

Environmental and Social Impact Assessment of Gökres-2 Wind Farm, Manisa, Turkey



Prepared for:
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Environmental and Social Impact Assessment of Gökres-2 Wind Farm, Manisa, Turkey

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List of Acronyms

APCRH	Air Pollution Control Regulation for Heating Sources
AQAMR	Air Quality Assessment and Management Regulation
CHC	Central Hunting Commission
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CO	Carbon Monoxide
dB(A)	A-Weighted Decibel
EGECR	Exhaust Gases Emission Control Regulation
EHS	Environmental Health & Safety
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMP	Environmental Management Plan
EMRA	Energy Market Regulatory Authority
EPFI	Equator Principles Financial Institutions
ERL	European Red List
ESIA	Environmental and Social Impact Assessment
ETL	Energy Transmission Line
G	Gauss
Garet Enerji	Garet Enerji Üretim ve Ticaret A.Ş
H ₂ S	Hydrogen Sulfur
ha	hectare
HASP	Health and Safety Plan
hr	hour
HWCR	Hazardous Wastes Control Regulation
Hz	Hertz
IAPCR	Industrial Air Pollution Control Regulation
IBA	Important Bird Areas
ICAO	International Civil Aviation Organization
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEC	International Electrotechnical Commission
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Areas
kg	kilogram
km	kilometer
kV	kilovolt
kW	kilowatt
m	meter
MENR	Ministry of Energy and Natural Resources
mg	milligram
mm	millimeter
MoEU	Ministry of Environment and Urbanization
MW	Megawatt
MWCR	Medical Waste Control Regulation

NO	Nitrogen Oxide
NO ₂	Nitrogen Dioxide
NSR	Noise Sensitive Receptor
O&M	Operations and Maintenance
°C	Degree Celsius
PCB	Polychlorinated Biphenyls
PDöEU	Provincial Directorate of Environment and Urbanization
PDR	Project Description Report
PM	Particulate Matter
PWCR	Packaging Waste Control Regulation
RAMEN	Regulation on Assessment and Management of Environmental Noise
RSPB	Royal Society for the Protection of Birds
sec	second
SO ₂	Sulfur Dioxide
SWCR	Solid Waste Control Regulation
TEİAŞ	Turkish Electricity Transmission Corporation
TOC	Total Organic Carbon
TUBITAK	Scientific and Technological Research Council of Turkey
TÜBİVES	Turkish Plant Information Service
TurkStat	Turkish Statistical Institute
UTM	Universal Transverse Mercator
VOC	Volatile Organic Carbon
WB	World Bank
WF	Wind Farm
WHO	World Health Organization
WOCR	Waste Oil Control Regulation
WPCR	Water Pollution Control Regulation
WWF	World Wildlife Fund
µT	Microtesla

Executive Summary

Garet Enerji Üretim ve Ticaret A.Ş. (Garet Enerji) plans to develop and operate a wind farm in Akhisar District of Manisa Province in Turkey. The proposed Gökres-2 Wind Farm (the Project) will have 13 turbines each with an installed capacity of 2.75 MW. Thus, the total installed capacity of the plant will be 35 MW. A “49-year electric power generation license” (License No EÜ/3683-3/2235, dated February 9, 2012) has been obtained from the Energy Market Regulatory Authority (EMRA) by Garet Enerji for the Project. As required by the Turkish Environmental Impact Assessment (EIA) Regulation, a Project Description Report (PDR) was prepared for the wind farm. The PDR was reviewed by the Manisa Provincial Directorate of Environment and Urbanization (PDoEU) and the Project secured an “EIA is not Required” decision on April 20, 2009, thus a detailed EIA was not prepared for the Project. Since the Project has been revised afterwards (the number and capacity of the turbines have been changed), the revision was notified to the PDoEU and an approval was obtained for this revision on September 13, 2012.

The Project owner, Garet Enerji, plans to apply international finance institutions for financing of the Project. The purpose of the Environmental and Social Impact Assessment (ESIA) is to identify the potential environmental and social impacts of the Project on the local environment and community during the construction, operation and decommissioning of the turbines. The ESIA also aims at providing mitigation measures to eliminate potential adverse impacts and propose a management and monitoring plan. This report is prepared in accordance with Turkish Legislation and the Equator Principles (EP). The “Equator Principles” is a financial industry benchmark for determining, assessing and managing social and environmental risk in project financing. The Equator Principles are based on the IFCs Environmental and Social Safeguard Policies. Thus, this report has been also prepared according to IFCs guidelines.

AECOM conducted a detailed environmental baseline study in the scope of the ESIA study in the Project site. General climatology, air quality, land use, background noise, geology, flora, fauna, naturally protected areas, archeologically protected areas specific to the Project site were assessed in the scope of this study. As a result of this baseline study, it was concluded that;

- Average temperature, wind, precipitation and humidity data recorded in the vicinity of the Project site is in the range of operation parameters of turbines and the Project site is suitable for turbine operation in terms of general climatology.
- In terms of air quality, the Project site can be regarded to be located in a non-degraded airshed. As for land use, the Project site and surrounding area is mostly rural.
- No threatened or endangered flora and fauna species were identified in the Project site and its vicinity. Although there are some endemic flora species within the Project site according to the Red Data Book of Turkish Plants, they are abundant in the Aegean and Mediterranean Regions, according to the official website of Turkish Plants Data Service

(TUBIVES). Therefore, the populations of these species will not be adversely affected from the Project.

- In accordance with the national environmental legislation, there are no national parks, nature reserves, natural monuments, wildlife protection/ improvement areas, special hunting areas and cultural/archaeological assets within the Project site and its close vicinity.

The ESIA report also provides mitigation measures to eliminate potential adverse impacts and propose a management and monitoring plan. The following topics have studied in the ESIA report: Noise, air emissions, water supply and wastewater, hazardous wastes, non-hazardous wastes, soil and groundwater, biological resources (including bird collision risk and avian mortality), cultural and historical resources, visual impacts, shadow flicker and blade glint, socio-economic impact. The results of this impact assessment are briefly presented below:

- The noise and air emissions during construction will be temporary and will not have adverse effects on local air quality and background noise levels.
- During the operation phase of the Project, wind turbines will cause mechanical sounds and aerodynamic sounds. A modeling study was carried out in order to determine the noise impact on the sensitive receptors in Tütenli Village. Commercially available WindPro version 2.7 noise propagation model was used for this purpose. As a result of the study, it has been demonstrated that the operational noise of Gökres-2 Wind Farm Project will not exceed the Turkish noise regulation and the IFC/WB daytime and nighttime noise limits. Thus, the significance of potential noise impact is expected to be negligible.
- Minor amounts of hazardous wastes and waste oil, domestic solid wastes, recyclable wastes and only domestic wastewater will be generated during construction and operation. With proper disposal methods of these wastes, the Project will not create any adverse impact on the local environment and natural resources.
- An adverse impact to soil or groundwater due to hazardous wastes and chemicals is not expected during the construction and operation phases since proper handling, storage and transportation methods will be implemented as mitigation to prevent potential releases of these wastes and chemicals from reaching the environment.
- There will be an impact on the existing vegetation during site preparation and excavation activities. However, vegetation loss will be limited to the access roads and tower bases.
- Another potential concern of the Project during operation is the risk of collision of birds and bats with the wind turbines. The tips of the turbine blades will be painted and lighting will be installed properly to minimize bird collision risk. An ornithological monitoring study will be carried out covering the spring and autumn migration periods in 2013 in order to determine the potential effects of the Project on the population and the behavior of the birds.

- Visual impact of the Project is also assessed. The Project site is not located in a protected area or a tourist/resort area; it is mostly rural and not considered as an aesthetically significant place. Thus, a visual impact is not considered as significant. However, the visual impact associated with the Project will be permanent for those residing at the closest settlements. The residents living in Tütenli Village located in the south of the Project site will see seven turbines that are located on the southern part of the Project site and the turbines situated in the northern part of the Project Site will be seen from İlyaslar Town in the north of the Project site. In addition, there are a number of operating wind power plants located in Manisa Province and one of these wind power plant is located approximately 3.7 km northeast of the Project Site. Therefore, residents of the settlements around the Project Site are familiar with wind farms.
- For shadow flicker effect of the Project, a modeling study is performed in order to estimate the shadow casting areas and to create a shadow model for each of the wind turbines. The modeling results revealed that in realistic case the shadow impact is negligible and it can be stated that the Project will not cause significant shadow flickering on the closest settlements. In addition, blade glint is not expected to be important since the blades will be made of and painted non reflective materials.
- Socio-economic impacts of the Project are also assessed. A public disclosure meeting was held at the closest settlement to the project site, İlyaslar District, with the participation of people from Tütenli Village. There is not a directly affected community as the Project site is located on a rural area. Employment opportunity during construction and operation phases might provide positive socio-economic impact to the Project. Since there are no privately owned lands within the Project, no expropriation will be carried out; therefore, there will be no resettlement. Permits will be taken before the construction phase for the forest areas to be used within the Project in accordance with the Article No. 17/3 (amended by Law No. 5192) of Forestry Law No. 6831.
- Occupational and community health and safety issues are also assessed in the scope of the ESIA study. As a result, it is concluded that potential risks associated with unauthorized access to Project site, increase in traffic, working at height, blade/ice throw risk will be eliminated.
- An environmental management plan, which addresses the impacts, significance of the impacts, mitigation measures, responsible parties, monitoring methods and frequencies and costs, is also prepared for the Project.

The Gökres-2 WF will comply with all relevant Turkish environmental as well as the IFC/WB Guidelines during construction and operation phases. As stated above, potential adverse environmental and social impacts associated with the Project are expected to be generally negligible and will be mitigated fully by Garet Enerji.

1.0 INTRODUCTION

1.1 Background to the Project

Garet Enerji Üretim ve Ticaret A.Ş. (Garet Enerji) plans to develop and operate a wind farm in Akhisar Akhisar and Kırkağaç Districts of Manisa Province in Turkey. The Gökres-2 Wind Farm (the Project) will have 13 turbines each with an installed capacity of 2.75 MW. Thus, the total installed capacity of the plant will be 35 MW. The Project is planned to generate about 122,640,000 kWh of electrical energy annually. The energy will be connected to the existing substation of Soma-B Thermal Power Plant located about 18 km northwest to the wind farm. The characteristics and the route of the Energy Transmission Line (ETL) planned to be constructed within this Project has not been determined yet. A “49-year electric power generation license” (License No EÜ/3683-3/2235, dated February 9, 2012) has been obtained from the Energy Market Regulatory Authority (EMRA) by Garet Enerji for the Project.

According to the Turkish Environmental Impact Assessment (EIA) regulation, an environmental Project Description Report (PDR) was required for the Project. The PDR was prepared and submitted to the Manisa Provincial Directorate of Environment and Urbanization (PDoEU). The PDR was reviewed by the PDoEU and the Project had secured an “EIA is not Required” decision on April 20, 2009, thus a detailed EIA was not prepared for the Project. The Project was revised afterwards (the number and capacity of the turbines were changed), and thus, these changes were declared to the PDoEU and an approval was obtained for these revisions on September 13, 2012.

The Project is being developed in accordance with the National Energy Strategy of the Republic of Turkey that enhances diversifying resources for electricity generation and encourages use of renewable energy. The need for and the objectives of the Project are fully discussed in Section 3.0 of this Environmental and Social Impact Assessment (ESIA) report.

1.2 The Project Owner

The Project owner, Garet Enerji was established on March 29, 2006 to develop and invest in wind energy projects. Application has been submitted to the EMRA for eight wind power projects with a total installed capacity of 220.50 MW. Garet Enerji is a subsidiary of GAMA Enerji A.Ş. (GEAŞ). The shareholders of GEAŞ are GAMA Holding and General Electric Energy Financial Services, each holding 50% stake in the company. GAMA Holding is pursuing activities over a wide geographical area, covering the Middle East, Russia, CIS Countries, South East Asia, North Africa and Ireland for the last 50 years (see, www.gama.com.tr). GE-EFS is a business unit of the General Electric (GE). GEEFS employs 350 professionals to invest in the energy and water sector.

This ESIA report for the Gökres-2 WF has been prepared by AECOM Turkey. AECOM is a global leader in providing fully integrated engineering, design and program management services for a broad range of markets, including architecture, building engineering, design and planning, economics, energy, environment, government services, program management, transportation and

water. With more than 50,000 employees around the world, AECOM, a Fortune 500 firm, serves clients in more than 100 countries (see, www.aecom.com).

1.3 Purpose and Scope of the ESIA

Garet Enerji plans to apply to the Equator Principles Financial Institutions (EPFI) for potential financing. In addition to the Equator Principles, the EPFIs also apply applicable International Finance Corporation – World Bank (IFC/WB) Performance Standards and Guidelines. Therefore, this ESIA has been prepared in accordance with the applicable Turkish regulations, the Equator Principles and IFC/WB Performance Standards and Guidelines.

The purpose of the ESIA is to identify potential environmental and social impacts of the Project to the local ecosystem and community during construction, operation and decommissioning phases of the Project. The ESIA also aims at providing mitigation measures to eliminate or minimize potential adverse impacts and propose a management and monitoring plan. The ESIA evaluates potential impacts in terms of additionally caused by the Project. Thus, an environmental baseline data is also assessed within the scope of the ESIA. The ESIA was carried in the following stages:

- Review of applicable national and international regulations and standards, industry best practice.
- Compilation of a technical description of the Project.
- Description of the existing environmental and socio-economic conditions within the Project area.
- Identification, characterization and quantification of all emissions to air, water and soil during construction, operation and decommissioning phases of the Project.
- Assessment of the environmental and socio-economic impacts of the Project.
- Identification of mitigation measures that minimize or eliminate potential impacts.
- Provision of plans for monitoring programs, auditing and feedback.

The EPFIs use the environmental and social screening criteria of the IFC in order to identify the category of the Project. The Project is categorized as a “Category B” in review of WB/ IFC guidelines.

The ESIA report includes following sections:

1. Executive summary;
2. Policy, legal and administrative framework;
3. Project description;
4. Baseline data;
5. Environmental impact assessment;
6. Analysis of alternatives;

7. Environmental management plan; and
8. Public consultation.

Following issues are addressed in the ESIA:

- a) Assessment of the baseline social and environmental conditions;
- b) Consideration of feasible environmentally and socially preferable alternatives;
- c) Requirements under Turkish laws and regulations, applicable international agreements;
- d) Protection of community health and safety;
- e) Protection of cultural property and heritage;
- f) Protection and conservation of biodiversity, including endangered species and sensitive ecosystems in modified, natural and critical habitats, and identification of legally protected areas;
- g) Use and management of dangerous substances;
- h) Cumulative impacts of existing projects, the Project, and anticipated future projects; and
- i) Consultation and participation of affected parties in the design and review of the project.

2.0 LEGAL FRAMEWORK

2.1 Turkish Environmental Legislation

The Environmental Law (No. 2872), which was published in Turkish Official Gazette No. 18132 dated August 11, 1983 and revised in Turkish Official Gazette No. 26167 dated May 13, 2006 (Law No. 5491) provides the legislative framework for the regulation of industries and their potential impact on the environment. Industrial projects are subject to varying levels of review that begin while projects are in the development and pre-operation phases. Additional regulations apply to facilities once they are in operation.

The Environmental Law authorized the promulgation of a number of regulations. Those that pertain to development and operation of the wind farm projects are the following:

- Management of the Surface Water Quality, Official Gazette No. 28483 dated November 30, 2012;
- Industrial Air Pollution Control Regulation, Official Gazette No. 27277 dated July 3, 2009 and lastly revised in Official Gazette No. 28325 dated June 16, 2012;
- Packaging Waste Control Regulation, Official Gazette No. 28035 dated August 24, 2011;
- Environmental Permit and Licenses Regulation, Official Gazette No. 27214 dated April 29, 2009 and lastly revised in Official Gazette No. 28411 dated September 14, 2012;
- Regulation Related to Workplace Opening and Operation Permits, Official Gazette No. 25902 dated August 10, 2005 and lastly revised in Official Gazette No. 28231 dated March 12, 2012. This regulation supersedes the former “Non-Hygienic Establishments Regulation”;
- Environmental Impact Assessment Regulation, Official Gazette No. 27214 dated July 17, 2008 and lastly revised in Official Gazette No. 27980 dated June 30, 2011;
- Regulation on Assessment and Management of Environmental Noise, Official Gazette No. 27601 dated June 4, 2010 and revised in Official Gazette No. 27917 dated April 27, 2011;
- Water Pollution Control Regulation, Official Gazette No. 25687 dated December 31, 2004 and lastly revised in Official Gazette No. 28257 dated April 7, 2012;
- Regulation on General Principles of Waste Management, Official Gazette No. 26927 dated July 5, 2008;
- Waste Oil Control Regulation, Official Gazette No. 26952 dated July 30, 2008 and revised in Official Gazette No. 27744 dated October 30, 2010;
- Regulation on Protection of Wetlands, Official Gazette No. 25818 dated May 17, 2005 and revised in Official Gazette No. 27684 dated August 26, 2010;

- Regulation on Soil Pollution Control and Contaminated Sites by Point Source, Official Gazette No. 27605 dated June 8, 2010 and revised in Official Gazette No. 28323 dated June 14, 2012;
- Hazardous Wastes Control Regulation, Official Gazette No. 25755 dated March 14, 2005 and lastly revised in Official Gazette No. 27537 dated October 30, 2010;
- Vegetable Waste Oil Control Regulation, Official Gazette No. 25791 dated April 19, 2005 and revised in Official Gazette No. 27537 dated March 30, 2010;
- Medical Waste Control Regulation, Official Gazette No. 25883 dated July 22, 2005 and revised in Official Gazette No. 28131 dated December 3, 2011;
- Waste Batteries and Accumulators Control Regulation, Official Gazette No. 25569 dated August 31, 2004 and revised in Official Gazette No. 27537 dated March 30, 2010;
- Excavation, Construction and Demolition Waste Control Regulation, Official Gazette No. 25406 dated March 18, 2004 and revised in Official Gazette No. 27533 dated March 26, 2010;
- Solid Waste Control Regulation, Official Gazette No. 20814 dated March 14, 1991 and revised in Official Gazette No. 27533 dated March 26, 2010;
- Air Pollution Control Regulation For Heating Sources, Official Gazette No. 25699 dated January 13, 2005 and lastly revised in Official Gazette No. 27475 dated January 27, 2010;
- Air Quality Assessment and Management Regulation, Official Gazette No. 26898 dated June 6, 2008 and revised in Official Gazette No. 27219 and dated May 5, 2009;
- Exhaust Gases Emission Control Regulation, Official Gazette No. 27190 dated April 4, 2009;
- Regulation on the Septic Tanks to be installed where a Sewer System is not Available, Official Gazette No. 13783 dated March 13, 1971;
- Regulation on Inventory and Control of Chemicals, Official Gazette No. 27092 dated December 26, 2008 and revised in Official Gazette No. 27589 and dated May 23, 2010;
- Guideline Concerning the Measures to be Taken at Work Sites and Works Utilizing Explosive, Flammable, Hazardous and Detrimental Materials” Official Gazette No. 14752 dated December 24, 1973;
- Communiqué on Recovery of Some Non-Hazardous Wastes, Official Gazette No. 27967 dated June 17, 2011; and
- Waste Tires Control Regulation, Official Gazette No. 26357 dated November 25, 2006 and revised in Official Gazette No. 27537 and dated March 30, 2010;

In addition to the Environmental Law and its associated regulations, there are several other laws that directly or indirectly include environmental review, and thus, are applicable to the Project. The Project will comply with the 4857 numbered Labor Law and its regulations stated below:

- Occupational Health and Safety Regulation, Official Gazette No. 25311 dated December 9, 2003;
- Health and Safety Regulation for Construction Works, Official Gazette No. 25325 dated December 23, 2003; and
- Occupational Health and Safety Statute, Official Gazette No. 14765 dated April 11, 1974.

Other regulations that the Project will comply with can be listed as follows:

- 5346 numbered Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy;
- 2863 numbered Law on Protection of Cultural and Natural Heritage (revised by 5226 numbered Law);
- 6831 numbered Forestry Law (amended by 5192 numbered Revision in Forestry Law);
- Regulation on Buildings located on the Disaster Areas, Official Gazette No. 26582 dated July 14, 2007;
- Regulation on the Buildings to be Constructed in Earthquake Zones, Official Gazette No. 26454 and dated February 6, 2007; and
- 167 numbered Groundwater Law.

The following sections provide brief explanation of the regulations that are relevant to the proposed Gökres-2 WF.

2.1.1 Environmental Impact Assessment

The first Environmental Impact Assessment (EIA) Regulation was published in Official Gazette No. 21489 dated February 7, 1993. The EIA regulation was subsequently revised three times and reissued in Official Gazette on June 23, 1997, June 6, 2002, and December 16, 2003. The final version of EIA regulation was published on July 17, 2008 in Official Gazette No. 26939. The EIA Regulation was revised lastly in Official Gazette No. 27980 dated June 30, 2011. The purpose of the EIA regulation is to define the administrative and technical aspects that must be followed during an environmental impact assessment process.

The scope of the EIA regulation includes the following:

- Determination of the type of projects required to prepare an environmental impact assessment report or a project description report and the issues to be covered in these applications or reports;
- The technical, administrative and legal aspects related to the environmental impact assessment process;
- The work related to the establishment of the Scope Definition, Review and Evaluation Committee; and

- Monitoring and auditing of the projects subject to this regulation, prior to the commissioning phase, during the operational phase and the decommissioning phase.

According to Article 6 of the EIA regulation, projects should either submit an Environmental Impact Assessment (EIA) Report or Project Description Report (PDR) based on the classification of the projects listed in Annex I and Annex II of the EIA regulation. Annex I and Annex II define the type and projects that are subject to preparing and submitting an EIA Report and PDR, respectively.

The projects that are listed in Annex II should prepare a PDR and apply to the Provincial Directorate of Environment and Urbanization by submitting a report that includes a project description and information according to the format given in the Annex IV of EIA Regulation. The Directorate reviews the report in 5 days and may ask for detailed information on the project or request analysis or measurements in the project area. The Directorate gives a final decision in as “EIA is not required” or “EIA is required” for the project after the submission of the final Project Description Report.

An “EIA is not required” decision means that the project does not need to prepare and submit a detailed EIA report to the MoEU. The project can obtain other permits as required by the relevant Turkish regulations. An “EIA is required” decision means that the EIA procedures outlined in the EIA regulation should be followed to prepare a detailed EIA report and to obtain an approval for the project from the MoEU.

The wind farm projects with a capacity of 10 MW and up to 75 MW are included in Annex II, projects with a capacity of 75 MW and higher are included in Annex I of the EIA Regulation. During the EIA process of Gökres-2 WF in 2009, all wind farm projects were included in Annex II of EIA regulation, therefore a PDR was prepared and submitted to the Manisa PDoEU for development consent. As a result, Garet Enerji has obtained an “EIA is not Required” decision for the Project from the Manisa PDoEU on April 20, 2009.

2.1.2 Air Quality

Industrial Air Pollution Control Regulation (IAPCR) was published in the Official Gazette No. 25606 on October 7, 2004 and revised and re-issued in Official Gazette No. 26236 dated July 22, 2006. This regulation was abolished by a new Industrial Air Pollution Regulation published in the Official Gazette No. 27277 dated July 3, 2009 and the regulation was revised lastly in Official Gazette No. 28263 dated June 16, 2012. Similar to previous regulation, the purpose of the new IAPCR is to control soot, fume, dust, gas, vapor, and aerosols emitted to the atmosphere resulting from the activities of industrial and energy production facilities, to protect and prevent the environment and human beings from atmospheric pollution hazards, to eliminate adverse impacts due to air pollution which cause harm to the general public and to ensure that such impacts do not emerge.

Air Quality Assessment and Management Regulation (AQAMR) was published in the Official Gazette No. 26898 on June 6, 2008. The regulation amended and re-issued in Official Gazette No. 27219 and dated May 5, 2009. The purpose of the AQAMR is to define and establish objectives for

ambient air quality designed to prevent or reduce harmful effects on human health and the environment, to assess the ambient air quality on the basis of common methods and criteria, to maintain air quality where it is good and improve it in other cases and to obtain adequate information on ambient air quality and ensure that the such information on ambient air quality is available to the public.

Air Pollution Control Regulation for Heating Sources (APCRH) was published in the Official Gazette No. 25699 dated January 13, 2005. The regulation was revised lastly in Official Gazette No. 27475 dated January 27, 2010. The purpose of the APCRH is to reduce and control harmful effects of soot, fume, dust, gas, vapor, and aerosols emitted to the atmosphere resulting from the heating sources used in places such as residences, schools, universities, hospitals, offices, social facilities and industrial facilities.

Exhaust Gases Emission Control Regulation (EGECR) was published in the Official Gazette No. 27190 dated April 04, 2009 and supersedes the Regulation on Control of Exhaust Emissions of Motorized Vehicles published in the Official Gazette No. 25869 dated August 7, 2005. The purpose of the EGECR is to determine the necessary methods and principles regarding reduction of the exhaust gas pollutants and control of the pollutants via measurements to protect the living organisms and environment from the air pollution and its effects of exhaust emission caused by the motorized vehicles in traffic. This regulation does not cover the construction vehicles.

The Gökres-2 WF will generate fugitive dust emission due to excavation works, exhaust emissions due to heavy construction vehicles during the construction phase. The Project will not have any point or fugitive emission and heating source emissions during operation other than an emergency diesel generator.

Emission Limits

The IAPCR defines emission limits according to the industrial activity and the type of combustion unit and the fuel used. The regulation sets emission limits for the following pollutants: sulfur dioxide (SO₂), nitrogen oxides (NO and NO₂), particulate matter (PM), carbon monoxide (CO), formaldehyde and hydrogen sulfur (H₂S).

The Project will not generate any emission due to its operation. As indicated above, air emissions are generated only during the construction phase. In accordance with the IAPCR, monthly average settled dust amount generated due to loading, unloading, sieving, transporting, crushing and milling activities of particulates should not exceed 450 mg/m².day. There is no limit value defined for the exhaust emissions of heavy construction vehicles in the Turkish Environmental Legislation.

Ambient Air Quality

Air Quality Assessment and Management Regulation defines ambient air quality limits for two regulatory periods. The first period is transitional period which is until December 31, 2013. The transitional period ambient air quality standards are given in Annex-IA of AQAMR. Limit values for ambient air quality standards after transitional period are given in Annex I of AQAMR. Wind power generation is a non-combustion process that relies on the direct conversion of mechanical energy

into electrical energy and no air emission will be generated due to operation of the plant and thus the Project will not have any impact on the local ambient air quality. The emission generated in the construction phase will be temporary and is expected to have minor effect on the local ambient air quality.

2.1.3 Wastewater

Water Pollution Control Regulation (WPCR) was published in Official Gazette No. 25687, dated December 31, 2004 and lastly revised in Official Gazette No. 28257 dated April 7, 2012. The aim of the WPCR is to determine the necessary legal and technical principles in order to protect surface and groundwater resources, provide sustainable water use and prevent water pollution in harmony with sustainable development objectives.

The WPCR covers water quality classes and utilization purposes, planning principles and prohibitions concerning protection of water quality, wastewater discharge principles and discharge permits, applications in wastewater infrastructure facilities and monitoring and auditing principles in order to prevent water pollution. Industries are categorized according to their sectors in the WPCR. The WPCR presents “sector-specific” discharge limits for numerous types of wastewater discharges. The WPCR also sets the discharge limits for domestic wastewaters according to pollution load.

For facilities located in an area where sewer system is not available and having a population less than 84 employees, the WPCR allows the construction of an impervious septic tank or basin for disposal of domestic wastewaters. The Project is located in an area where a sewerage system is not available. In case the population is less than 84 employees, wastewater to be generated from the Project should be collected into a septic tank, pumped out with a vacuum truck and should be transported to a wastewater infrastructure system/wastewater treatment plant. In addition, the wastewater generators should keep the protocol with Wastewater Administration and the receipts of disposal of wastewater by vacuum truck for five years and declare them to the officials during audits. If the population exceeds 84 employees, wastewater to be generated from the Project should be collected and sent to the package treatment plant which should be constructed in the project area. After the treatment process, domestic wastewater should be sent to a receiving environment. Discharge limits for the domestic wastewater discharge to a receiving environment are given in Table 2-1 below. The Project should comply with the below mentioned limits given in the WPCR.

Table 2-1 Domestic Wastewater Discharge Limits to Receiving Environment

WPCR Table 21.1 Domestic Wastewater (BOD load 5-120 kg/day; Population 84-2000)			
Parameter	Unit	Composite Sample (2 hr)	Composite Sample (24 hr)
BOD	mg/l	50	45
COD	mg/l	180	120
TSS	mg/l	70	45
pH	-	6-9	6-9

The Project will not generate industrial wastewater. Only domestic wastewater will be produced during the construction and operation phases.

2.1.4 Soil Pollution

Regulation on Soil Pollution Control and Contaminated Sites by Point Source was published in Official Gazette 27605 dated June 8, 2010 and revised in Official Gazette No. 28323 dated June 14, 2012. This Regulation superseded the previous Soil Pollution Control Regulation. The purpose of the Regulation is to prevent soil pollution and to undertake required measures to clean up soil contamination.

In accordance with the Regulation, necessary precautions are taken to prevent soil pollution in the facilities where hazardous materials used, stored and produced. In case, there will be a pollution the polluter is obliged to determine the extent of the pollution and pay for remediation activities. The regulation has a number of technical appendices that describe the methods for subsoil investigation and remediation. This regulation also allows a health risk based approach for remediation management.

The Project should comply with the regulation during the construction and operation phases.

2.1.5 Noise

Regulation on Assessment and Management of Environmental Noise (RAMEN) was published in Official Gazette No. 26809 dated March 7, 2008 and re-issued in Official Gazette No. 27601 dated June 4, 2010 and revised in Official Gazette No. 27917 dated April 27, 2011. The purpose of the RAMEN is to take necessary precautions in order to prevent the disturbance of the comfort and tranquility of public and ensure physical and mental health of human beings due to exposure to environmental noise.

The facilities that should secure noise control permit are listed in **Environmental Permit and Licenses Regulation**. The wind farm projects are not included in this list. Thus, the Project is not obliged to secure a noise control permit. However, the Project must prepare environmental noise assessment reports during “workplace opening and operation permitting” phase of and/or during programmed, not programmed or complaint basis audits if the competent authority requests.

The Project site is located in the rural area. RAMEN sets the limits on noise levels generated from the construction sites and perceived by the receptors. The limits depending on the type of the construction activity are given in Table 2-2. The Project should comply with these limits during construction phase.

Table 2-2 Noise Limits for Construction Sites

Type of Activity (construction, demolition, restoration)	Lday (dBA)
Building	70
Road	75
Other Resources	70

Various equipment and machinery will be used during the construction phase of the Project. Thus, the Project should also comply with the limits stated in the Regulation on Noise Emission by Outdoor Equipment which was published in the Official Gazette No. 26392 dated December 30, 2006.

For the operation phase of the facilities, RAMEN also sets the noise level criteria (for night, day and evening periods) for the industrial facilities categorized into four groups according to sensitivity of the area. The Project is subject to limits given in the category which is referred to as “areas with both noise sensitive areas and industrial activities (predominantly residential)”. The corresponding limits are given in Table 2-3. Thus, the Project should not exceed these limits during operation phase.

Table 2-3 Turkish Noise Level Limits for Industrial Facilities

Areas	L _{day} (dBA)	L _{evening} (dBA)	L _{night} (dBA)
Noise sensitive areas such as place of education, cultural activities, health center and summer resorts and camping sites	60	55	50
Areas with both noise sensitive areas and industrial activities (predominantly residential)	65	60	55
Areas with both noise sensitive areas and industrial activities (predominantly industrial)	68	63	58
For each facilities that are in organized industrial zone or industrial region	70	65	60

In accordance with Article 23(1)-b of the RAMEN, the construction activities within residential areas and in the close vicinity cannot be carried out during evenings and nighttime except daytime period (07:00-19:00). Also Article 23(1)-ç of this regulation states that construction activities of dam, bridge, conduit, highway, local highway, housing and similar projects requiring public interest, could be performed during the evening and night time provided that the noise limit for evening time is 5 dBA lower than day time noise limit stated in Table 5 of RAMEN (which is 70 dBA) and noise limit for night time is 10 dBA lower than the same day time noise limit given in the regulation. In this case the activities can only be carried out with an official decision of the Provincial Local Environmental Board.

In addition, information related to starting and finishing dates and working durations of the construction and the permits obtained from municipalities should be displayed on a signboard that can easily be seen by everyone.

2.1.6 Waste

Regulation on General Principles of Waste Management was published in Official Gazette No 26927 dated on June 5, 2008. The purpose of the regulation is to provide waste management without causing harm to the environment and human health.

It is indicated in Article 5 of the Regulation that waste generators are obliged to decrease the amount of waste and its hazardous properties, utilize methods for separation, collection, transportation, recycling and disposal operations that will not cause a risk for water, air, soil, flora and fauna. In addition, according to Article 11 of the Regulation, the waste generating facilities should record the waste quantity, source, type and the corresponding waste code given in the annex part of this regulation, disposal facility the waste was sent and applied processes and keep the records for at least five years; submit them to the Ministry on periods determined by Ministry; and make them accessible for the inspection of Ministry.

The regulation also includes the list of hazardous and non-hazardous wastes and their waste codes, their way of recycling and disposal methods and properties of hazardous wastes. The Project must comply with the Regulation on General Principles of Waste Management.

2.1.6.1 Solid Waste

Solid Waste Control Regulation (SWCR) was published in Official Gazette No. 20814 dated March 14, 1991 and lastly revised in Official Gazette No. 27533 dated March 26, 2010. The aim of the SWCR is to prohibit the disposal of any kinds of wastes and residues to receiving bodies directly or indirectly in a manner harmful for the environment. In addition, the storage, transportation and removal of the waste should be conducted such that damages of pollutants which make permanent effects in air, water, earth and on animals, plants, natural resources and ecological balance should be prevented.

In accordance with Article 4 of the SWCR, facilities generating solid wastes are liable to choose the technology generating the least quantity of solid waste, to reduce the amount of solid waste quantity of the existing production, to eliminate harmful materials from the solid wastes and participate in and contribute to the efforts of recycling of materials.

According to Article 8 of SWCR, domestic solid wastes and the used batteries, used accumulators, medical wastes, used vehicle tires, packaging wastes and recyclables wastes should be disposed of separately. In addition, it is also indicated that disposal of solid wastes by waste generating or transporting parties to seas, lakes and similar receiving environments, streets, forests and other places where environment would be adversely affected is prohibited.

According to the SWCR, facilities generating domestic wastes and industrial sources with domestic wastes are required to collect their solid wastes in the facilities where they are produced, as required by the municipalities. Within the municipality boundaries, the municipality is responsible for providing collection services and the disposal of domestic waste from industrial sources. However, industrial facilities out of municipal borders are responsible for transportation of their wastes. The generators are obliged to keep the garbage containers closed in such manner not to cause any harm to the environment and to make them ready on the street at the time of collection of garbage.

Excavation, Construction and Demolition Wastes

Excavation, Construction and Demolition Waste Control Regulation was published in Official Gazette No. 25406 dated March 18, 2004 and revised in Official Gazette No.27533 dated March 26, 2010. The aim of this regulation is to set the principles and procedures firstly to minimize the excavation, construction and demolition wastes at the source of generation and to collect, temporarily store, transfer, recycle, reuse and dispose them in a manner not to cause harm to the environment.

In accordance with Article 9 of the regulation, excavation, construction and demolition generating facilities are obliged to provide the waste management in a way that will minimize the adverse effects of wastes on the environment and human health. The facilities must acquire the necessary permissions that concern the generation, transportation and storage operations of the wastes. The facilities are not allowed to dump construction wastes to the sites/locations and facilities other than the permitted ones by the municipal or other authorities.

The regulation also stipulates that the project owner is responsible for having precautions in order to minimize noise or visual impacts and dust emissions during removal of excavation soil and for closing the sides of the operation area. In addition, planning should be done in a way that the amount of excavation soil is equalized to the filling volume and excavation soils are utilized within the operation area.

Packaging Wastes

Packaging Waste Control Regulation (PWCR) was published in the Official Gazette No. 26562 dated June 24, 2007. This regulation was abolished by a new Packaging Waste Control Regulation published in Official Gazette No.28035 dated August 24, 2011. The aim of the PWCR is to provide production of packages with certain environmental criteria, requirements and characteristics; to prevent direct and indirect release of package wastes causing environmental damage; to prevent formation of package wastes; and to reduce the amount of those, which cannot be prevented, by means of reuse, recycling and recovery methods.

Article 26 of PWCR states that the package wastes should be collected and stored separately from the other wastes at source in order to ensure their disposal without causing any environmental damage; to reduce environmental pollution; to benefit from the landfills at maximum levels; and to contribute to the economy. Packaging waste generating parties located in the boundaries of districts which conduct separate collection at source is obliged to deliver the packaging wastes to the responsible municipalities or their contracted and licensed collection/separation entities.

The Project should comply with the Solid Waste Control Regulation, the Excavation, Construction and Demolition Waste Control Regulation and the Packaging Waste Control Regulation during the construction and operation phases.

2.1.6.2 Hazardous Waste

Hazardous Wastes Control Regulation (HWCR) was published in Official Gazette No. 25755 dated March 14, 2005 and lastly revised in Official Gazette No. 27537 dated October 30, 2010. The purpose of the HWCR is to prevent direct and indirect disposal of hazardous wastes in a manner that can adversely affect human health and the environment; control the production of and transportation of hazardous wastes; minimize production of hazardous wastes at the source and specify that disposal of hazardous wastes be at the closest appropriate location to the site of generation. The regulation aims to determine the principles and procedures in order to provide the management of solid wastes in conformity with the environment from the generation phase until the final disposal phase.

