project. Duties, responsibilities and respective applications of the Emergency Response Team, which will be established under the Emergency Response Plan, were presented in detail in the plan. (See Appendix-11).

IX. THE ASSESSMENT OF CUMULATIVE EFFECTS

IX.1. General

Torlar HEPP project is located on Körsulu stream, Ceyhan watershed, in the province of Kahramanmaraş, in the mediterranean region of Turkey. On the upstream of the Torlar Reg and HEPP project, Değirmenüstü Reg. and HEPP (installed capacity 24.29 MW – admission stage), Kale HEPP (installed capacity 35.33 MW – online), Gökgedik diversion weir and HEPP (installed capacity 24.29 MW – admission stage) and Karasu HEPP which is run by Kahramanmaraş municipality are being built by a private company. Sır Dam, which is run by DSI, is located at the downstream of the project. Table 51 shows the distances between the regulator structures and the power plants of related projects. The figure below shows other hydropower plants on the Körsulu stream. At the lowest altitude but before Sır Dam Torlar HEPP has been constructed. The detailed map is provided in App. 32.

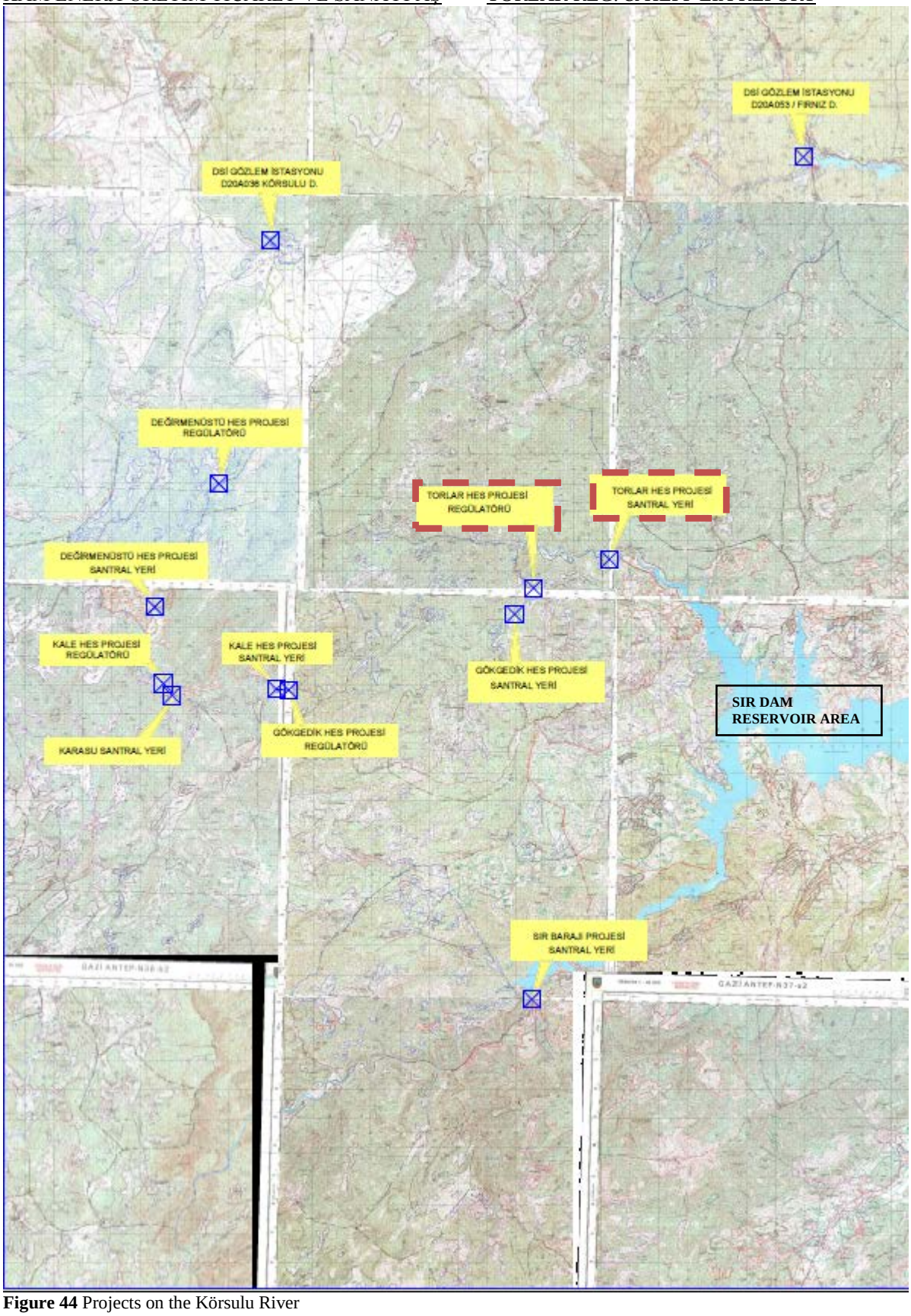


Figure 44 Projects on the Körsulu River

As mentioned in the previous sections, during the operation phase of the HEPPs, the most significant potential cumulative impacts will be observed in aquatic environment. These potential impacts include:

- Change of water flow regime;

- Change of water quality; and
- Change of aquatic ecological characteristics of the Korsulu River.

The assessment of cumulative impacts of the HEPP projects in the Korsulu River has been carried out considering the results of these field studies and report on "Cumulative Impact Assessment for Torlar Reg. And HEPP" (App. 25) prepared by Mavi Yeşil Environmental Engineering Company Limited.

Sır Dam (284 MW), locating downstream of the Torlar HEPP, constructed in 1987. A fish way has not been constructed on the dam. Therefore in terms of fish migration, the connection between Torlar HEPP and the downstream of Sır Dam has been blocked. This results in with the fact that fish way of Torlar HEPP has been constructed for the species living in Sır Dam's reservoir and the upstream of it. As a cumulative perspective, Torlar HEPP has almost no effect to the fish movements on the entire Korsulu River in terms of migration possibilities.

Table 50 The distances in between the regulator buildings and the power plants of the near-by projects (m)

	Değirmenüstü Reg.	**Kale Reg.**	**Karasu HEPP**	**Gökgedik Reg.**	**Torlar Reg.**
Değirmenüstü HEPP	4962	7536	8002	7846	17,453
Kale HEPP	12,216	4680	3527	310	9917
Gökgedik HEPP	21,136	13,600	3670	8610	997
Torlar HEPP	24,812	17,276	15,804	12,286	2679

IX.2. Valuable Ecosystem Elements

In a study conducted by considering the Protection Zones list prepared by the Ministry of Forest and Water Affairs, General Directorate of Nature Preservation and National Parks, no preservation areas were found in and around the project site. Therefore, it is not possible to talk about any historical monuments, protection area etc.

All residual environmental effects are seen on water and they are all connected to aquatic fauna. From the aquatic fauna seen in the project area, focus species were chosen by considering economic value, endemism state, preservation status and water intake points in the river. These species are *Garra rufa of fish familia, rana ridibunda of amphibians and Natrix natrix and Natrix taselleta of reptile familia.* (See Appendix-5: Ecosystem Evaluation Report). Some biological features why they are selected as focus species and valuable ecosystem elements are stated below.

***Garra rufa* HECKEL. 1843**

They are observed in Ceyhan, Dicle and Fırat river basins and inland waters of Syria (Geldiay and Balik, 1988). Habitat elevation in the area of dominance is more than 1000 m but Geldiay and Balik state that they live in elevations lower than 1000 m in Ceyhan River System and that they cannot survive upper sections. However, Garra species are reported in many fresh water sources in Eastern Anatolia and South Eastern Anatolia where the elevation is more than 1000m. ıt is also observed that natural populations live in stream branches fed by thermal sources of the area.

Their mouth is located at the bottom and their shape is a horse shoe, they have two pairs of barbs. One of the pairs is at the edge of the mouth and the other between mouth tip and nose tip. Their belly is whiteish, back side ranges from brown to yellow. There is a black spot on tail root just the bottom of caudal paddle. There are tubercules in front and nose. Their total length is between 7,5-13 sm. They eat planktons and algs on the rock surfaces in the water.

Their distribution area on earth as well as in Turkey is not wide. They are used in Sivas-Kangal SPA pools for treatment purposes.