According to Article 9 of HWCR, the hazardous waste producers are obliged to take the required precautions in order to minimize hazardous waste generation; to provide waste management in a way that minimizes the adverse affects of wastes on human health and environment; to prepare 3-year waste management plan within six months from the issue date of this Regulation and obtain approval from the Governorate; to record the hazardous wastes generated; to fill in the waste declaration form by using the web based program prepared by the Ministry of Environment and Urbanization with including the information belonging to the previous year until the end of March, approve, print out and keep it for five years; to provide proper packaging and labeling; and to dispose and transfer the hazardous wastes in conformity with the principles stated in the regulation.

According to HWCR, facilities are required to secure a permit from local Governorate in case of temporary onsite storage of their wastes. However, facilities producing less than 1,000 kg/month of hazardous wastes may store these waste temporarily onsite for up to 180 days without obtaining a permit from the local Governorate. In this situation, the total amount of the collected waste must not exceed 6,000 kg at any time.

In case of temporary onsite storage of hazardous wastes, the hazardous wastes should be stored in containers that are non-damaged, leak-proof, safe and appropriate for the international standards, on concrete place within the land of the facility, away from the plants and buildings. "Hazardous waste" label should be placed on the containers and this label should also indicate the amount of stored waste as well as the storage time of the hazardous waste. In case the containers are damaged, wastes should be transferred to the other containers with the same properties. Containers should be kept closed and wastes should be stored in a way that they will not go in chemical reactions.

Transportation of the wastes should be done by the licensed persons and entities with appropriate vehicles for the properties of the transported waste. The vehicles that are used to transport hazardous wastes should carry a waste transport form as specified in the regulation. The HWCR also contains a list of hazardous materials, their properties and their way of disposal.

Battery and Accumulator Wastes

Waste Batteries and Accumulators Control Regulation was published in Official Gazette No. 25569 dated August 31, 2004 and lastly amended in Official Gazette No. 27537 dated March 30, 2010. The purpose of this Regulation is to arrange legal and technical principles to determine principles, policies and programs for used batteries and accumulators from their production to their final disposal; to ensure production of batteries and/or accumulators with certain criteria and basic conditions and characteristics in terms of the environment; to prevent the discharge to the receiving environment directly or indirectly damaging human health and the environment; to ensure technical and administrative standards necessary in their management; to establish a collecting system for the recovery and final disposal of used batteries and accumulators and compose a management plan.

According to Article 13 of the Waste Batteries and Accumulators Control Regulation the battery and accumulator consumers are obliged to collect used batteries separately from household wastes, and deliver used batteries to the collection points to be established by enterprises engaged in the distribution and sales of battery products, or by municipalities; to deliver the old accumulator when replacing their vehicles' accumulators to the temporary storage places established by the enterprises engaged in the distribution and sale of accumulator products and enterprises operating vehicle maintenance/repair sites free of charge; and pay a deposit if a new accumulator is to be purchased when delivering the old one and not to keep accumulators of benches, facilities, forklift, tractors and other motor vehicles, power supplies and transformers used in the production processes of consumer industrial facilities after the accumulators become a waste longer than 90 days on impervious ground within the factory site until they are delivered to the producer. The Article 15 of the Regulation stipulates that the transportation of waste accumulators from the point of collection to the temporary storage or to the disposal facility by the highway should be carried out using an appropriate vehicle according to the type of waste by real and legal entities who have obtained a transportation license from the Governorate.

Some minor amount of hazardous waste will be generated during construction and operation of the Project. The Project must comply with the requirements of the Hazardous Wastes Control Regulation and the Waste Batteries and Accumulators Control Regulation during construction and operation phases.

2.1.6.3 Waste Oil

Waste Oil Control Regulation (WOCR) was published in the Official Gazette No. 26952 dated June 30, 2008 and lastly revised in Official Gazette No. 27744 dated October 30, 2010. The purpose of the WOCR is to prevent direct and indirect disposal of waste oils to receiving environment; to ensure temporary storage, transportation and disposal thereof without causing harm to environment and human health; to set up necessary technical and administrative standards in management of waste oils; to determine the required principles and programs in order to establish temporarily storage, handling and disposal facilities and manage these facilities in an environmental friendly manner.

According to Article 9 of WOCR, waste oil producers are obliged to take required measures to minimize the generation of waste oils including waste motor oils and residues resulting from processing of waste oils. Waste oil producers must conduct waste oils analyses once at licensed laboratories in case there is no change in the oil type used, and declare to the Ministry of Environment and Urbanization. The waste oils of different category should not be mixed with each other, PCB and other hazardous wastes. The waste producers must obey the conditions of Hazardous Waste Control Regulation for disposal and for transporting waste oils by licensed transporters to the licensed processing and disposal facilities. The National Waste Transportation Form in the case of transporting the waste oil out of the facility and waste oil declaration form annually must be prepared and submitted to the competent authority before the end of February. All records including waste oil declaration forms, analyses report and national waste transportation form should be kept for at least five years.

Waste oil should be collected in tanks/containers placed on a impermeable ground whose thickness is at least 25 cm and covered by epoxy, geomembrane and similar insulation materials and waste accumulation areas should be protected from the rain. Furthermore it is required to store waste oils in red colored tanks/ containers with a label of "Atık Yağ" ("Waste Oil") on it. Waste oils of different categories should not be mixed with each other. Any foreign substance like water, gasoline, fuel-oil, dye, detergent, solvent, antifreeze and diesel oil should not be mixed with the oil in these tanks/containers.

The Project should comply with the requirements stated in the Waste Oil Control Regulation.

2.1.6.4 Medical Wastes

Medical Waste Control Regulation (MWCR) was published in Official Gazette No. 25883 dated July 22, 2005 and revised in Official Gazette No. 28131 dated December 3, 2011. The purpose of the MWCR is to establish principles, policies, and programs along with legal, administrative, and technical fundamentals to prevent direct or indirect discharge of medical waste into receiving environment in any way that could harm the environment or human health. The Regulation also requires that medical waste must be collected separately at source and be transported, temporarily stored and disposed of without causing harm to environment or human health.

The Project should comply with the Medical Waste Control Regulation during the construction and operation phases.

2.2 International Conventions Adopted by Turkey

Turkey signed many international conventions and agreements to protect its environment and biodiversity. Potential related international conventions with the Project are the following:

- Convention on Biological Diversity, approved by 4177 numbered Law dated August 29, 1996 and published in the Official gazette No. 22860 and dated December 27, 1996, Ratified 1997;

- Convention on the International Trade in Endangered Species of Wild Flora and Fauna (CITES), published in the Official Gazette No.22672 and dated June 20, 1996, Ratified 1996;
- Convention on The Conservation Of European Wildlife And Natural Habitats (Bern), published in the Official Gazette No. 18318 and dated February 20, 1984, Ratified 1984;
- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar), published in the Official Gazette No. 21937 and dated May 17, 1994, Ratified 1994;
- International Convention For the Protection of Birds, published in the Official Gazette No. 12480 and dated December 17, 1966, Ratified 1967; and
- Convention Concerning the Protection of the World Cultural and Natural Heritage published in the Official Gazette No. 17959 and dated February 14, 1983.

The Project should comply with the relevant provisions of conventions mentioned above.

2.3 Equator Principles

The Project is assessed in accordance with the Equator Principles. The “Equator Principles” is a financial industry benchmark for determining, assessing and managing social and environmental risk in project financing. The Principles apply to all new project financings globally with total project capital costs of US\$10 million or more, and across all industry sectors.

The Equator Principles (2006) that are adopted by the Equator Principles Financial Institutions (EPFIs) are listed below:

➤ Principle 1: Review and Categorization

The project is categorized based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of the International Finance Corporation (IFC).

➤ Principle 2: Social and Environmental Assessment

A Social and Environmental Assessment is prepared to address the relevant social and environmental impacts and risks of the Project. The Assessment should also propose mitigation and management measures relevant and appropriate to the nature and scale of the Project.

➤ Principle 3: Applicable Social and Environmental Standards

The Social and Environmental Assessment refers to the applicable IFC Performance Standards and the applicable IFC Industry Specific EHS Guidelines.

➤ Principle 4: Action Plan and Management System

The Action Plan describes and prioritizes the actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to manage the impacts and risks identified in the Social and Environmental Assessment. Borrowers establish a Social and

Environmental Management System that addresses the management of these impacts, risks, and corrective actions required to comply with applicable host country social and environmental laws and regulations, and requirements of the applicable IFC Performance Standards and EHS Guidelines, as defined in the Action Plan.

➤ **Principle 5: Consultation and Disclosure**

Project affected communities are consulted with in a structured and culturally appropriate manner. For projects with significant adverse impacts on affected communities, the process ensures their free, prior and informed consultation.

➤ **Principle 6: Grievance Mechanism**

Grievance mechanism allows the borrower to receive and facilitate resolution of concerns and grievances about the project's social and environmental performance raised by individuals or groups from among project-affected communities.

➤ **Principle 7: Independent Review**

For all Category A projects and, as appropriate, for Category B projects, an independent social or environmental expert not directly associated with the borrower reviews the Assessment, Action Plan and consultation process documentation in order to assist EPFI's due diligence, and assess Equator Principles compliance.

➤ **Principle 8: Covenants**

For Category A and B projects, the borrower covenants in financing documentation; a) to comply with all relevant host country social and environmental laws, regulations and permits in all material respects, b) to comply with the Action Plan during the construction and operation of the project in all material respects, c) to provide periodic reports in a format agreed with EPFIs, d) to decommission the facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan.

➤ **Principle 9: Independent Monitoring and Reporting**

For all Category A projects, and as appropriate, for Category B projects, in order to ensure ongoing monitoring and reporting over the life of the loan, EPFIs require appointment of an independent environmental and/or social expert, or require that the borrower retain qualified and experienced external experts to verify its monitoring information which would be shared with EPFIs.

➤ **Principle 10: EPFI Reporting**

Each EPFI adopting the Equator Principles commits to report publicly at least annually about its Equator Principles implementation processes and experience, taking into account appropriate confidentiality considerations

The Equator Principles are based on the IFCs Environmental and Social Safeguard Policies. Thus, the IFC/World Bank environmental, health and safety guidelines are described in the following section.

2.4 IFC/World Bank Group Environmental, Health, and Safety Guidelines

The Project is assessed in accordance with the IFC guidelines, performance standards and their related guidance notes, and manuals related to environmental, social, health and safety issues. The documents that guided the ESA study are listed in the following sections.

Guidelines:

- IFC/WB Environmental, Health, and Safety General Guidelines (2007),
- IFC/WB Environmental, Health, and Safety Guidelines for Wind Energy (2007); and
- IFC/WB Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution (2007).

The IFC/WB EHS Guidelines for wind energy defines the environmental issues specific to the operation of wind energy projects and facilities as visual impacts, noise, species mortality or injury and disturbance, light and illumination issues, habitat alteration and water quality. The Guidelines state that wind energy facilities do not normally generate process emissions and effluents during their operation and it also emphasizes that guideline values for process emissions and effluents in this sector are indicative of good international industry practice as reflected in relevant standards of countries with recognized regulatory frameworks.

The IFC/WB EHS Guidelines for electric power transmission and distribution explain the environmental issues specific to the construction phase as terrestrial habitat alteration, aquatic habitat alteration, electric and magnetic fields, hazardous materials.

Air emissions, wastewater discharges, and solid wastes related to construction and decommissioning activities for the project are evaluated in accordance with the EHS General Guidelines.

The Guidelines also addresses the occupational and community health and safety hazards during the construction, operation, and decommissioning of wind energy conversion projects which are generally similar to those of most large industrial facilities and infrastructure projects. The occupational health and safety hazards may include physical hazards such as working at heights, working in confined spaces, working with rotating machinery, and falling objects. According to the guidelines occupational health and safety hazard specific to onshore wind energy facilities is working at heights. Whereas the major community health and safety hazards are aircraft safety, blade and ice throw, electromagnetic interference and radiation and public access.

Performance Standards:

- IFC Performance Standards on Environmental and Social Sustainability (2012),
 - Performance Standard 1 – Assessment and Management of Environmental and Social Risks and Impacts
 - Performance Standard 2 - Labor and Working Conditions

- Performance Standard 3 – Resource Efficiency and Pollution Prevention
 - Performance Standard 4 - Community Health, Safety and Security
 - Performance Standard 5 - Land Acquisition and Involuntary Resettlement
 - Performance Standard 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources
 - Performance Standard 7 - Indigenous Peoples
 - Performance Standard 8 - Cultural Heritage
- IFC Guidance Notes: Performance Standards on Environmental and Social Sustainability (2012).

IFC's Performance Standards and related guidance notes were followed in the ESIA. The overall content of the ESIA is formulated in accordance with the Guidance Note on Performance Standard 1. Guidance notes for Performance Standard 2 to 8 were addressed when applicable. Performance Standard 7 is not applicable to the Project.

Operational Manuals:

- Operational Manual OP 4.01 – Environmental Assessment (1999).

The Operational Manual and Annex A, Annex B and Annex C of the Manual are followed in the ESIA.

In general, content of the ESIA was in accordance with the “IFC Environmental, Health, and Safety Guidelines for Wind Energy” (IFC, 2007a). Additionally, “IFC Environmental, Health, and Safety General Guidelines” (IFC, 2007b) are also followed in the ESIA. Following sections provide a brief explanation of the IFC's General EHS Guidelines.

2.4.1 Noise

Wind turbines produce noise when operating. The noise is generated primarily from mechanical and aerodynamic sources. The Noise Guidelines addresses the impacts of noise beyond the property boundary of the facilities. According to the Guidelines, noise impacts should not exceed the levels presented in Table 2-4 below, or result in a maximum increase in background levels of 3 dBA at the noise sensitive receptor location off-site.

Table 2-4 Noise Limits

Receptor	One Hour L_{Aeq} (dBA)	
	Day Time (07:00-22:00)	Night Time (22:00-07:00)
Residential; Institutional; Educational	55	45
Industrial, Commercial	70	70

Measures to prevent and control noise are mainly related to engineering design standards. For example, broadband noise is generated by air turbulence behind the blades and increases with increasing blade rotational speed. This noise may be controlled through the use of variable speed turbines or pitched blades to lower the rotational speed.

Additional recommended noise management measures by IFC/WB include:

- Proper siting of wind farms to avoid locations in close proximity to sensitive noise receptors (e.g. residences, hospitals, and schools);
- Adherence to national or international acoustic design standards for wind turbines (e.g. International Energy Agency, International Electrotechnical Commission [IEC], and the American National Standards Institute).

2.4.2 Air Emissions and Ambient Air Quality

The projects should avoid, minimize, and control adverse impacts to human health, safety and the environment from emissions to air. If this is not possible the generation and release of emissions should be managed through a combination of energy use efficiency, process modification, selection of fuels or other materials that may result in less polluting emissions, application of emission control techniques.

According to the General EHS Guidelines, projects with significant sources of air emissions and potential for significant impacts to ambient air quality should prevent or minimize these impacts. In this respect, the emissions of the projects should not result in pollution concentrations that reach or exceed relevant ambient air quality guidelines and standards by applying national legislated standards or in their absence, the current WHO Air Quality Guidelines or other internationally recognized sources. In addition, the emissions should not contribute a significant portion to the attainment of relevant ambient air quality guidelines and standards.

Wind farm projects are superior amongst other energy production plants in terms of release of emissions. The Project is not expected to have a significant effect on air quality and any degradation in the existing ambient air quality and airshed.

2.4.3 Wastewater and Ambient Water Quality

The IFC/WB Wastewater and Ambient Water Quality Guidelines are applicable to projects that have both direct or indirect discharge of process wastewater or wastewater from utility operations to the environment and industrial discharges to sanitary sewers that discharge to the environment without any treatment. The guideline provides information on common techniques for wastewater management, water conservation, and reuse that can be applied to a wide range of industry sectors. According to the guidelines the projects with the potential to generate process wastewater, sanitary (domestic) sewage, or storm water should incorporate the necessary precautions to avoid, minimize, and control adverse impacts to human health, safety, or the environment.

In accordance with the guidelines, the septic systems should be properly designed and installed in accordance with local regulations and guidance to prevent any hazard to public health or contamination of land, surface or groundwater, well maintained to allow effective operation, installed in areas with sufficient soil percolation for the design wastewater loading rate, installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters.

The guidelines also state that if sewage from the industrial facility is to be discharged to a septic system, treatment to meet applicable national or local standards for sanitary wastewater discharges is required.

2.4.4 Hazardous Materials

The Hazardous Material Management guidelines apply to projects that use, store, or handle any quantity of hazardous materials, defined as materials that represent a risk to human health, property, or the environment due to their physical or chemical characteristics. Hazardous materials can be classified according to the hazard as explosives; compressed gases, including toxic or flammable gases; flammable liquids; flammable solids; oxidizing substances; toxic materials; radioactive material; and corrosive substances.

According to the guidelines the overall objective of hazardous materials management is to avoid or, when avoidance is not feasible, minimize uncontrolled releases of hazardous materials or accidents (including explosion and fire) during their production, handling, storage and use. Projects which manufacture, handle, use, or store hazardous materials should establish management programs that are commensurate with the potential risks present. The main objectives of projects involving hazardous materials should be the protection of the workforce and the prevention and control of releases and accidents. These objectives should be addressed by integrating prevention and control measures, management actions, and procedures into day-to-day business activities.

The guidelines also address preventive measures for hazardous materials transfer. It states that uncontrolled releases of hazardous materials may result from small cumulative events, or from more significant equipment failure associated with events such as manual or mechanical transfer between storage systems or process equipment. It is recommended to use dedicated fittings, pipes, and hoses specific to materials in tanks and maintaining procedures to prevent addition of hazardous materials to incorrect tanks, to use of transfer equipment that is compatible and suitable for the characteristics of the materials transferred and designed to ensure safe transfer, to regular inspect, maintain and repair of fittings, pipes and hoses, to use secondary containment, drip trays or other overflow and drip containment measures for hazardous materials containers at connection points or other possible overflow points.

There will be a minor amount of hazardous material stored and used during construction and operation of the Project. The Project will comply with the requirements of the Hazardous Materials Management Guidelines.

2.4.5 Waste Management

Waste Management Guidelines apply to projects that generate, store, or handle any quantity of waste across a range of industry sectors. It emphasizes that the facilities should establish a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes, avoid or minimize the generation waste materials as far as practicable, recover or reuse waste where waste generation cannot be avoided, treat, destroy and dispose wastes in an environmentally sound manner where waste cannot be recovered or reused.

The guidelines stipulate that the facilities that generate waste should characterize their waste according to composition, source, types of wastes produced, generation rates, or according to local regulatory requirements. It also requires that the processes of the facilities should be designed and operated to prevent, or minimize, the quantities of wastes generated and hazards associated with the wastes generated. It is also essential to implement recycling plans in order to reduce the total amount of waste. If waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, waste materials should be treated and disposed of and all measures should be taken to avoid potential impacts to human health and the environment.

Solid (non-hazardous) Wastes

According to the guidelines solid wastes generally include any garbage, refuse. Examples of such waste include domestic trash and garbage; inert construction / demolition materials; refuse, such as metal scrap and empty containers (except those previously used to contain hazardous materials which should, in principle, be managed as a hazardous waste).

Very small amount of solid waste will be generated throughout the construction and operational phases of the Project. They will be managed with the provisions stated in the guidelines.

Hazardous Wastes

According to the guidelines hazardous wastes share the properties of a hazardous material (e.g. ignitability, corrosivity, reactivity, or toxicity), or other physical, chemical, or biological characteristics that may pose a potential risk to human health or the environment if improperly managed. Wastes may also be defined as "hazardous" by local regulations or international conventions, based on the origin of the waste and its inclusion on hazardous waste lists, or based on its characteristics.

The guidelines state that the hazardous wastes should always be segregated from nonhazardous wastes and its management should focus on the prevention of harm to health, safety, and the environment. It is crucial that the potential impacts and risks associated with hazardous wastes should be completely understood, the hazardous wastes are handled, treated and disposed by reputable and legitimate enterprises licensed by the relevant regulatory agencies and they should be stored so as to prevent or control accidental releases to air, soil and water resources. On-site and off-site transportation of wastes should be conducted so as to prevent or minimize spills, releases, and exposures to employees and the public.

3.0 PROJECT DESCRIPTION

3.1 Gökres-2 Wind Farm Project

Garet Enerji plans to develop Gökres-2 WF including 13 turbines each with 2.75 MW installed capacity in Akhisar and Kırkağaç Districts of Manisa Province in Turkey. The total installed capacity of the project will be 35 MW. It is planned to generate about 122,640,000 kWh /year of energy using the wind turbines. The energy will be connected to the existing substation of Soma-B Thermal Power Plant located about 18 km northwest to the wind farm. The characteristics and the route of the Energy Transmission Line (ETL) within this Project has not been determined yet. A “49-year electric power generation license” (License No. EÜ/3683-3/2235, dated February 9, 2012) has been obtained from the Energy Market Regulatory Authority (EMRA) by Garet Enerji for the Project.

3.2 Project Objective

Turkey has an increasing energy demand. This rate of demand growth has been higher than the growth rates seen in other major Turkish industries and outstrips growth in the Turkish economy overall.

Instantaneous peak demand and energy demand of Turkey interconnected electricity system is presented in Table 3-1 and in Figure 3-1 (Turkish Electricity Transmission Corporation (TEİAŞ), 2011). As seen in the table, energy demand has reached 194.1 billion kWh in 2009 with a decrease of 2% compared to 2008, whereas energy demand has recorded as 210.4 billion kWh in 2010 with an increase of 8.4%. The reason for the decrease in 2009 was global economic crises. In addition, in 2010, the peak demand was 33,392 MW.

Table 3-1 Interconnected Electricity Power System Peak Power and Energy Demand

Years	Peak Demand (MW)	Increase (%)	Energy Demand (GWh)	Increase (%)
2001	19612	1.1	126,871	-1.1
2002	21006	7.1	132,553	4.5
2003	21729	3.4	141,151	6.5
2004	23485	8.1	150,018	6.3
2005	25174	7.2	160,794	7.2
2006	27594	9.6	174,637	8.3
2007	29249	6.0	190,000	8.8
2008	30517	4.3	198,085	4.2
2009	29870	-2.1	194,079	-2.0
2010	33392	11.8	210434	8.4

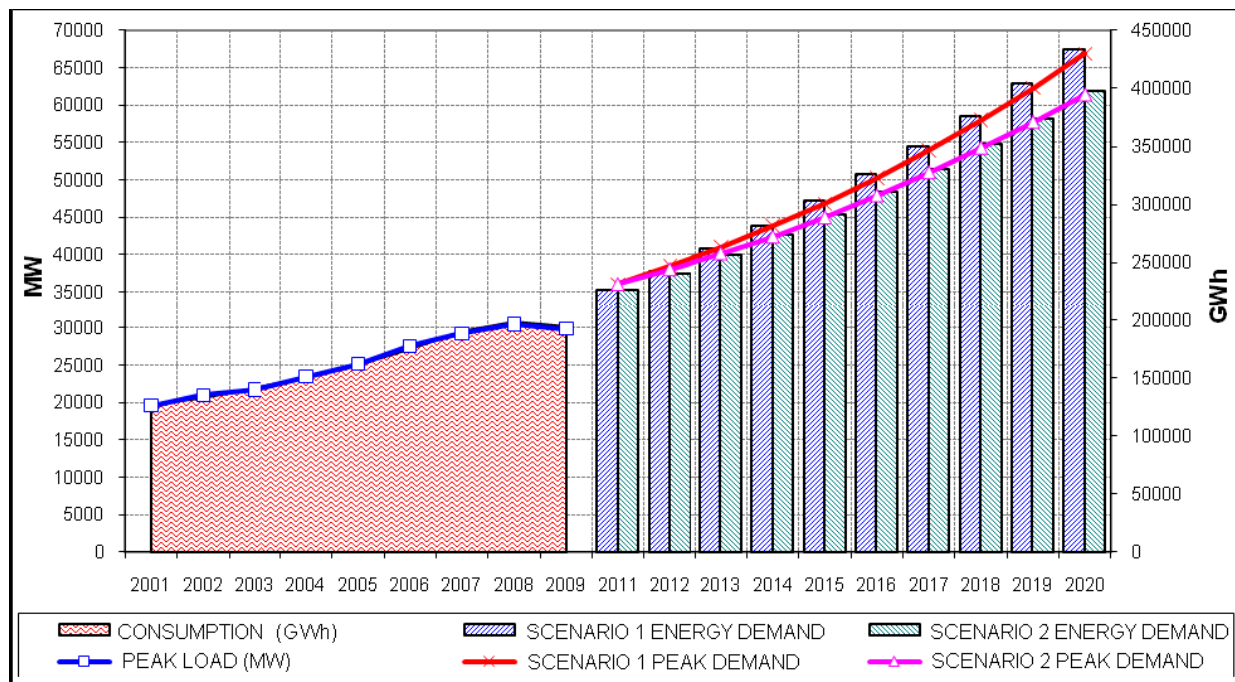


Figure 3-1 Interconnected Electricity Power System Peak Power and Energy Demand

Source: TEİAŞ, Turkish Electrical Energy 10-Year Generation Capacity Projection Report, 2011

By the end of April 2011, the installed power capacity of Turkey was 50,422 MW. In addition to this installed power, it was reported that the capacity of wind farms under operation is 1,414.55 MW and the capacity of wind farms under construction is 749.95 MW (Turkish Wind Energy Association, March 2011). According to the Ministry of Energy and Natural Resources (MENR), the potential wind power in Turkey is prescribed to be a total of 8,000 MW of installed capacity for high efficient regime facilities and a total of 40,000 MW of installed capacity for moderately efficient facilities.

The purpose of this Project is to utilize wind energy potential and to compensate energy requirement through a sustainable, environmentally and cost effective way by using wind energy.

3.3 Project Background

Wind speed and frequency are the most important factors to determine the power that can be generated from a wind turbine. Wind measurement was started for Gökres-2 WF project site on March 6th 2012 and it is still in operation. The measurement height of this Mast is 85 m. The coordinates of the Mast is given in Table 3-2, below. The location of the Mast is presented in Figure 3-2.

Table 3-2 Coordinates of the Mast (UTM Projection, ED50 Datum Zone 35)

Mast	Coordinates	
	Easting (m)	Northing (m)
Gokres-2 Mast	567972	4323802

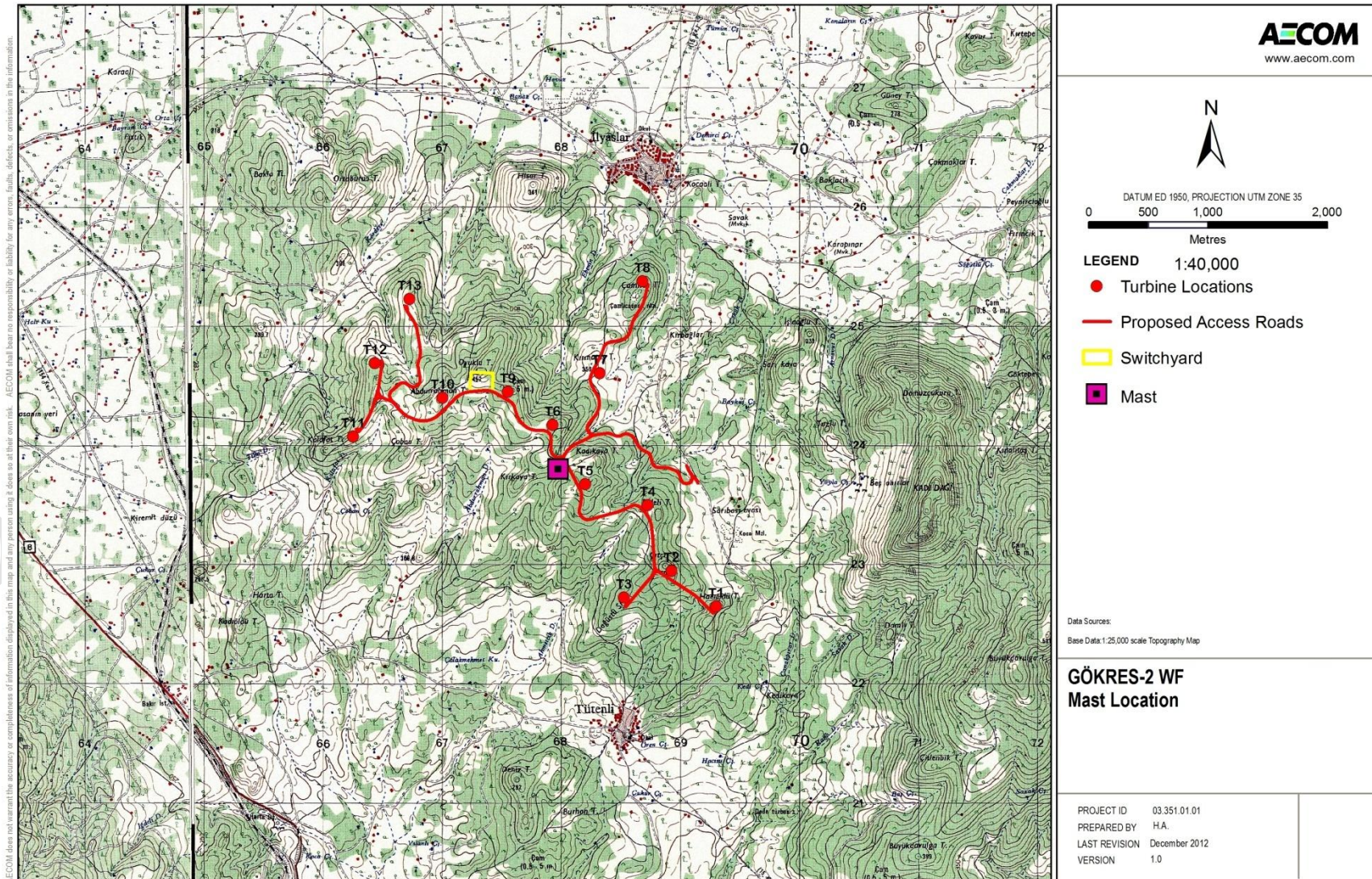


Figure 3-2 Location of the Mast

3.4 Project Location

Gökres-2 WF is located in Manisa Province of Turkey in the Aegean Region. The Project site is located on a series of hills located approximately 10 km southeast of Kırkağaç District Center and 15 km north of Akhisar District Center. The Project site is approximately 58 km to the Manisa city center.

The Project site has a total area of 314,107 m² including turbine locations and access roads. The closest settlement to the Project site is İlyaslar Town (town in Turkey is larger than a village and has a municipality) at the north. Other surrounding settlements are Musalar Village at the southeast and Tütenli Village at the south. The final coordinates of the turbines are provided in Table 3-3.

Table 3-3 Turbine Coordinates (UTM, ED50 Datum Zone 35)

Turbine	Easting (m)	Northing (m)
T1	569300	4322650
T2	568925	4322950
T3	568525	4322725
T4	568725	4323500
T5	568200	4323675
T6	567925	4324175
T7	568322	4324607
T8	568680	4325379
T9	567550	4324450
T10	567000	4324400
T11	566250	4324075
T12	566434	4324692
T13	566724	4325230

Besides, there will be an administrative building and a switchyard within the scope of the Project. The coordinates of the switchyard is given in Table 3-4, below.

Table 3-4 Coordinates of the Switchyard (UTM, ED50 Datum Zone 35)

Corner Coordinates	Easting (m)	Northing (m)
1	567238.34	4324616.06
2	567425.97	4324605.78
3	567417.41	4324457.79
4	567335.43	4324466.58
5	567229.06	4324455.82

The location map and general layout of the Project are given in Figure 3-3 and Figure 3-4, respectively. As seen in Figure 3-4, the closest turbine to İlyaslar Town is T8 with a distance of approximately 670 m.

The layout of the turbines within the Project is designed so as to minimize potential environmental impact while maximizing the exposure of the turbines to the wind resource. The spacing between individual turbines ensures safe and efficient operation. This spacing is a compromise between compactness, which permits a higher number of turbines and the need for adequate separations to lessen energy loss through wind shadowing and wake-effects from up-wind turbines.

The general views of the Project site are shown in Figure 3-5, Figure 3-6. Moreover, the location of the turbines on two dimensional topography map is shown in Figure 3-7.

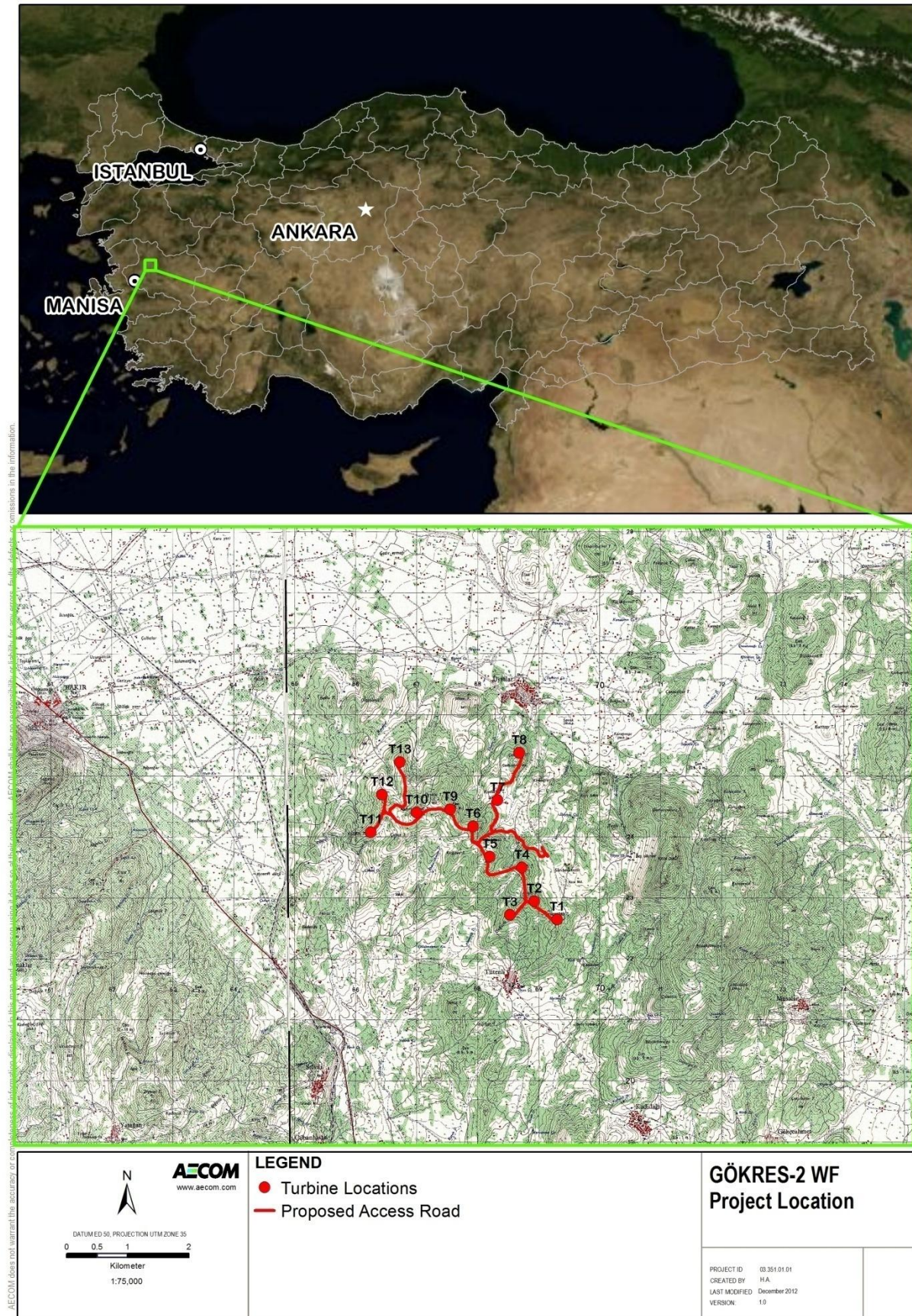


Figure 3-3 Project Location Map

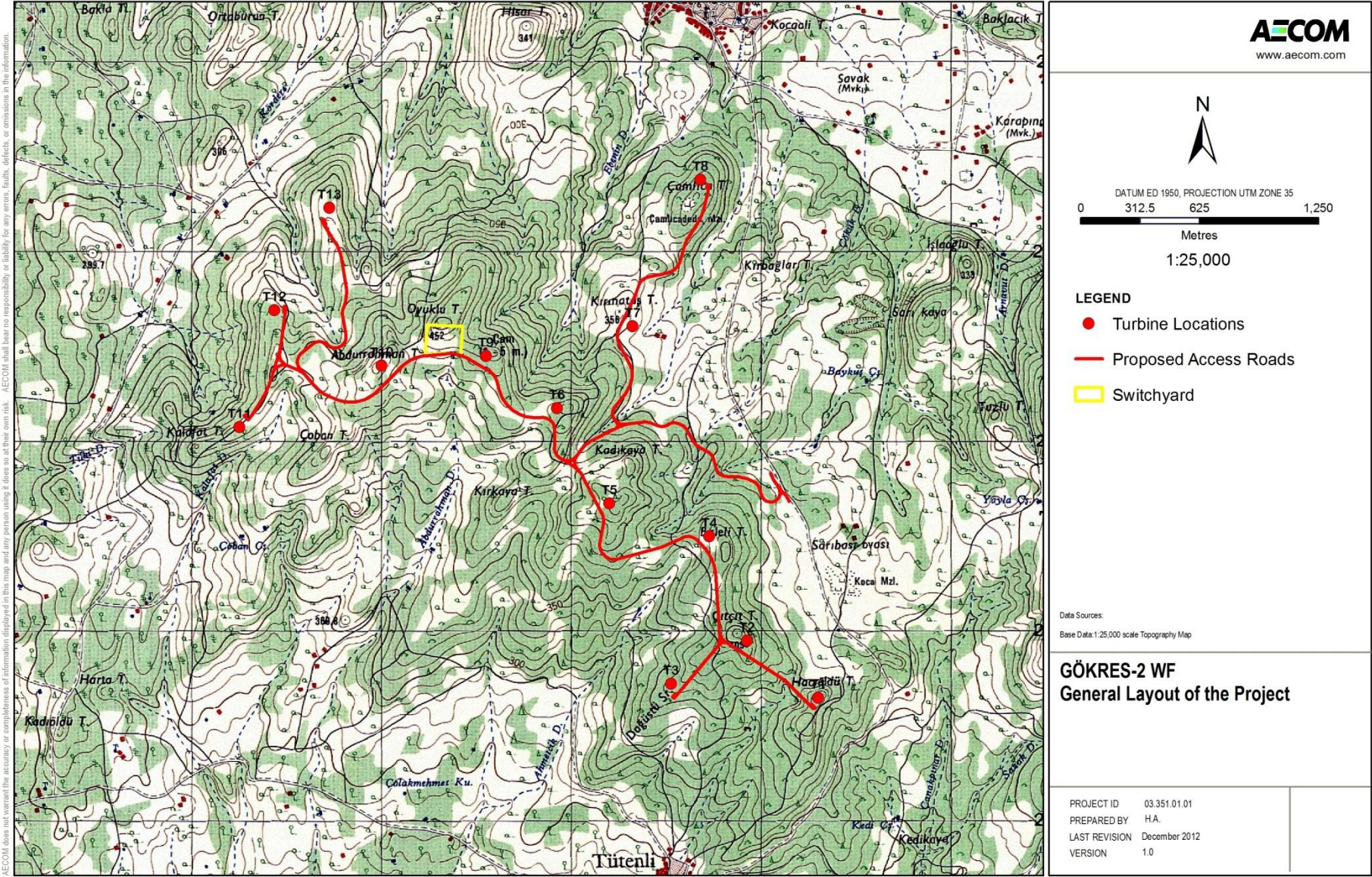


Figure 3-4 General Layout of the Project



Figure 3-5 General Views of the Project Site (from *Kadı Dağı/Kaletepe*)



Figure 3-6 General Views of the Project Site (from *Hisartepe*)

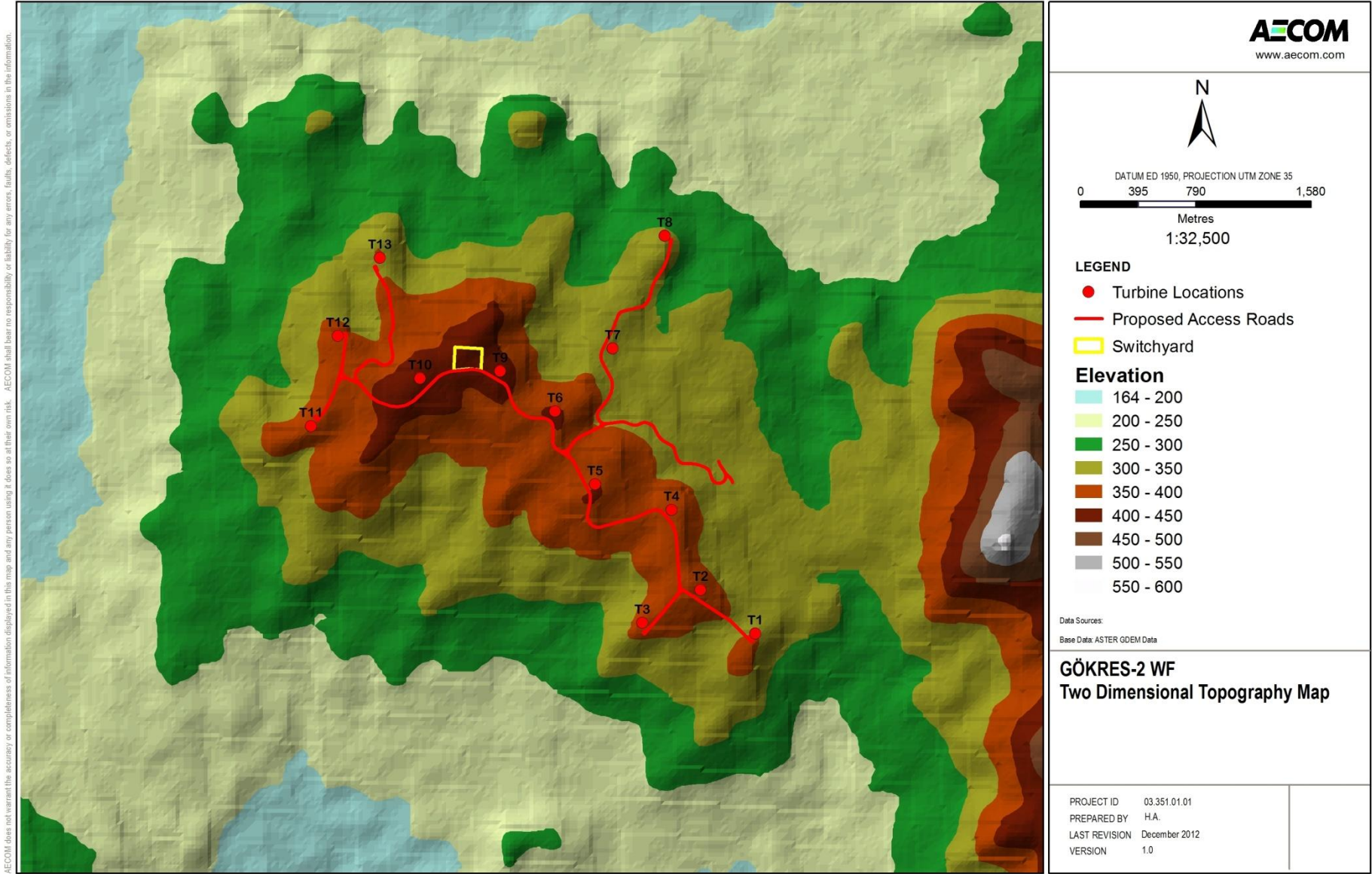


Figure 3-7 Two Dimensional Topography Map

3.5 Project Technical Characteristics

General Electric (GE) 2.75 – 103 wind turbines with 98.3 m hub height will be used in the Project. Each turbine has an installed capacity of 2.75 MW. Gökres-2 WF will generate 122,640,000 kWh /year electrical energy annually after commissioning and during operation with 13 turbines.

Within the project, mechanical energy generated from moving air will be transmitted to an electric generator through an adequate coupling and a gear box. Output from generator will be connected to a loader or a network depending on its design.

Modern wind turbines are fully automatic, turning into the prevailing wind direction and shutting down when necessary. The minimum wind speed for the turbine to begin operating would be approximately 3 m/s at hub height and will be shut down in the rare event that the wind speeds at the site exceed about 25 m/s to prevent damage to the turbine components. The rotor swept area of the turbines is 8,332 m² with a rotor diameter of 103 m. Each turbine will have 3 rotor blades. The turbine tower will be installed on a concrete base that covers an area of approximately 400 m². Installation of turbines will be made both in-lands and abroad. Cables, transformers and other electromagnetic equipment will be supplied domestically and/or from abroad.

Turbines will be connected to the switching gear by means of underground cables. Transfer of the power to the national grid will be through an aboveground aerial power transmission line that will be connected to existing substation of Soma-B Thermal Power Plant located about 18 km northwest to the wind farm.

The view of GE 2.75 – 103 wind turbine can be seen in Figure 3-8 and technical characteristics of the turbines are presented in Table 3-5.



Figure 3-8 View of GE 2.75- 103 Wind Turbine

Table 3-5 Technical Characteristics of GE 2.75-103 Turbines

Power	
Rated power	2,750 kW
Rated wind speed	13.0 m/s
Cut-in wind speed	3.0 m/s
Cut-out wind speed	25.0 m/s
Rotor	
Diameter	103.0 m
Swept area	8,332.29 m ²
Number of blades	3
Rotor speed	4.7-14.8 rpm
Material	glass-fiber reinforced plastic
Generator	
Type	synchronous, permanent magnet
Voltage	690 V
Grid connection	via converter
Control and Protection System	
Power limitation	pitch
Speed control	variable via microprocessor
Main brake	individual blade pitch control

Second brake system	disk brake
Tower	
Hub height	98.3 m
Type	steel tubular
Shape	conical
Corrosion protection	multi-coated

3.6 Shipment and Transportation

Since Shipment Agreement with GE has not signed, factory that the turbine parts will be purchased has not been determined yet. However, according to GE turbine supplier's report, there are two transportation options. If the turbines arrive to the Aliğa Petkim Port, Aliğa – Bergama – Soma – Kırkağaç route will be followed. If the turbines arrive to the Bandırma Port, Bandırma – Susurluk – Balıkesir – Akhisar route will be followed. The Project site is located about 77 km to the Aliğa Petkim Port and 143 km to Bandırma Port.

3.7 Project Construction

A total of 13 turbines will be installed within this Project. The hub height of the turbines will be 98.3 m. Approximately 400 m² area will be excavated for each turbine foundation.

The following works will be performed during the installation of the turbines:

- Preparation of site;
- Excavation activities for turbine tower foundations and control building pad foundations;
- Site access roads preparation;
- Preparation of crane pads at each wind turbine location;
- Service road construction between turbines;
- Construction of turbine/tower foundations;
- Construction of auxiliary units and control building;
- Transportation and erection of the towers;
- Transportation and assembly of the turbines, rotors and blades;
- Construction and installation of 154 kV Switchyard;
- Installation of the electricity (overhead lines) and control system;
- Connection to the system;
- Commissioning and energizing the plant; and
- Site re-instatement and restoration.

It has not been determined yet whether a construction camp site will be constructed or not. Other alternative for this issue is the accommodation of the workers in nearby villages. The materials, including turbine blades and other components, will be temporarily stored at the Project site.

Once the access roads and site compound are in place, turbine foundation construction will be commenced. It is not proposed to borrow pit to obtain materials and no crushing plant will be

used at the site. The concrete for the foundation will be supplied from a ready mixed concrete plant in Akhisar District and will be brought to the site by ready- mix concrete mixers. Construction of the foundation will comprise excavation of the hole using a digger, outer form setting, rebar and bolt cage assembly, casting and finishing concrete, removing the forms, backfilling, compacting and foundation site restoration. Excavation and foundation construction will be conducted in a manner that will minimize the size and duration of the excavated area. On-site excavated materials will be used for backfill as much as possible. After the concrete foundation construction, the base of the towers will be backfilled according to the project requirements and the mounting platforms will be prepared.

Other remaining works such as tower and turbine installations, construction of substation, operation and management buildings and the transmission lines will be performed in parallel after completing the tower foundations.

Turbine erection will be performed in multiple stages including: erecting the tower (usually in three or four sections for this size), erecting the nacelle, assembling and erecting the rotor, connecting and terminating the internal cables and inspecting and testing the electrical system prior to operation. Towers, blades and turbine will be lifted and installed with a special high crane.

The feeders from wind turbines will be connected via underground cable channels parallel to the access roads, which will be prepared by an excavator and backfilled in compliance with the technical requirements of the Project. The electrical power generated by the wind turbines will be connected to the existing substation of Soma-B Thermal Power Plant located about 18 km northwest to the wind farm.

3.8 Project Operation and Maintenance

The operation period of the Project will be 49 years. The operation will be undertaken in accordance with an Environmental Management Plan (EMP) that is developed for the Project.

Typically modern wind turbines operate with an availability of 95 to 99% (i.e. the turbines are available to operate for this percentage of the year). Forced outages can occur mainly because of malfunctioning of mechanical or electrical components or computer controls. These are generally due to malfunction of auxiliaries and controls rather than with the heavy rotating machinery. Heavy rotating machineries are routinely inspected during planned maintenance or by condition monitoring.

Following the more frequent and detailed initial turbine inspections and maintenance in the first year of operation, a semi-annual service is usually expected. The actual service periods will be determined after the operations and maintenance (O&M) contract is finalized. The semi-annual inspection and maintenance generally include taking the wind turbine off-line for a day and consist of inspecting and testing safety systems, inspecting wear and tear on components such as seals and bearings, lubricating the mechanical systems, performing electronic diagnostics on the control systems; verifying pre-tension of the mechanical fasteners; gearbox oil change and inspecting the overall structural components of the wind turbines. Blades will be inspected

regularly. Since Manisa receives sufficient rain, blade washing might not be necessary for the Project.

The turbines will need to be visited typically once per month for routine visual inspections. As far as is practical, short term routine maintenance procedures will need to be undertaken during periods of little or no wind to minimize the impact on electricity generation. Major maintenance/servicing are planned where practical during the months where low wind speeds are encountered.

In the event of a fault, the modular design of modern wind turbines allows most of the parts to be rapidly replaced, especially in the electrical and control systems.

Electrical equipment such as breakers relays and transformers require annual visual inspections which does not affect availability of the turbines. Basis testing and calibration of this equipment will require a short break in operation.

3.9 Project Decommissioning

The project life will be 49 years. The main decommissioning activities will comprise of removal of tower, nacelle, blades; reuse/disposal of foundation, tower, nacelle, blades and removal of cable and ancillary structures.

There are several aspects of the decommissioning phase of the Project that may have environmental impacts. Decommissioning will take account of the environmental legislation and the technology available at the time. Necessary notices will be given to the environmental authorities in advance of the commencement of the decommissioning work. Any necessary licenses or permits will be acquired prior to the decommissioning activities.

It is probable that most of the plant and equipment will be at the end of its useful operating life and will be obsolete and unsuitable for further use. Thus, it will need to be dismantled for recycling. Decisions on reuse of plant items, recycling of materials or the disposal to waste will be made at the time of decommissioning in the light of the technology then available, environmental and economic considerations and legislation. Unsalvageable material will be disposed of at a licensed landfill. A crane will be required to dismantle the turbines. Soil surface will be restored to its original condition. Disturbed areas will be re-vegetated or made available for any future intended use.

Compared to thermal power plants, wind turbines can be easily and economically decommissioned and removed from site at the end of their economic life and the site returned to its original condition. There will be little or no trace that the wind turbines had been there following decommissioning.

3.10 Project Work Force

For the construction phase of the Project, approximately 130 personnel are expected to work. However, not all workers will be on-site at any one time. Local contractors will be encouraged to

tender for the civil and electrical works. Electricians, riggers, crane operators and heavy equipment operators will also be required.

After construction phase, about 12 personnel will work during the operation phase of the wind farm. The proposed work force details are given in Table 3-6.

Table 3-6 Work Force Details

Duty	Number of Personnel
Construction Phase	
<i>Construction Works</i>	
Engineer	9
Technician	7
Foreman	9
Concrete mason worker	5
Ironmaster	5
Mold Master	5
Worker / Assistant (general)	13
<i>Electrical Works</i>	
Electrical foreman	7
Cable worker	7
Electrical technician	7
Electrical worker	7
<i>Turbine Works</i>	
Quality control chief	2
Turbine technician	5
Operators (crane, forklift)	6
Mechanical &Electrical installation Foreman	7
Mechanical &Electrical installation Worker	11
<i>General</i>	
Business manager	1
Data entry / Document specialist	2
Staff	9
Security Guards	6
<i>Total</i>	130
Operation Phase	
Manager	1
Technical Operator	2
Electrical & Turbine technicians	2
Electrical worker	2
Security Guards	3
Worker	2
<i>Total</i>	12

4.0 ENVIRONMENTAL AND SOCIAL BASELINE

4.1 General Climatology of the Region

The Project site is located within Akhisar and Kırkağaç Districts of Manisa Province. Although these districts are close to the Aegean Coast, the climate of the region is relatively harsh compared to the coastal zone. It is hot and dry in summer while it is cool and wet in winter. The closest meteorological station to the wind farm is the Akhisar Meteorological Station which is located 38.55 latitude and 27.51 longitude. Long-term meteorological data (1975-2009) recorded by Akhisar Meteorological Station is used to discuss general meteorological conditions of the Project site.

Temperature

According to the long-term meteorological data (1975-2009) recorded by the Akhisar Meteorological Station, the annual average temperature is 16.1°C. As seen in Figure 4-1, the warmest months are July and August, whereas the coldest months are December, January and February. The maximum and minimum temperatures during the observation period (1975-2009) were recorded as 44.4°C on July 6, 2000 and -11.3°C on February 15, 2004, respectively.

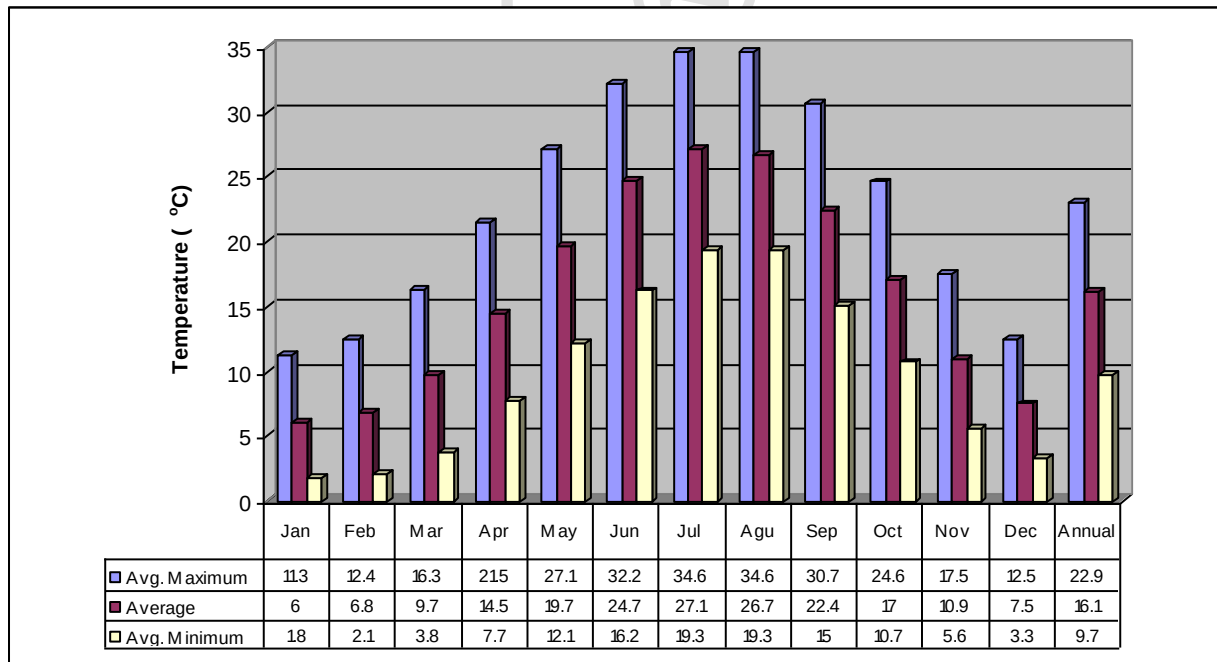


Figure 4-1 Long Term Temperature Data
(Source: Akhisar Meteorological Station (1975-2009))

The minimum ambient temperature for the operation of turbines is given as -15°C / -20°C. In addition, the maximum ambient temperature for the operation of turbines is given as +40°C. Since,

the average temperature data recorded in the vicinity of the Project site is in the range of operation temperature limits, the Project site is suitable for turbine operation.

Wind

According to measurements conducted at the Akhisar Meteorological Station (1975-2009), annual wind speed is 2.5 m/sec. The prevailing annual wind direction is north-northeast for all seasons and the annual wind speed in this direction is 2.5 m/sec. The wind rose in Figure 4-2 depicts the annual and seasonal wind directions and intensity recorded at the proposed station.

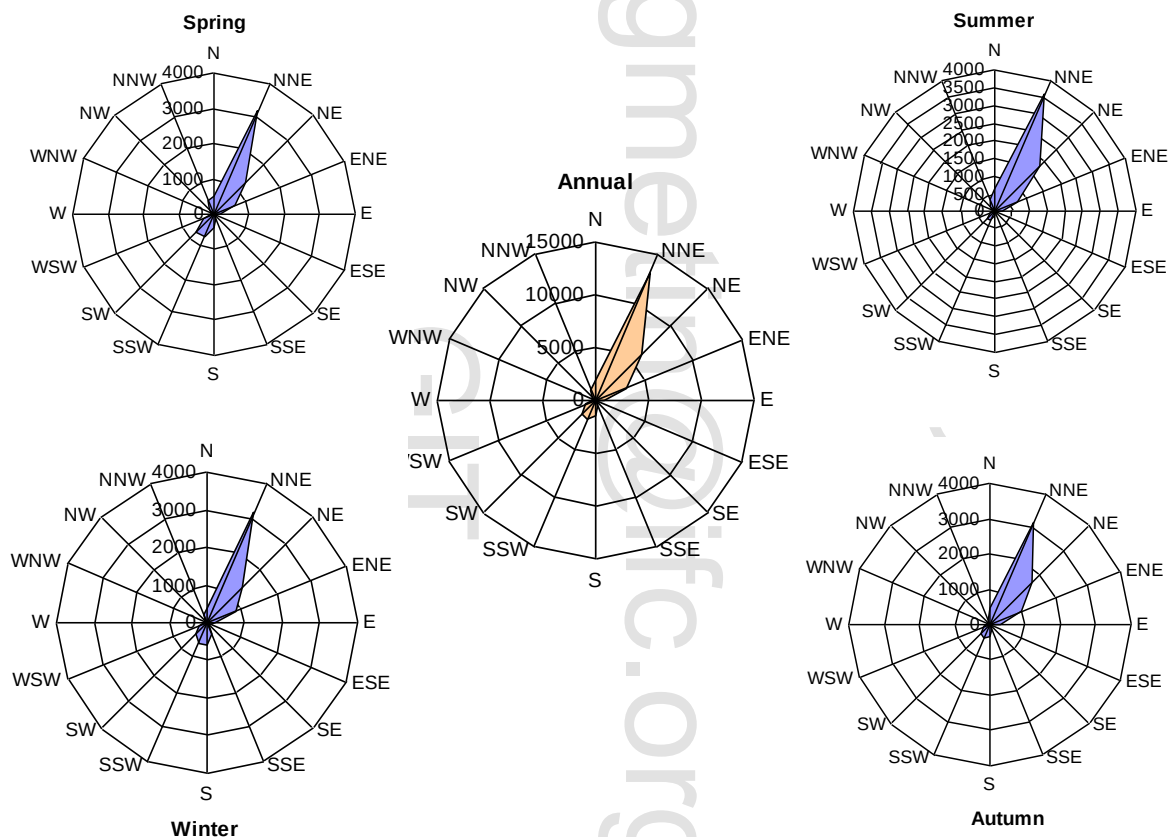


Figure 4-2 Seasonal and Annual Wind Roses

(Source: Akhisar Meteorological Station (1975-2009))

Precipitation

According to long-term meteorological data recorded at the Akhisar meteorological station, amount of precipitation differs seasonally. Precipitation decreases dramatically in summer season and precipitation occurs in November, December and January months in general. As seen in Figure 4-3, the wettest month is December with 96.2 mm monthly average precipitation. On the other hand, the lowest precipitation falls in August with the precipitation amount of 2.8 mm.

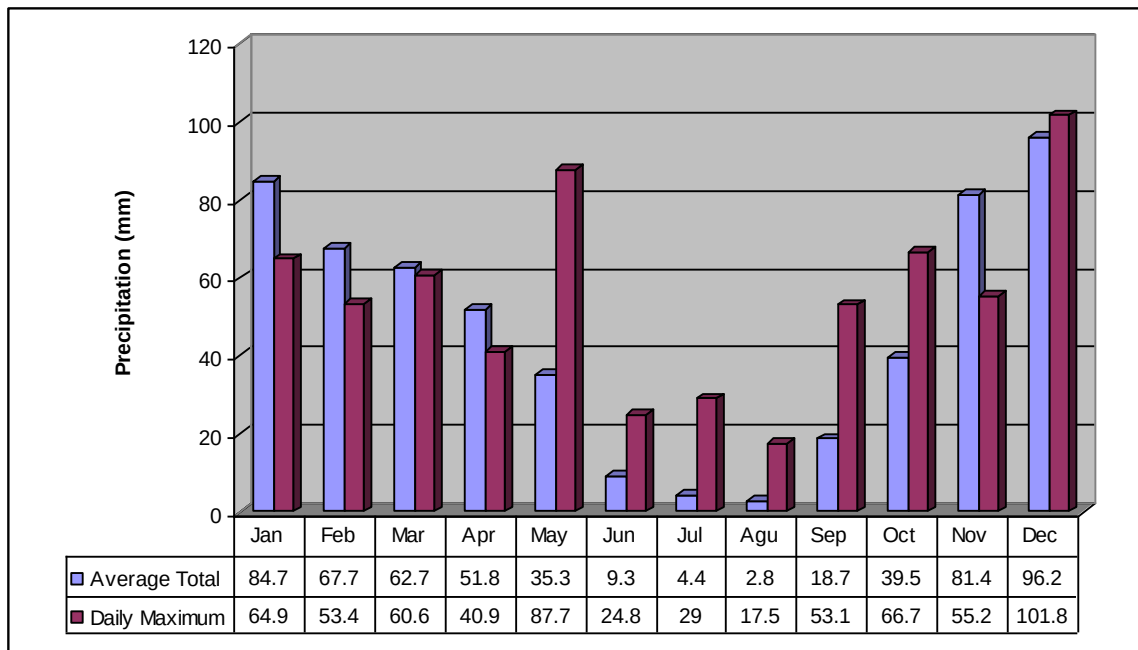


Figure 4-3 Long Term Precipitation Data

(Source: Akhisar Meteorological Station (1975-2009))

Humidity

According to long-term meteorological data recorded at the Akhisar Meteorological Station, the average relative humidity is low throughout the entire year. The annual average relative humidity in Akhisar District is 63%. In addition, the highest average relative humidity value is 74.6% in December, whereas the least humid month is July with an average relative humidity of 51.5%.

4.2 Air Quality

Air quality is not expected to be an issue in wind power projects. However, a brief background information about the local air quality is provided in this section.

Turkish Statistical Institute keeps air pollution statistics for each province center in Turkey. The statistical data include annual data for PM and SO₂ parameters recorded by the Ministry of Environment and Urbanization. There is no air quality measurement station in Akhisar District. The nearest station to the Project site is located in Manisa Central District. General statistical information on the PM and SO₂ are given in

Table 4-1 for Manisa in 2010. As seen in the table, annual average SO₂ and PM concentrations are 8 µg/m³ and 79 µg/m³, respectively.

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Table 4-1 SO₂ and PM Concentrations Measured in Manisa in 2010

	Pollutant Parameters	
	SO ₂	PM
Number of Days of Measurement	330	288
Annual Average Concentration (µg/m ³)	8	79
Minimum Concentration (µg/m ³)	1	23
Maximum Concentration (µg/m ³)	97	231
Number of days exceeding the Short-Term Limits for 2010 (≥340 µg/m ³ for SO ₂ and ≥220 µg/m ³ for PM)*	0	2
Number of days exceeding the First Level Alert Threshold (≥ 500 µg/m ³ for SO ₂ and ≥ 260 µg/m ³ for PM)*	0	0

(Source: Official Website of TurkStat, 2012)

* AQAMR, Annex I-A

While air emission will be generated temporarily only during the construction phase, operation phase of the project will not generate air emissions. Since the construction period of the Project is estimated as approximately 30 months (together with the transportation and installation) and the main emission source will be movements of vehicles at the site, potential effect on the air quality will be temporary and expected to be minor.

4.3 Land Use and Landownership

The wind turbines, access roads and switchyard will be located within forest areas with an area of 314,107 m². Since there are no privately owned lands within the Project, no expropriation will be carried out; therefore there will be no physical and economic displacement. Permits will be taken before the construction phase for the forest areas to be used within the Project in accordance with the Article No. 17/3 (amended by Law No. 5192) of Forestry Law No. 6831. AECOM was informed that Garet Enerji has applied for the Forest Permit.

4.4 Background Noise Levels

The Project site is located on a hilly terrain between two settlements; Tütenli Village in the south and İlyaslar Town in the north. In order to determine existing ambient noise levels (background noise) in the project site, background noise monitoring studies were undertaken at the noise sensitive receptor (NSR) to the Project site.

4.4.1 Noise Sensitive Receptor

The NSR, selected as the nearest permanent residence, was determined according to its distance to the highest noise level generated by the operation of the Project. Although the closest dwelling is in İlyaslar Town, located about 670 m to the turbine T8, the noise sensitive receptor for Gökres-2

project is selected in Tütenli Village. The coordinates (UTM Projection ED-50 Datum Zone 35) of the NSR are given in Table 4-2.

Table 4-2 UTM Coordinates of Noise Sensitive Receptor

Noise Sensitive Receptor	X (East)	Y (North)
NSR	568521	4321871

The NSR is situated in the south of the Project site. It is a permanently used house located in north of Tütenli Village. There is an asphalt road to the house. The closest turbine is Turbine 3 (T3) and with a distance of 854 m. The view and the map showing the location of the receptor are given in Figure 4-4 and Figure 4-5 below, respectively.



Figure 4-4 View of NSR

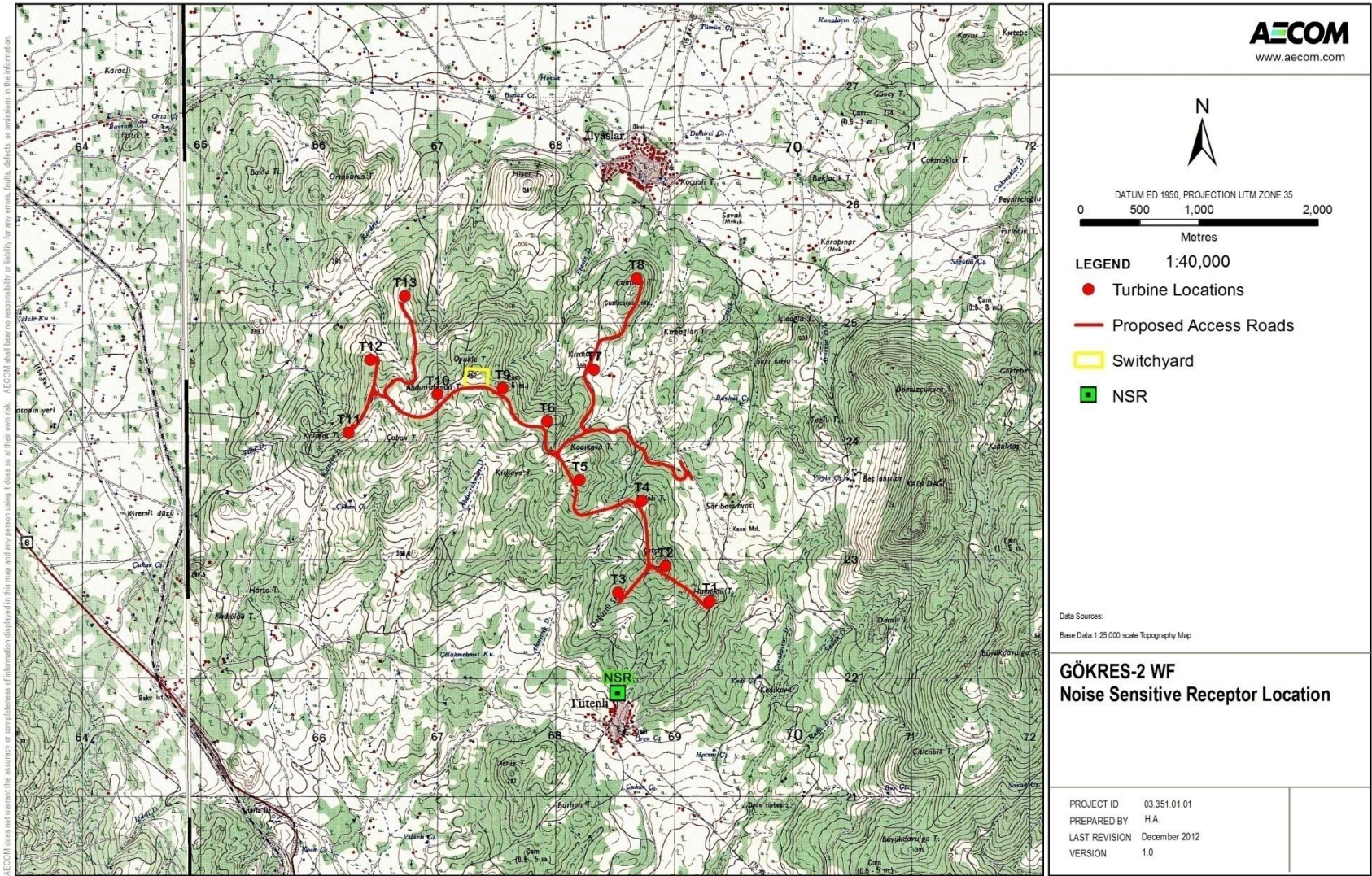


Figure 4-5 Location of Noise Sensitive Receptor

4.4.2 Noise Survey

Background noise level monitoring studies were undertaken for two days between November 12-14, 2012. Ambient noise levels were continuously measured for 48 hours and the levels were logged for ten minute sampling interval. The noise measurements were undertaken with *Type 1 Quest SoundPRO SE/DL Sound Level Meter*. The equipment used is in compliance with the standards of ANSI S1.4, IEC 61672-1. Calibration of the equipment was checked before and after each measurement with an acoustic calibrator that is *Quest QC/10 Calibrator*. The calibrator complies with the standards of ANSI S1.4 and IEC 60942. All measurement systems were set to log the L_{min} , L_{max} , L_{Aeq} , L_{A90} noise levels over the required ten minute intervals over the deployment period.

The equipment used for the measurements set to a-weighted, fast response, continuously monitoring mode over ten minute sampling period. All noise measurements were performed with the following precautions;

- Field calibration checked before and after measurements,
- Windshield positioned over the microphone,
- Microphone was positioned approximately 1.5 m above local ground level,
- Microphone placed away from any significant vertical reflective surfaces, and
- Monitoring equipment was secured so as to avoid extraneous wind noise generated in close proximity to the microphone.



Figure 4-6 Background Noise Level Measurement

4.4.3 Measured Background Noise Levels

The results of the background noise level measurements are compared with both IFC/World Bank Group Environmental, Health and Safety Guidelines – Wind Energy (April 30, 2007) and Turkish Regulation on Assessment and Management of Environmental Noise (RAMEN). Both IFC/WB and RAMEN provide noise limits in Equivalent Sound Level (L_{Aeq}) which is the average A-weighted sound pressure level that gives the same total energy as the varying sound level during the measurement period of time. Since both IFC/WB and RAMEN give the noise limits in L_{Aeq} , the comparisons are made with the L_{Aeq} values measured during the noise survey.

4.4.3.1 Comparison with IFC/WB Environmental Noise Guidelines

The IFC/WB noise guideline provides limits for daytime (07:00-22:00) and nighttime (22:00-07:00). Since the noise sensitive receptor is a residential area in this project, noise level limits of 55 dBA and 45 dBA are considered for daytime and nighttime guideline L_{Aeq} limits, respectively.

Daytime

The results of the daytime background noise levels are compared with the IFC/WB guideline values. In this regard, the daytime noise measurement results (L_{Aeq}) and IFC/WB guideline value of 55 dBA are plotted together in the graph and given in Figure 4-7.

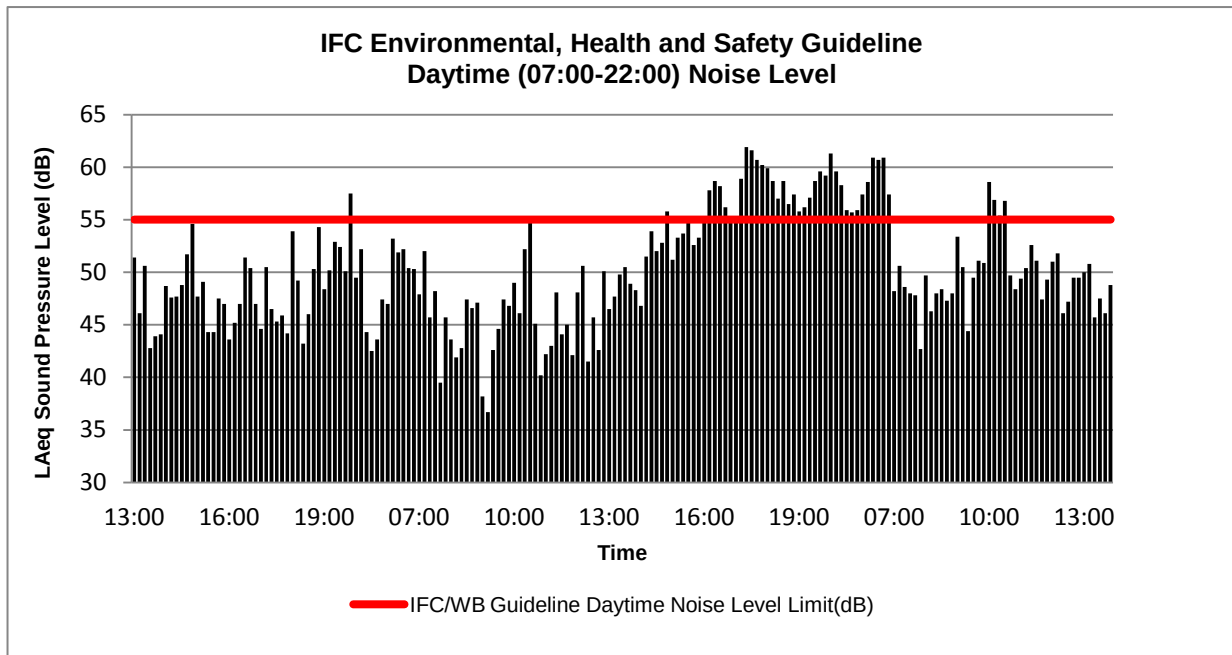


Figure 4-7 Daytime Background Noise Measurement Results compared to IFC/WB Guideline

As can be seen from the graph above, background noise levels at the NSR are mostly below the IFC/WB daytime noise level limit of 55 dBA. The measurements between the afternoon of the second day and the morning of the last day exceed the IFC/WB daytime noise level limit of 55 dBA. Background noise levels measured ranges between 35 and 62 dBA.