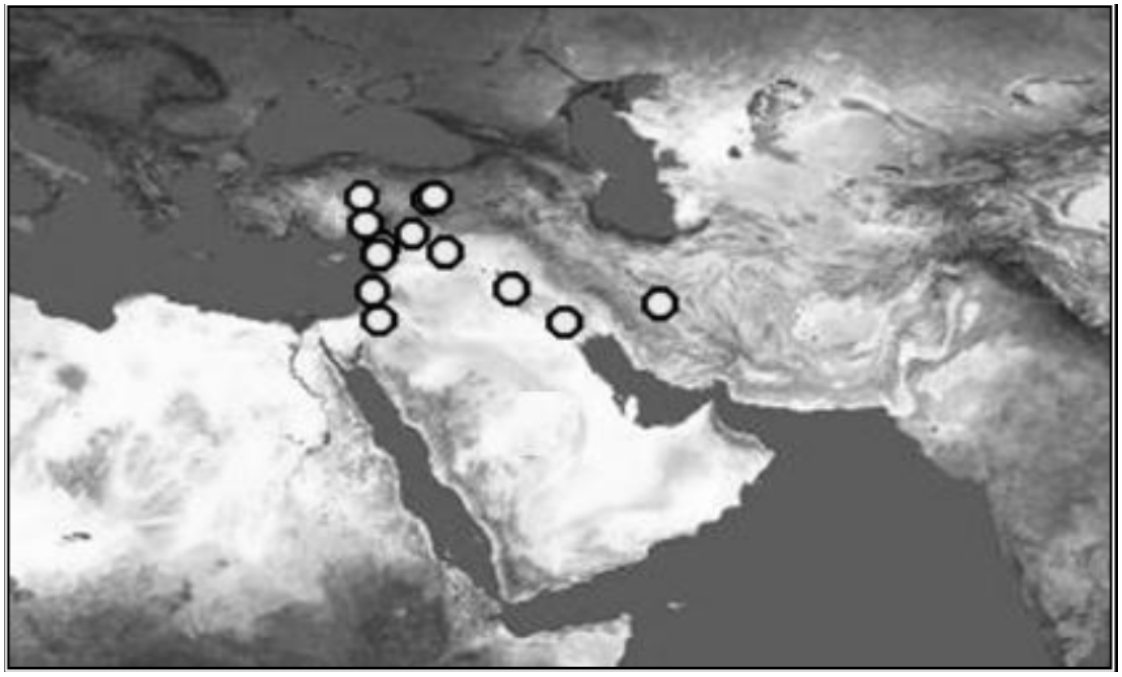


Figure 45 Distribution areas of *Garra rufa* (Heckel, 1843)

Rana ridibunda

They were first identified by Pallas in 1771 as a member of Terra typica restrica. Distribution of the species extends from Middle and south Europe to North Africa and West Asia. Turkish population was studied by Bodenheimer (1944), Baran (1969, Yılmaz (1984) and Olgun (1986) as complex, sensu lato.

Usually they don't leave the water. They are observed in the water, by the water and on some objects on the surface such as leaf, branch. Their preferred habitats are pool, river and lake with abundant vegetation. The highest elevations that they have been reported so far were 1800 m by Werner and 2250 m by Baran.

Figure 46 Distribution areas of Rana ridibunda

They are the biggest anuras ever lived in Turkey. Mature females can reach 10 cm and rarely 15 cm (Başoğlu et. Al. 1994). Despite many of researches conducted on this species, there is still not enough information about its nourriture biology.

***Natrix tessellata* (Laurenti, 1768)**

Usually they live in rivers, streams and lakes, in the water and by the water. They can be observed in elevations up to 2500 m. Their pattern on the back is highly different from each other. Usually, they are in green, greenish, grayish and yellowish colors. Dark spots are observed on the back but not on the head. There is a distinct “V” shaped spot on the neck. Their belly section is small dark dotted, yellowish or pinkish. On the back side, their color is blakish with pinkish spots.

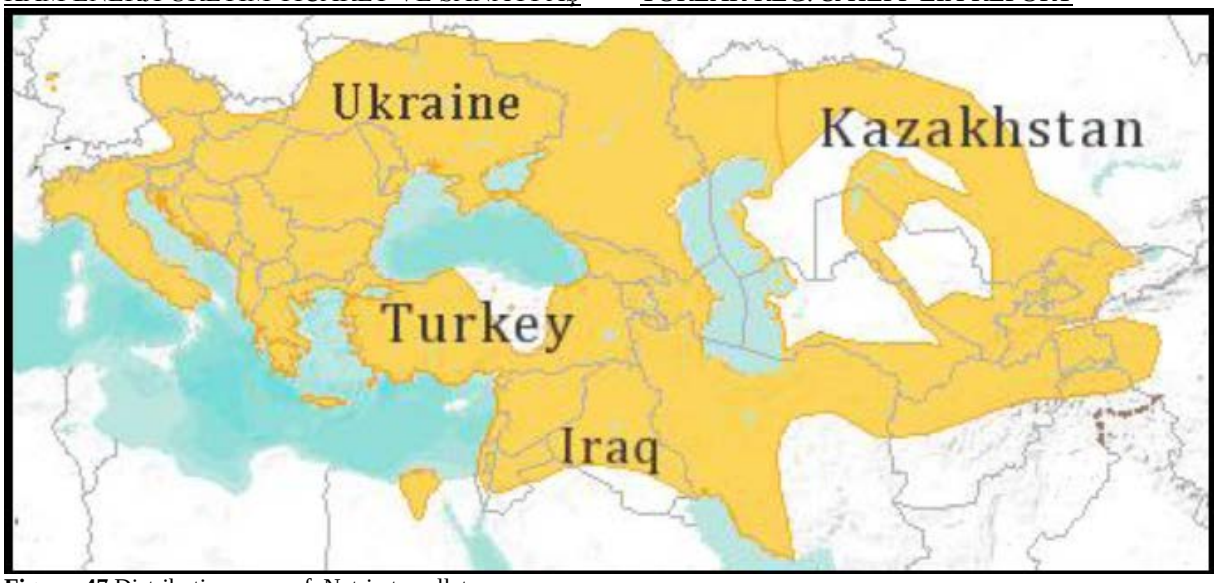


Figure 47 Distribution areas of Natrix tessellata

They eat little fishes, frogs, newts and some gnawing animals. For hibernation, most of them come together by the rivers. Females can spawn 5-25 eggs at a time. Offsprings become mature in 1-3 years depending on climate conditions. Their average length is 120 cm.

***Natrix natrix* (Linnaeus, 1758)**

Usually they live in sides of rivers, streams, lakes and in meadows nearby. They frequently enter water. They can be observed in elevations up to 2000 m. Their pattern on the back is highly different from each other. Generally, they are brown and grayish color. There are two longwise lines on the back side with dark spots around them. There are little spots on their sides. Belly area is usually yellowish but rarely yellowish spots on black surface. They are known for being semi-aquatic snakes.