Nighttime

The results of the nighttime background noise levels are compared with the IFC/WB guideline values. The noise measurement results (L_{Aeq}) and IFC/WB guideline value of 45 dBA are plotted together and given in Figure 4-8.

The nighttime measurement results show that background noise levels show rapid changes in the nighttime hours (22:00 – 07:00). As can be seen in Figure 4-8, almost all of the nighttime background noise levels measured are above the IFC/WB limit value of 45 dBA except the occurrences at night of the first measurement day and the morning of the second measurement day. Background noise levels measured ranges between 34 and 57 dBA.

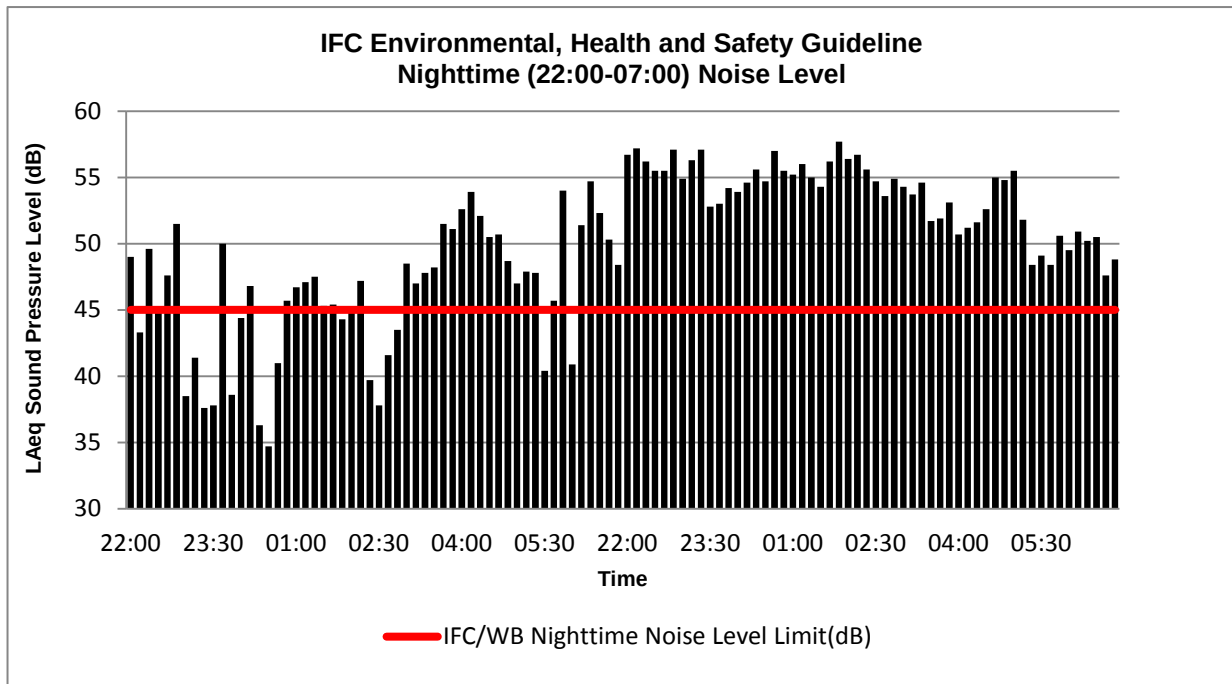


Figure 4-8 Nighttime Background Noise Measurement Results Compared to IFC/WB Guideline

4.4.3.2 Comparison with Turkish Noise Limits

RAMEN sets noise limits for daytime (07:00-19:00), evening time (19:00-23:00) and nighttime (23:00-07:00). Since there is no industrial or commercial area in the close vicinity of the Project site and there are residences situated around, the Project area is classified as “Noise sensitive areas such as place of education, cultural activities, health center and summer resorts and camping sites” according to RAMEN, and thus, the L_{Aeq} noise level limits of 60 dBA, 55 dBA and 50 dBA are considered for daytime, evening time and nighttime periods, respectively.

Daytime

The daytime noise measurement results (L_{Aeq}) and RAMEN limit of 60 dBA are plotted in the graph and given in Figure 4-9. As can be seen from the figure, the daytime background noise levels at the NSR are all below the RAMEN limit of 60 dBA except two occurrences.

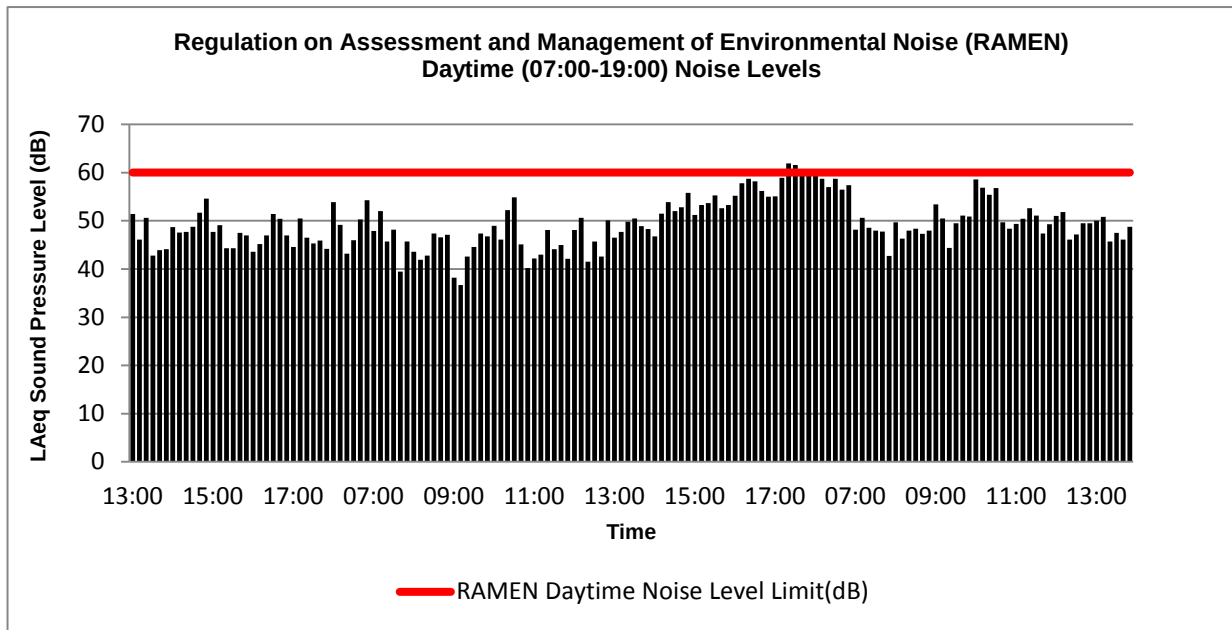


Figure 4-9 Daytime Background Noise Measurement Results compared to Turkish RAMEN

Evening time

The results of the eveningtime background noise measurements are compared with the Turkish RAMEN. The evening noise measurement results (L_{Aeq}) and RAMEN limit of 55 dBA are plotted together and shown in Figure 4-10. Background noise level measurements performed between 19:00 and 23:00 at NSR show that the first measurement day background noise levels at the receptor are below the RAMEN evening time limit of 55 dBA whereas the background noise levels measured in the second measurement day are above the RAMEN evening time limit of 55 dBA.

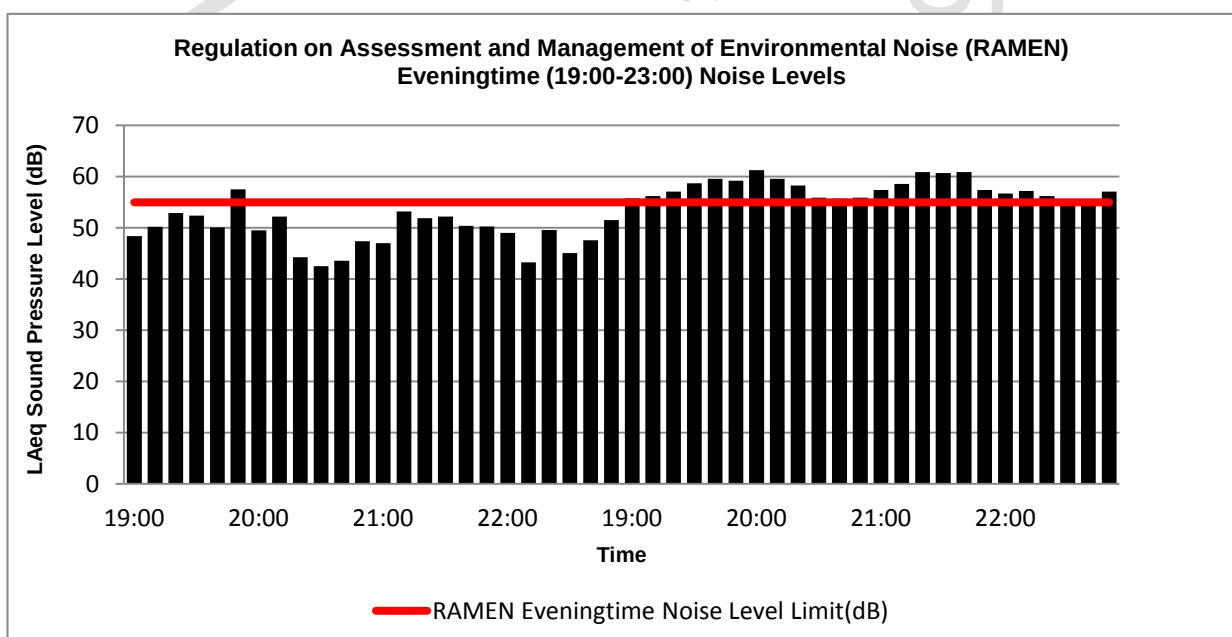


Figure 4-10 Eveningtime Background Noise Measurement Results compared to Turkish RAMEN

Nighttime

The results of the nighttime background noise measurements are compared with the Turkish RAMEN. The night noise measurement results (L_{Aeq}) and RAMEN limit of 50 dBA are plotted together and shown in Figure 4-11.

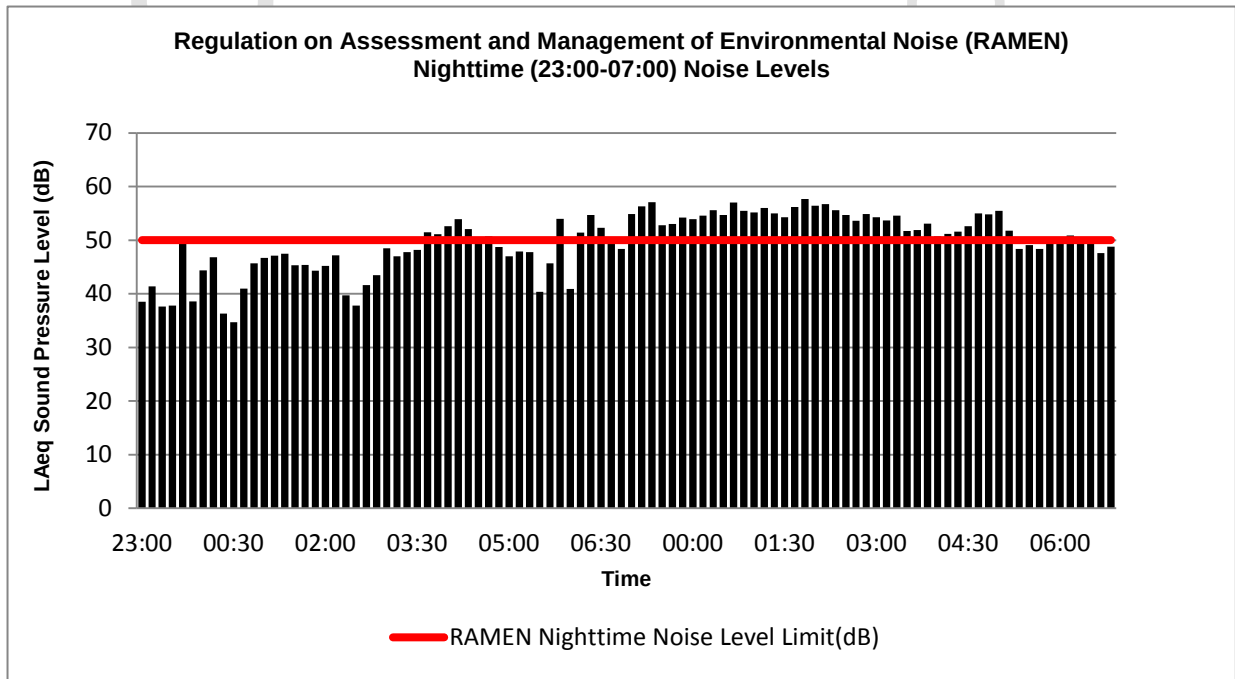


Figure 4-11 Nighttime Background Noise Measurement Results compared to Turkish RAMEN

Background noise level measurements performed between 23:00 and 07:00 at the NSR shows that nighttime background noise levels measured are mostly below the RAMEN nighttime limit of 50 dBA in the first measurement day. The background noise levels measured through the end of the measurement are below the limit value of 50 dBA whereas the other measured background noise levels in the second measurement day are higher than 50 dBA.

4.5 Geology

4.5.1 Regional Geology

According to the Balıkesir G-5 sheet of the 1/100 000 scale geological map and its description book in which the project site location is included, there are sedimentary, magmatic, and metamorphic rocks pertaining to geological time intervals from Lower Triassic to the Quaternary. The geological map modified from the Balıkesir G-5 sheet of the 1/100 000 scale geological map is given in Figure 4-12. The units that outcrop within the scope of the reference sheet are; allochthonous Çaldağ limestone member of Permian Çamoba formation, Kınık formation of Lower Triassic, Halilağa group and Upper mantle originated ultramafic rocks in forms of blocks within Upper Cretaceous Eydemirçay formation.

Triassic

Halilağa Group:

Lower Triassic Halilağa group is studied under Çavdartepe and Kınık formations. Çavdartepe formation is divided into Kocaçukur and Ayçalıtepe members where one of the components of Kınık formation is Bakırtepe volcanic member. Throughout the area that is included in this 1/100000 scale map, Kınık formation and Bakırtepe volcanic rocks that pertain to Halilağa group can be observed in outcrops.

Kınık Formation

The outcrops of this unit can be observed in the central and northern regions of the sheet. This formation is comprised of meta-conglomerates, meta-sandstone, meta-mudstone, sandy limestone, sandstone, agglomerates and meta-volcanic rocks. There are also Permian Çaldağ limestones in blocks with different size within this formation. Kınık formation is yellow, beige, brown and gray in color and presents thin to moderate bedding with folding.

Bakırtepe Volcanic Rocks

Bakırtepe volcanic member is comprised of spilite pertaining to green-schist facies, diabase and tuff. The pores of these rocks are impregnated with calcite. The matrix is formed of fine sized feldspars. Permian limestone can also be observed in this volcanic member.

Çaldağ Limestone Member

This member is comprised of gray, black thin-moderate layered and occasionally re-crystallized limestone. They are observed in various sizes of blocks within Bakırtepe volcanic rocks and Kınık formation. According to the fossil content of this member, it was dated Late Permian.

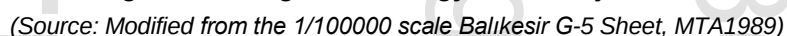
Kırkağaç Formation

This unit is observed with a NE-SW orientation. The limestones that comprise Kırkağaç formation, are white and gray in color and present moderate to thick bedding with dolomitization and occasional recrystallization. This formation overlies Kınık formation with unconformity. Gray layers of this formation contain large number of fossils. According to the researches the age of this formation is determined to be Middle-Late Triassic.

Jura

Sarıkaya Formation

This formation outcrops only in the close vicinity of Sarıkaya crest in the south of Soma and disclosed by incidental fossils where Kırkağaç formation ranges. This formation is comprised of white, beige, light gray and yellowish limestone. According to its fossil content, this formation is determined as Liassic.



Avgediği Formation

This formation overlies progressively Liassic Kırkağaç formation in the south excluding Sarıkaya formation and underlies Pilavtepe formation with conformity.

Pilavtepe Formation

This formation is observed in small fragments of outcrops within the field that is included in the sheet. It is observed in Pilavtepe in the south of Soma as thinly to moderately layered, dark green, yellowish, loamy rock fragments and thinly bedded oolitic limestone successions. The rest of the components are; occasionally silicified dark red limestone, radiolaritine, laminated reddish, gray limestone with thin silica layers and gray recrystallized limestone. Pilavtepe formation overlies Kınık formation with angular unconformity and gradually overlies Kırkağaç formation uninterruptedly.

Menderes Massive Platform

Hasköy Formation

The formation that correspond to the Menderes Massive platform in the SE corner of the sheet is defined as Hasköy formation (Akdeniz et al., 1980).

Hasköy formation is comprised of; tinted yellow, reddish sandstone, brown, reddish, violet siltstone, dark green claystone and fine limestone lenses and gravel. The layers present a periodical succession with various bedding thicknesses.

Jura-Cretaceous

Görenez Limestone The Jura-Cretaceous carbonate sedimentation that overlies Hasköy formation is named as Görenez Limestone. This unit outcrops in the close vicinity of Görenez mountain at the southwest corner of the sheet. It is comprised of limestones of distinct color, texture and various facies. The Görenez Limestone which was deposited within static physicochemical conditions, is overlain tectonically by Ulupınar and Eydemirçay formations.

Cretaceous

Ulupınar formation This formation is made up of limestone blocks of different ages, pertaining to flysch facies (Konak et al., 1980). Ulupınar formation can be observed in the west of Görenez mountain. This formation is comprised of gravel, sandstone, shale, pelagic micrite with foraminifera and limestone blocks contained within these lithologies.

The predominant turbiditic stratification can be observed within the unit which presents typical flysch structure. There can be observed crystallized limestone of unknown age, Permian dark colored sparimicrite, Triassic-Liassic pinkish limestone, Jurassic Lower Cretaceous micrite containing calcite, beige light gray bio-micrite and sandy calcarenite blocks all scattered within the turbidites form fine material to blocks in size, as the constituents of the unit. Eydemirçay formation, which is observed transitive with Ulupınar formation in the south of Görenez mountain, thrusts upon Ulupınar formation in the north. According to the fossil content of this unit, the age of Ulupınar formation is defined to be Upper Cretaceous.

Eydemirçay Formation

The unit that is comprised of basic, volcanic, ultramafic rocks and ocean sediments that are known as the ophiolitic series within İzmir-Ankara zone, is named as Eydemirçay formation by Konak et al., (1980). Eydemirçay formation comprises; detritic sedimentary rocks like greywacke, marl, shale and mudstone, chert, re-crystallized limestone, volcanic rocks like basalt and spilite, pyroclastic rocks like agglomerates and tuff, basic rocks like gabbro and diabase, ultramafic rocks like peridotite and serpentinites, metamorphic rocks of green-schist and blue schist facies. The litho-facies within the unit have been relocated both horizontally and vertically, there can also be observed substantial foldings but not in a measure to fully create a mélange of these layers. Eydemirçay formation is overlaid by Başlamış formation with angular disconformity. According to the fossil content of this unit, the age of Ulupınar formation is defined to be Upper Cretaceous (Konak et al., 1980; Akdeniz, 1985).

Tertiary

Başlamış Formation

Başlamış formation is comprised of detritic rocks and lenses with limestone that constitutes the base of the Tertiary that segregates from the Mesozoic with angular disconformity. This formation was named by Konak et al., (1980). The outcrops of this formation can be observed throughout Akhisar-Sındırgı state road in the close vicinity of Başlamış village.

Kurtulmuş Formation

The unit that overlies Başlamış formation which is made up of reddish coarse size material is called Kurtulmuş formation (Akdeniz., 1985). This unit outcrops in the southern flanks of Gürdük creek and is observed as an elongating plain from Kuru mountain to the south. This formation is comprised of reddish, ruby, scarlet, brown and greenish loosely fitted sandstone-gravel succession.

Andesite

The andesite unit is black, gray, maroon in color and includes trachyte, basalt and occasionally trachyandesite. The preliminary flow traces of andesites have been preserved within the land. According to the thin section examinations of the minerals of this unit, porphyritic textured chloridized, carbonated plagioclase microlithes and biotite and opaque minerals that are contained in a matrix of pyroxene and opaque minerals.

Yuntdağ Volcanics

Yuntdağ volcanics can be observed in different parts of the region as volcanic (andesite) and pyroclastic (tuff and silicified tuffs) units. Andesites have primary flow lineation and porphyritic texture with coarse grained plagioclase crystals. Yuntdağ volcanics are occasionally overlain by Soma Formation and also cover some parts too as young volcanic flows.

Dededağ Basalts

In the region, these basaltic flows can be seen in a type of columnar structure. These young flows overlay Soma Formation, Rahmanlar Formation and Yuntdağ Volcanics.

Neogene Terrestrial Detritics

Balıca Formation

Balıca Formation is formed of alluvial and river deposits, which consist of gravel and sandstone layers with rubbles in various size. The origin of gravels are mainly meta-sandstone, limestone, andesite and granite rocks.

Soma Formation

Soma Formation consists of limestone, clay, marl, tuff, sandstone and gravel. This formation generally beds horizontally but in some parts of the region, formation shows overturned anticline and syncline structures.

Rahmanlar Formation

Rahmanlar Formation has a form of volcano-sedimentary units, which consist of rounded and semi-rounded volcano-clastic material and tuff deposits. This formation covers Soma Formation and Yuntdağ volcanics mostly. Also, disconformity surfaces can be seen in some contact zones within Kınık and Kırkağaç Formations.

Quaternary Period

Mollase and Alluvial

These series are typically made up of a variety of materials, including fine particles of silt and clay and larger particles of sand and gravel. Bakırçay River is continually picking up and dropping solid and loose particles of rock and soil from its bed throughout its extension. The molasse series of the quaternary period refer to sandstone, shale and conglomerate formed as terrestrial or shallow marine deposits in front of rising mountain chains. In this region alluvial series are deposited along the Bakırçay valley and these alluvial flows form Kırkağaç, Bergama, Dikili and Çandarlı Plains and measured thickness can reach up to 150 m in Bakırçay Graben (Akyürek, 1981). The Quaternary series prevail throughout the coastal zone in the west. The Quaternary terrace material is comprised of loosely fitted sand and gravel that are deposited around stream beds. The Quaternary alluvium can be observed throughout the surface water courses covering narrow lines and in Kırkağaç plain as covering broad lands.

4.5.2 Local Geology

The geological features of the Project site are involved in Eydemirçay formation in reference with the 1:100,000 scale Balıkesir Geological Map G-5 Sheet, (MTA1989). The unit that is comprised of

basic, volcanic, ultramafic rocks and ocean sediments that are known as the ophiolitic series within İzmir-Ankara zone, is named as Eydemirçay formation by Konak et al., (1980). Eydemirçay formation comprises; detritic sedimentary rocks like greywacke, marl, shale and mudstone, chert, re-crystallized limestone, volcanic rocks like basalt and spilite, pyroclastic rocks like agglomerates and tuff, basic rocks like gabbro and diabase, ultramafic rocks like peridotite and serpentinites, metamorphic rock of green-schist and blue schist facies. The litho-facies within the unit have been relocated both horizontally and vertically, there can also be observed substantial foldings but not in a measure to fully create a mélangé of these layers. Eydemirçay formation is overlaid by Başlamış formation with angular unconformity. According to the fossil content of this unit, the age of Ulupınar formation is defined to be Upper Cretaceous (Konak et al., 1980; Akdeniz, 1985). The geological map modified from the Balıkesir G-5 sheet of the 1:100,000 scale geological map that includes the turbines is given in Figure 4-12.

4.6 Tectonics and Structural Geology

West Anatolia graben systems are origins of active tectonics in Turkey. Most of the earthquakes that took place in the west of Turkey, occur at West Mediterranean and Aegean Graben systems.

The Project Area is located in the most active part of the region in which the extensional tectonic regime is dominant. The region is characterized by a group of approximately east-west trending, sub-parallel, normal fault zones bordering a set of grabens and intervening horst blocks. Seismic activity is intense, and dominant motion on the faults is in north-south direction. There are about ten graben systems in Western Anatolia, which are orientated approximately in east-directions (MTA, 2005). The best known grabens which are close to the project site are Bergama Graben (BG), Gediz Graben, Küçük Menderes Graben (KMG), Simav Graben, Akçay Graben (AG), Manisa-Akhisar Graben (MAG), Bigadiç Graben (Bg), Bozhöyük-İnegöl Graben (BIG) are shown in Figure 4-13.

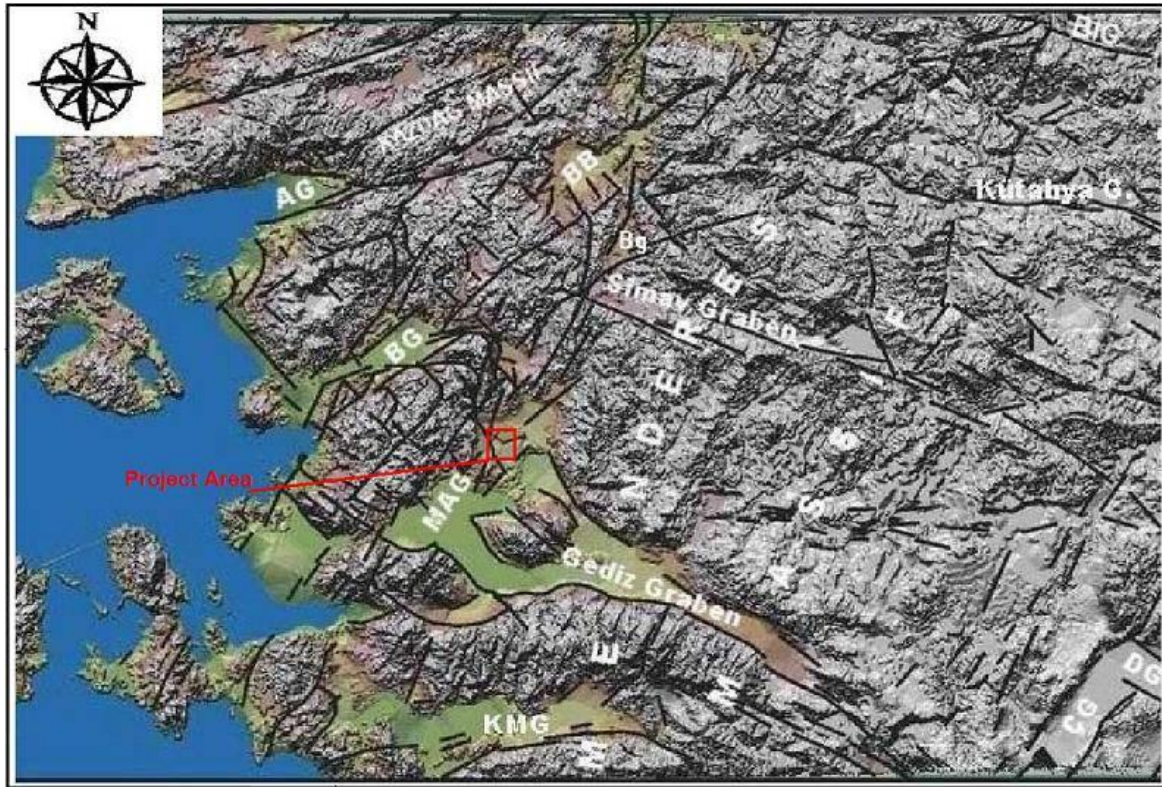


Figure 4-13 Distribution of Grabens and Faults in the Region

The Bergama Graben

The Bergama Graben in which the project site lies, has an elongation of 60 km and 5 km width. This structure is one of the major east-west grabens of Western Anatolia. The Bakırçay River flows west along the valley floor. The Graben has an asymmetric topography, being steeper along the northern part of the valley, where Kozak Magmatics also rise steeply. The faults along both sides of the graben, around the Bergama area, indicate mainly normal faulting. The fault pattern is compatible with a north-south extensional regime. The major faults along the northern side of the graben dip steeply with angles around 70° to the south. The main active faults place young alluvial deposits against the older Miocene succession.

The Gediz Graben

The Gediz Graben is located in the central part of Western Anatolia where one of the major east-west trending grabens are present. The Gediz Graben elongates 140 km and it is 10-15 km wide, and forms an arc shaped structural pattern. This graben trends approximately east-west. The graben is asymmetrical, with the southern margin steeper and seismically more active. Along the southern margin the steep northern flank of Bozdağ Mountain rises, bounded by a major fault zone consisting of a number of steeply ($>70^\circ$) north dipping normal faults, one of which moved during a major earthquake that occurred near Alaşehir in 1969. The major fault is also observed throughout the whole extension of the graben.

The Simav Graben

The Simav Graben was formed due to the activation of the lateral component of the Simav Fault by N-S extension. The Simav basin is the largest graben formed in the system. This depression was produced by right stepping bend between Simav and Şaphane faults.

4.6.1 Seismicity

Manisa City and the project area are located in the 1st Degree Seismic Zone according to the earthquake zones determined by the General Directorate of Disaster Affairs (GDDA) (Figure 4-14). The project site can be considered tectonically very active. There are a significant number of faults in this area, which are considered to be tectonically active.

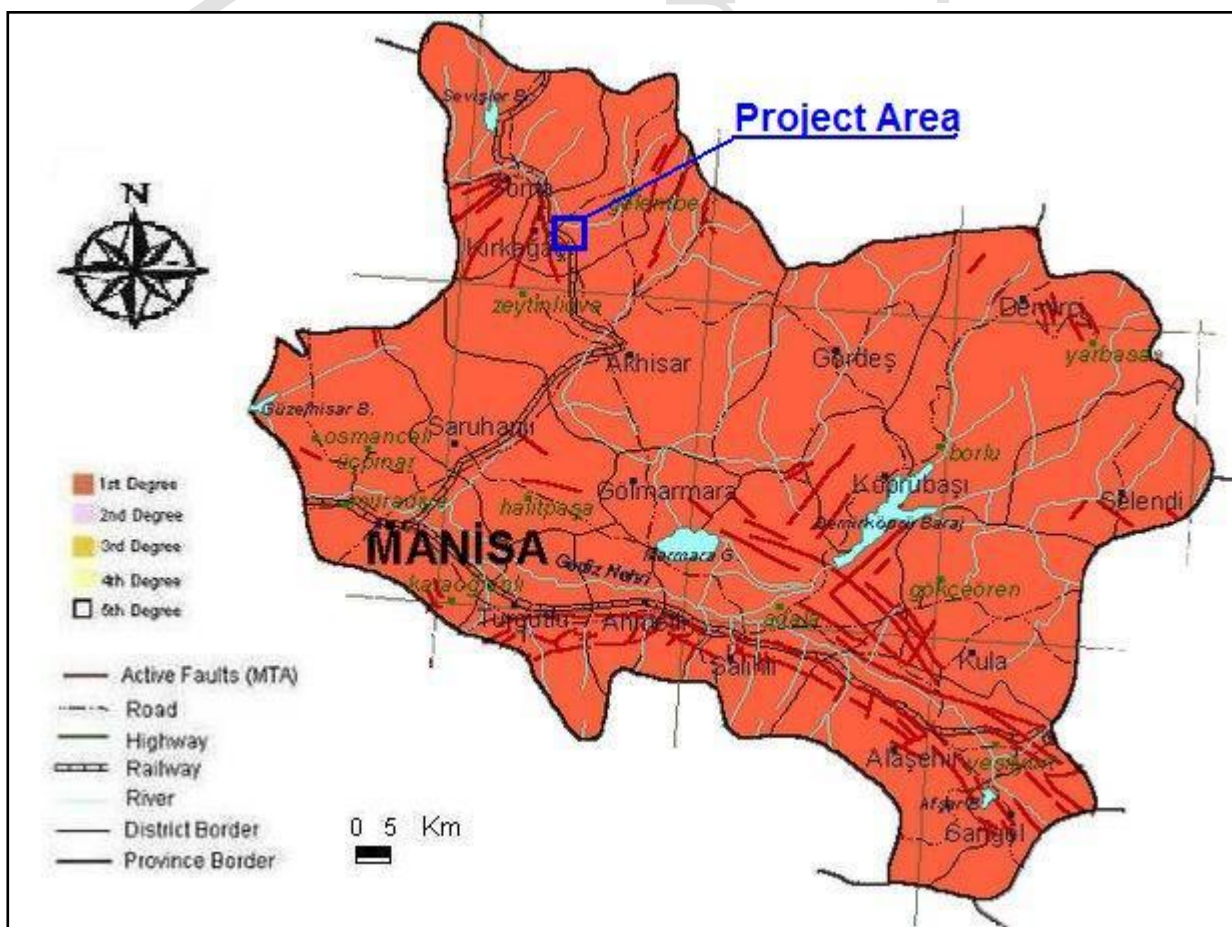


Figure 4-14 Earthquake Zone Map of Manisa Province

(Source: Official Website of GDDA, 2012)

The Region has experienced courses of major earthquakes whose magnitudes ranged between 3 and 7.9 throughout the history (Figure 4-15 and Figure 4-16). Earthquakes that have 5 or higher magnitudes are listed in Table 4-3 and Table 4-4.

Table 4-3 Historical Earthquake Data from Kandilli, 2010

Date	Time (GMT)	Easting	Northing	Depth (km)	Magnitude
17.02.2009	5:28	39.10	29.00	7.0	5.0
22.06.2001	11:54	39.35	27.73	5.0	5.0
23.02.1971	19:41	39.62	27.32	10.0	5.0
30.04.1969	20:20	39.12	28.52	8.0	5.0
24.03.1969	1:59	39.11	28.51	30.0	5.0
11.01.1905	17:32	39.60	27.90	15.0	5.0
28.11.1950	17:53	39.73	28.05	40.0	5.1
18.07.1979	13:12	39.66	28.65	7.0	5.2
23.04.1970	9:01	39.13	28.65	28.0	5.2
22.07.1953	15:09	39.24	28.43	10.0	5.2
22.01.1924	11:05	39.51	28.40	80.0	5.3
19.03.1952	1:27	39.60	28.64	40.0	5.4
28.10.1942	0:31	39.27	28.19	10.0	5.4
22.12.1924	17:49	39.60	27.70	15.0	5.4
25.03.1969	13:21	39.25	28.44	37.0	5.5
28.10.1942	2:41	39.46	27.79	10.0	5.5
04.04.1903	-	39.00	28.00	20.0	5.5
23.03.1969	21:08	39.14	28.48	9.0	5.6
28.10.1942	2:22	39.10	27.80	50.0	5.9
15.11.1942	17:01	39.55	28.58	10.0	6.1
22.09.1939	0:36	39.07	26.94	10.0	6.6
18.11.1919	21:54	39.26	26.71	10.0	7.0

Table 4-4 Historical Earthquake Data from USGS, 2010

Date	Time (GMT)	Easting	Northing	Depth (km)	Magnitude
22.06.2001	11:54	39.31	27.91	10.0	5.0
25.07.1999	6:56	39.31	28.00	10.0	5.0
23.08.1979	16:47	39.69	28.57	10.0	5.0
18.07.1979	13:12	39.67	28.66	10.0	5.2

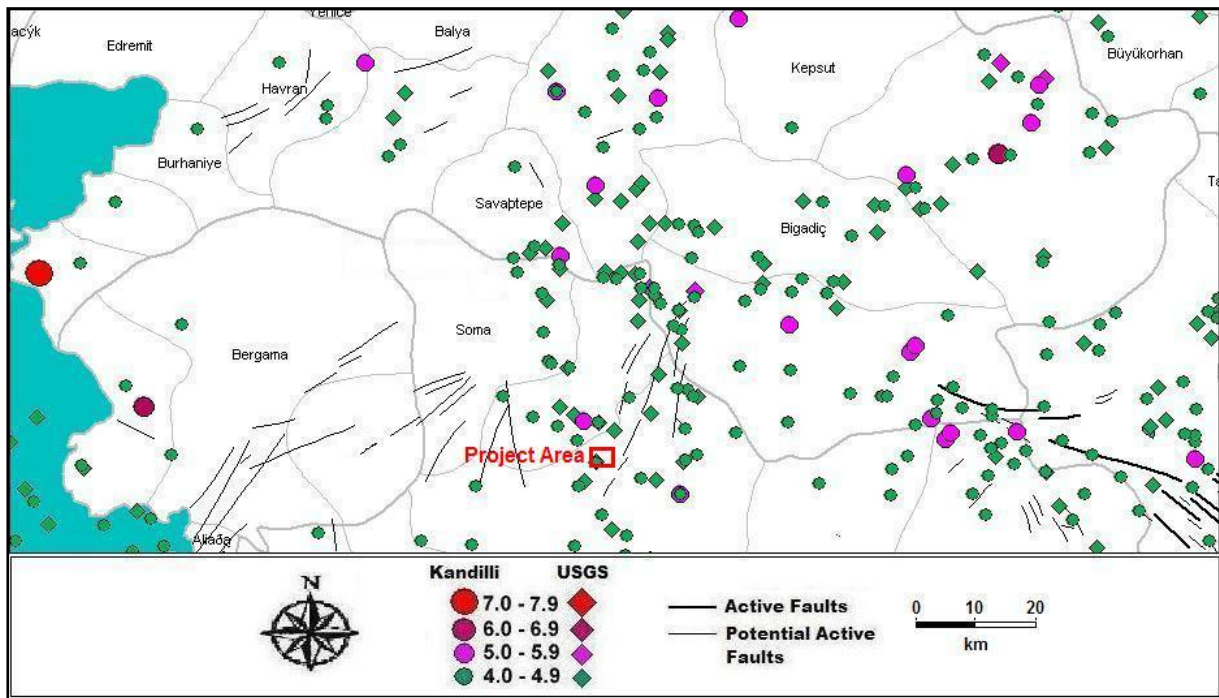


Figure 4-15 Distribution of Earthquakes with Magnitudes 4.0 or Higher Since the 20th Century

(Source: Sayısalgrafik, 2009)

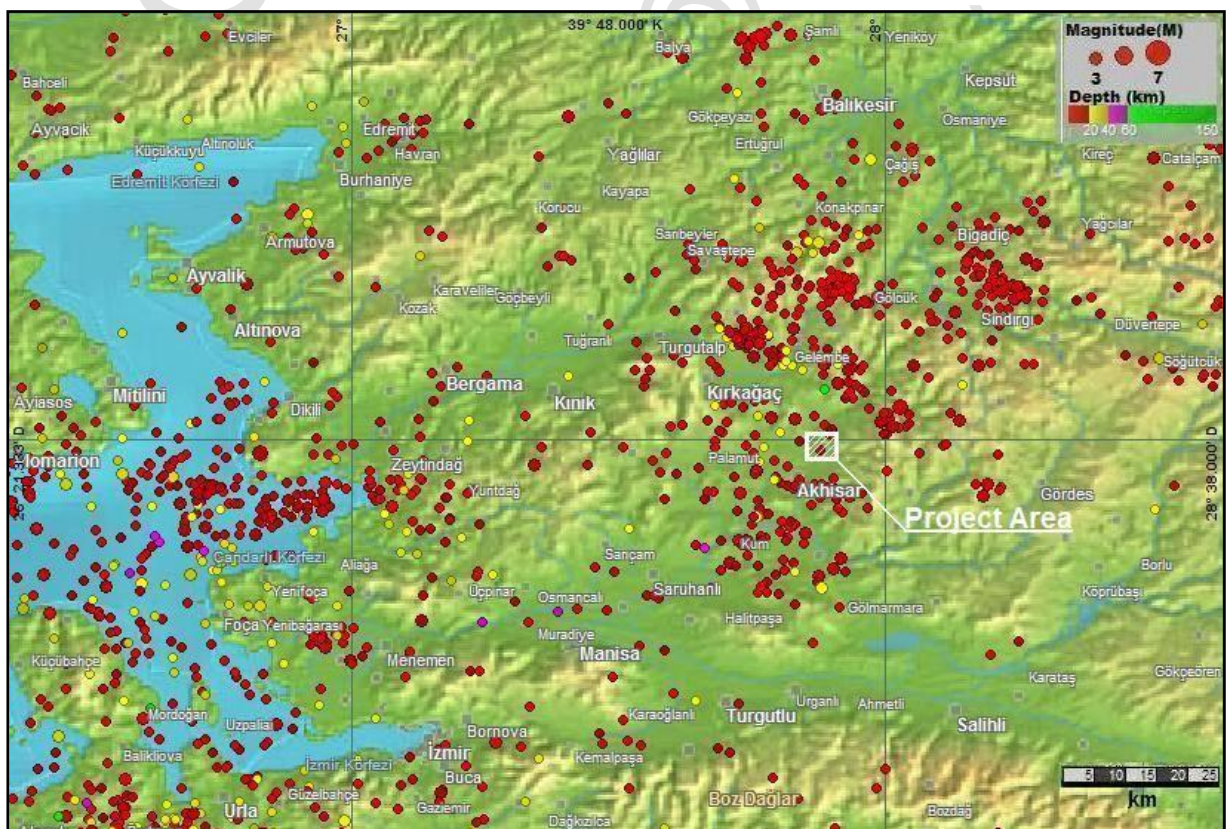


Figure 4-16 Earthquakes in the Last Year with Magnitudes Ranging from 3.0 and 7.0

(Source: Kandilli, 2009)

4.7 Hydrology and Hydrogeology

4.7.1 Surface Water

The wind turbines are located in the Gediz Basin which is the part of the Scattered Aegean Waters Basin (Müteferrik Ege Suları Havzası). The following settlements; Manisa Province and Menemen, Turgutlu, Salihli and Kula towns lie within this basin.

The main surface waters of Gediz Basin are the Gediz River and its tributaries, which are namely Selendi Creek, Kocaçay Creek, Demirci Creek, Kum Creek, Nif Creek and Alaşehir Creek. The Gediz River that originates from the piedmont of Mt. Murat, discharges into the Aegean Sea. Figure 4-17 shows the Gediz Basin together with the surface water courses and gauging stations. Detailed information for the gauging stations is listed in

Table 4-5.

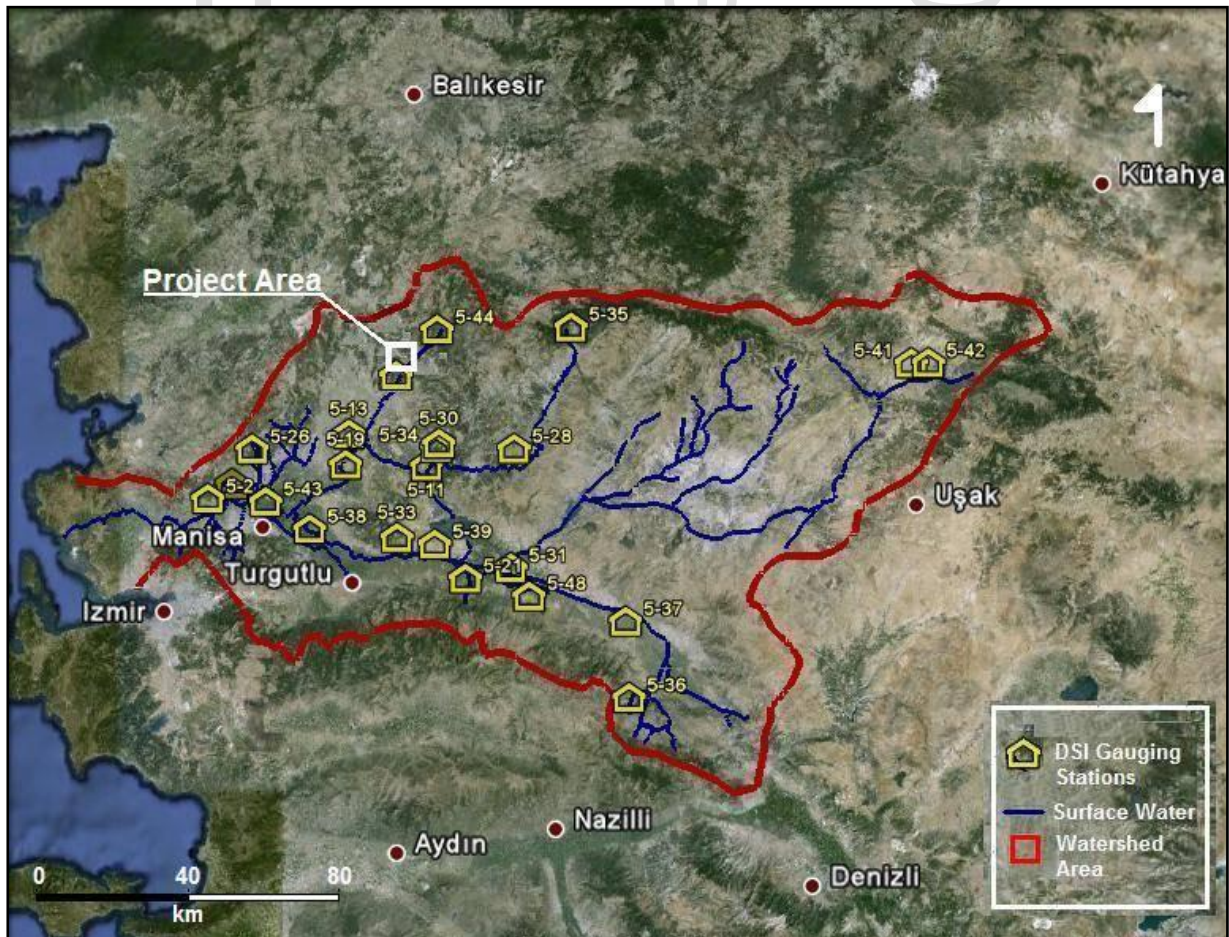


Figure 4-17 DSI Gauging Stations in the Bakırçay Basin on Topographic View

(Source: Modified from Google Earth, 2009)

Table 4-5 Detailed Information on DSI Gauging Stations

Stream	Gauging Station number (AGI)	Drainage Area (km ²)	Maximum Monthly Flow (m ³ /s) / Month
Çitalan Creek	4-30	72.2	8.30 / January
Bakırçay River	4-2	2940.0	40.28 / February
Bakırçay River	4-25	96.8	0.78 / February
Bakırçay River	4-24	486.9	3.30 / January
Bakırçay River	4-8	727.7	11.50 / January
Bergama Creek	4-34	81.0	1.97 / February
Çaltıcak Creek	4-27	34.3	0.50 / February
İlica Creek	4-7	287.4	10.91 / February

4.7.2 Springs

Geothermal activities are controlled by thrust faults and strike-slip fault systems of Manisa Region. Important geothermal fields in the region are Alaşehir-Sarıköz (25°C), Manisa-İlıcak, Kula-Acısü, Kula-Selendi (54°C), Demirci-Hisar (37°C), Demirci-Borlu (54°C), Soma-Menteş (42°C), Salihli-Kurşunlu (52°C), Salihli-Sart, Turgutlu-Urganlı (45-76°C) and Kula-Şehitler (Manisa Province Environmental Status Report, 2010).

4.7.3 Groundwater and Wells

Groundwater reservoir of Manisa Province was calculated as 202.5 hm³/year in Provincial Environmental Report of Manisa Province which was completed by Manisa Provincial Department of Environment and Urbanization in 2004. Nearly all of this groundwater is discharged by the wells in the agricultural zones, again according to the Manisa Province Environmental Status Report (2010).

According to the DSI records, there are 48 investigation and production wells in the basin where the project area is included. These numbers do not include the private wells in the region (both registered and unregistered). The water bearing geological units are comprised of clay, gravel, radiolarite, conglomerate, marble and limestone. The average depth of these wells is 156 m of which the shallowest one is 47.8 m and the deepest is 464 m. Table 4-6 gives detailed information about the registered DSI wells in the basin below. Total average yield is 34.6 l/s.

Table 4-6 Records of DSI Wells

Well ID	Well Name	Town	Easting	Northing	Total Depth (m)	General Aquifer Lithology	Yield (l/s)
29936	Tekel Sigara Fab.	Akhisar	570000	4307275	80.0	Clay and gravel	60.0
29937	Tekel Sigara Fab.	Akhisar	569850	4307050	81.2	Gravel	60.0
30064	Akpınar Kaynakları	Akhisar	584374	4284550	109.0	Marble	63.0
30065	İlıcak Su Kaynağı	Akhisar	579100	4291675	73.0	Breccia and limestone	60.0
30688	Akpınar Kaynağı	Akhisar	584900	4285150	79.1	Marble	57.5
34799	Beyoba	Akhisar	570400	4298050	150.0	Limestone	40.0
38135	Beyoba Koop.	Akhisar	569150	4296370	168.0	Clay and calcareous gravel	40.0
38136	Beyoba	Akhisar	595875	4268875	148.0	Clay and calcareous gravel	40.0
38137	Beyoba	Akhisar	595375	4268450	120.0	Clay and calcareous gravel	40.0
38138	Beyoba	Akhisar	567100	4296335	170.0	Clay and calcareous gravel	40.0

Well ID	Well Name	Town	Easting	Northing	Total Depth (m)	General Aquifer Lithology	Yield (l/s)
41799	Mecidiyeköy	Akhisar	559275	4305350	220.0	Claystone and conglomerate	55.0
41845	Akçeşme	Akhisar	578575	4293725	120.0	Clay and gravel	20.0
42925	Ovaköy (Medar)	Akhisar	572125	4314400	116.0	Clay and gravel	40.0
42926	Ovaköy (Medar)	Akhisar	571900	4314350	126.0	Clay, sand and gravel	40.0
42927	Ovaköy (Medar)	Akhisar	571600	4314175	130.0	Gravel, radiolarite and scist	40.0
42928	Ovaköy (Medar)	Akhisar	572125	4314100	130.0	Gravel, radiolarite and scist	40.0
42929	Ovaköy (Medar)	Akhisar	571975	4313825	125.0	Gravel, radiolarite and scist	40.0
42930	Ovaköy (Medar)	Akhisar	571875	4314125	122.0	Clay and gravel	40.0
42931	Ovaköy (Medar)	Akhisar	571700	4313825	130.0	Gravel, radiolarite and scist	40.0
50389	Akhisar - Çoban	Akhisar	566900	4319450	152.0	Clay, sand and marl	18.0
52465	Akhisar - Sazoba	Akhisar	569600	4295000	464.0	Calcareous gravel and limestone	-
52466	Akhisar - Sazoba	Akhisar	570000	4295125	200.0	Calcareous and clay	30.0
52467	Akhisar - Sazoba	Akhisar	569150	4294450	99.2	Limestone	25.0
52468	Akhisar - Sazoba	Akhisar	569000	4295850	196.0	Clay and calcareous gravel	30.0
52469	Akhisar - Sazoba	Akhisar	569250	4295375	192.0	Clay, sand and gravel	30.0
52471	Akhisar - Sazoba	Akhisar	570300	4295250	452.0	Clay, sand and gravel	30.0
52826	Akhisar - Sazoba	Akhisar	571190	4309471	148.0	Clay and gravel	30.0
52827	Akhisar - Sazoba	Akhisar	571175	4294625	164.0	Clay and gravel	30.0
52828	Akhisar - Sazoba	Akhisar	569175	4293625	112.0	Conglomerate	30.0
53245	Akhisar - Mecidiye	Akhisar	558750	4306300	141.0	Conglomerate	25.0
53246	Akhisar - Mecidiye	Akhisar	558875	4306200	107.0	Claystone and conglomerate	20.0
53247	Akhisar - Mecidiye	Akhisar	558375	4306125	244.0	Claystone and conglomerate	2.0
53248	Akhisar - Mecidiye	Akhisar	558600	4306425	186.0	Sandstone and conglomerate	4.5
53249	Akhisar - Mecidiye	Akhisar	558200	4306325	210.0	Claystone and conglomerate	20.0
53274	Akhisar Beyoba - Gediz	Akhisar	568250	4297550	160.0	Clay and gravel	20.0
53275	Akhisar - Beyoba	Akhisar	570500	4297700	160.0	Clay, sand and gravel	30.0
53276	Akhisar - Beyoba	Akhisar	569075	4296050	142.0	Clay and gravel	30.0
53277	Akhisar - Beyoba	Akhisar	568875	4297525	160.0	Clay and gravel	30.0
54351	Akhisar - Çobanhasan	Akhisar	567400	4319050	172.0	Marl and limestone	20.0
54352	Akhisar - Çobanhasan	Akhisar	567225	4319225	168.0	Marl and limestone	22.0
54353	Akhisar - Moralılar	Akhisar	573100	4302175	120.0	Limestone	50.0
54354/A	Akhisar - Moralılar	Akhisar	573175	4302375	47.8	Limestone	-
54354/B	Akhisar - Moralılar	Akhisar	573360	4302600	106.0	Limestone	40.0
54355	Akhisar - Moralılar	Akhisar	573000	4301925	120.0	Gravel and limestone	40.0
54356	Akhisar - Moralılar	Akhisar	573025	4301700	152.0	Clay, gravel and limestone	50.0
54357	Akhisar - Moralılar	Akhisar	572940	4301375	136.0	Clay, gravel and limestone	50.0
57253	Akhisar - Beyoba	Akhisar	569600	4296850	-	Clay, sand and conglomerate	30.0
50667/B	Kırkağaç - İlyaslar Köyü	Kırkağaç	570875	4326500	222.0	Claystone and siltstone	1.0

4.8 Flora

Methodology

In order to determine the flora species within the Project site and its vicinity, site survey on the Project site and literature survey was conducted. The site survey was conducted within the scope of the Project Description Report (PDR) in July 2008 by a local consultancy company. Flora inventory was prepared by the expert biologist Lütfiye Özdirek from AECOM following a comprehensive literature survey covering the results of the site survey, Turkish Plants Data Service (TUBIVES) database and referencing floristic studies of the similar ecological characteristics. Flora inventory, conservation status of flora species any risk related to them are presented in this section.

In the flora inventory, conservation status of flora species, risks related to the Project and appropriate mitigation measures are specified.

The inventory of the flora species on the Project site is presented in Table 4-8. The flora species in the table are in alphabetical order. The flora table presents the family, scientific name, endemism category, phytogeographical region, common name, habitat type and the conservation status of the plants according to International Union for Conservation of Nature (IUCN) Red List of Threatened Species (2008).

In order to determine conservation status of the identified flora species “Red Data Book of Turkish Plants” (Ekim *et al.*, 2000) that is published by Turkish Association for the Conservation of Nature (*Türkiye Tabiatını Koruma Derneği*) was used. In the nomenclature, *Turkish Plant Names Dictionary* (Türkçe Bitki Adları Sözlüğü) (Baytop, 1997) was used. In addition, for the local name, habitat and endemism categories Turkish Plant Information Service (TÜBİVES), which is prepared by the Scientific and Technological Research Council of Turkey (TUBİTAK), was used.

Endemics by the hazard categories were determined and assessed in accordance with the study titled as “Türkiye’nin Tehlike Altındaki Nadir ve Endemik Bitkileri” (List of Rare, Threatened and Endemic Plants of Turkey) authored by Ekim *et al.* and prepared jointly by Turkish Association for Conservation of Nature and Van Yüzüncü Yıl University (2000) and according to “Flora of Turkey 1-10” (Davis, 1994). The risk categories of endemic taxa are given below:

The categories of conservation status according to Red Data Book are as follows:

EX: Extinct	NT: Near Threatened
EW: Extinct In The Wild	LC: Least Concern
CR: Critically Endangered	DD: Data Deficient
EN: Endangered	NE: Not Evaluated
VU: Vulnerable	

Vegetation

Dominant vegetation type in the Project site and its vicinity is assessed in this part. According to terrestrial eco-regions determined by the World Wildlife Fund (WWF), the Project site and its vicinity lies in the “Aegean and Western Turkey Sclerophyllous and Mixed Forests (PA1201)”. Communities of maquis, dominated by evergreen shrubs and Callabrian pine (*Pinus brutia*), are the most common formations in this eco-region (National Geographic, 2009).

According to the vegetation map prepared by İzmir Regional Directorate of Forestry (Official Website, 2009) and the visual observations, Turkish pine (*Pinus brutia*) dominates in the region where Project site is located. The natural vegetation map of Manisa Province is shown in Figure 4-18.

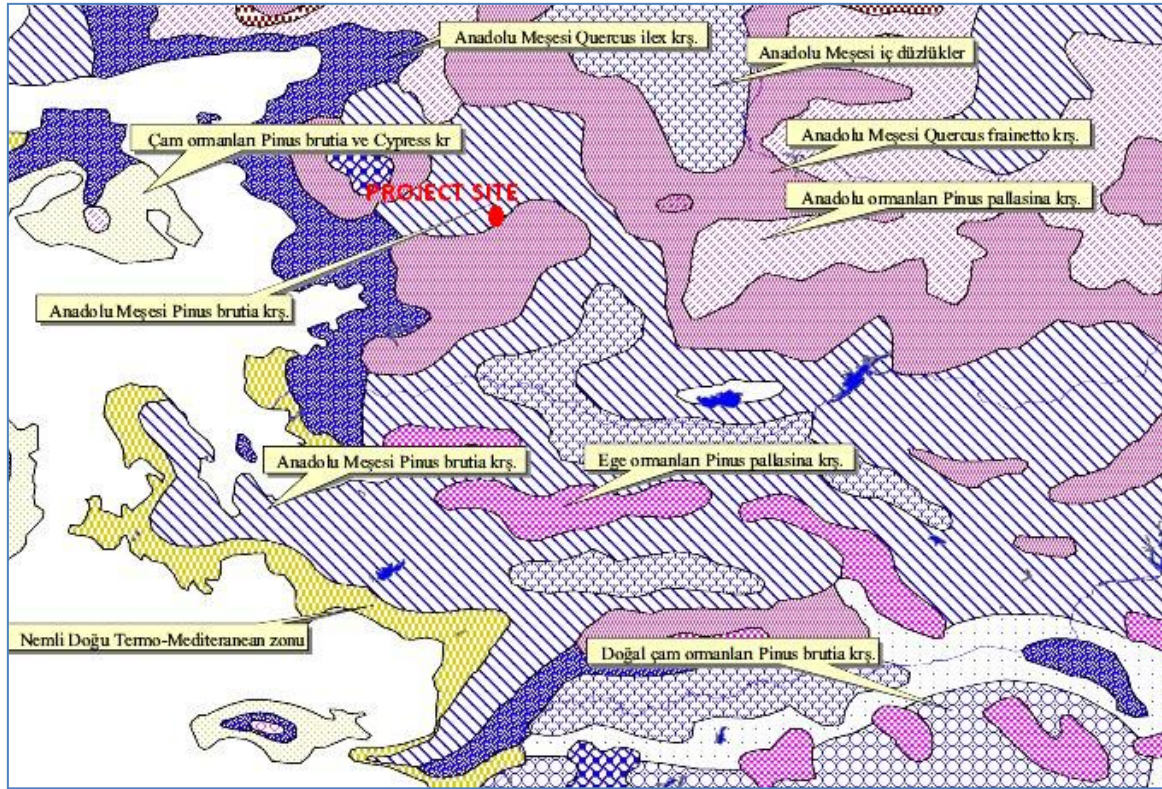


Figure 4-18 Natural Vegetation Map

(Source: Official Website of İzmir Regional Directorate of Forestry)

According to the 1:25,000 scale topographic map, the Project site is located mainly in the forest area. During the site visit (2008), it was observed that the site is dominantly covered by evergreen trees. The general view of the Project site and fire protection roads are given in Figure 4-19.



Figure 4-19 General View of the Project Site and Fire Prevention Roads

Floristic Analysis

Anatolia has been divided into three main phytogeographical regions: The European-Siberian (Black Sea), Iran-Turan (Central, Eastern and Southeastern Anatolia Regions) and Mediterranean (Aegean and Mediterranean Regions) Phytogeography (Atalay, 1994) (Figure 4-20). Being in the western Anatolia the project site is located in the Mediterranean Phytogeographical Region.

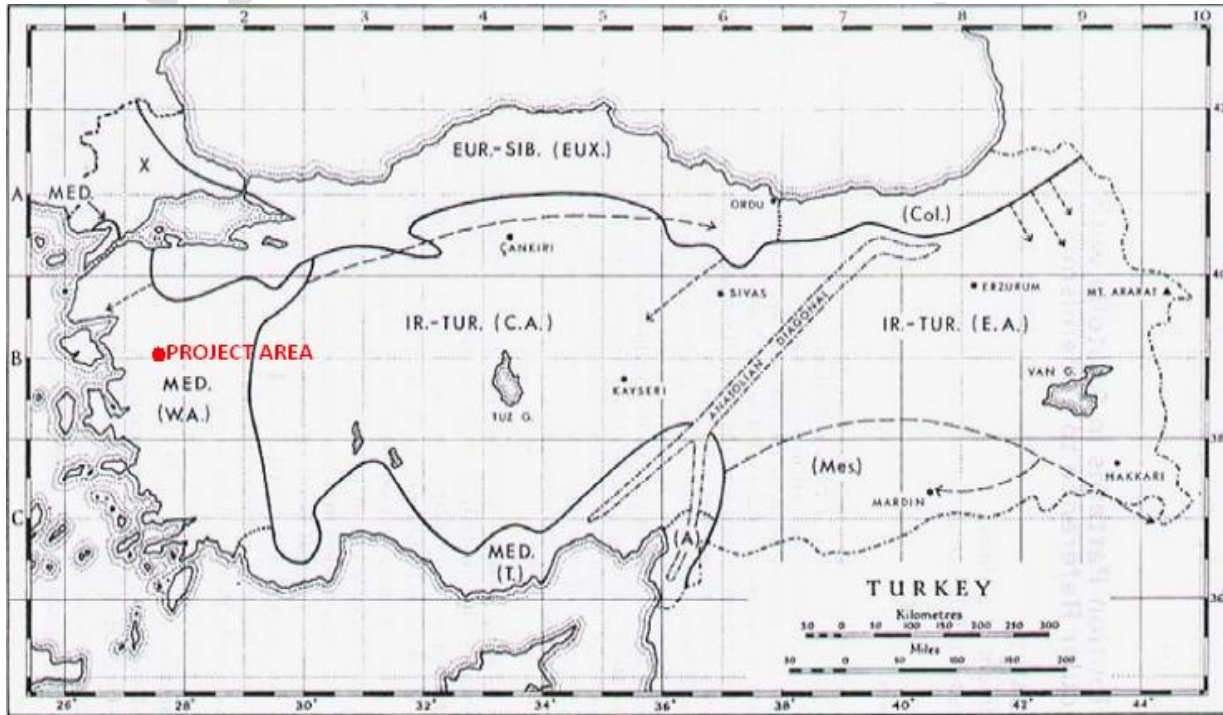


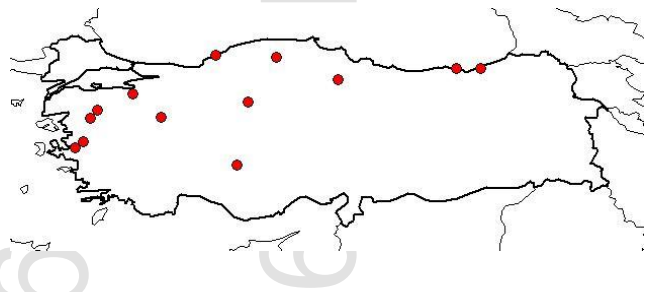
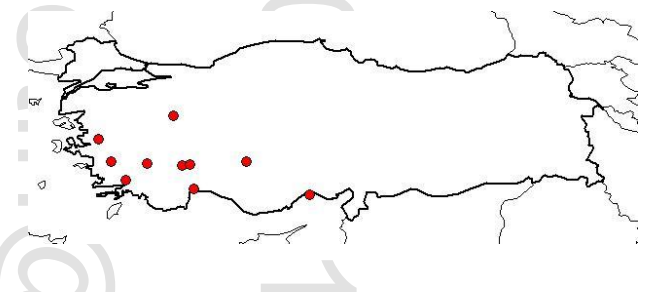
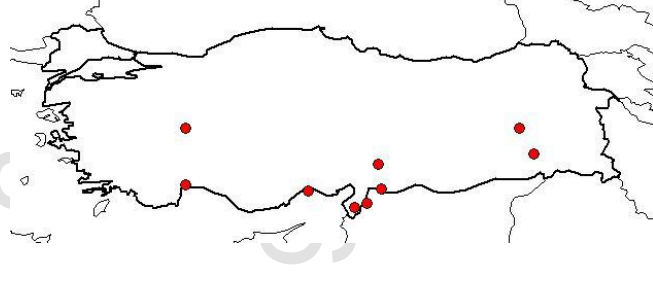
Figure 4-20 The Location of project site with respect to the Phytogeographical Regions of Turkey

Source: Davis P.H., Harper P.C. and Hege I.C. (eds.), 1971. *Plant Life of South-West Asia*. The Botanical Society of Edinburgh

As described in the methodology section, the flora table is prepared using the results of the site survey which was conducted within the scope of the PDR, literature, Turkish Plants Data Service (TUBIVES) database and referencing floristic studies of the similar ecological characteristics. As a result of this inventory study, 73 species belonging to 24 families are identified in the Project area and its vicinity. Flora inventory is provided in Table 4-8.

As a result of this study, no threatened, vulnerable or endangered flora species were determined in the Project area in accordance with the Red Data Book (IUCN). Among these species, *Heracleum platytaenium*, *Peucedanum chryseum*, and *Dorycnium pentaphyllum subsp. haussknechtii* are classified as LC (Least Concern) and endemic according to the Red Data Book of Turkish Plants. Although these species are endemic, they are abundant in Aegean and Mediterranean Regions, according to the official website of Turkish Plants Data Service (TUBIVES) (Table 4-7).

Table 4-7 Taxon Data and the Distribution Maps of the Endemic Plant Species of Project site

<i>Heracleum platytaenium</i> BOISS.	
General Taxon Information	Distribution of The Taxon Over Turkey
Type : Monocarpic Structure : herbaceous Blooming period : 5-7 Habitat : mixed forests, rocky slopes, river banks, shores Height : 0-1500 Endemism : endemic Phytogeographical region : Blacksea Turkey distribution : Southern., Western And Central Anatolia General distribution : Turkey	
<i>Peucedanum chryseum</i> (BOISS. ET HELDR.) CHAMBERLAIN	
General Taxon Information	Distribution of The Taxon Over Turkey
Type : Perennial Structure : Herbaceous Blooming period : 7-8 Habitat : dry slopes, <i>Pinus brutia</i> forests, streams, Height : 100-1200 Endemism : endemic Phytogeographical region : Not known General Distribution : Southern., Western. and Central Anatolia General Distribution : Turkey	
<i>Dorycnium pentaphyllum</i> SCOP. subsp. <i>haussknechtii</i> (BOISS.) GAMS	
General Taxon Information	Distribution of The Taxon Over Turkey
Type : Perennial Structure : herb or semi-shrub Blooming period : 5-8 Habitat : Dry limestone slopes, <i>Quercus coccifera</i> shrubs, coniferous forests, under <i>Pinus brutia</i> Height : 200-1650 Endemism : endemic Phytogeographical region : Iran-Turanian Turkey distribution : Central, South and Eastern(Southern edge) Anatolia General Distribution : Turkey	

There are no plant species in the Project area that are protected under CITES and the Bern Convention.

Table 4-8 List of Flora Species Identified in the Project Site

Scientific Name	Turkish Name	Common Name	Phytogeographical region	Habitat	RDB* (IUCN)	Endemism
Apiaceae						
<i>Bupleurum asperuloides</i>	-	-	Not known	forests, shrubs,	NE	-

Scientific Name	Turkish Name	Common Name	Phytogeographical region	Habitat	RDB* (IUCN)	Endemism
<i>Foeniculum vulgare</i>	Rezene	Fennel	Not known	dry slopes, pine forests,	NE	-
<i>Heracleum platytaenium..</i>	Tavşancıl otu	Cow Parsnip	Blacksea	mixed forests,	NE	+
<i>Peucedanum chryseum</i>	-	-	Not known	dry slopes, <i>Pinus brutia</i>	LC	+
Asteraceae						
<i>Anthemis aciphylla</i> var. <i>aciphylla</i>	-	-	Eastern Mediterranean	Quercus, Pinus, Juniperus	LC	-
<i>Anthemis austriaca</i>	-	Austrian	Not known	steppe, fallow fields,	NE	-
<i>Carduus pycnocephalus</i> L. subsp. <i>albidus</i>	-	Italian thistle	Not known	rocky area, field, free space, Pinus	NE	-
<i>Centaurea triumphettii</i>	Peygamber çiçeği	Compositae	Not known	Forest of Pinus, Quercus	NE	-
<i>Centaurea solstitialis</i> L. subsp. <i>solstitialis</i> L.	Zerdali diken	-	Not known	Pinus forest, arid slopes,	LC	-
<i>Filago eriocephala</i>	-	Cudweeds	Eastern Mediterranean	forest opening,	NE	-
<i>Jurinea consanguinea</i>	-	-	Not known	steppe, fallow fields,	NE	-
<i>Lapsana communis</i> L. subsp. <i>adenophora</i>	-	Nipplewort	Not known	forest, shaded area, river edge,	NE	-
<i>Lapsana communis</i> L. subsp. <i>pisidica</i>	-	Nipplewort	Not known	opening of forest, scrub,	NE	-
<i>Lapsana communis</i> L. subsp. <i>intermedia</i>	-	Nipplewort	Not known	deciduous forest, Pinus forest clearance,	NE	-
<i>Pilosella hoppeana</i> subsp. <i>pilisquama</i>	-	-	Not known	Pinus sylvestris. and Pinus brutia forest,	NE	-
<i>Pilosella hoppeana</i> subsp. <i>troica</i>	-	-	Not known	pine forest, grassland,	NE	-
Boraginaceae						
<i>Alkanna tinctoria</i> subsp. <i>anatolica</i>	-	Alkanet	Eastern Mediterranean	dry hillsides, limestone, steppe, scrub, Pinus	NE	-
<i>Alkanna tinctoria</i> subsp. <i>subleiocarpa</i>	-	Alkanet	Eastern Mediterranean	sand dunes, pine forests,	LC	-
Campanulaceae						
<i>Asyneuma rigidum</i> subsp. <i>rigidum</i>	-	-	Iranian Turanian	forests, scrub,	NE	-
<i>Legousia speculum-veneris</i>	-	European Venus	Mediterranean	Pinus sylvestris	NE	-
Caryophyllaceae						
<i>Dianthus calocephalus</i>	Yabani karanfil	-	Not known	sand dunes, volcanic and limestone slopes, steppe	NE	-

Scientific Name	Turkish Name	Common Name	Phytogeographical region	Habitat	RDB* (IUCN)	Endemism
Crassulaceae						
<i>Sedum pallidum</i>	-	Pale stonecrop	Not known	deciduous forests, the	NE	-
Cyperaceae						
<i>Carex divulsa</i> subsp. <i>divulsa</i>	-	Sedge	European Siberian	Forests, shaded and open areas, ravines, thickets	NE	-
<i>Carex divulsa</i> subsp. <i>leersii</i>	-	Sedge	European Siberian	forests, gorges, mountains	NE	-
Datisceae						
<i>Datisca cannabina</i> L.	Yalancı kenevir	False hemp	Not known	open forests, river banks	NE	-
Ericaceae						
<i>Arbutus andrachne</i> L.	Sandal Ağacı	-	Not known	shrubs, Pinus brutia	LC	-
Euphorbiaceae						
<i>Euphorbia falcata</i> L. subsp. <i>falcata</i> L. var. <i>falcata</i> L.	Sütlegən	-	Not known	the edge of pine forests, <i>Quercus coccifera</i>	LC	-
<i>Euphorbia kotschyana</i>	-	-	Eastern Mediterranean (Mountain)	Abies and Cedrus and Juniperus	NE	-
Fabaceae						
<i>Anthyllis vulneraria</i> L. subsp. <i>hispidissima</i>	-	-	Not known	-	NE	-
<i>Astragalus trojanus</i>	Geven	-	Eastern Mediterranean	steppe, maquis	LC	-
<i>Dorycnium pentaphyllum</i> subsp. <i>anatolicum</i>	-	-	Not known	calcareous steppe, dry meadows, stony	NE	-
<i>Dorycnium pentaphyllum</i> subsp. <i>haussknechtii</i>	-	-	Iranian Turanian	dry limestone slopes,	LC	+
<i>Hymenocarpus circinnatus</i>	-	Disk Trefoil	Mediterranean	Degraded shrubs and pine forests,	NE	-
<i>Lathyrus laxiflorus</i> subsp. <i>laxiflorus</i>	-	-	Not known	forest, bush, shady	NE	-
<i>Lens nigricans</i>	-	-	Mediterranean	hill slopes, rocky Pinus brutia	NE	-
<i>Trifolium glanduliferum</i> var. <i>glanduliferum</i>	yonca	-	E. Mediterranean	under shrubs and pine	NE	-
<i>Vicia articulata</i>	-	-	Not known	pine woods, scrub, limestone	NE	-
<i>Vicia grandiflora</i> var. <i>grandiflora</i>	-	-	Multi element	forest, bushes,	NE	-
Fagaceae						

Scientific Name	Turkish Name	Common Name	Phytogeographical region	Habitat	RDB* (IUCN)	Endemism
<i>Quercus cerris</i>	Türk meşesi	Turkish oak	Mediterranean	mixed and deciduous forests, other types of <i>Quercus</i>	NE	-
<i>Quercus coccifera</i>	Kermes meşesi	-	Mediterranean	scrub and maquis, <i>Pinus brutia</i>		
<i>Quercus pubescens</i>	Tüylü meşe	Downy Oak	Not known	<i>Pinus nigra</i> , <i>Quercus cerris</i> , <i>Fagus</i> , <i>Cestegus</i>	NE	-
<i>Quercus trojana</i>	Makedonya meşesi	Macedonian Oak	E. Mediterranean	together with other types of <i>Quercus</i> deciduous groves,	NE	-
<i>Quercus infectoria subsp. infectoria</i>	Mazı meşesi	-	European –Siberian	With species of <i>Quercus</i> and <i>Pinus brutia</i>	NE	
Gentianaceae						
<i>Blackstonia perfoliata subsp. perfoliata</i>	-	Yellow-wort	Not known	in the humid forests, roadside boundaries.	NE	-
Lamiaceae						
<i>Calamintha nepeta subsp. glandulosa</i>	Ballıbaba	-	Not known	<i>Fagus</i> - <i>Castanea</i> forests, sandy and rocky	NE	-
<i>Lamium caricense</i>	Bahçe ballıbabası	-	E. Mediterranean	<i>Pinus nigra</i> forests, shady rocks,	NE	-
<i>Micromeria myrtifolia</i>	Taş nanesi	Maquis	E. Mediterranean	rocky slopes and crevices (usually	NE	-
<i>Sideritis montana . subsp. remota</i>	-	-	Mediterranean	cultivated and fallow fields, steppe, dry	NE	-
<i>Stachys cretica subsp. smyrnaea</i>	-	-	E. Mediterranean	<i>Pinus brutia</i> forests, limestone hill	LC	-
<i>Teucrium orientale var. glabrescens</i>	-	-	Not known	sparse <i>Pinus nigra</i> forests, dry, volcanic	NE	-
Liliaceae						
<i>Allium amethystinum</i>	-	Round-headed leek	Mediterranean	<i>Pinus</i> forests, <i>poterium</i> scrub,	NE	-
<i>Allium guttatum subsp. sardoum</i>	Yabani Sarımsak	-	Mediterranean	coniferous forests, rocky	NE	-

Scientific Name	Turkish Name	Common Name	Phytogeographical region	Habitat	RDB* (IUCN)	Endemism
<i>Allium paniculatum</i> L. subsp. <i>paniculatum</i> L.	Sirmo	-	Mediterranean	Pinus forests, groves of Fagus and	NE	-
<i>Merendera attica</i>	Yırtık Çiğdem	-	E. Mediterranean	over-grazed hills of limestone, bare slopes, <i>Pinus brutia</i>	NE	-
<i>Tulipa orphanidea</i>	Manisa Lalesi	-	E. Mediterranean	<i>Pinus nigra</i> forest,	NE	-
Myrtaceae						
<i>Myrtus communis</i> subsp. <i>communis</i>	Mersin	-	Not known	kayalık yamaçlar, <i>Pinus brutia</i> ormanları,	LC	-
Orchidaceae						
<i>Ophrys reinholdii</i> subsp. <i>reinholdii</i>	Orkide	-	Eastern mediterranean	calcareous slopes, scrub, scrub thickets of	NE	-
<i>Ophrys reinholdii</i> subsp. <i>straussii</i>	Orkide	-	Iranian Turanian	Quercus thickets and Pinus	NE	-
<i>Ophrys vernixia</i> subsp. <i>vernixia</i>	Orkide	-	Mediterranean	calcareous slopes, scrub and	NE	-
<i>Orchis provincialis</i>	Orkide	-	Mediterranean	Pinus forests with grassy	NE	-
Paeoniaceae						
<i>Paeonia mascula</i> subsp. <i>arietina</i>	Ayrgülü (Orman	-	Not known	bush, rocky slope	NE	-
Papaveraceae						
<i>Papaver gracile</i>	Kara Gelincik	-	E. Mediterranean	rocky scrub	-	-
Pinaceae						
<i>Pinus nigra</i> subsp. <i>pallasiana</i>	Kara Çam	-	Not known	forest	LC	-
<i>Pinus brutia</i>	Kızıl Çam	-	E. Mediterranean	forest	LC	-
Poaceae						
<i>Apera intermedia</i>	-	-	Iran Turanian	dry hillsides, sandy shores of the river, bush	NE	-
<i>Phleum exaratum</i> subsp. <i>exaratum</i>	-	-	Not known	open areas, pine forests, salt flat	NE	-
<i>Poa angustifolia</i>	-	-	Not known	wet meadows, pine and oak forest, dry	NE	-
<i>Poa pratensis</i>	-	Maquis	Not known	alpine meadows, wet meadows	NE	-

Scientific Name	Turkish Name	Common Name	Phytogeographical region	Habitat	RDB* (IUCN)	Endemism
Rosaceae						
<i>Potentilla micrantha</i>			Not known	forests, streams	NE	-
<i>Sanguisorba minor subsp. muricata</i>	Çayırduğmesi, Kara	–	Not known	fields, forests, hills	NE	-
Santalaceae						
<i>Thesium divaricatum</i>	-	-	European-Siberian	birch forest, pine forest	NE	-
Scrophulariaceae						
<i>Verbascum cheiranthifolium</i>	-	-	Not known	forests, Quercus thickets, savannas	NE	-
<i>Verbascum glomeratum</i>	Siğirkuyruğu	–	Iran Turanian	Quercus, Pinus	NE	-
<i>Veronica trichadena</i>	-	-	Mediterranean	limestone Pinus Forests, Quercus and	NE	-

Red Data Book of Turkish Plants

4.9 Fauna

In order to determine the terrestrial fauna species within the Project site and its vicinity, subsequent to the fauna field survey which was conducted within the scope of the PDR, a literature survey was conducted. This section includes the fauna inventory, characteristics of their habitats and the conservation status. According to this study, the project related impacts on the terrestrial fauna species as well as the mitigation measures for these impacts are presented in Section 5.8.