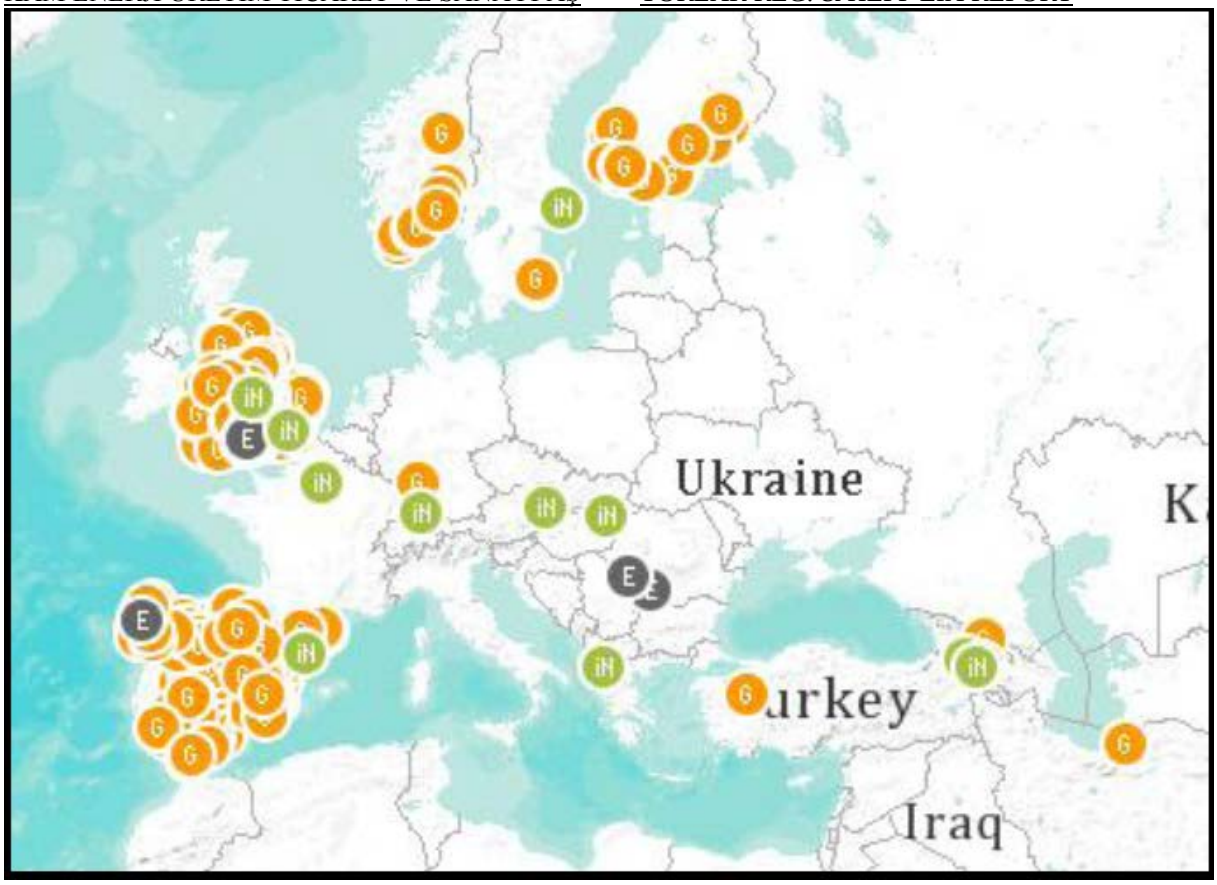


Figure 48 Distribution areas of Natrix natrix

They are active during the day. They don't bite when they are caught but they release a bad-smelling gas. They can fake dead in order ot protect themselves. Usually they eat little fishes, frogs, newts and some gnawing animals. For hibernation, most of them come together by the rivers. Females can spawn 6-13 eggs at a time. Offsprings become mature in 1-3 years depending on climate conditions. Their average length is 100 cm (150 max).

IX.3. Evaluation of Cumulative Effects on Water Flow Regime

With the regulators and HEPPs, 20.43 km long section of the Körsulu stream which is approx. 53.11 km long in total will be taken from its original stream bed and carried away by channels or tunnels. This will change flow regime in the stream bed. Changing the flow regime is the most important effect towards the natural habitat. Taking this action as one of the base points for cumulative evaluation, Torlar HEPP has the least effect compared to the other HEPP projects on the Korsulu River since the water coveyange structure of it is the shortest tunnel. In the below table, channel and tunnel lenghts of such projects to be built are given. The locations of the projects and the distances between eachother are given in App. 32.

Torlar HEPP has the lowest installed power capacity compared to the other HEPP Projects except Karasu HEPP which is constructed on potable water line with an installed capacity of 2.135 MW which is not on the Korsulu River.

Table 51 Lengths of Water Conveyance Structures of Near-by Projects

PROJECT NAME	CHANNEL LENGTH (km)	TUNNEL LENGTH (km)	PENSTOCK PIPE LENGTH (km)	TOTAL (km)
Değirmenüstü Reg. and HEPP	0.15	4.21	0.61	4.96
Kale Reg. and HEPP	0.00	4.20	0.48	4.68
Gökgedik Reg. and HEPP	0.00	8.04	0.57	8.61
Torlar Reg. and HEPP	***0.00***	***2.57***	***0.11***	***2.68***

As shown in the table, water is collected from the dams on Körsulu river and carried by tunnels and channels which are 20.43 km long in total. Torlar HEPP's tunnel and pipe length is 2.68 km and it has lesser effects on water flow regime compared to other projects. It is important to

IX.4. Assessment of Cumulative Impacts on Aquatic Ecological Environment

Değirmenüstü, Kale, Karasu, Gökgedik and Torlar HEPP projects are located on the same stream, aligning from upper parts to lower parts. These projects are evaluated as one (Table 51). Karasu facility, which is also on the project area, is built for potable water purposes. Water is obtained from Obaönü and Değirmenözü sources with caisson wells. Therefore no regulations exist and it is not feeding from Körsulu stream.

Tablo 52 Water budget values of projects that are on the same watershed with Torlar HEPP

Regulator	Environmental/ecological water (m^3/s)	Watershed Water Volume (m^3/s)	Total Water Budget (m^3/s)
Değirmenüstü	1,534	0,094	1,628
Kale	1,600	0,098	1,698
Gökgedik	1,900	0,116	2,487
Torlar	***0.950***	***1,537***	***2.679***

When the above table is observed, it is seen that as moving to the lower sections of the basin, total water budget increases. This is totally expected. Because the water feeding the streams is formed by water drainage basins of HEPP projects and surface and underground watersheds between the Regulator area and the HEPP.

Total water budget increases by 11% as it goes downwards of the project area – from Değirmenözü HEPP to Kale and then Gökgedik HEPP projects – and this budget is added to the next project. In the Torlar HEPP project which is located at the latest end point, total water budget is increased by 27%. This situation is originated from a cumulative increase.

Project's regulator water levels represent average flowrate values. These waters are the ones in the drainage basins which are located on the upper part of regulators. Environmental/ecological water values and determined values of the project represent the water that will be released to downstream. After projects start running, there will be a decrease in the water level on stream beds, which are located between regulators and HEPPs. There will be support from the watersheds which are located between regulators and HEPPs. Such waters along with waters coming from between regulators and HEPPS and environmental/ecological waters form the total water budget. Increase in the total water budget will have important contributions to continuity of aquatic ecological life.

Projects were developed based on Flow Observation Station (AGİ) data which are created by using DSİ proved long-term measurements. Approved data is given as monthly average flowrates of the Regulator area of the project. Maximum, minimum and average values are taken for each month and the table of average flowrates by month is created for that sitation.

Cross section of streams with AGİ are taken by related institutions (DSİ, EİEİ, Private Institutions). River's section is delivered by calculating the levels that are corresponding to the highest flowrates ever observed in such stations.

Debi curve is obtained by dotting the corresponding level and flowrate values on a coordinate system. It is called a rating curve. Flowrate values are found by using this rating curve by means of only making level records.

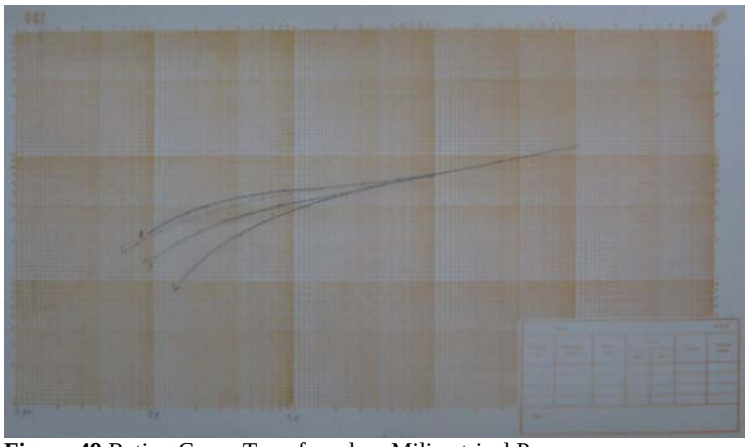


Figure 49 Rating Curve Transferred on Milimetrical Paper

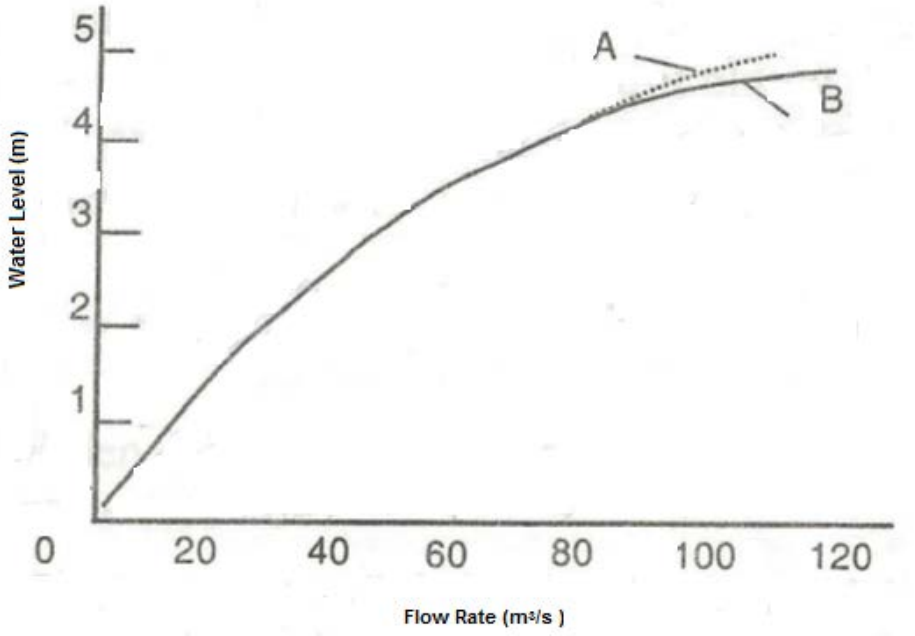


Figure 50 Ajdusted Rating Curve

Flowrate can be obtained by using the curve measuring only depths where AGİs are located. Speed is calculated by using the following formula:

Q=A.V
With
Q=flowrate
A= Surface
V= Speed.

Depth and speed values are measured by the station and their values are used. Graphics are drawn accordingly (Table 54 and 55)

Table 53 Average water depth data for torlar reg and HEPP project

Q(m^3/s)	Avg. Depth (m)
0,95	0,33
1,44	0,39
5,96	0,72
6,41	0,75
18,35	1,18
24,02	1,33

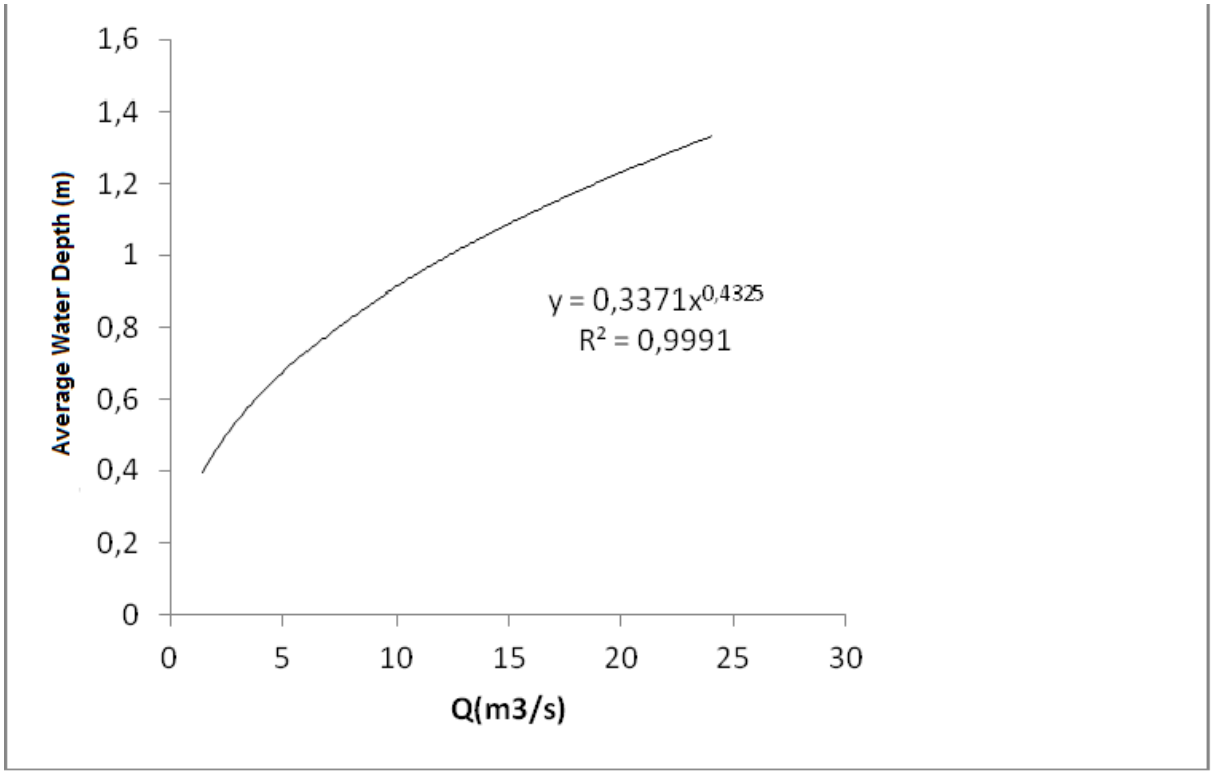


Figure 51 Average depth-flowrate relation for Torlar Reg and HEPP

Using the above graphic, depth is calculated as follows:

If we were to calculate the depth value corresponding to total water amount taken 2,487 m^3/s

2,487^0,4325 =1,482X0,3371=0,49.

Table 54 Average water speed-flowrate for Torlar Reg and HEPP

Q(m^3/s)	Avg. Speed(m/s)
0,95	0,47
1,44	0,54
5,96	0,87
6,41	0,90
18,35	1,28
24,02	1,41

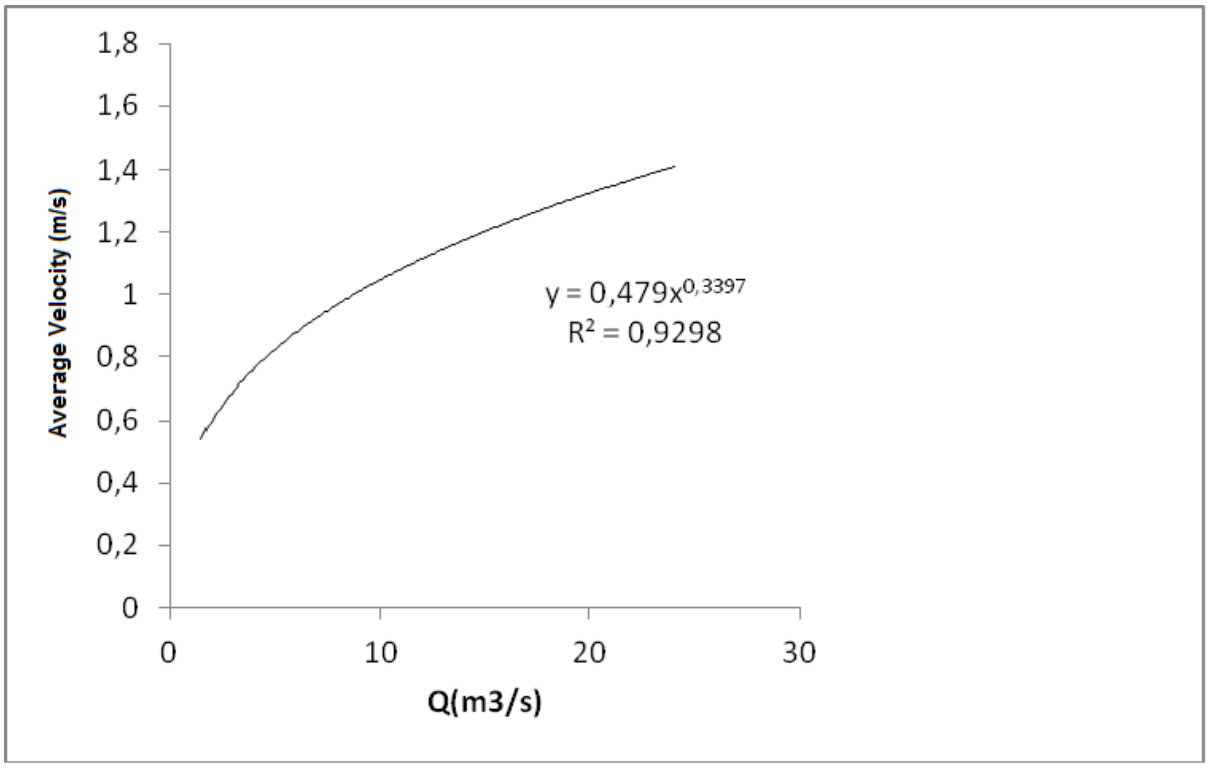


Figure 52 Average speed-flowrate relation for Torlar Reg and HEPP

If we were to calculate the speed value corresponding to total water amount taken 2,487 m^3/s

2,487^0,3397=1,362X0,497=0,67

Average depth and speed values formed by total water budget by calculating for other projects in the upstream are shown in Table 57.