In the scope of the terrestrial fauna study, amphibians, reptiles, birds and mammals within the Project site and its vicinity with their habitats are reviewed. The species, which are identified in the areas that are ecologically connected to the Project site and its vicinity, are also included in this study. The main reason for that inclusion is the mobility of the animals so that they are able to enter to the Project site.

In the course of the literature survey “Vertebrates of Turkey, Amphibians “(*Türkiye Omurgalıları, Amfibiler*)” by Prof. Dr. Ali Demirsoy (1996), “Vertebrates of Turkey, Reptiles “(*Türkiye Omurgalıları, Sürüngenler*)” by Prof. Dr. Ali Demirsoy (1996), and “Vertebrates of Turkey, Mammals “(*Türkiye Omurgalıları, Memeliler*)” published by Prof. Dr. Ali Demirsoy (1996) were utilized.

The national and international conservation statuses of the fauna species of the Project site were evaluated. For this purpose, most updated versions of European Red List (ERL) prepared by the International Union for Conservation of Nature (IUCN), the Bern Convention criteria, the 2012-2013 Decisions of Central Hunting Commission (CHC) of Ministry of Forestry and Water Affairs have been used. In addition, the “Red Data Book for Turkish Birds” prepared by Kızıroğlu (2008) has been used as a national scale reference for the birds observed within the Project site.

Finally, it has also been assessed that if there are any endemic species identified in the area.

The categories classified according to the Central Hunting Commission decision for 2012-2013 are shown in the table below.

1	Wild Animals under Protection by the Ministry of Environment and Forestry
2	Wild Animals under protection by the Central Hunting Commission
3	Wild Animals permitted for Hunting in Specific Periods

The fauna species that are protected by the Bern Convention are grouped under two categories:

Annex II	Strictly protected species
Annex III	Protected species

Annex II- Strictly Protected Species

The following activities are strictly prohibited:

- Any kind of deliberate capturing- keeping and illegal methods of killing;
- Deliberate damage and destruction of the breeding or sheltering areas;
- Deliberately disturbing the wild fauna especially during their breeding, development and winter hibernation seasons in a manner contrary to the intended purpose of this convention;
- Collecting eggs from the wild or deliberately destructing such eggs or keeping such eggs even if they are empty;
- Being in possession of or domestic trading of the fauna species either alive or dead.

Annex III- Protected Fauna Species

Temporary or regional prohibition under appropriate conditions should be taken in order to ensure that the related wild fauna reach to the satisfactory population levels. There are prohibited hunting seasons and the other national principles according to the decisions of the Central Hunting Commission.

The related works and activities will not certainly lead to any negative impacts on the species specified in the fauna lists above and the other wildlife species. During the related works and activities, the decisions taken by the Ministry of Forestry, Central Hunting Commission for the season 2011-2012 and the decisions of the Central Hunting Commission to be declared in future years and the provisions of the Bern Convention will be strictly followed.

The fauna species under protection by **IUCN** are classified as follows:

EX (EXTINCT)	A taxon is Extinct when there is no reasonable doubt that the last individual has died.
CR (CRITICALLY ENDANGERED)	Severely endangered taxon. The population of the species in this category is facing high risk of extinction appearing nearly imminent.
EN (ENDANGERED)	Endangered taxon. The populations of the species in this category are not critically endangered; but are facing a risk of extinction in near future.
VU (VULNERABLE)	High risk of endangerment in the wild.
NT (NEAR THREATENED)	Likely to become endangered in the near future.
LC (LEAST CONCERN)	Lowest risk. Does not qualify for a more at risk category. Widespread and abundant taxa are included in this category.
DD (DATA DEFICIENT)	Not enough data to make an assessment of its risk of extinction
NE (NOT EVALUATED)	Has not yet been evaluated against the criteria

4.9.1 Amphibians

Five amphibian species are estimated to exist in the Project area and its close surroundings. The amphibian species listed in the Project site and its vicinity, their national and international conservation status and information on their population are presented in Table 4-9 below.

The most important elements of amphibians are tailed amphibians (Urodela) which are salamanders and frogs (Anura) which are tailless amphibians. These species need wetlands at least during breeding. Therefore, habitats of amphibians within the Project site were searched in the first hand in the scope of this study.

All amphibian species that are likely to exist in the Project site and its close vicinity are classified as LC (least concern) according to IUCN Red List. European Green Toad (*Bufo viridis*) and Eastern Spadefoot (*Pelobates syriacus*) are included in Annex II of Bern Convention which list strictly protected fauna species. Other amphibians are included in Annex III of Bern Convention which list protected fauna species.

Table 4-9 Amphibians at the Project Area and Their Protection Status

Scientific Name	Common Name	(ERL) IUCN	BERN
HYLIDAE			
<i>Hyla arborea</i>	The European tree frog	LC	Annex -II
BUFONIDAE			
<i>Bufo viridis</i> <i>Pseudopidalea viridis</i>	European green toad	LC	Annex -II
<i>Bufo bufo</i>	The common toad	-	Annex -III
DISCOGLOSSIDAE			

Scientific Name	Common Name	(ERL) IUCN	BERN
<i>Pelobates syriacus</i>	Eastern European Spadefoot Toads	LC	Annex -II
RANIDAE			
<i>Rana ridibunda</i> <i>Pelophylax ridibundus</i>	The Marsh Frog	LC	Annex -III
The abbreviations in the list			
BERN = Bern Convention on the Conservation of European Wildlife and Natural Habitats			
CITES = Convention on International Trade in Endangered Species of Wild			
BERN CONVENTION Annex-II: SPFS (Strictly Protected Fauna Species) Annex-III: PFS (Protected Fauna Species)			
IUCN (International Union of Conservation Nation) Status LC: Least Concern			

Hyla arborea (The European tree frog) is generally associated with open, well-illuminated broad-leaved and mixed forests, bush and shrublands, meadows, gardens, vineyards, orchards, parks, lake shores and low riparian vegetation. Dark and dense forests are avoided. Populations can tolerate periods of dryness and can be encountered in dry habitats. Spawning and larval development takes place in stagnant waters such as lakes, ponds, swamps and reservoirs, and sometimes in ditches and puddles. The species has been reported from anthropogenic landscapes, including large cities.

Bufo viridis (European green toad) species lives in a wide range of forests, forest steppe, scrubland, grassland and alpine habitats. Animals may be present in modified areas including urban centers (e.g. Bucharest), city parks and gardens - and often benefits from disturbed habitats. Spawning and larval development occurs in a diverse range of temporary and permanent water bodies including swamps, ponds, lakes, pools in streams and rivers, reservoirs, ditches and puddles (IUCN, 2011).

Bufo bufo (The common toad) is a widespread and adaptable species present in coniferous, mixed and deciduous forests, groves, bushlands, meadows, arid areas, parks and gardens. It is usually in damp areas with dense vegetation, and large open areas are generally avoided. The species spawns and larval development takes place in still waters and slow-moving parts of rivers and streams. It is present in many modified habitats (IUCN, 2011).

Pelobates syriacus (Eastern European Spadefoot Toad) is a largely fossorial species. Terrestrial habitats occupied are generally open uncultivated lands such as light forests, steppe (and steppe-like habitats), semi-desert and rocky areas. Spawning sites include stagnant temporary waterbodies; river or lakeside temporary water bodies and large permanent pools. It can occur in slightly modified areas, including intensively grazed areas.

Pelophylax ridibundus/ *Rana ridibunda* (The Marsh Frog) is a highly opportunistic amphibian, living in mixed and deciduous forests, forest steppe, and steppe and other grasslands, semi-desert and desert zones. Arid areas are largely colonized through river valleys and channels. The frog prefers open, well-warmed areas with abundant herbaceous vegetation. It is a semi-aquatic species, inhabiting (and breeding in) a wide variety of flowing and stagnant water habitats, from shallow

puddles and ponds to large lakes, reservoirs, rivers and brooks. It may also be found in slightly saline water (IUCN, 2011).

4.9.2 Reptiles

As a result of the literature research, 10 reptiles were listed in the Project site and its vicinity. The reptile species identified in the Project site and its vicinity, their national and international conservation status and information on their population are presented in Table 4-10 below.

Table 4-10 Reptiles at the Project Site and Their Conservation Status

Scientific Name	Common Name	Turkish name	ERL (IUCN)	BERN
CHELONIA (Turtles, tortoises and terrapins)				
TESTUDINIDAE (Tortoises or land turtles)				
<i>Testudo graeca</i>	The Spur-thighed Tortoise	<i>Tosbağa</i>	VU	<i>App-II</i>
SQUAMATA (scaled reptiles) (amphisbaenians, lizards, and snakes)				
<i>Hemidactylus turcicus</i>	<i>Mediterranean House Gecko</i>	<i>Geniş parmaklı keler</i>	-	<i>App-III</i>
<i>Ophisops elegans</i>	Snake-eyed Lizard	<i>Tarla kertenkelesi</i>	LC	<i>App-II</i>
<i>Lacerta viridis</i>	The European Green Lizard	<i>Yeşil kertenkele</i>	-	<i>App-II</i>
<i>Lacerta trilineata</i>	The Balkan Green Lizard	<i>Büyük Yeşil Kertenkele</i>	-	<i>App-III</i>
<i>Elaphe situla</i>	European Ratsnake or Leopard Snake	<i>Ev Yılanı</i>	-	<i>App-III</i>
<i>Natrix tessellata</i>	Tessellated Water Snake	<i>Su yılanı</i>	LC	<i>App-III</i>
<i>Elaphe quatuorlineata</i>	The Four-lined Snake	<i>Sarı yılan</i>	-	<i>App-II</i>
<i>Ablepharus kitaibelii</i>	European Copper Skink	<i>İnce kertenkele</i>	LC	<i>App. II</i>
<i>Typhlops vermicularis</i>	The European blind snake	<i>Kör Yılan</i>	-	<i>App-III</i>
The abbreviations in the table				
BERN = Bern Convention on the Conservation of European Wildlife and Natural Habitats CITES = Convention on International Trade in Endangered Species of Wild Fauna and Flora			O=Observation L=Literature	
BERN CONVENTION				
Annex-II: SPFS: Strictly Protected Fauna Species				
Annex-III: PFS: Protected Fauna Species				
IUCN (International Union of Conservation Nation) Status				
VU: Vulnerable				
LC: Low Concern				

As seen in Table 4-10, among 10 reptile species identified in the Project site and its vicinity, 5 of them are included in Annex II of Bern Convention (strictly protected fauna) and 5 species are included in Annex III of Bern Convention (protected fauna). However, many of these species are very abundant in Turkey.

According to the 2012-2013 Decisions of Central Hunting Commission, all reptile species are included in Annex I which lists species protected by the Ministry of Forestry and Water Affairs. Annex I is the list indicates the species under conservation by the Turkish Government.

There are not any endemic reptilian species found in and around the Project site.

4.9.3 Birds

In the PDR approved by the Manisa Provincial Directorate of Environmental and Urbanization, bird species in the project site and its close vicinity were identified. AECOM reviewed this study and also conducted a literature survey in order to determine the bird species that are most likely to exist in the Project site and its closed vicinity.

The main groups that are affected from wind farms are raptors, waterfowl and migratory birds. Therefore the importance of the Project area and the surrounding areas in terms of these groups of birds are emphasized.

In scope of literature study Kuşbank database which is a service supported by Nature Society of Turkey (*Doğa Derneği*), Birdlife International, Erciyes University and Royal Society for the Protection of Birds (RSPB) is used. This system is the part of global family of "Worldbirds" which is a network that provides a platform for the collection, storage and retrieval of bird observations worldwide by BirdLife International, the RSPB and National Audubon Society. According to the literature study, the probable bird species in the Project site, their conservation status and information on their population are presented in Table 4-11.

As a result of this study, thirty seven (37) bird species are identified as most likely to exist in the Project site and its vicinity. No near-threatened, vulnerable and endangered bird species were identified in the Project area in accordance with the IUCN Red List of Threatened Species. From

For each bird species, family name, common names, Turkish names and conservation status information in accordance with IUCN, Bern Convention and Turkish Central Hunting Commission Decisions (CHC) are provided in Table 4-11.

No bird species identified in the Project site and its vicinity is endemic.

Table 4-11 Birds (Aves) identified in the Project Site and its vicinity and Their Conservation Status

Scientific name	Turkish name	RDB	IUCN	Bern Convention	Status	CHC
<i>Ciconia ciconia</i>	Ak leylek	A.3.1	LC	Annex II	YZ	Annex I
<i>Buteo buteo</i>	Şahin	A.3	LC	Annex II	Y	Annex I
<i>Buteo rufinus</i>	Kızıl şahin	A.3	LC	Annex II	Y	Annex I
<i>Falco tinnuculus</i>	Kerkenez	A.2	LC	Annex II	Y	Annex I
<i>Alectoris chukar</i>	Kıralı keklik	A.2	LC	Annex III	Y	Annex III

Scientific name	Turkish name	RDB	IUCN	Bern Convention	Status	CHC
<i>Columba livia</i>	Kaya güvercini	A.5	LC	Annex III	Y	Annex III
<i>Columba palumbus</i>	Tahtalı güvercin	A.4	LC	Annex III	KZ	Annex III
<i>Streptopelia decaocta</i>	Kumru	A.5	LC	Annex III	Y	Annex II
<i>Streptopelia turtur</i>	Üveyik	A.3.1	LC	Annex III	YZ	Annex III
<i>Otus scops</i>	Ishak kuşu	A.2	LC	Annex II	YZ	Annex I
<i>Athene noctua</i>	Kukumav	A.2	LC	Annex II	Y	Annex I
<i>Caprimulgus europaeus</i>	Çobanaldatan	A.1.2	LC	Annex II	YZ	Annex I
<i>Apus apus</i>	Ebabil	A.3.1	LC	Annex III	YZ	Annex I
<i>Apus melba</i>	Akkanlı ebabil	A.3.1	LC	Annex II	YZ	Annex I
<i>Merops apiaster</i>	Arıkuşu	A.3.1	LC	Annex II	YZ	Annex I
<i>Upupa epops</i>	ibibik	A.2	LC	Annex II	YZ	Annex I
<i>Galerida cristata</i>	Tepeli toygar	A.3	LC	Annex III	Y	Annex II
<i>Alauda arvensis</i>	Tarlakuşu	A.4	LC	Annex III	KZ	Annex II
<i>Hirundo rustica</i>	Kır kırlangıcı	A.5	LC	Annex II	T	Annex I
<i>Hirundo daurica</i>	Kızıl kırlangıç	A.3	LC	Annex II	T	Annex I
<i>Delichon urbicum</i>	Ev kırlangıcı	A.3	LC	Annex II	YZ	Annex I
<i>Anthus campestris</i>	Kır incirkuşu	A.2	LC	Annex II	YZ	Annex I
<i>Oenanthe oenanthe</i>	Kuyrukkakan	A.3	LC	Annex II	YZ	Annex I
<i>Phylloscopus collybita</i>	Çıvgın	A.3.1	LC	Annex II	KZ	Annex I
<i>Lanius collurio</i>	Kızıl sırtlı örümcek kuşu	A.3	LC	Annex II	YZ	Annex I
<i>Lanius senator</i>	Kızıl başlı örümcek kuşu	A.2	LC	Annex II	YZ	Annex I
<i>Pica pica</i>	Saksağan	A.5	LC	Annex III	Y	Annex III
<i>Corvus frugilegus</i>	Ekin kargası	A.5	LC	Annex III	Y	Annex III
<i>Corvus corone</i>	Leş kargası	A.5	LC	Annex III	Y	Annex III
<i>Corvus corax</i>	Kara karga	A.5	LC	Annex III	Y	Annex II
<i>Sturnus vulgaris</i>	Siğircik	A.5	LC	Annex III	Y	Annex II
<i>Passer domesticus</i>	Ev serçesi	A.5	LC	Annex III	Y	Annex III
<i>Fringilla coelebs</i>	ispinoz	A.4	LC	Annex III	KZ	Annex II
<i>Carduelis chloris</i>	Florya	A.3	LC	Annex II	Y	Annex I
<i>Emberiza melanocephala</i>	Kara başlı kirazkuşu	A.4	LC	Annex II	YZ	Annex I
<i>Miliaria calandra</i>	Tarla kirazkuşu	A.4	LC	Annex III	Y	Annex II
<i>Luscinia megarhynchos</i>	Bülbül	A.3	LC	App. II	YZ	App. I

Abbreviations in the Table**RDB:** Red Data Book for Birds of Turkey**A.1.0=** Species that are extinct and no more observed in the nature.**A.1.1=** Domestic species that are extinct in the wild or can not be observed in the nature at least last 15-25 years time,

Scientific name	Turkish name	RDB	IUCN	Bern Convention	Status	CHC
however, they live in cages and other artificial environment. A.1.2= Population of these species has decreased throughout Turkey. They are found to be 1 individual-10 pairs (=1-20 individuals) where they are observed. They are considered to be facing a high risk of extinction, therefore, these species should be protected in Turkey. A.2= Population of these species varies around 11-25 pairs (22-50 individuals). They are considered to be facing risk of extinction. A.3= Population of these species varies around 26-250 pairs (52-500 individuals). They are also considered to be facing a high risk of extinction. A.3.1= Population of these species has decreased in recent years. Population of these species varies around 251-500 pairs (502-1000 individuals) and has decreased comparing to the previous records. A.4= According to the criteria of IUCN, these species are not considered yet to be facing a high risk of extinction, but their populations have decreased locally and have potential of facing risk of extinction in time. Population of these species varies around 501-5000 pairs (1002-10000 individuals). A.5= There is no risk of extinction for these species and their populations have not decreased yet. A.6= There is inadequate information to make an assessment of its risk of extinction based on its distribution and/or population status. Since they are based on one or two observations, there is no chance to make a reliable assessment on these species. Therefore, they have to be well studied. A.7= It is not possible to make an assessment on these species, because the records of these species in Turkey are not reliable. IUCN: LC=(Least Concern): A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category. BERN: Bern Convention Appendix II: List of strictly protected fauna species Appendix III: List of protected fauna species CHC: 2011-2012 Decisions of Central Hunting Commission Appendix -I (species protected by the MoFWA) Appendix -II (species protected by the CHC) Appendix -III (species allowed to be hunted for a time period) Status of the Bird: G: Breeding species-only summer birds; breeds regularly or irregularly Y: Breeding species- year birds-breeds regularly T: Invasion species; occurs irregularly but usually in great numbers KZ: Winter visitors						

Bird Migration

Bird migration is a seasonal journey undertaken by many species of birds. These regular journeys result from change in food availability, habitat or weather. Many bird populations migrate long distances along a flyway between their breeding and wintering habitats.

Turkey is a major Palaearctic migration crossroads, with corridors and bottlenecks in the north-west, north-east and southern part of the country. Climatic and topographic structure of the Anatolia is the most important factors that increase in the diversity of life.

A total 502 species are considered to be regular breeding species in Turkey (Kiziroğlu 2009). Turkey is especially important in a European context for its steppic (and semi-steppic) avifauna.

Turkey is part of a land that serves as a bridge in the middle of three continents. Thus, Turkey is important not just for the birds in intercontinental migrations also many for other species.

Since there are many wetlands in Turkey, the Eurasian migrants flying to the south use these wetlands as a nesting area. While majority of the migratory birds flying through the Balkans prefers Bosphorus and Dardanelles, the birds flying through the Caucasus migrate along the mountain valleys in the Eastern Black Sea. These birds finally concentrate around Belen Pass in Hatay Province (Okan C., 2004).

Gökres-2 WF is located quite apart from the main migration routes. The location of the Project area with respect to the main and secondary migration routes is shown in Figure 4-21.

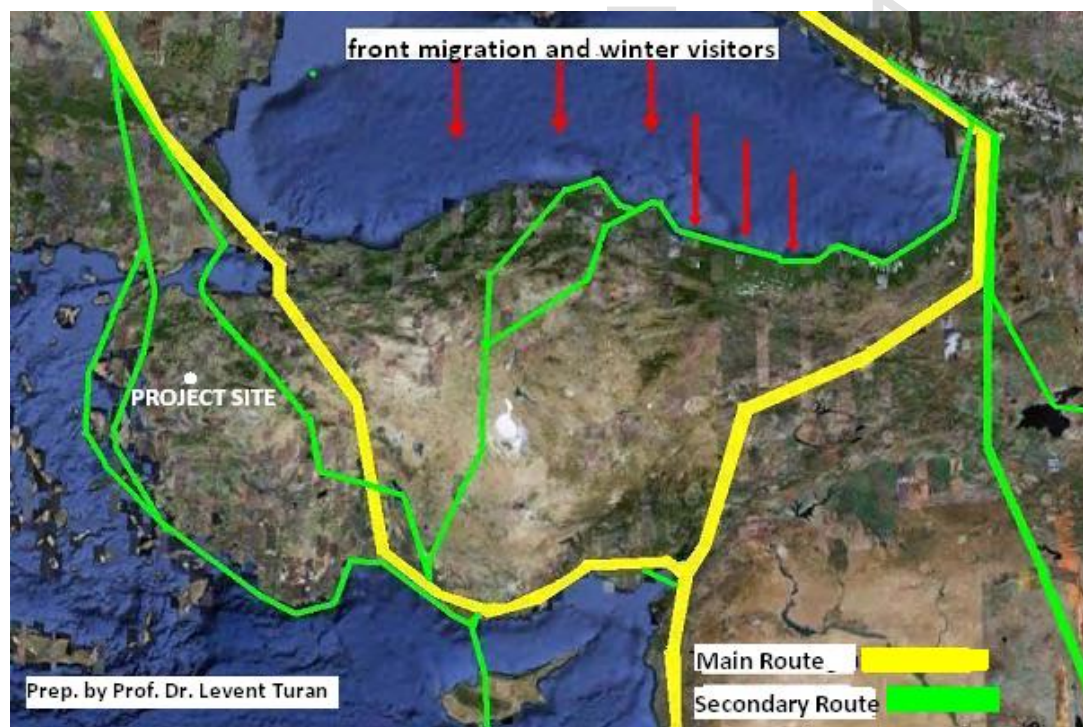


Figure 4-21 Project Location with Respect to Bird Migration Routes

Modern wind turbines are known to present a risk of collision mortality to diurnal and nocturnal migrant birds. The greatest losses seem to occur at wind farms situated at narrow migration routes or near wetlands, which attract congregations of waterfowl and other large birds.

Ciconiiformes (herons and storks), Anatinae, (ducks), Accipitridae (raptors), Charadriiformes (waders), Strigiformes (owls), Gruidae (cranes), Otidae (bustards) and Passeriformes (especially

nocturnal migrants) are the most sensitive (or potentially sensitive) species and species groups according to Birdlife International guidance on the effects of wind farms.

Relatively high collision rates have been recorded at several large, poorly sited wind farms in areas where large concentrations of birds are present, especially on migration routes and where large raptors or other large soaring species are present (Kirby, 2010). Research suggests that collision mortality only becomes a significant detrimental factor if wind farms are inappropriately located.

In addition to turbines, overhead electricity lines and associated infrastructure can pose a significant collision risk for many larger migrant birds (e.g. swans, geese, raptors), especially if sited across flight-paths or close to congregation sites such as wetlands. Furthermore, electrocution on poorly designed medium-voltage lines is a significant cause of mortality in large perching species such as raptors (Birdlife International, 2007).

4.9.4 Mammals

In the scope of the fauna survey carried out in the Project site and its close vicinity, mammals such as insectivores, bats, rabbits, rodentia, predators, and ungulates and the characteristics of their habitats have been reviewed.

The inventory of mammals which was formed as a result of literature survey is presented in Table 4-12. The conservation statuses of the mammals in the Project site and its vicinity are presented in the table in accordance with,

- a) Annex II and Annex III of Bern Convention;
- b) European Red List (ERL) prepared by IUCN; and
- c) 2012-2013 Decisions of Central Hunting Commission (CHC) of MoFWA.

13 mammal species are distributed in and around the project area.

Table 4-12 Mammals Identified in the Project Site and its vicinity and Their Conservation Status

Scientific Name	Common Name	(ERL) IUCN	BERN	CHC
INSECTIVORA				
ERINACEIDAE				
<i>Erinaceus concolor</i>	Eastern European Hedgehog	LC	Annex-III	Annex1
SORICIDAE				
<i>Crocidura leucodon</i>	Bicoloured White-toothed Shrew	LC	Annex-III	-
CHIROPTERA				
VESPERTILIONIDAE -				
<i>Myotis myotis</i>	Greater Mouse-eared Bat	LC	Annex-II	Annex-I
RHINOLOPHIDAE				
<i>Rhinolophus ferrumequinum</i>	Greater Horseshoe Bat	LC	Annex-II	Annex-I

Scientific Name	Common Name	(ERL) IUCN	BERN	CHC
<i>Rhinolophus hipposideros</i>	Lesser Horseshoe Bat	LC	Annex-II	Annex-I
LAGOMORPHA				
LEPORIDAE				
<i>Lepus europaeus</i>	The European Hare	LC	Annex-III	Annex-III
RODENTIA				
MURIDAE				
<i>Rattus rattus</i>	The black rat			
<i>Apodemus flavicollis</i>	The Yellow-necked Mouse	LC		
<i>Cricetulus migratorius</i>	Grey Dwarf Hamster	LC		-
<i>Allactaga williamsi</i>	-	LC		App. I
SPALACIDAE				
<i>Nannospalax leucodon</i>	Lesser Blind Mole Rat	DD		
CARNIVORA				
CANIDAE				
<i>Vulpes vulpes</i>	Red Fox	LC	--	Annex-III
ARTIODACTYLA				
SUIDAE				
<i>Sus scrofa scrofa</i>	Eurasian Wild Boar	LC	--	Annex-III
LC: Least Concern DD: Data Deficient CHC: 2012-2013 Decisions of Central Hunting Commission Annex I: species protected by the MoEU Annex II: species protected by the CHC Annex III: species allowed to be hunted for a time period				

Source: Demirsoy, A., 1997, Türkiye Omurgalıları (*Vertebrates of Turkey*), Memeliler (*Mammals*)

Two (2) of these species are included in Annex II of Bern Convention (strictly protected fauna) and two (2) species are included in Annex III of Bern Convention (protected fauna). Among these species, no endemic or near-threatened, vulnerable or endangered mammal species were identified in the Project area in accordance with the IUCN Red List of Threatened Species.

The mammalian species that are identified in the Project site and its vicinity are the abundant mammal species.

According to the European Red List (ERL) prepared by IUCN, Lesser Blind Mole Rat (*Nannospalax leucodon*) is classified as DD (Data Deficient) category. The rest of the species are classified as LC (Least Concern) category.

4.10 Naturally Protected Areas

In accordance with the national environmental legislation, there are no national parks, nature reserves, natural monuments, wildlife protection/ improvement areas, special hunting areas within the Project site.

There are key biodiversity areas around the Project site. These are briefly explained in the following sections.

Key Biodiversity Areas (KBAs) and Important Bird Areas (IBAs)

Key Biodiversity Areas (KBAs) are places of international importance for the conservation of biodiversity at the global level. The concept of KBAs has been developed by conservation organizations including BirdLife International, Conservation International, and PlantLife International.

The scientific studies in order to determine the KBAs in Turkey are being carried out by Doğa Derneği with the support of the Royal Society for the Protection of Birds and Birdlife International. In 2006, Doğa Derneği published the book “Key Biodiversity Areas of Turkey” which is also available in the Official Website of Doğa Derneği. This book identifies 305 KBAs which cover 20,280,149 hectares, equivalent to Turkey’s 26% surface area. Only 19% of KBAs are under protection

These KBAs also constitute the basis of scientific studies that are carried out within the scope of Natura 2000 network for Turkey’s EU accession process. Natura 2000 is an ecological network of protected areas in the territory of the European Union (EU). There are two directives of EU that form the Natura 2000 network. These are the Birds Directive (Council Directive 79/409/EEC on the conservation of wild birds) and the Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora). In order to meet the requirements of these directives, Doğa Derneği and the MoEU are carrying out studies in cooperation. The revision of the book “Important Bird Areas in Turkey” and the publication of the book “Key Biodiversity Areas of Turkey” by Doğa Derneği can be considered within this context.

The European Important Bird Area (IBA) Programme is implemented through national IBA Programmes in 29 countries with the support and co-ordination of the European Division of the Bird Life Secretariat. The IBAs in Turkey have identified by the Society for the Protection of Nature (Doğal Hayatı Koruma Derneği) and Bird Life International and this study was published as a book called “Important Bird Areas in Turkey” in 1997. This book was revised in 2004 by the Nature Society (Doğa Derneği) and Birdlife International with additional support from Royal Society for the Protection of Birds (RSPB).

According to the books “*Important Bird Areas in Turkey*” (Doğa Derneği, 2004) and “*Key Biodiversity Areas of Turkey*” (Doğa Derneği, 2006) the closest KBAs to the Project site are Spil Mountain KBA and Marmara Lake KBA. These KBAs are presented in Figure 4-22.



Figure 4-22 Key Biodiversity Areas Close to the Project Site

The Marmara Lake KBA also corresponds to the Marmara Lake IBA. Since the ecological criteria used for determination of the IBAs are same with the criteria used for KBAs, 184 KBAs in Turkey also correspond to IBAs.

The Marmara Lake KBA is approximately 44 km to the closest turbine. It has a surface area of 6,911 ha. The area is originally a temporary brackish lake in a closed basin and fed by groundwater. As mentioned before, the area is accepted as an important area for great number and types of birds for all year. The area has an international importance since it is a breeding area for Mute swan (*Cygnus olor*) and Greylag Goose (*Anser anser*). There is no conservation status for this area in accordance with the national environmental legislation.

The Spill Mountain KBA is approximately 56 km to the closest turbine. It has a surface area of 26,449 ha and lies within the boundaries of Central District of Manisa, Kemalpaşa and Bornova. Dominant vegetation in the area is black pine forest and maquis shrublands. The Spill Mountain KBA has an importance due to the plant species within the area. Thirteen (13) plant taxons satisfy the characteristics of important biodiversity areas. The area is also registered as Natural Park by General Directorate of by Nature Protection and Natural Parks.

WETLANDS

Wetlands are areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters. Therefore lakes, lagoons, shores, and deltas with depths generally to 6 m are defined as wetlands.

Wetlands have an incomparable function and value among other ecosystems. Waterfowl are birds ecologically dependent on wetlands. Wetlands provide local migratory birds with invaluable ecological systems. They serve as nesting and breeding area for migratory birds in their long survey through oceans.

Half of the wetlands are destroyed through this century by mostly human actions as: agriculture, chemicals, drinking water need of overcrowded populations, cutting of reeds and settlement.

The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

"Ramsar Convention" is an intergovernmental treaty that embodies the commitments of its member countries to maintain the ecological character of their Wetlands of International Importance and to plan for the "wise use", or sustainable use, of all of the wetlands in their territories.

Desiring to stem the progressive encroachment on and loss of wetlands now and in the future; RAMSAR convention is signed in 1971.

The mission of the convention is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world".

The Convention uses a broad definition of the types of wetlands covered in its mission, including lakes and rivers, swamps and marshes, wet grasslands and peat lands, oases, estuaries, deltas and tidal flats, near-shore marine areas, mangroves and coral reefs, and human-made sites such as fish ponds, rice paddies, reservoirs, and salt pans.

As The Contracting Parties have agreed on Convention on Wetlands of International Importance especially as waterfowl habitat, there are fundamental ecological functions of wetlands as regulators of water regimes and as habitats supporting a characteristic flora and fauna, especially waterfowl.

Wetlands constitute a resource of great economic, cultural, scientific, and recreational value, the loss of which would be irreparable.

Waterfowl in their seasonal migrations may transcend frontiers and so should be regarded as an international resource. The conservation of wetlands and their flora and fauna can be ensured by combining far-sighted national policies with coordinated international action;

Turkey became a contracting party of the convention on May 17, 1994. With over 1 million hectare area, 250 small and large water bodies Turkey is one of the most important countries in Europe and Middle East.

13 wetlands are included in the conservation list of Ramsar; these are: Akyatan Lagoon, Gediz Delta, Göksu Delta, Kızılırmak Delta, Kızören Obruğu, Lake Burdur, Lake Manyas (Kuş), Lake Kuyucuk, Lake Seyfe, Lake Uluabat, Meke Crater Lake, Sultan Marshes, Yumurtalık Lagoon.

Wetlands are good places for feeding and living of birds. Thus, existence of wetlands in an area might indicate potential for observing migratory birds and/or resident bird habitats.

Existence of wetlands in an area might indicate potential for observing migratory birds and/or resident bird habitats. According to the list of wetlands presented in the Official Website of Ministry of Forestry and Water Affairs, General Directorate of Nature Conservation and National Parks, the Project site does not lie within any wetland. The closest wetland to the Project site is Marmara Lake (about 44 km) which is also an IBA presented in the previous section.

Important Bird Areas in Turkey

IBAs are key sites for ornithological conservation that meet one or more of the following criteria:

- Hold significant numbers of one or more globally threatened species.
- Are one of a set of sites that together hold a suite of restricted-range species or biome-restricted species.
- Have exceptionally high numbers of migratory or congregator species.

Since the 1980s, Birdlife International has been working with a wide range of collaborators to identify IBAs. The work has resulted in internationally accepted standards for selecting networks of key areas that fulfill the site level targets for bird conservation. A regional IBA inventory has been produced for southern Europe which includes Turkey (Eken *et al.*, undated). The 1997 IBA inventory for Turkey (Magnin and Yazar, 1997) informed the overview of IBAs in Turkey which are detailed in Important Bird Areas in Europe; Priority Sites for Conservation (Magnin *et al.*, 2000). Turkey has 97 IBA's which cover 4% of the total land area in Turkey.

Turkey is currently in the EU Accession period and therefore there are no Natura 2000 sites. The IBA inventory described in Magnin *et al.* (2000) could be considered as a candidate list for potential Natura 2000 areas.

According to this revised version, the Project site does not lie within any Important Bird Area (IBA). The closest IBA to the Project site is Marmara Lake (Marmara Gölü) IBA and the area is presented in Figure 4-23. The distance between the IBA and the closest turbine is approximately 44 km.