Table 55 Assessment of Torlar HEPP and other HEPP projects on the same watershed as one

Regulator	Total Budget (m^3)	Depth	Speed (m/s)
Değirmenüstü	1,628	0,41	0,56
Kale	1,698	0,42	0,57
Gökgedik	2,016	0,45	0,63
Torlar	***2,487***	***0,49***	***0,67***

Effects On Fauna

The minimum flow (ecological flow) amount is important for aquatic ecosystem. Theminimum flow was determined as 0.950 m3/s for the project and the details were provided in the above sections.

7 fish species - *Alburnus orontis*, *Phoxinellus sp.*, *Leuciscus cephalus*, *Garra rufa*, *Capoeta capoeta angorae*, *Cobitis sp.* and *Nemacheilus angorae* – are observed on Körsulu stream, on which Torlar HEPP project was built. All of these species can live in slow flow speeds and 20-25 cm water depth. As can be seen at Table 54, average depth for projects are above 0.30 m and speed is below 2 m/sn. These values are enough for continuity of aquatic life in this stream. It can be concluded that there will be no problems with continuity of aquatic life when water budget values between regulators and HEPPS taken into consideration. Moreover the environmental flow amount (0.95 m^3/s) corresponds to 0,47 m/s average water speed with an average depth of 0,33 m. These amounts have been found by using the regression equations given in Figure 48 and 49. Therefore these water values (speed and depth) do not affect negatively to the species since they meet the living conditions of the corresponding species.

Three amphibian species were found on the project area. None of these species are in the list of IUCN's NT (Near Threatened) or VU (Vulnerable) category. All of them are in LC (Least Concern) category.There are, also, no endemic species. ***Rana ridibundula*** which is one of this three species have been exported to abroad lately. Frog species that live on project area only need stream water during spring (May – July) to lay their eggs. Only *Rana ridibunda* species continue to live in stream water other than just to lay eggs. In order to lay eggs, these species require 5-15 cm water level. As Table 54 shows *the minimum flow amount will be enough for amphibians.*

On the project area 8 possible reptilian species were detected. All of these species are under IUCN's low risk (LC) category. Four species are in Bern appendix II (strictly protected fauna species), others are in Bern appendix III (protected fauna species) category. Rock viper (Vipera xanthina (Montivipera xanthina)) is an endemic to Turkey. Only water snake (Natrix natrix and Natrix taselleta) uses stream water to hunt and to drink. They prefer 1-30 cm deep puddles located side of the streams. This species doesn't have any economical or ecologocial value and they feed on the eggs and cubs of the valuable water frogs which are valuable for foreign trade.None of the other reptilians use water to hunt or breed. They use puddle on land to satisfy their needs. Determined amount of released water is enough for the reptilian species.

17 bird species were detected, by observation, literature search and by information obtain from villagers in the project area. All of the observed bird species are in LC (least concern) category. Project area isn't one of the vital places for bird species in Turkey. These bird species don't need stream for their breeding and growing, they only use water for meeting their drinking water demands. They can meet their drinking water demands from lateral streams which are connected to main stream, upstream and downstream of river. So there will be no danger for them.

Effects On Flora

In the project area, there are no plant species that under national or international protection (ENDEMIC, RARE, IUCN, BERN and CITES) criterias. Annual plants, shrubs and trees located on riparian zone requires large amount of water during vegetation period. They use run-off waters, undersurface waters, water sources, ground water and waters that move in soil by percolation for their needs. During months when project operates, there will be some differences between average rainfall volume and the volume of average released lifeline Environmental/Ecological water. The released volume of lifeline water is lower than montly rainfall volume. However, the Environmental/Ecological released lifeline water that runs through the stream bed wets the soil, water storing of soil, horizontal and vertical via percolation. Water's movement in soil is from its high rest energy zone to its low rest energy. Amount of the moving water depends on the energy (energy) difference between these two energy zones.

Vegetation period on project area starts early and ends late. Average altitude of the project area is **974 m**. The required temperature, $+8^{o}C$, for vegetation, is being reached in the middle of March and ends on late November where temperature drops below $+8^{o}C$. This is the reason why vegetation lasts for 8,5 months on project area. Since vegetation period (spring and autumn) rainfall (mostly as snow and rain) is enough soil is saturated. There is enough water in the ground at the begining of the vegetation period. This is due to snows that melt. In this period (spring) it is easy for plant species and other ecological systems on the riparian zone to obtain water from soil. During summer time transpiration rate of plants increases due to activities of their assimilation organs and this increases the rate of water intake. Even if this lowers the amount of water in the soil the Evironmental/Ecological water released to stream bed will prevent any decrease in the soil water by its percolation effect. So that there are no changes anticipated for the standard of living of riparian zone ecosystem.

Grass and shrub species which live in riparian zones and terrestrial ecosystems can easily use water sources located on riparian zone. Their need for water isn't as high as other tree species.

Scientific studies demonstrated that tree species, the ones on the project area, require large amounts of water (maturity period) and use up to 150-220 liter/hour during vegetation period. Determined amount of Evironmental/Ecological water that will be released on this project is minimum 950 litre/s. This makes 3420 m^3/s of water, hourly. Discharge at this rate will help riparian zone soil to get saturated. Plants increase their water intake from ground during day time due to high transpiration rate and by night time water intake rate decreases. During night the streaming Evironmental/Ecological water will saturated soil with percolation (water's movement in soil, horizontal and vertical). This shows that there will be no water shortage during vegetation period on riparian zone. This way both riparian vegetations and terrestrial ecosystems continue to live on healthily. This plays an important role in biological diversity and sustainability.

In conclusion, it is anticipated that our project won't cause any important changes on current and future characteristics of the ecosystem. Evironmental/Ecological released, into downstream, lifeline water will be enough for aquatic ecosystem and terrestrial ecosystem for their needs. Also, waters from lateral rivers will feed this lifeline water too. This will allow us

to produce energy without causing any harm to ecosystem. The average depth and average speed values formed by the total water budget are given in Table 54.

The literature data about the site shows that the lowest flow rates were between 0.005 m^3/sec – 0.019 m^3/sec (data of last 30 years) and the aquatic organisms lived and adapted the water value. The minimum water to be relased to downstream from Torlar HEPP is determined as 0.95 m^3/s. So no problems are expected for the continuity of aquatic ecosystem by releasing determined minimum ecological flow for Hydrobiologic parameters.

As a result of the calculation performed within the scope of the project, evironmental/ecological water volume was determined as enough to keep aquatic ecosystem life (Animals and plants) in stream alive and continuous. There are no problems about this to prevent the project to come alive. It is not possible to undo the changes, destruction of soil and vegetation cover, caused by construction of other project units (conveyance tunnel, penstock pipe and HEPP). It is necessary to apply landscape and afforestation projects, which are must based on natural structure of the surrounding area. This will prevent the unpleasant view and on the other hand will help to reduce the vegetation cover loss and thus reduce the erosion rates, etc. Rehabilitation work on ecosystem will contribute to CO_2/O_2 balance on the atmosphere and will help to reduce global warming. Seedlings that are raised by the seeds of local trees neededto be used in this type of practices.

Above data show that Evironmental/Ecological water that will be relased into downstream and also the water from lateral rivers will be added to this lifeline water and this will affect stream water positively. This amount of water will be enough for the continuity of the aquatic ecosystem. This way energy will be produced without doing any damage to ecosystem.

Changes on the stream bed during HEPP and regulator construction, buildings that prevent aquatic organisms' movement, tunnel systems and using almost all of the stream water for energy production via drainage basins and interuptions on released lifeline water amount have adcerse effects on aquatic ecosystem.