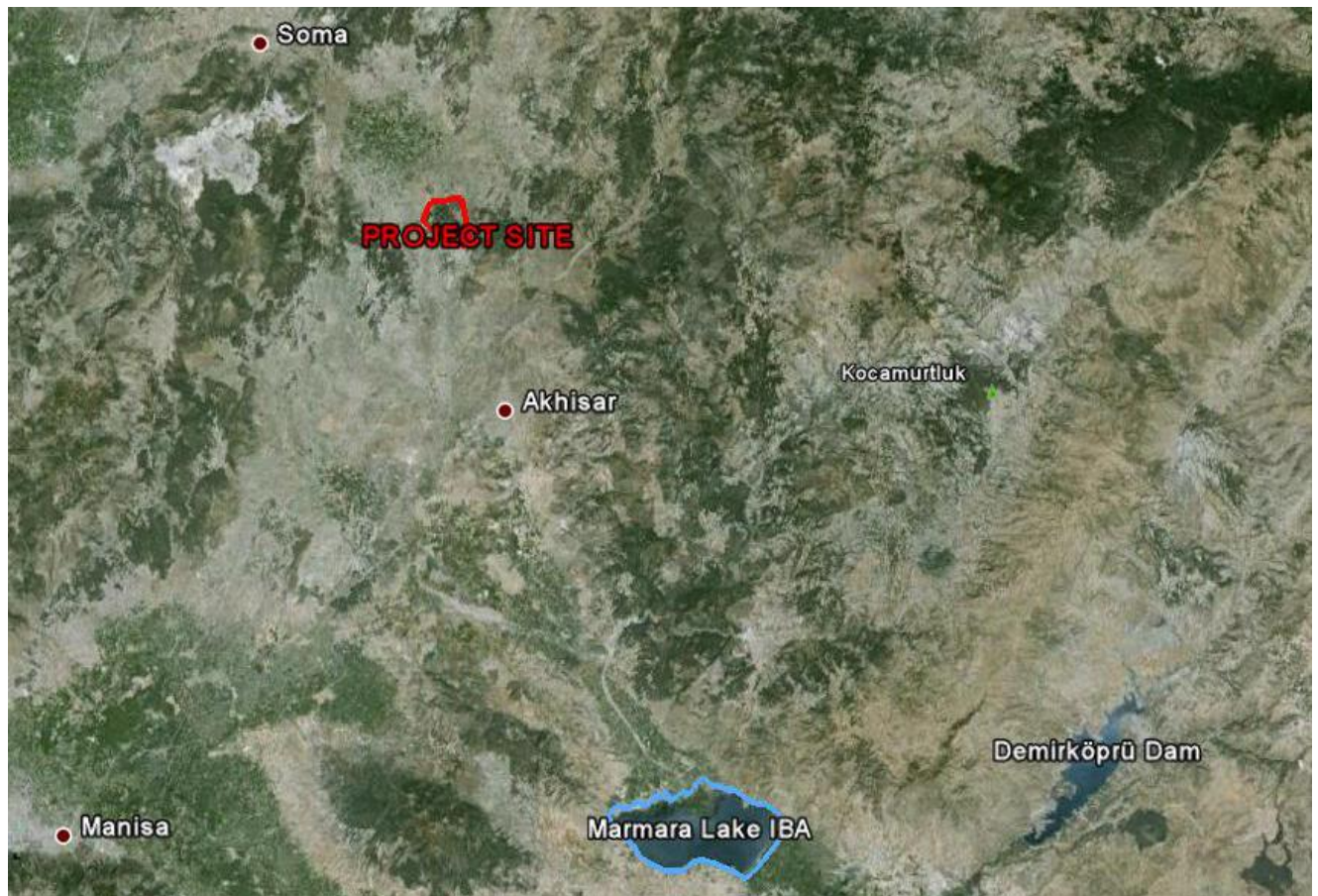


Figure 4-23 Closest Important Bird Areas to the Project Site

(Source: *Important Bird Areas in Turkey, 2004 Revision, Doğa Derneği*)

Ramsar Convention

The Convention on Wetlands of International Importance, known as the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and intergovernmental cooperation for the conservation and wise use of wetlands and resources. Turkey became a contracting party of the convention in 1994 and currently has 13 sites designated as Wetlands of International importance (Ramsar sites).

Bern Convention

Turkey is party to the Bern Convention (Convention on the Conservation of European Wildlife and Natural Habitats). Contracting parties to the Bern Convention are required to maintain populations of wild flora and fauna and give particular emphasis to endangered and vulnerable species, including endangered and vulnerable migratory species.

Red Data Book Birds in Turkey

The national conservation statuses of bird species occurring in Turkey are included within the Turkish Red Data Book. The species accounts in Kirwan *et al.* (2008) commence with the species' conservation status, for all species as globally endangered or included within the Turkish Red Data

Book. A total of 164 species of European conservation concern (SPECS) regularly breed in Turkey (Magnin *et al.*, 2000); most, if not all, of these species are also likely to be included within the Turkish Red Data Book.

4.11 Archeologically Protected Areas

According to the Manisa Provincial Environmental Status Report (Manisa Provincial Directorate of Environment and Urbanization, 2010) there are no registered archaeological, historical or cultural assets within the Project site and its close vicinity. The closest archaeological assets are located in Bakır Town (nearly 5.5 km) at the northwest and Karakurt Town (nearly 4.5 km) at the northeast. Due to the distance, these areas are not expected to be adversely impacted from the activities within the Project.

4.12 Socio-Economic Characteristics

4.12.1 Settlements and Demographics

Manisa Province is located north of İzmir-Istanbul Highway and between Spil Mountain and Gediz River. Manisa Province, which is one of the most important cities of Aegean Region, has a total population of 1,340,074 according to the results of the Address Based Population Census carried out by the Turkish Statistical Institute (TurkStat) in the year 2011.

The Project will be located within Kırkağaç and Akhisar districts of Manisa Province. Akhisar District, which is the second largest settlement of Manisa Province following the central district, has a total population of 159,650 according to the Address Based Population Census of 2011 carried out by the TurkStat. The population of Kırkağaç District is 47,165.

The closest settlement to the wind farm is İlyaslar Town (Kırkağaç District) at the northeast. Other close settlements are Bakır Town at the northwest and Karakurt Town at the northeast; Tütenli Village at the south, Selvili Village at the southwest, Çobanhasan Village at the southwest and Kadıdağı Village at the south. The populations of these settlements are summarized in Table 4-13 below.

Table 4-13 Populations of the Close Settlements

Settlement	Total Population	Urban Population	Rural Population
Manisa Province	1,340,074	891,084	448,990
Kırkağaç District	47,165	27,350	19,815
Bakır Town	3,247	-	3,247
İlyaslar Town	1,510	-	1,510
Karakurt Town	2,010	-	2,010
Akhisar District	159.650	104.777	54.873
Tütenli Village	657	-	657
Selvili Village	263	-	263
Çobanhasan Village	458	-	458
Kadıdağı Village	817	-	817

(Source: Address Based Population Census of TURKSTAT, 2011)

4.12.2 Livelihoods and Economics

The main economic activity in Manisa Province is agriculture and main agricultural products are seedless grapes, cotton, olive and fruit. Cotton textiles, aluminum, radiators, plumbing supplies, flour, animal feed, vegetable oil, cotton gin, brick and tile factories are the main industrial establishments in the Province.

Similar to Manisa, economy of Akhisar District and Kırkağaç District are largely based on and the main agricultural products are cotton, olives, tobacco, seedless grape, wheat, barley, melon, watermelon and seasonal vegetables. The highest quality types of world-famous oriental tobacco are grown in Akhisar District and in recent years, industrial activities are developing after having Organized Industrial Zone (OIZ) in the district. In addition, source of income of 85% of Kırkağaç District's population is agriculture. Animal husbandry is not common in that district.

5.0 ENVIRONMENTAL IMPACTS

This chapter covers construction and operation phase related environmental impacts of the wind farm. A detailed EMP is presented in Table 9-1. The methodology used for the impact assessment is given below.

Impact Assessment Methodology

To identify and evaluate potential impacts (positive or negative) of the Project on identified receptors and resources, an impact assessment is carried out and associated mitigation measures are recommended for the Project. Mitigation measures are developed and described measures to be taken to avoid or minimize any potential adverse effects and enhance potential benefits. The study also assesses the significance of the residual impacts that remain following mitigation.

Impact Types and Definitions

An impact can be defined as the change in any manner to source or receptor caused by the project or project related activities. The assessment study is carried out to evaluate and describe how the physical, chemical, biological and socio-economic environment can be affected by the Project. Impacts of the project may be categorized as Positive, Negative, Direct, Indirect and Cumulative. To define them briefly:

Positive Impact: Improvement occurs on the baseline conditions, or cause improvement,

Negative Impact: Adverse change from the baseline, or cause a new undesirable condition,

Direct Impact: Direct interaction between a project activity and the receiving environment/receptors,

Indirect Impact: Result from other activities that occur as a consequence of the project,

Cumulative Impact: Consider and include other project impacts to affect the same resources and/or receptors as the project.

Significance

“Significance” is used to describe the impact which is a function of the magnitude of the impact and the probability of the impact occurring (i.e. likelihood). Impact magnitude, or severity, is a function of the extent, duration and intensity of the impact.

The impact significance and its components are presented in a matrix structure as shown in Table 5-1.

Table 5-1 Significance Rating Matrix with Significance Color Scale for Negative Ratings

SIGNIFICANCE				
		LIKELIHOOD		
		Unlikely	Likely	Definite
MAGNITUDE	Negligible	Negligible	Negligible	Minor
	Low	Negligible	Minor	Minor
	Medium	Minor	Moderate	Moderate
	High	Moderate	Major	Major
<u>LIKELIHOOD</u> Likelihood: The likelihood that an impact will occur. Unlikely: The impact is unlikely to occur. Likely: The impact is likely to occur under most conditions. Definite: The impact will occur.				
<u>MAGNITUDE</u> Negligible: The impact on environment is not detectable. Low: The impact affects the environment in such a way that natural functions and processes are not affected. Medium: Where the affected environment is altered but natural functions and processes continue, however in a modified way. High: Where natural functions or processes are altered to the extent that it will temporarily or permanently cease.				
<u>SIGNIFICANCE</u> Negligible: A resource or receptor will not be affected in any way by a particular activity, or the predicted effect is deemed to be imperceptible or is indistinguishable from natural background levels. Minor: An effect will be experienced, but the impact magnitude is sufficiently small and well within accepted standards, and/or the receptor is of low sensitivity/value. Moderate: Within accepted limits and standards. Major: An accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors.				

Mitigation of Potential Impact

Mitigation is the measures and acts that will be implemented to reduce or eliminate the adverse direct or indirect impacts. Minor impacts generally do not require mitigation measures since the impacts is within the accepted standards. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is reasonably low. This does not always mean that “moderate” impacts have to be reduced to “minor” impacts or to “negligible”, but that medium impacts are being managed effectively and efficiently.

An ESIA study aims not to have any major residual impacts, certainly not ones that would endure into the long term or extend over a large area. However, it is possible that there may be major residual impacts after all practicable mitigation options have been applied. Visual impacts of the projects may be an example for that. However, positive impacts of the project such as employment should be weighed against the negative ones before come up to the decision about the project by the stakeholders.

Residual Impact

Suitable and practical mitigation measures required to be identified and fully implemented for the significant impacts brought about by the project. An EMP (given in Table 9-1) ensures the implementation of the mitigation measures specified for each issue defined in the ESIA study. After the implementation of the mitigation measures, each impact is re-evaluated, assuming that the mitigation measure is effectively applied, and any remaining impact is rated once again using the process outlined above. The result is a significance rating for the residual impact.

5.1 Noise

5.1.1 Construction

Construction inevitably creates some degree of noise emissions at locations in close vicinity of the construction activities. However, construction noise is temporary and transient in nature. The noise levels generated by construction works would have the potential to impact on noise sensitive receptors. Noise levels during construction at a receptor depends on several factors such as number and type of equipment and machinery used, the distance between noise sensitive receptor and the construction site and level of attenuation likely due to ground absorption, air absorption and barrier effects.

Type and Number of Construction Machines

Type and number of equipment and machines that will be used during construction activities and their sound power levels are listed in Table 5-2.

Table 5-2 Sound Power Levels of the Construction Machinery/Equipment

Machine	Number	Lw(dB)
Concrete Mixer	1	115
Loader	1	115
Bulldozer	1	115
Excavator	1	105
Truck	3	105
Crane	1	105
Generator	1	97
Welding Machine	2	97

Total Noise Level at the Source

The noise levels are calculated assuming that all machines/equipment will operate at the same time at one location in order to demonstrate the worst case situation. Total noise level generated by all noise sources is calculated with the formula (RAMEN, Annex-I) given below:

$$L_{WT} = 10 \log \left(\sum_{i=1}^n 10^{L_{wi}/10} \right)$$

where;

n: Number of noise source

L_{wi} : Sound power level of each source (dBA)

L_{WT} : Total noise level

$$L_{WT} = 10 \times \log \left[\left(1 \times 10^{115/10} + 1 \times 10^{115/10} + 1 \times 10^{115/10} + 1 \times 10^{105/10} + 3 \times 10^{105/10} + 1 \times 10^{105/10} + 1 \times 10^{97/10} + 2 \times 10^{97/10} \right) \right]$$

$$L_{WT} = 120.50 \text{ dBA}$$

The total noise level at the construction site is calculated as 120.50 dBA.

Total Noise Level at the Receptor

In order to assess the noise impact during the construction activities at the settlements around the project site, the house located in the south of Ilyaslar Town is chosen as the sensitive receptor for the noise impacts of construction activities. The closest construction site to the chosen dwelling will be located at Turbine 8 (T8) with a distance about 666 m.

Air absorption is also taken into account for the calculation of the noise levels. A numerical model was used for open areas to predict noise levels at the receptor as function of distance. The following formula (RAMEN, Annex-I) is used to calculate the noise levels at a given distance;

$$L_{PT} = L_{WT} + 10 \times \log \left(\frac{Q}{4 \cdot \pi \cdot r^2} \right)$$

where;

L_{PT} : Noise power level at the receptor (dB);

Q: ground absorption coefficient (assumed as 1);

r: distance between the source and the receptor.

The noise levels at different distances are calculated using the above formula and the results are given in

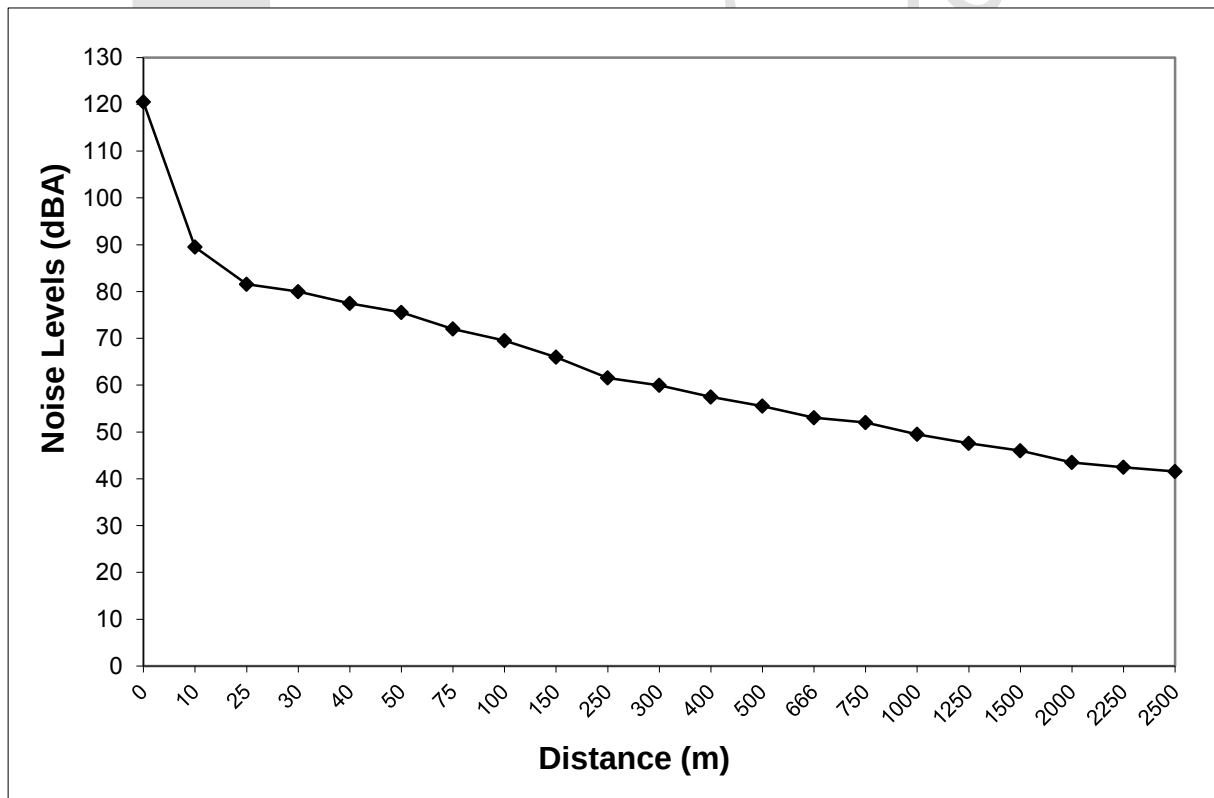
Table 5-3, below.

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Table 5-3 Noise Levels with respect to Distance during Construction

Distance (m)	Lp (dBA)
10	89.5
25	81.6
50	75.5
100	69.5
250	61.6
500	55.5
666	56.1
1000	53.0
2000	43.5

In addition to tabular noise level results at different distances, a graphical view of decreasing noise levels with increasing distances is shown in Figure 5-1.

**Figure 5-1 Noise Levels with respect to Distances during Construction**

As can be seen from Figure 5-1, the noise level generated from construction activities at the chosen dwelling situated in south of İlyaslar Town, is calculated as 53.0 dBA.

In accordance with the Article 23(1)-b of the Regulation on Assessment and Management of Environmental Noise, the construction activities within residential areas and in the close vicinity cannot be carried out during evenings and nighttime except daytime period (07:00-19:00). RAMEN also states construction site noise level limits which are given in Table 2-2 of Section 2.1.5. According to this table, the construction of a wind farm is classified as “Other Resources”

and the noise level limit in this class of areas is set to 70 dBA. Turkish RAMEN noise limits are complied with at the nearest sensitive receptor during construction phase of the wind farm.

In addition to the regulatory compliance demonstrated above, the construction noise is temporary and transient in nature and can be controlled through good site working practices, limiting construction hours and adopting noise control measures where necessary.

Thus, the likelihood and magnitude associated with the construction activities are expected to be likely and low, respectively, and the noise impact associated with the construction activities is expected to have minor significance for the Project. The residual impact will be negligible after taking all necessary mitigation measures.

5.1.2 Operation

Operating wind turbines generate noise varying with wind speed. The sources of sounds emitted from wind turbines consist of 1) mechanical sounds and 2) aerodynamic sounds.

Mechanical sound originates from the rotation of mechanical and electrical equipment. Sources of mechanical sounds include gearbox, generator, yaw drives, cooling fans and auxiliary equipment. Mechanical sounds can be transmitted directly to air (air-borne) or transmitted along structural components before noise is radiated into the air (structure-borne).

Aerodynamic sound originates from the flow of air around the blades. Continuous improvements in mechanical design of large wind turbines have resulted in significant reductions in mechanical sounds. Presently, noise emissions from modern wind turbines mostly come from broadband aerodynamic sounds.

Since the operating wind turbines generate noise, there is a potential impact at the neighboring residential homes. Thus, a noise impact assessment is carried out for this Project.

Noise assessment study basically consists of the following major steps:

1. Selection of methodology;
2. Noise survey to determine existing ambient background noise levels;
3. Noise levels predicted or measured for the turbines;
4. Applying a sound propagation model;
5. Specifying noise criteria;
6. Comparison of estimated sound pressure levels with noise criteria.

5.1.2.1 Methodology

General guidance and regulatory policy concerning noise associated with new developments in Turkey is provided by the Turkish Regulation on Assessment and Management of Environmental Noise (RAMEN). IFC/WB EHS guidelines for wind energy also provides noise limits that should not be exceeded during the operation of the Project. However, it is apparent that existing noise standards do not fully address the issues associated with the unique characteristics of wind farm developments and there is a need for an agreed methodology for defining acceptable noise limits for wind farm developments. The Turkish Ministry of Environment or IFCWB does not provide any noise assessment methodology for the wind farm development.

In the U.K. a methodology was developed for the Department of Trade and Industry (DTI) by the Working Group on Noise from Wind Turbines (WGNWT) and known as ETSU-R-97, The Assessment and Rating of Noise from Wind Farms (1996). ETSU-R-97 provides a robust basis for determining the noise criteria for wind farms and has become a well-respected and accepted standard for such developments within the UK. This methodology has therefore been adopted for this Project.

5.1.2.2 Noise Background Survey

As described in the previous section in detail, background noise was measured near the NSR. During the survey, $L_{A90-10min}$ data was collected. Generally, $L_{90,10min}$ is taken as for both the background noise and the wind farm noise in noise assessment studies (ETSU-R-97, 1997; Rogers, et al, 2006; EPA 2008). L_{A90} is the A-weighted sound levels that are exceeded 90% of the time. The use of the $L_{A90-10min}$ data avoids corruption of data from relatively loud, transitory noise events from other sources. Thus, in this assessment, $L_{A90-10min}$ is used for the calculation of the background noise levels and also for the wind farm. It should be noted that $L_{A90-10min}$ is likely to be about 2 dBA less than the L_{Aeq} measured over the same time (ETSU-R-97, 1997).

In addition to measured 10-minute average background noise levels, concurrent wind speed and direction data was obtained from the Mast situated in the Project site. The measured L_{A90} noise levels are then plotted against simultaneously measured wind speed data for daytime and nighttime hours. A "best fit" curve is fitted to the data to establish the background noise level as a function of wind speed as shown in Figure 5-2 below.

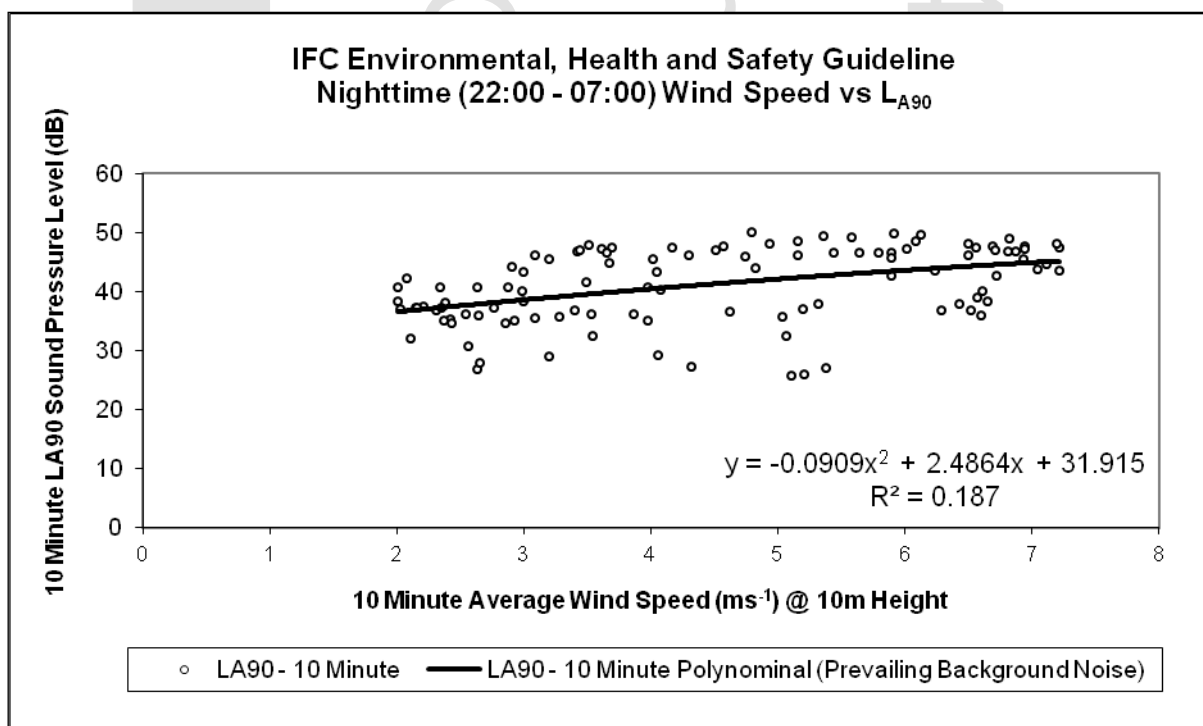
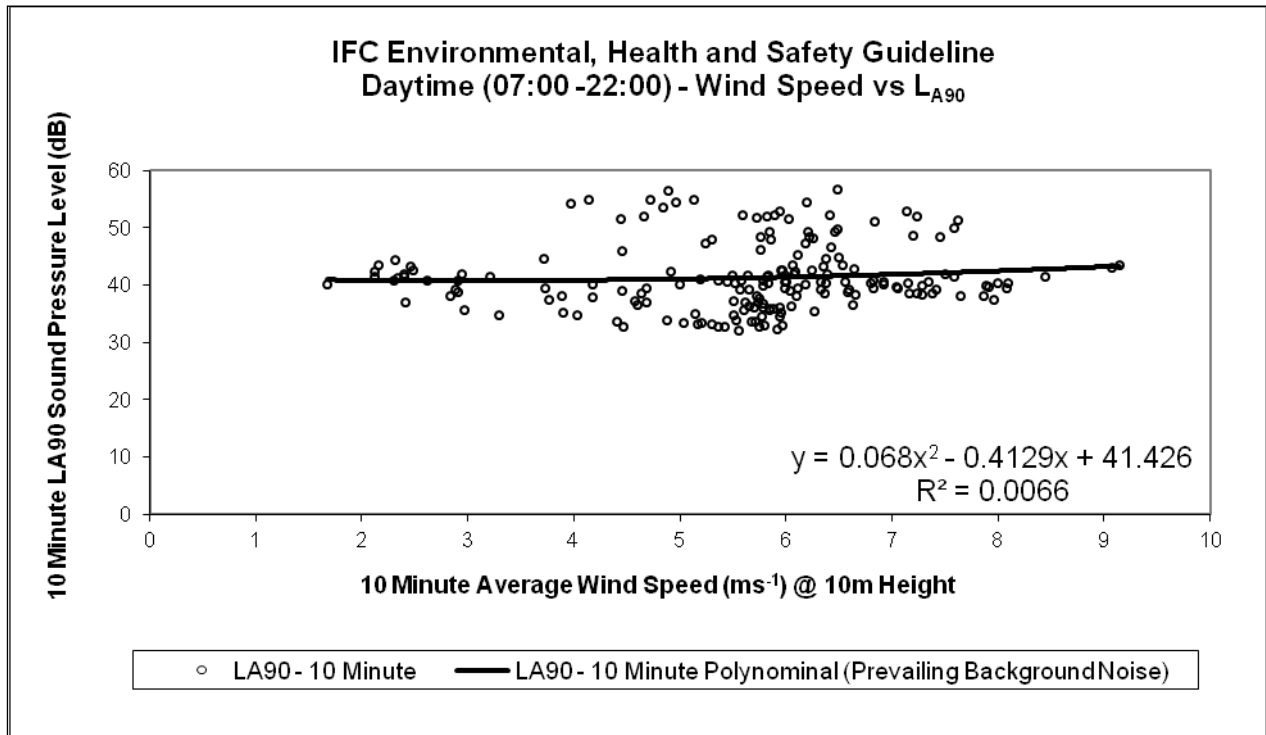


Figure 5-2 Daytime and Nighttime Wind Speed vs L_{A90} Background Noise Level Plots

5.1.2.3 Turbine Noise Characteristics

GE 2.75-103 model turbines with 98.3 m hub height will be used in the Project. The noise levels generated by the model GE 2.75-103 is obtained from the turbine manufacturer. The noise data includes octave band spectra and broadband levels as the variation of sound output with wind

speed over a range of 3 to 10 m/s (referenced to a 10 m height). and broadband noise levels at each wind speed are given in Table 5-4 and Table 5-5.

Table 5-4 Octave Band Spectra of GE 2.75-103 at 10 m/s Wind Speed

Octave Band Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	L _{wa} , dBA
L _{wa} (dB)	85.1	89.9	89.8	90.7	95.4	95.0	84.5	59.9	105.0

Table 5-5 Broadband Noise Levels at each Wind Speed from 3 to 10 m/s

Wind Speed (m/s)	3	4	5	6	7	8	9	10
Sound Power Level, L _{wa} (dBA)	92.4	93.2	97.6	102.6	105.0	105.0	105.0	105.0

5.1.2.4 Noise Propagation Model

The potential noise impact of the wind turbines on sensitive receptors is determined by noise modeling. Commercially available WindPro version 2.7 noise propagation model, which is based on ISO 9613-2, is used in this Project. The model is capable of utilizing different propagation modules, for a variety of wind speed, and it incorporates terrain data into calculations. The model also includes absorbances due to atmosphere and nearby surfaces. Ambient noise levels at the NSR are modeled under worst case conditions.

The model contained within ISO 9613-2 Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General method of Calculation (1996) has been used to calculate the noise emission levels at the noise sensitive receptor. The ISO 9613-2 algorithm, which is one of the available models presented in WindPro software, has been chosen as being the most robust prediction method based on the findings of a joint European Commission (EC) research project into wind farm noise propagation over large distances.

Although it is not possible to specify exact error bands on noise predictions, the ISO 9613-2 model was found to be the best available, both in flat and hilly, complex terrain. ISO 9613-2, like all the other models, tends to over-estimate the noise at the noise sensitive receptor, rather than under-estimate it. The study performed as part of the EC research (“Development of a Wind Farm Noise Prediction Model”, JOR3-CT95-0051) concluded that the ISO 9613-2 method tended to predict noise levels that would generally occur under downwind propagation conditions. The probability of non-exceedence of the levels predicted by the ISO 9613-2 algorithm was about 85%. The same research also demonstrated that under upwind propagation conditions, between a given receiver and the wind farm, the noise level at that receiver will be as much as 10dB(A) to 15dB(A) lower.

Model Inputs

ISO 9613-2 model uses the following equation in calculating the noise levels at the receptor locations.

$$L(DW) = LWA_{ref} + K + Dc - (Adiv + Aatm + Agr + Abar + Amisc) - Cmet$$

where,

$L(DW)$	: Calculated noise level at the receptor, dBA
LWA_{ref}	: Noise emission of Wind Turbine, dBA
K	: Pure tone, dBA
Dc	: Directivity correction, dB
$Adiv$	: Attenuation due to the geometrical divergence, dB
$Aatm$	: Attenuation due to atmospheric absorption, dB
Agr	: Attenuation due to ground effect, dB
$Abar$	: Attenuation due to a barrier, dB
$Amisc$	: Attenuation due to miscellaneous other effects, dB
$Cmet$	: Meteorological correction, dB

All the input values except LWA_{ref} are calculated according to coordinates of the wind turbines and noise sensitive receptor. Turbine noise emission levels given in Table 5-4 are used as $LW_{A,ref}$ values but deducted 2 dB as a fair approximation of the L_{A90} levels. Other inputs and assumptions used for the noise propagation model are as follows;

- Wind turbine and noise sensitive receptor coordinates,
- 10m elevation contour data of the project site is used to determine ground effect,
- Meteorological coefficient value is assumed as 0 dB to represent worst case conditions,
- Pure tone value is assumed as 0 dB,
- Air absorption value is assumed 1.9 dB/km, default value of ISO 9613-2.

Model Output

Predicted turbine noise levels at the NSR, in terms of L_{A90} , over the wind speed range from 6 m/s to 10 m/s are estimated with the model and shown in Table 5-6 below.

Table 5-6 Predicted Wind Farm Noise Levels at the NSR

	Reference Wind Speed (v_{10}), ms^{-1}				
	6	7	8	9	10
Turbine Noise Levels at NSR (dBA)	36.3	38.7	38.7	38.7	38.7

Noise contour map obtained from the results of noise modeling is given in Figure 5-3.

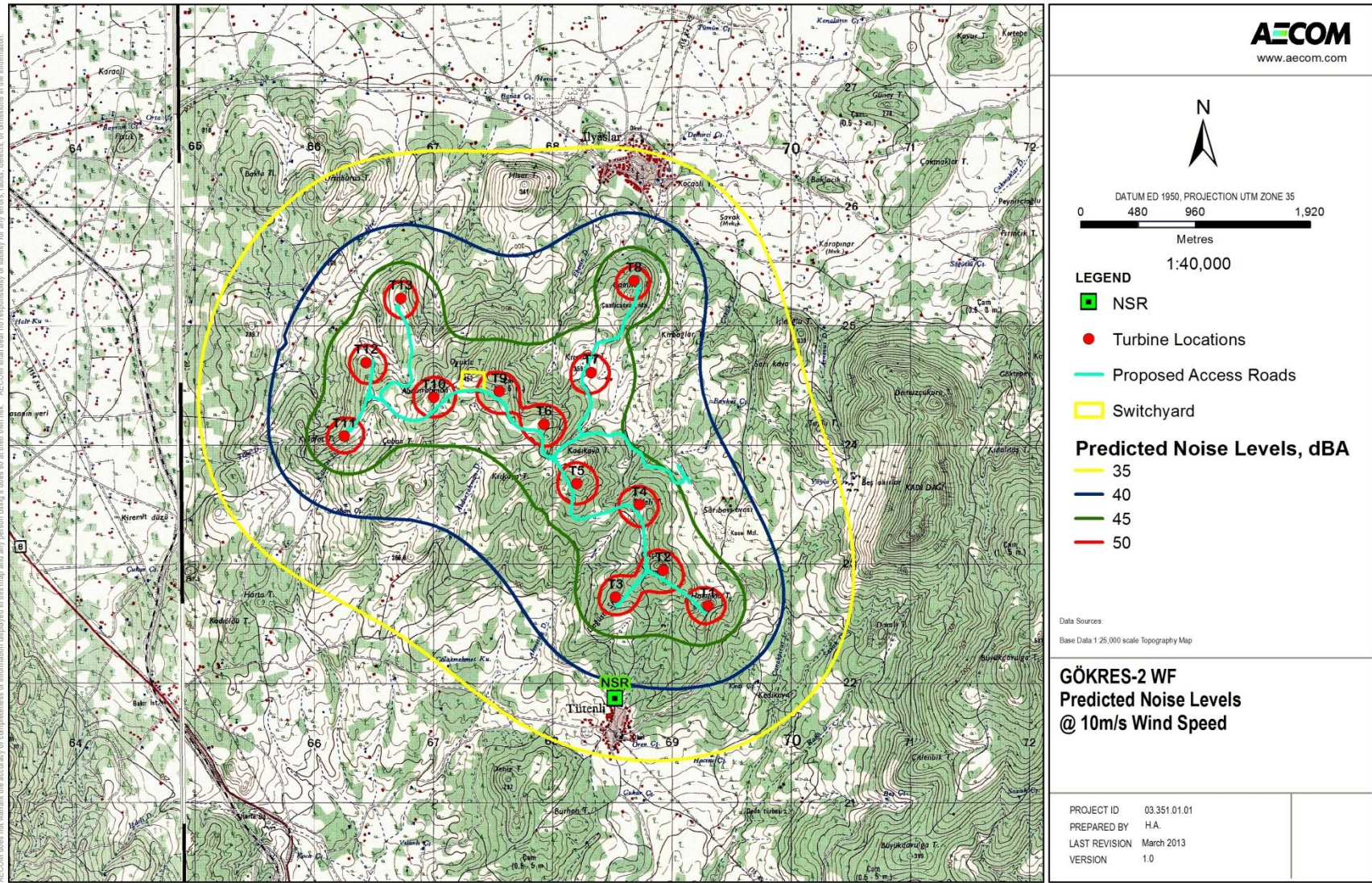


Figure 5-3 Noise Contour Map

5.1.2.5 Noise Criteria

In this assessment, four noise criteria are used:

1. A constant regulatory noise limit set for the daytime (07:00-19:00); eveningtime (19:00-23:00) and nighttime (23:00-07:00) by the Turkish noise regulation (RAMEN). These noise limits are 60 dBA, 55 dBA and 50 dBA, for the daytime, eveningtime and nighttime, respectively. Since L_{A90} is the most appropriate descriptor to represent background noise levels and the background noise levels are determined as $L_{A90-10min}$ during the noise survey in this study, the Turkish noise criterion is set to 58 dBA, 53 dBA and 48 dBA for the daytime, eveningtime and nighttime, respectively, by simply subtracting 2 dBA from the L_{Aeq} values. The regulatory noise criterion is an absolute value that does not vary with the background wind speed.
2. The IFC/WB noise guideline limit is given as L_{Aeq} and is set for 55 dBA for daytime (07:00-22:00) and 45 dBA for nighttime (22:00-07:00). For this assessment, the limits are set to 53 dBA for daytime and 43 dBA for nighttime to be compared with the $L_{A90-10min}$ background values. The IFC/WB noise criterion is an absolute value that does not vary with the background wind speed. It should be also noted that the nighttime absolute lower limit of 43 dBA is also based on World Health Organization guidelines for the protection of sleep indoors with windows open.

If the above stated criteria are not met, then the following criteria are used:

3. The IFC/WB noise guideline states that if the noise impact is above the IFC/WB limits then it requires that proposed activities should not result in a maximum increase in background levels of 3 dBA at the noise sensitive receptor.
4. The RAMEN states that if the noise impact is above the RAMEN limits then it requires that proposed activities should not result in a maximum increase in background levels of 5 dBA at the noise sensitive receptor.
5. The ETSU-R-97 noise criterion is based on a level 5 dBA above the best fit curve over the 6-10 m/s wind speed range (actually the ETSU-R-97 criterion is similar to the IFC/WB criterion given above). If the ETSU-R-97 criterion curve is found to be below the IFC/WB nighttime absolute value of 43 dBA (since this value is the lowest of all absolute limits given by RAMEN and IFC/EB), it is basically fixed at 43 dBA.

Thus, the noise criteria set either at the prevailing measured background level plus 3 dBA and 5 dBA or the absolute lower limits, whichever is the greater.

5.1.2.6 Comparison of Noise Impact with Noise Criteria

Noise impact values result from turbine operation at the NSR for daytime and nighttime periods are calculated as a function of wind speed from 6 m/s to 10 m/s and given in Table 5-7 with the

background noise levels and the difference between background noise levels and cumulative noise levels.