Benthic organisms that have adapted flowing water will be wiped out on the drainage basin areas of the weir where the water is still. There will be also changes in the distribution of species that have show drifting behavior. Weir construction will change quality and quantity of the benthic species composition in this drainage basin. When water travels through tunnels after weir its speed will be reduced due to bypass process and this will change the stream bottom sturcture. Instead of gravelly and craggy stream bottom there will muddy and loamy areas. On locations where there will be only lifeline water flows stream bed will be withdrawn and leave puddles and this will destroy suitable areas for fishes to feed and hide. These areas can be good for some species that haven't existed on the area before. Species that are adapted to flows can continue to live on the flows of before and after weir process.

Adverse effects of HEPP projects to aquatic ecological life will be reduced by continuously releasing the minimum flow, needed biologicaly by the species that are living at the base of the river, into stream bed. Considering all the projects that are built/building on Körsulu stream, it can be said that this project has the least affects on the water quality since its short conveyance line and has the highest volume of lifeline water 0,950 m^3/s (10,3%).

Regulator constructions, as a physical obstacle, block movement of species who travel back and forth between upstream and downstream. However, fishpasses were built for every

HEPP on the stream. 7 fish species are identified in field studies. Denil type fishway will be constructed on Torlar Reg. and HEPP. The fishway project is approved by the authoritatives of the Ministry of Food, Agriculture and Livestock (seen in annex 6). When fishway of Torlar HEPP is constructed, there will be nothing to block the path of fishes and they will be free to travel upstream, downstream without restrictions of obstacles.

IX.5. Conclusion

During the operation phase of the Torlar HEPP, the most significant potential cumulative impacts will be observed in aquatic environment. These potential impacts include:

- Change of water flow regime;
- Change of water quality; and
- Change of aquatic ecological characteristics of the Korsulu River.

Körsulu river waters are collected from five dams/regulators including Torlar Regulatory and carried by tunnels and channels which are 20.431 km long in total. Torlar HEPP's tunnel and pipe length is 2,679 km and it has lesser effects on water flow regime compared to other projects. From every dam/regulator needed lifeline water which is determined by State Hydraulic Works and Ministry of Environment and Urbanism are releasing and released from each dam/regulator. As moving to the lower sections of the basin, total water budget increases. This is totally expected. Because the water feeding the streams is formed by water drainage basins of HEPP projects and surface and underground watersheds between the Regulator area and the HEPP. Total water budget increases by 11% as it goes downwards of the project area – from Değirmenözü HEPP to Kale and then Gökgedik HEPP projects – and this budget is added to the next project. In the Torlar HEPP project which is located at the latest end point, total water budget is increased by 27%. This situation is originated from a cumulative increase. So it is clear that as a result of measures taken from each project and the drainage water and lateral rivers feedings the effects on flow regime is minimized.

According to calculations made above the cumulative lifeline water released from dams/regulators are enough for fishes, amphibians and reptilian species which lives in Körsulu river.

From aquatic fauna, the most affected species related to economic value, endemism state, preservation status and water intake points in the river are: fish Gara rufa, frog Rana ridibunda and snakes Natrix natrix and Natrix tasseleta.

The fish Gara Rufa can live in slow flow speeds and 20-25 cm water depth. The average depth for projects on Körsulu River are above 0.30 m and speed is below 2 m/sn. These values are enough for continuity of Gara Rufa in this stream. It can be concluded that there will be no problems with continuity of aquatic life when water budget values between regulators and HEPPS taken into consideration.

The frog Rana ridibunda can live in 5-15 cm water depth. The average depth for projects on Körsulu River are above 0.30 m. This value is enough for continuity of Rana ridibunda in this stream. It can be concluded that there will be no problems with continuity of aquatic life when water budget values between regulators and HEPPS taken into consideration.

The snake Natrix natrix and Natrix tasseleta prefer 1-30 cm deep puddles located side of the streams. None of the other reptilians use water to hunt or breed. They use puddle on land to satisfy their needs. The average depth for projects on Körsulu River are above 0.30 m. Determined amount of released water is enough for Natrix natrix and Natrix tasseleta.

X. PUBLIC PARTICIPATION

(How and by which mean the local people, likely to be affected from the project, have been informed? People's views about the project and comments related to the subject.)

Torlar Regulator and HEPP project is located within the scope of the "Appendix-2, 32 – The run-of-the-river station with 0-25 MWm installed power" within the scope of Regulation Amending the Regulation on Environmental Impact Assessment, which has been published in the Official Gazette with number 27980, dated 30 June 2011 of the Environmental Impact Assessment Regulation which was published in the Official Gazette with number 26939, dated 17 July 2008 and and the Certificate of Environmental Impact Assessment was obtained from Provincial Directorate of Environment and Forestry of Kahramanmaras Governorship through 31.12.2009 date and 2009/54 resolution for the project. In this regard, the public participation meeting was organized in terms of Environmental Impact Assessment (EIA) for the project. But, two public information meetings were held by Kam Energy to inform the local people about the project: first one was held on 23th November, 2010 with the cooperation with EMRA Expropriation Office and the second one took place at the Dining Hall of Torlar HEPP Worksite on 2nd May, 2011 at 14:00. These public meetings are announced from mosque minarets before prayer (5 times a day) beginning 5 days before the meeting. It was also announced on the village headman's office board. 29 people from villagers attended the first meeting while 31 for the second one from Sarimollali Village, Cinarpinar Village, Demrek Village and Aysepinari Village participated in the meeting (See Appendix-12).

In the meetings, discussed issues were providing employment possibilities to local people and benefits of the project for that it will decrease Turkey's dependence to foreign countries in terms of energy matter.

XI. NON-TECHNICAL SUMMARY OF THE INFORMATION UNDER THE ABOVEMENTIONED HEADINGS

(The explanation of all work planned for the construction and operation phases and all measures assumed to be received for the environmental impacts in a way which people can understand easily as simple as possible without including the technical terms.)

Torlar Regulator and HEPP project; is located on Korsulu River at central district of the city of Kahramanmaras. The project field is found on 1/25000 scaled maps No: M37-c3 and M37-d4 and the general layout on the 1/25000 scaled topographic map is presented in the attachment (See Appendix-1).

Within the scope of the project, it is planned to construct the following units: regulator, fish passage, transmission structure (tunnel), forebay, penstock pipe, power house, facilities related to tail water channel, worksite area, excavation storage area, access roads and produce energy.

30-months application program was planned for Torlar Regulator and HEPP project. With the introduction of the system at the end of this period, it will contribute to the national development by producing totally 34.38 GWh energy in a year (0 GWh is firm energy and 34.38 GWh secondary energy in Torlar HEPP having 15.03 MW installed power).

The possible environmental effects and all the measures set forth for these effects in land preparation, construction and operational phase of the project are summarized below briefly:

- The storage are made properly without disturbing the river bed, making change of direction of the river and scattering excavation in Excavation Storage Area. No material shall be scattered to the slope during the excavation work.
- No blasting are made by business owner during the reproduction periods (March-June) of the organisms.
- To minimize the dusting which may occur in the field, the provisions to meet air quality standards related with dusty bulky material stored in open area, which were stated in “Emission Limits for Facilities Subject to Permission” attachment (Attachment-1) of SKHKKY are met.
- To minimize the dusting which may occur in the field, the measures such as making the process of loading and unloading without scattering at the emission source, improvements of roads, closing the top of vehicles with canvas while carrying the materials and holding the top of the material at 10% humidity shall be taken. Since the project area carries typical Mediterranean Region features, it has a rainy climate. But, the roads in the project area will be irrigated during the drought periods without rain.
- Since there is no wastewater (sewer) system in the operating area and its surroundings; the domestic waste water generated during the land preparation and construction phases of the project will be pumped to package wastewater treatment plant and treated here and afterwards this waste water will be discharged into the nearest receiver environment (Körsulu River) after providing the discharge criteria stated in “Water Pollution Control Regulations” published and entered into force in the Official Gazette dated 31 December 2004 with number 25687.

- The domestic solid waste resulting from the personnel working for the project will be collected in sealed garbage barrels placed at various points of the areas which will be used as worksite. These solid wastes, collected in containers, will be collected in the closest Municipality to the project area, Kahramanmaras Municipality solid waste collection system, and disposed here.
- Aprrox. 150 personnel were employed when construction is busy and in current situation 75 people are working because the construction works slow down. Unqualified personnel to work within the project will be employed as much as possible from the region and during the operating phase the permanent personnel will be employed from the region again and the contribution to the local economy will be provided by supporting local employment. Technical and social needs (housing, recreation, dining, etc.) of the personnel working on the project will be provided through the social facilities to be constructed within the scope of the project.
- For fish species specified in the fauna part of the report, the fish passage will be constructed for providing fishes going to/from river to ensure the continuity of life and not to deteriorate the natural balance in the river environment. A scientific investigation has been done and reported (Ap.-29) by Assoc. Prof. Dr. Mehmet KOCABAŞ (Karadeniz Technical University, Head Of Facultyof Forestry Department of Wildlife Ecology and Management) in order to determine the suitability of the existing fishpass. As it is concluded in the report, the fishway was found to be suitable for local (native) fish species (Salmo trutta macrostigma, Barbus capito pectoralis, Capoeta capoeta angorea, Chondrostoma Regium, Alburnus orontis, Leuciscus cephalus, Lucioperca lucioperca, Garra rufa obtuse, Nemachelus angore, Nemachelus tigris, Cobitis sp, Silirus triostegus and Aphanius cypris), especially for Brown trout. One of these species is Alburnus orontis which is under IUCN- EN category, while two species Barbus capito pectoralis and Leuciscus cephalus are under LC (low risk) category. It was also observed that the fishway was currently functioning well.
- According to the prepared ecosystem report, the amount of water to be released from Torlar Regulator to river bed is determined as 0.950 m^3/s (10.3%).
- The daily flow values of the released sap will be measured by remote detection Flow Monitoring Station and the data transfer will be provided to the XX Regional Directorate of State Hydraulic Works and Kahramanmaraş Provincial Directorate of Environment and Urbanism monthly. The location of the remote detection Flow Monitoring Station (AGİ) to be constructed will be determined on the land with XX. Regional Directorate of State Hydraulic Works and this AGİ will be equipped with GPRS modem. Also, AGİ station will be in working order before proceeding to trial production following the construction phase.
- New job opportunities for local people will be provided in the all phases untill the construction works ends and the project passes to the operation phase. Thus, with the employment to be created, the number of person to be included in the social systems will increase.

XII. THE CONCLUSIONS

(Summary of the all explanations, a general assessment in which the environmental effects of the project are listed and to what extent the success will be obtained in the prevention of negative environmental effects in case the project is to be materialized, choices between alternatives and the reasons for these choices for the project)

Electric power consumption is one of the most important indicators of economic development and social welfare. Electric energy production and / or consumption per capita in a country is of great importance in terms of reflecting the standard of living in that country. Turkey, as a country developing and industrializing rapidly, is in need of uninterrupted, high quality, reliable and affordable energy. Therefore, “Torlar Regulator and Hydroelectric Power Plant (HES) project” will be constructed and operated by Kam Energy Production Trade and Industry Inc., which is in the status of the production company under the Electricity Market Law No. 4628, published and entered into force in Official Gazette dated 3 March 2001, and it will contribute to satisfy a portion of Turkey's growing energy needs.

Torlar Regulator and HEPP project is located on Körsulu River at Central District of the city of Kahramanmaras, on 1/25000 scaled maps No: M37-c3 and M37-d4. 30-months application program was planned for Torlar Regulator and HEPP project. With the introduction of the system at the end of this period, it will contribute to the national development by producing totally 34.38 GWh energy in a year (0 GWh is firm energy and 34.38 GWh secondary energy in Torlar HEPP having 15.03 MW installed power).

EThe energy consumption increases in parallel with the population growth, industrialization progress, spread of technology and gradually increasing welfare level and the necessity of this and similar projects increases day by day. The energy, which will be produced by the project, will provide an important contribution to meet energy needs of the provinces in the region and will reduce the foreign-source dependency for the energy. Therefore, the establishment of the project will positively affect the economy of the region's economy as well as Turkey’s.

It is planned to establish and operate the project within 30 months (application program). Almost all of the building materials used in the project and labor, machinery and equipment which can be described as temporary will be provided from the region in these periods. This will bring buoyancy to the region's economy even if temporarily. In the land preparation and construction phases of the project Aprrox. 150 personnel were employed when construction is busy and in current situation 75 people are working because the construction works slow down. Project responsibles try to recruit the personnel working for the project from the local people as possible. A slight contribution to the local economy will be provided by both recruiting personnel from the region and the creation of the employment situation and the meeting need of personnel coming from outside the city from the region.

The geological structure will be crumpled slightly and the land topography will change very little with the land preparation, construction and storages for diversion buildings in the project site, transmission structure, headpond, penstock pipe, excavation storage area and power plant building. Since the diverted water from Korsulu River will be taken through a diversion structure, the formation of a lake as a dam reservoir will not come into question. The first effect on biological environment in the Regulator field may be especially the effects on the fish ***and other aquatic organisms*** as a result of reduce of flow.

For Torlar Regulator and HEPP project, the amount of environmental water was calculated as 0.950 m^3/s so that the aquatic organisms, living in river, would not lose their living habitats during the operational phase of the activity (See Appendix-20). Also, in case of the flowrates lower than the minimum operating flow rate of turbines all water is released. Moreover, serious participation from side waters in between the regulator and the power house contribute to the water budget.

The daily flow values of the released sap will be measured by remote detection FMS and the data transfer will be provided to the XX. Regional Directorate of State Hydraulic Works and Kahramanmaras Provincial Directorate of Environment and Urbanism monthly. The location of the remote detection FMS to be constructed will be determined on the land with the XXth Regional Directorate of State Hydraulic Works and this FMS will be equipped with GPRS modem. Also, AGİ station will be in working order before proceeding to trial production following the construction phase.

Since the regulator, which is constructed to get water within the planned investment, is not a storage structure as a dam reservoir, and the construction field is not an investment involving a very large area of thousands of square kilometers (For example: GAP (Southeastern Anatolia Project) project) no change on the amount of natural humidity and on climate is expected. Therefore, since climatic change is not expected, depending on this, no negative effect on flora, fauna and their habitats is expected.

The greatest change to take place naturally and physically will be in the regulator, forebay, penstock pipe, power plant building and excavation storage area. While the natural vegetation is being destroyed, the ecosystem balance will temporary suffer from disruptions as a result of the interventions. With the landscaping works to eliminate this disruption; the region will regain the value of the natural landscape by carrying out the rehabilitation of devastated region primarily. Before starting the land preparation works, the visual status of the region will be put down by taking the photos of the region in which the facility units will be constructed These areas will be vegetated and arranged similar to the original after the completion of construction works (Annex 30).

Figure 53 Power House Location (Before The Construction)

To ensure the continuity of life of the fish species, which has been specified in the fauna part of the report in terms of the project, and not to disrupt the natural balance in the river environment, the fish passage will be constructed for providing them to go and come back to/from river bed.

The blasting processes, which will carried out in open areas during the construction phase, will be made out of the productive periods (March-June) of the organisms and there will be no blasting in these periods. In the construction and operation phase of the project, the characteristics of the environmental effects, stated in V.1 and V.2 sections of this report, and the measures against these environmental effects are discussed in detail. To explain them briefly;

- In all kind of works to be done in terms of the project, the values of the receiving environment and criteria for wastewater discharge will be complied within the scope of “Regulation On Control of Water Pollution” published and entered into force in the Official Gazette dated 31 December 2004 with no 25687, “Regulation Amending the Water Pollution Control Regulations” published and entered into force in the Official Gazette dated 13 February 2008 with no 26786, and Fisheries Law and Regulation No 1380.

- For the disposal of possible waste oils the provisions of "Waste Oils Control Regulation", which was published and entered into force in the Official Gazette dated 30 July 2008 with no 26952, shall apply.

- The necessary measures against spill, leak, overflow of isolation oils and rain and a safety pool will be constructed. For all the works to be carried out related with the isolation oils, the provisions of “Regulation on Control of Polychlorinated Biphenyls and Polychlorinated Terphenyls”, which was published and entered into force in the Official Gazette dated 27 December 2007 with no 26739, shall be complied with.

- All the personnel will be informed that it is forbidden to leave the solid wastes (food waste, etc.), which will emerge in the all phases of the project, to seas, lakes and other similar receiving environments, streets as stated in Article 18 of “ Regulation on Solid Waste Control” dated 14 March 1991 with no 20814 and all the prohibitions and all the provisions of “ Regulation On Solid Waste Control” shall be complied with within the project.

- The possible packaging and packaging wastes, which may occur at all stages of the project, will be eliminated in accordance with the provisions of “Packaging Waste Control Regulation” which was published and entered into force in the Official Gazette dated 24 June 2007 with no 26562.

- The use of explosive substance, its protection and handling issues will be carried out in accordance with “By-law Regarding the Methods and the Principles for Production, Importation, Transportation, Preservation, Storage, Selling, Exploitation, Disposal, Controlling of Non-Tekel Explosives, Hunting Supplies etc.” which was published and entered into force in the Official Gazette dated 29 September 1987 with no 19589 and 87/12028 decision number.

- The provisions of " Regulation on Soil Pollution Control", which was published and entered into force in the Official Gazette dated 31 May 2005 with no 26952, shall apply.

- In case of blasting, all the environmental safety will be taken, necessary warning signs will be placed and siren warning will be given before conducting the blasting. "The Measures to be taken in the Works and Workplaces dealing with Flammable, Explosive, Dangerous and Hazardous Substances" Rule will be complied with in relation to the materials which possess the features of hazardous, flammable and explosive in the operation.

- The provisions of the "Regulation on Environmental Noise Assessment and Management", which was published and entered into force in the Official Gazette dated 04 June 2010 with no 27601, shall apply. In case of need to protect the personnel from the noise taking place because of machinery and equipment during the construction phase; the necessary measures shall be taken for personnel to protect them from the risks, particularly the risks associated with the hearing, as a result of workers exposed to noise, in terms of health and safety, in accordance with the provisions of the "Noise Regulation" regulated in accordance with the Article No:78 of Labor Law No:4857 and published and entered into force in the Official Gazette dated 23 December 2003 No:25325. The suitable protective tools and equipment such as helmets, earflaps and earplugs will be provided to the personnel working on the machinery and equipment during the construction phases and they will be provided not to affect by noise.

- In all excavation works to be performed under the project, the provisions of "Excavation Soil, Construction and Demolition Wastes Regulation", which was published and entered into force in the Official Gazette, dated 18 March 2004 with no 25406 shall apply.

- During the all land preparation and construction works, the provisions of meeting the air quality standards related with the stockpiling dusty materials stored in the open areas, stated in "Emission Limits for Facilities Subject to Permission" Attachment (Attachment-1) of "Industrial Air Pollution Control Regulations" (SKHKKY), which has been published and entered into force in the Official Gazette, dated 03 July 2009 with no 27277, shall apply.

- To minimize the emissions generated by the vehicles, the routine controls of all vehicles and equipment will be made and the necessary vehicles will be taken to the maintenance and other vehicles will be used in the works until the finish of the maintenance of these vehicles in accordance with Article 7 of "Exhaust Gas Emission Control Regulation", which was published and entered into force in the Official Gazette, dated 04 April 2009 with no 27190. Also, they will be warned to work by obeying the Traffic Law and it will be paid attention to the loading in accordance with the loading standards.

- The possible tires which completed its life and expired in the project field will be given to the recycling companies and in this context the provisions of "The Regulation on Control of Tires Which Has Completed its Life", which was published and entered into force in the Official Gazette, dated 25 November 2006 with no 26357.

- The provisions of "Regulation on Control of Waste Vegetable Oil", which was published and entered into force in the Official Gazette, dated 19 April 2005 with no 25791, shall apply for the waste vegetable oils which may emerge in the dining hall to be used for the project.
- The waste accumulator, which comes from as a result of the maintenance of vehicles to be used for the project, will be maintained in a closed environment which is provided by base seal within the project area in accordance with the provisions of " Regulation on Waste Batteries and Accumulators Control", which was published and entered into force in the Official Gazette, dated 03 March 2005 with no 25744, and afterwards they will be eliminated by giving them to licensed recycling companies.

- For the use of areas regarded as forest, "Forest Permission" are taken from Kahramanmaraş Regional Forestry Directorates in accordance with 17/3 Article of Law No.192 Amendment to Forest Law No.6831.

- During the processes of installation and operation of all facilities to be planned to operate within the project and following the close of operation, all the provisions and liabilities and relevant legislations stated in EIA report and Public Health Law in Turkey No.1593, Labor Law No.4857, Environment Law No.2872, Law No.4856 and 5491, will be complied with.

- Environment Law No.2872, Law No.5491 Amendment to Environment Law, Labor Law No.4857 and all Provisions and Rules of the Regulations will be complied with during all phases of project within the scope of Torlar Regulator and HEPP project. Thus, with this project, one of the renewable energy sources, the HEPP project will be carried into effect by minimizing the environmental effects.

The Laws and the Regulations to be followed throughout the construction and operational phases of the project are listed below:

- Environment Law No.2872 and the Law No.5491 Amendment to the Environment Law
- Labor Law No.4857
- Forest Law No.6831
- Fisheries Law and Regulations No.1380
- Regulation on Health and Safety at Work (*published and entered into force in the Official Gazette dated 11.01.1974 and with No. 14765)*
- Regulation on Health and Safety at Construction Works *(published and entered into force in the Official Gazette dated 23.12.2003 and with No.25325)*
- Assessment and Management Regulation of Environmental Noise *(published and entered into force in the Official Gazette dated 04.06.2010 and with No.27601)*
- *Regulation on Solid Waste Control and Amendments to this Regulations (published and entered into force in the Official Gazette dated 14.03.1991 and with No. 20814)*
- Regulation on Excavation Soil, Construction and Demolition Waste Control *(published and entered into force in the Official Gazette dated 18.03.2004 with No.25406)*
- Regulations on Industrial Air Pollution Control (SKHKKY) (*published and entered into force in the Official Gazette dated 03.07.2009 with No.27277)* In the regulation, an amendment has been done with the *Official Gazette dated 30 March 2010 with No.27537.*

- Regulation on Water Pollution Control and the Amendments to this Regulations

(Published and entered into force in the Official Gazette dated 31.12.2004 with No. 25687)
In the regulation, an amendment has been done *with the Official Gazette dated* 30 *March 2010 with No. 27537.*

- Regulation on The Protection of Wetlands

(Published and entered into force in the Official Gazette dated 17.05.2008 with No. 25818)
In the regulation, an amendment has been done with the Official Gazette dated 26 August 2010 with No. *27684.*

- Regulation on Packaging Waste Control

(Published and entered into force in the Official Gazette dated 24.06.2007 with No. 26562)
In the regulation, an amendment has been done with the Official Gazette dated 30 March 2010 with No. 27537.

- Regulation on Hazardous Waste Control

(Published and entered into force in the Official Gazette dated 14.03.2005 with No. 25755)
In the regulation, an amendment has been done with the Official Gazette dated 30 March 2010 with No. 27537.

- Regulation on Waste Oils Control

(Published and entered into force in the Official Gazette dated 30.07.2008 with No. 26952)
In the regulation, an amendment has been done with the Official Gazette dated 30 March 2010 with No. 27537.

- Regulation on Control of Polychlorinated Biphenyls and Polychlorinated Terphenyls

(Published and entered into force in the Official Gazette dated 27.12.2007 with No.26739)
In the regulation, an amendment has been done with the Official Gazette dated 30 March 2010 with No.27537.

- Regulation on Control of Waste Vegetable Oil

(Published and entered into force in the Official Gazette dated 19.04.2008 with No. 25791)
In the regulation, an amendment has been done with the Official Gazette dated 30 March 2010 with No. 27537.

- Regulation on Medical Waste Control

(Published and entered into force in the Official Gazette dated 22.07.2005 with No. 25883)
In the regulation, an amendment has been done with the Official Gazette dated 30 March 2010 with No. 27537.

- The Regulation on Control of Tires Which Has Completed its Life

(Published and entered into force in the Official Gazette dated 25.11.2006 with No. 26357)
In the regulation an amendment has been done with the Official Gazette dated *30 March 2010 with No. 27537.*

- Regulation on Exhaust Gas Emission Control

(Published and entered into force in the Official Gazette dated 04.04.2009 with No. 27190)

- Regulation on Waste Batteries and Accumulators Control

(Published and entered into force in the Official Gazette dated 03.03.2005 with No. 25744)
In the regulation, an amendment has been done with the Official Gazette dated *30 March 2010 with No. 27537.*

- Regulations on Buildings to be constructed on Disaster Areas