Background noise levels for each wind speed from 6 m/s to 10 m/s for daytime and nighttime periods are calculated by using the equation of regression curve given in Figure 5-2.

Table 5-7 Daytime and Nighttime Predicted Turbine and Background Noise Levels

		Reference Wind Speed (v_{10}), ms^{-1}				
		6	7	8	9	10
Predicted Turbine Noise Levels, dBA		36.3	38.7	38.7	38.7	38.7
Daytime Period (07:00 – 22:00)	Background Noise Levels, dBA	41.4	41.9	42.5	43.2	44.1
	Cumulative Noise Levels, dBA	42.6	43.6	44.0	44.5	45.2
	Difference, dBA	1.2	1.7	1.5	1.3	1.1
Nighttime Period (22:00 – 07:00)	Background Noise Levels, dBA	43.6	44.9	46.0	46.9	47.7
	Cumulative Noise Levels, dBA	44.3	45.8	46.7	47.5	48.2
	Difference, dBA	0.7	0.9	0.7	0.6	0.5

In addition to the tabulated view of noise impact values of the Project, graphical representation of noise impact values at the NSR and the noise criteria for both daytime and nighttime periods are given in Figure 5-4.

As can be seen in Table 5-7 and Figure 5-4, the predicted noise levels at the NSR are well below the absolute noise criteria of RAMEN and IFC/WB for daytime and nighttime. Moreover, the differences between cumulative noise levels and background noise levels in daytime and nighttime periods are below 5 dB at wind speeds where ETSU-R-97 criterion value is above 43 dBA indicating compliance with the ETSU-R-97 noise criteria.

As a summary, this noise assessment study has demonstrated that the operational noise of Gökres-2 Wind Farm Project will not exceed the Turkish noise regulation and IFC/WB daytime and nighttime noise limits. Thus, during the operation of the wind turbines, the likelihood and magnitude of the potential noise impact will be unlikely and negligible, respectively. Thus, the significance of potential noise impact is expected to be negligible.

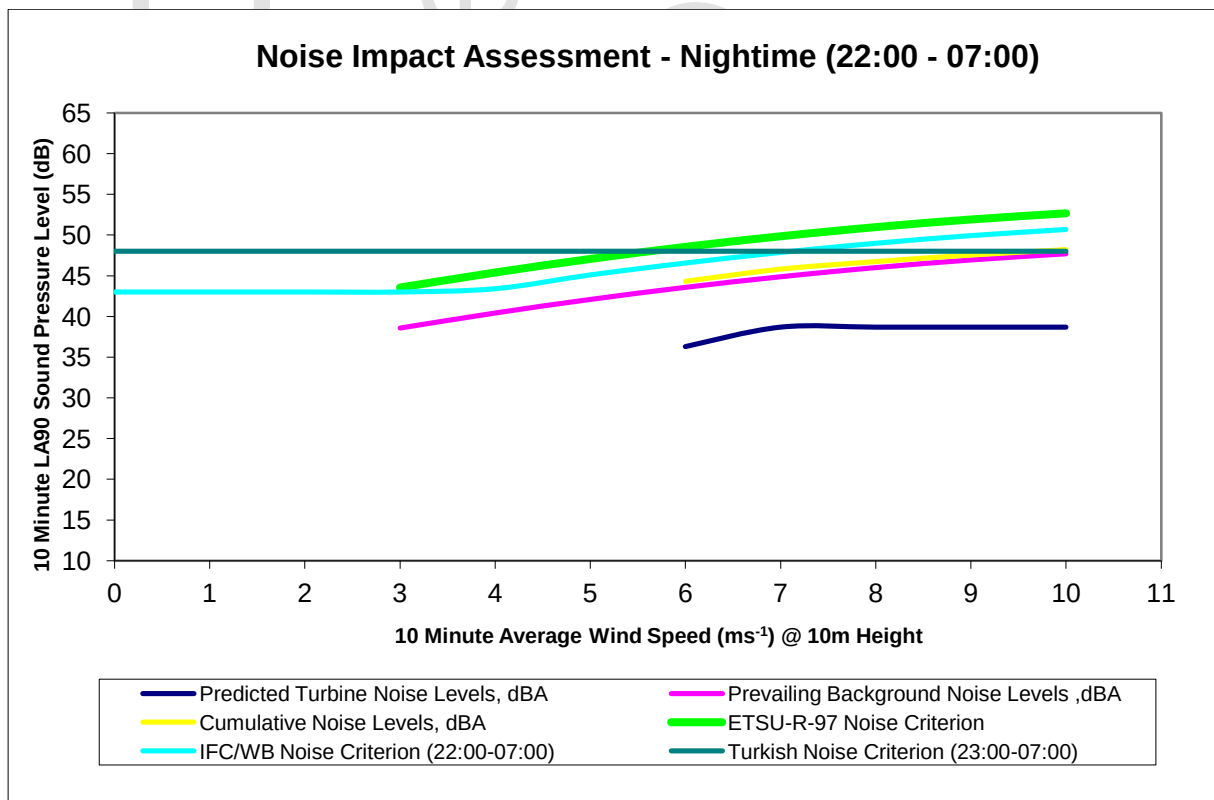
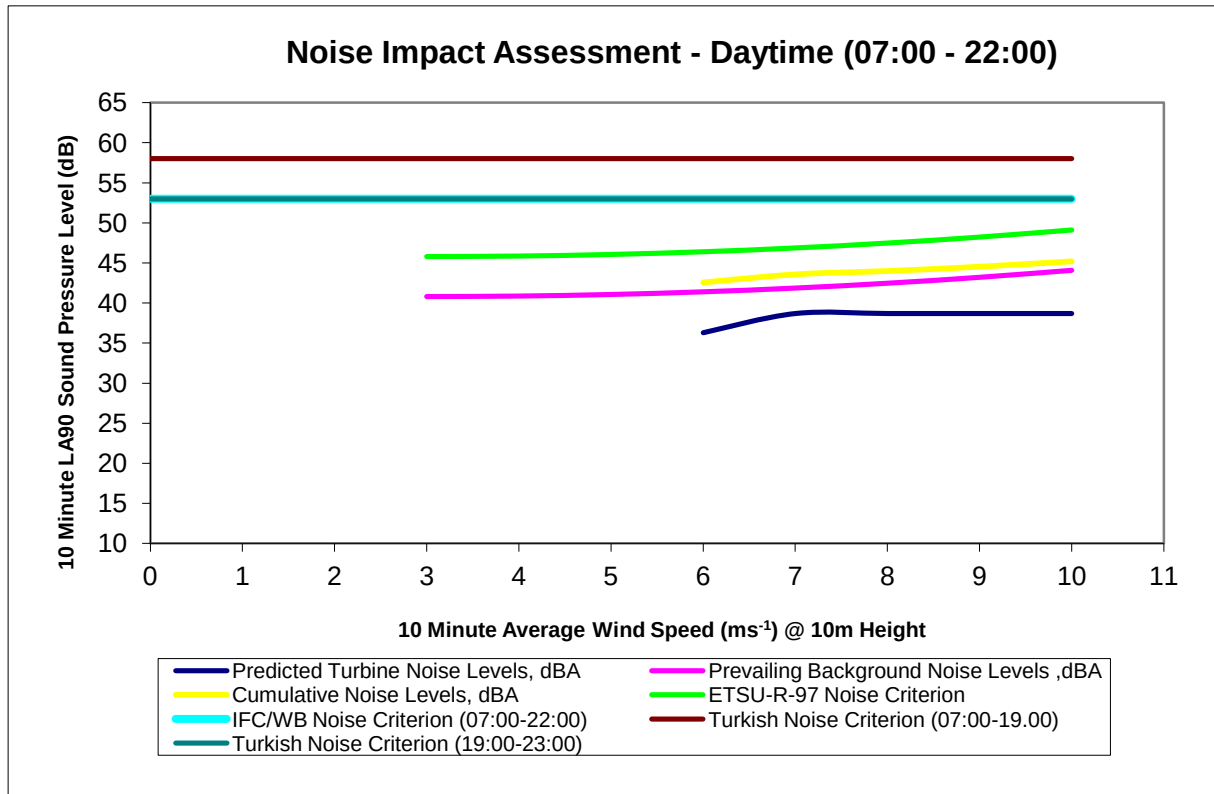


Figure 5-4 Daytime and Nighttime Wind Farm Noise Levels Compared to Noise Criteria

5.1.3 Decommissioning

Noise levels during decommissioning are expected to be similar to the noise levels during construction. Decommissioning noise will be temporary and transient in nature and like the construction activities, it can be controlled through good site working practices, limiting decommissioning hours and adopting noise control measures where and when necessary. Thus, noise impacts associated with the decommissioning activities are not expected to be a significant issue for the Project.

5.2 Air Emissions

5.2.1 Construction

Main emission sources during the construction period are excavation activities and heavy construction vehicles. The construction period will be approximately 30 months.

Exhaust Emissions

During civil works, the earth moving vehicles, heavy vehicles used for the transportation of excavation materials and generators will burn diesel fuel and fuel consumption will be about 15 L per vehicle in an hour. It is assumed that five construction vehicles will be in operation at the same time. Hence, the hourly total diesel consumption at the construction site will be 75 L.

The USEPA AP-42 Emission Factors are used for the calculation of emissions generated by the diesel fueled vehicles. Since the emissions, generated due to operation of these vehicles, will include sulphur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM₁₀) and total organic carbon/volatile organic carbon (TOC/VOC), hourly mass flow of these pollutants were calculated individually.

Calorific value of diesel = 137,000 BTU/gal x gal/4.54609 L = 30,135.8 BTU/L.

Emissions from construction vehicles are as follow;

Carbon monoxide : $0.95 \text{ lb}/(10^6 \text{ BTU}) \times 30,135.8 \text{ BTU/L} \times 75 \text{ L/hr} \times 0.4536 \text{ kg/1 lb} = 0.97 \text{ kg/hr}$

Sulfur oxides : $0.29 \text{ lb}/(10^6 \text{ BTU}) \times 30,135.8 \text{ BTU/L} \times 75 \text{ L/hr} \times 0.4536 \text{ kg/1 lb} = 0.3 \text{ kg/hr}$

Total Organic Carbon: $0.35 \text{ lb}/(10^6 \text{ BTU}) \times 30,135.8 \text{ BTU/L} \times 75 \text{ L/hr} \times 0.4536 \text{ kg/1 lb} = 0.36 \text{ kg/hr}$

Nitrogen oxides : $4.41 \text{ lb}/(10^6 \text{ BTU}) \times 30,135.8 \text{ BTU/L} \times 75 \text{ L/hr} \times 0.4536 \text{ kg/1 lb} = 4.52 \text{ kg/hr}$

Dust (PM₁₀) : $0.31 \text{ lb}/(10^6 \text{ BTU}) \times 30,135.8 \text{ BTU/L} \times 75 \text{ L/hr} \times 0.4536 \text{ kg/1 lb} = 0.32 \text{ kg/hr}$

Taking into account the size of the wind farm area, the dispersion effect of the wind and short duration of the construction, it can be concluded that the Project will not affect the local air quality during the construction.

Dust Emissions Due to Excavation

Construction activities are a source of dust emissions that may have substantial temporary impact on local air quality. Emissions during the construction (especially excavation) of this Project or road can be associated with land clearing, ground excavation and construction of a particular facility itself. The construction activities that may cause dust emissions will be carried out in three phases. The first activity will be the construction of the access roads. After completion of the access road, in the second phase, the crane pads situated next to the turbine locations will be prepared. As the last construction activity, turbine foundations will be excavated. The construction phases and activities that will be carried out in each phase are presented in Table 5-8 below.

Table 5-8 Construction Phases and Activities

Construction Phase	Activity
Access Road Construction	Removal of Top Soil
Switchyard & Administration Building	Removal of Top Soil, Foundation Excavation
	Loading
	Transportation
	Unloading
Crane Pad Construction	Removal of Top Soil
Turbine Foundation Construction	Foundation Excavation
	Loading
	Transportation
	Unloading

The dust emissions caused by each activity of each construction phase are calculated and presented in the following section. In the calculation of dust emissions, the controlled dust emission factors given in Turkish IAPCR Table 12.6 were used. Controlled dust emission factors are given in Table 5-9.

Table 5-9 Controlled Dust Emission Factors Given in Turkish IAPCR

Activity	Controlled Dust Emission Factors
Excavation	0.0125 kg/ton
Loading	0.005 kg/ton
Transportation (total distance)	0.35 kg/km-vehicle
Unloading	0.005 kg/ton

Access Road Construction

The excavation will be performed for the removal of top soil and the removed top soil will be stored next to the access roads and the quality of the top soil will be protected. The width and depth of the excavation will be 5 m and 0.2 m, respectively. The length of the excavation for 1 hour is assumed as 40 m. The density of the soil is assumed as 1.6 tons/m³. According to these values and assumptions, the dust emission caused by access road construction is calculated as follows.

Total volume of excavated material per hour	$= \text{Width} \times \text{Depth} \times \text{Length}$ $= 5 \times 0.2 \times 40$ $= 40 \text{ m}^3/\text{hr}$
Total mass of excavated material	$= 40 \text{ m}^3/\text{hr} \times 1.6 \text{ ton/m}^3$ $= 64 \text{ ton/hr.}$
Dust emission caused by Access Road Construction	$= 64 \text{ ton/hr} \times 0.0125 \text{ kg/ton}$ $= \mathbf{0.8 \text{ kg/hr}}$

Switchyard & Administration Building

The switchyard and the administrative building construction phase will include removal of top soil and foundation excavation, loading, transportation and unloading of excavated material activities. The total area of switchyard and administrative building is assumed to be nearly 625 m^2 ($25 \times 25 \text{ m}^2$). The duration of the switchyard and administration building construction is assumed as 30 days. The depth of the foundation excavation is assumed as 1.5 m together with the topsoil. The total maximum distance for the transportation of the excavated materials is accepted as 1000 m.

Total volume of excavated material	$= 625 \text{ m}^2 \times (1.5 \text{ m})$ $= 937.5 \text{ m}^3$
Total mass of excavated material	$= 937.5 \text{ m}^3 \times 1.6 \text{ ton/m}^3$ $= 1500 \text{ ton}$
Total mass of excavated material per hour	$= 1500 \text{ ton} / (30 \text{ days} \times 8 \text{ hr/day})$ $= 6.25 \text{ ton/hr}$
The dust emission caused by each activity in the switchyard and administration building construction phase is calculated as follows;	
Dust Emission caused by Excavation	$= 6.25 \text{ ton/hr} \times 0.0125 \text{ kg/ton}$ $= 0.08 \text{ kg/hr}$
Dust Emission caused by Loading	$= 6.25 \text{ ton/hr} \times 0.005 \text{ kg/ton}$ $= 0.03 \text{ kg/hr}$
Dust Emission caused by Transportation	$= 1500 \text{ ton} / (30 \text{ days} \times 4 \text{ hr/day} \times 25 \text{ ton/trip}) \times$ $0.35 \text{ kg/km-vehicle} \times 1 \text{ km} = 0.18 \text{ kg/hr}$
Dust Emission caused by Unloading	$= 6.25 \text{ ton/hr} \times 0.005 \text{ kg/ton}$ $= 0.03 \text{ kg/hr}$

Total Dust Emission caused by Switchyard & Adm. Building Construction	$= 0.08 \text{ kg/hr} + 0.03 \text{ kg/hr} + 0.18 \text{ kg/hr} + 0.03 \text{ kg/hr}$ $= \mathbf{0.32 \text{ kg/hr}}$
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Crane Pad Construction

Crane pads that will be located next to each turbine will be constructed. The area of each crane pad will be approximately 2500 m². The top soil on the crane pad area will be removed and stored next to each crane pad to be used after the completion of the construction. The depth of excavation will be 0.2 m for the removal of the top soil. The duration for the removal of top soil for each crane pad is assumed as 2 days. The dust emission caused by each crane pad construction is calculated in the following section.

Total volume of excavated material	$= 2,500 \text{ m}^2 \times 0.2 \text{ m}$ $= 500 \text{ m}^3$
Total mass of excavated material	$= 500 \text{ m}^3 \times 1.6 \text{ ton/m}^3$ $= 800 \text{ ton}$
Total mass of excavated material per hour	$= 800 \text{ ton} / (2 \text{ days} \times 16 \text{ hr/day})$ $= 25 \text{ ton/hr}$
Dust emission caused by Crane Pad Construction	$= 25 \text{ ton/hr} \times 0.0125 \text{ kg/ton}$ $= \mathbf{0.31 \text{ kg/hr}}$

Turbine Foundation Construction

The turbine foundation construction phase will include foundation excavation, loading, transportation and unloading of excavated material. The area of excavation for each turbine foundation will be approximately 490 m² and the depth of the excavation is assumed as 3 m. The duration of the excavation of each turbine foundation will be 6 days. According to these values and assumptions, the calculation of dust emission caused by each activity in the turbine foundation phase is given as follows.

Total volume of excavated material	$= 490 \text{ m}^2 \times 3 \text{ m}$ $= 1,470 \text{ m}^3$
Total mass of excavated material	$= 1,470 \text{ m}^3 \times 1.6 \text{ ton/m}^3$ $= 2,352 \text{ ton}$
Total mass of excavated material per hour	$= 2,352 \text{ ton} / (6 \text{ days} \times 16 \text{ hr/day})$ $= 24.5 \text{ ton/hr}$
Dust Emission caused by Excavation	$= 24.5 \text{ ton/hr} \times 0.0125 \text{ kg/ton}$ $= 0.31 \text{ kg/hr}$
Dust Emission caused by Loading	$= 24.5 \text{ ton/hr} \times 0.005 \text{ kg/ton}$ $= 0.12 \text{ kg/hr}$

Dust Emission caused by Transportation = $2,352 \text{ ton} / (6 \text{ days} \times 16 \text{ hr/day} \times 25 \text{ ton/trip}) \times 0.35 \text{ kg/km-vehicle} \times 1 \text{ km}$
 = 0.34 kg/hr

Dust Emission caused by Unloading = $24.5 \text{ ton/hr} \times 0.005 \text{ kg/ton}$
 = 0.12 kg/hr

Total Dust Emission caused by Turbine Foundation Excavation

= $0.31 \text{ kg/hr} + 0.12 \text{ kg/hr} + 0.34 \text{ kg/hr} + 0.12 \text{ kg/hr}$
 = **0.89 kg/hr**

The total dust emission caused by activities that will be carried out in each phase is calculated and the results for each construction phase are given in Table 5-10 below.

Table 5-10 Total Dust Emission in each Construction Phase

Construction Phase	Total Dust Emission (kg/hr)
Access Road Construction	0.8
Switchyard & Administration Building	0.32
Crane Pad Construction	0.31
Turbine Foundation Construction	0.89

In the Turkish IAPCR, it is stated that if total dust emission from fugitive sources is greater than 1 kg/hr, a dispersion modeling should be performed for both total suspended particles and PM₁₀. As a result of dust emission calculations for each construction phase of the Project, the dust emissions do not exceed 1 kg/hr. Therefore, no dispersion modeling was performed as it is stated in the Turkish IAPCR.

As for mitigation measures, in order to prevent dust generation, roads will be sprinkled with water regularly, loading and unloading of material that could generate dust will be done without throwing into the air; loads on the hauling vehicles will be covered with tarpaulin type material while in transport. Materials deposited on stockpiles on site will be closely monitored for any emission of dust and if required they will be damped down, covered or treated with a dust suppressant.

All heavy commercial vehicles leaving the site will be washed to prevent the transmission of soil from the site to the public roads. Vehicles will be encouraged to reduce their speed while moving around the site during dry weather to minimize disturbance.

As a summary, the likelihood and magnitude of potential air quality impact will be likely and low, respectively. Thus, the impact significance of the dust emissions that will be generated during construction is determined as minor since all ambient concentrations will be below the limits.

Mitigation measures will further reduce the amount of dust generated and therefore it is not expected that dust generated from foundation excavation works and road during construction activities and decommissioning activities will not create any adverse impacts on local air quality.

After these mitigation measures are taken, residual impacts will be negligible or no residual impact will be expected.

5.2.2 Operation

Wind power generation is a non-combustion process that relies on the direct conversion of mechanical energy into electrical energy. Thus, during operation, fossil fuels will not be used for power generation and air emissions will not be generated. There will be no emission resulting from heating during winter season since catalytic heater or electric power will be used for heating purposes. There will be an emergency generator, however, the emissions associated with the temporary operation of the emergency generator, if occurs, is not expected to impact the local air quality. Therefore, the Project will not have any adverse impact on local air quality during operation and the impact significance is negligible.

5.2.3 Decommissioning

During decommissioning phase, potential impacts of emissions are likely to be minor and similar in scale to those associated with construction. There may be some dust generated during the decommissioning of the Project, however, this will not be to the same extent as during the construction phase as there will be limited amount of earth moving required. Demolition of the WF will be conducted so as to minimize the generation and spread of dust. The impact significance of the decommissioning activities will be negligible since the likelihood and the magnitude of the potential air quality impact will be likely and low, respectively.

5.3 Water Supply and Wastewater

5.3.1 Construction

Water will be required for the construction works, dust suppression and washing of construction equipment and it will be supplied by tanker trucks. The amount of water during construction is insignificant compared to the local water resources and will not impact adversely the local surface or groundwater resources. In addition, drinking water will be supplied with bottled water.

Water that will be used for construction activities and dust suppression system will not return as wastewater at the wind farm. Therefore, only domestic wastewater will be generated throughout the construction and operation periods of the wind farm. It is assumed that a single person requires about 150 L/day water and this water will return as wastewater completely. Then, the total wastewater generation during construction period will be as follows:

Maximum number of personnel	: 130
Water required	: 150 L/person/day = 0.15 m ³ /person/day
Total water requirement	: 0.15 m ³ /person/day x 130 persons = 19.5 m ³ /day.

Domestic wastewater from the personnel will be stored in sealed septic tanks or treated in a package treatment plant to be constructed in the construction site depending on the personnel

number. In accordance with the Water Pollution Control Regulation (WPCR), if the number is 84 and less, septic tank is required, if it is larger than 84 then a package treatment plant is required. It is expected that maximum 130 personnel will be working for the construction and installation phase of the Project. In accordance with the WPCR, a package treatment plant will be needed and it will be installed within the wind farm site for the domestic wastewater treatment. After the treatment process, treated water will be discharged into the closest receiving environment. The quality of the discharge water will comply with the limits given in the WPCR. The discharge limits are presented in Table 5-11 below.

Table 5-11 Domestic Wastewater Discharge Limits to Receiving Environment

WPCR Table 21.1 Domestic Wastewater (BOD load 5-120 kg/day; Population 84-2000)			
Parameter	Unit	Composite Sample (2 hr)	Composite Sample (24 hr)
BOD	mg/l	50	45
COD	mg/l	180	120
TSS	mg/l	70	45
pH	-	6-9	6-9

The domestic wastewater generated during the construction phase will not create any adverse impact on the local environment and will not impact groundwater. It is not expected that groundwater will be encountered during the excavations due to the limited depth of the necessary foundation works. Surface water run-off is not expected to be an issue; however, the contractor will take care to ensure that surface waters do not escape the site through the use of interceptors if necessary.

As a summary, it is anticipated that the likelihood and magnitude of the potential impact of wastewater during construction will be definite and low to medium, respectively. The impact significance of the wastewater generated during the construction will be minor to moderate since the wastewater generation will be limited to the domestic wastewater. The residual impact will be negligible after mitigation measures.

5.3.2 Operation

During operation period, the wind farm will not need process water. Thus, the wind farm will not have any adverse impact on the local water resources. Drinking water demand of workers will be supplied with bottled water. For potable water demand of workers, the water will be purchased from the nearest source and will be brought to the site by tanker trucks. Only domestic wastewater will be generated from 12 personnel during operation phase. Assuming water used will return as wastewater completely, wastewater generated from 12 personnel will be 1.8 m³/day of domestic wastewater (0.15 m³/person/day x 12 persons = 1.8 m³/day).

The domestic wastewater will be collected in a leak-proof septic tank and disposed periodically by Kırkağaç Municipality (another alternative is Akhisar Municipality). The septic tank will be installed in accordance with the Regulation on the Septic Tanks to be installed where no Sewer System is available (published in the Official Gazette dated 19.03.1971 and numbered 13783 by the Ministry

of Health). An agreement will be signed with the municipality related to the disposal of the wastewater.

The domestic wastewater generated during the operation phase will not create any adverse impact on the local environment and will not impact groundwater. The wind farm will comply with the Turkish Water Pollution Control Regulation and the IFCWB Guidelines. Thus, the potential impact significance will be negligible.

5.3.3 Decommissioning

During decommissioning phase, potential impacts of water supply and wastewater are likely to be similar in scale to those associated with construction and an adverse impact is not expected.

5.4 Hazardous Waste

5.4.1 Construction

Small amounts of wastes such as oily rags resulting from the maintenance of machine and equipment and various thinners, solvents and paints will be generated during the construction phase. Oil change of machine and equipments are planned to be performed outside the wind farm site; at the qualified service providers. In case, it is inevitable to perform maintenance of the construction vehicles on site, minor amounts of waste oil will be generated at the site. These liquid wastes will be collected in leak-proof and safe containers and stored in an area with a concrete surface and a proper secondary containment to prevent potential spills and leakages reaching to the soil and groundwater. "Hazardous waste" label will be placed on to the containers and this label will also indicate the amount of stored waste as well as the storage time of the hazardous waste. In case the containers are damaged, wastes will be transferred to other container with the same properties and kept closed. Transportation of the wastes will be done by the persons and entities that are licensed for this work and by the vehicles appropriate for the properties of the transported waste. The hazardous wastes will be sent to a licensed disposal facility. All health and safety precautions regarding for staff responsible for activities such as transport and temporary storage of wastes will be taken in the facility.

In addition to the liquid wastes, waste battery and accumulators will be generated during construction. These wastes will be collected separately from household wastes and will be delivered to the collection points to be established by enterprises engaged in the distribution and sales of battery products, or by municipalities within six months after they are generated.

As a summary, during the construction, the main hazardous waste will be the waste oil. It is anticipated that the impact significance of the waste oil is moderate to high if proper mitigation measures are not implemented. However, the residual impact will be negligible after the mitigation measures are implemented. Thus, the Project will not create any adverse impact on the local environment due to the handling, storage, transport and disposal of the hazardous waste generated during the construction and will comply with the requirements of the Turkish Regulations and the IFCWB Guidelines.

5.4.2 Operation

Waste oil will be generated due to periodical maintenance of the turbines. It is assumed that approximately 60 L of waste oil will be generated during the maintenance works of one turbine. Hence, for 13 turbines, approximately 780 L waste oil will be generated due to yearly maintenance works. The cooling oil for the transformers will not contain PCBs or any other carcinogenic type oils. Waste oils resulting from yearly maintenance works will be collected by an expert team working at the oil provider company. These wastes will be removed from the wind farm site in accordance with the Turkish Waste Oil Control Regulation. It should be noted that regular maintenance of the turbines will minimize the potential for fluid leaks. In addition, non-hazardous fluids will be used as much as possible and practicable.

In addition to the waste oils, waste battery and accumulators will be generated during operation. These wastes will be collected separately from household wastes and will be delivered to the collection points to be established by enterprises engaged in the distribution and sales of battery products, or by municipalities within six months after they are generated.

Any hazardous waste will be collected in leak-proof containers and removed to a licensed disposal facility by licensed transporters. The hazardous wastes will be handled, stored, transported and disposed of according to the Turkish Hazardous Wastes Control Regulation, Waste Oils Control Regulation and Waste Batteries and Accumulators Control Regulation, and the IFC/WB guidelines. Thus, an adverse impact on the local environment is not expected.

As a summary, during the operation, the main hazardous waste will be the waste oil. It is anticipated that the impact significance of the waste oil is moderate to high if proper mitigation measures are not implemented. However, the residual impact will be negligible after the mitigation measures are implemented. Thus, this Project will not create any adverse impact on the local environment due to the handling, storage, transport and disposal of the hazardous waste generated during the operation and will comply with the requirements of the Turkish Regulations and the IFC/WB Guidelines.

5.4.3 Decommissioning

During decommissioning, transformer oil and lubricating oil will be collected and stored on site as required by the Waste Oil Control Regulation prior sending them to a licensed company with licensed vehicles. Any hazardous waste generated during decommissioning will be stored on site temporarily until they are sent to the licensed treatment and disposal facilities. None of the hazardous waste will be left on site permanently. Thus, this Project will not create any adverse impact on the local environment due to the handling, storage, transport and disposal of the hazardous waste generated during the decommissioning and will comply with the requirements of the Turkish Regulations and the IFC/WB Guidelines.

5.5 Non-Hazardous Solid Waste

5.5.1 Construction

During the construction period, the following non-hazardous solid waste is expected to be generated:

- Recyclable solid wastes generated by workers (e.g. paper, glass, plastics, etc.);
- Organic solid wastes generated due to catering services provided for the employees;
- Construction wastes;
- Empty drums, cans, containers, etc. (according to the Turkish regulations, if they are used to contain hazardous chemicals, then the containers are considered as hazardous waste); and
- Scrap metal, packing material and card boxes, wood and timber scraps.

It is expected maximum 130 personnel will be working when the excavation and installation activities begin. According to the Turkish Statistical Institute Regional Statistics (2010), waste generation rate per person in Manisa Province is 1.21 kg/day/person. Thus, for maximum 130 personnel, daily total solid waste generation is estimated to be 157.3 kg/day.

Recyclable wastes like cement bags, metal scraps, packing boxes and wooden crates, etc. will be segregated from other wastes and stored temporarily on site for eventual recycling process. Any other solid wastes that are non-recyclable and non-hazardous will be collected within closed bags and these wastes will be collected and properly disposed by Kırkağaç Municipality (another alternative is Akhisar Municipality). All solid non-hazardous wastes will be treated according to the Turkish Solid Waste Control Regulation, Packaging Wastes Control Regulation and the IFCWB guidelines.

Excavated soil will be re-used for the backfilling of the turbine foundation and site leveling purposes. Hence, no excavated soil will be transported and stored outside the wind farm site.

As a summary, it is anticipated that the impact significance of non-hazardous wastes that will be generated during construction will be minor. The residual impact after taken all necessary measures can be defined as negligible.

5.5.2 Operation

During operation phase of the power plant, the only domestic solid wastes will be generated from people working at the plant. Based on 1.21 kg/person/day average solid waste generation, the daily total amount of waste is expected to be 14.52 kg/day (1.21 kg/person/day x 12 persons). Such solid wastes will include food leftovers, plastics, glass, etc. The paper, plastic and glass content in the wastes will be segregated from other wastes for recycling.

Similar to construction phase, non-recyclable and non-hazardous solid wastes will be collected within closed bags and these wastes will be collected and properly disposed by the municipality. The wind farm will comply with the Turkish Solid Waste Control Regulation and the IFCWB Guidelines when handling, storing and disposing of non-hazardous solid waste.

As a summary, it is anticipated that the impact significance of non-hazardous wastes that will be generated during operation will be minor. The residual impact after taken all necessary measures can be defined as negligible.

5.5.3 Decommissioning

During the decommissioning, non-hazardous waste will be segregated and non-recyclable waste will be taken to the local municipal land fill. The recyclable waste will be sent to the licensed and authorized recycling companies. Adverse environmental impact is not expected during decommissioning.

As a summary, it is anticipated that the impact significance of non-hazardous wastes that will be generated during decommissioning will be minor. The residual impact after taken all necessary measures can be defined as negligible.

5.6 Medical Wastes

It is not planned to construct infirmary within the scope of the wind farm. Closest health center will be used for health care purposes. Hence, no medical waste will be generated at the wind farm site during the construction and operation phase.

5.7 Soil and Groundwater

5.7.1 Construction

All chemical storage containers, including diesel fuel, and hazardous liquid waste drums/containers will be placed so as to minimize the risk of soil and groundwater contamination and water pollution. Such chemicals and fuel will be stored in concrete areas with proper secondary containments and drip trays during construction. When necessary, spill kits, absorbent pads or materials, and absorbent sands will be provided near the chemical storage areas at all times.

There is also a potential for spills/leakage of oil associated with the construction machinery and vehicles. Construction machinery will be checked regularly. Any maintenance required will occur over hardstanding or on a suitable impermeable ground cover. Refueling will be limited to a designated area. Spill kits, absorbent pads and absorbent sands will be available on site at all times. Parking of staff vehicles will only be permitted in designated areas.

Any spills will be cleaned up as soon as possible with any contaminated sands bagged up and disposed of correctly.

With such proper precautions to prevent potential releases to reach environment, an adverse impact to soil or groundwater is not expected during the construction.

As a summary, it is anticipated that the significance of impacts on the soil and ground water during construction will be minor. The residual impact after taken all necessary measures can be defined as negligible.

5.7.2 Operation

It is not expected to store large volumes of chemicals and oil during the routine operations. Only some minor and temporary storage of transformer and lubricating oil will take place during the routine maintenance. All storage tanks and drums, including those containing oil will be placed in concrete areas with proper secondary containments.

Most of the oil is contained in the gearbox and any leakage would be contained within the nacelle and tower structures. The turbines will be designed with fluid catch basins and containment systems to prevent accidental releases from leaving the nacelle. The door to the tower is situated above ground level. Any accidental gear oil or other fluid leaks from the wind turbines will be contained inside the towers as they are sealed around the base and will be cleaned up as soon as possible. The wind turbines will be equipped with sensors to automatically detect loss in fluid pressure and/or increases in temperature in the lubricating oils used, enabling the turbines to be shut down automatically in the event of a fluid leak.

Transformers will be sealed units with negligible leakages. The transformer oils will not contain polychlorinated biphenyls (PCB).

With these precautions to prevent potential releases from reaching the environment, an adverse impact to soil or groundwater is not expected during the operations phase.

As a summary, it is anticipated that the significance of impacts on the soil and ground water during operation will be minor. The residual impact after taken all necessary measures can be defined as negligible.

5.7.3 Decommissioning

The concrete foundations will likely be left in the ground after decommissioning the site. There is not considered to be any significant environmental impact generated from these bases. The ground will be reinstated back to its original state with suitably clean topsoil and grass covering where appropriate. The effects on soil and groundwater during decommissioning are expected to be minimal and similar to those for construction.

As a summary, it is anticipated that the significance of impacts on the soil and ground water during decommissioning will be minor. The residual impact after taken all necessary measures can be defined as negligible.

5.8 Biological Resources

As a result of increased human presence, noise or the movement of the operating turbines a significant habitat loss is anticipated. These impacts and related mitigation measures are discussed below.

5.8.1 Protected Areas

There are no national parks, nature reserves, natural parks, natural monuments, wildlife protection areas, wildlife improvement areas, tourism centers within the Project site as declared in accordance with the Turkish national legislation.

5.8.2 Impact on Flora

There will be a significant impact on the existing vegetation during site preparation and excavation activities. There will be no impact on the flora during the operation phase.

The Project site has characteristics of forest vegetation. There will be negative impact on the existing vegetation during site preparation and excavation work. In order to construct the project units and roads, the vegetation will be removed. The majority of the habitat destruction occurs during the road constructions in wind farm projects.

In the first phase of the Project, the vegetation will be stripped for the construction in the Project site. The trees will be cut and other bushes are going to be shaved. Thus, the natural vegetation will be destroyed by the cuttings, removal of the vegetation and excavation processes. The construction activities will cause most of the fauna species that depend on this flora and vegetation structure to lose their habitat.

As a result of this study, no threatened, vulnerable or endangered flora species were determined in the Project area in accordance with the Red Data Book (IUCN). Endemic plant species in the project area are *Peucedanum chryseum*, *Dorycnium pentaphyllum subsp. Haussknechtii* and *Stachys cretica subsp. Smyrnaea*. According to the Red Data Book of Turkish Plants all these endemic species are classified as LC (Least Concern). From these endemics, *Peucedanum chryseum* is abundant in Aegean and Mediterranean Regions, whereas *Dorycnium pentaphyllum subsp. haussknechtii* and *Stachys cretica subsp. smyrnaea* are abundant through Turkey according to the official website of Turkish Plants Data Service (TUBIVES).

There are no protected flora species in the Project site and its vicinity in accordance with the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) which was ratified in Washington, D.C. on March 3, 1973. In addition, there are no protected flora species in accordance with the Bern Convention (Convention on the Conservation of European Wildlife and Natural Habitats) which was ratified by Turkey on January 9, 1984.

5.8.3 Impact on Fauna

5.8.3.1 Impacts on Birds and Mitigation Measures

As is known, the wind and solar energy are considered as clean energy sources. However, this statement is valid when the mitigation measures are taken for the habitat losses and when the birds and bats are prevented to collide with the turbines. The most important mitigation measure is the site selection. The Project site should not be selected along the high mountain passes and breeding areas of birds and bats. If there is no other alternative, monitoring studies should be carried out in the Project site and its vicinity.

A detailed ornithological survey will be conducted for the sensitive (or potentially sensitive) species and species groups: large raptors or other large soaring species minimum one year in the project area. The monitoring surveys are suggested to be conducted during the migration period; preferably covering both spring and autumn bird migration periods. During these survey periods bird's potential or existing relationship with the turbines, their flight altitude, mortality, if any, and bird observation scan times should be determined.

All the bird species listed in the Project site and its vicinity are included in the national and international conservation lists. This is valid for all the countries in the West Palearctic ecozone. All countries in this ecozone ratify the same conventions in terms of nature protection. Most of the fauna species are conserved in these countries, like in Turkey, because of the global pollution of environment and habitat losses. During the activities to be carried out in the habitats of these species, especially breeding and nutrition areas, necessary mitigation measures should be taken.

Direct and indirect effect on living and nonliving entities around the wind turbines is inevitable. The facilities that have in a direct relationship with soil, vegetation and wildlife will also affect the habitat use of native bird species' use of the site.

Within the Project site and its vicinity, mostly common species with a high degree of ecological tolerance, such as wheatear, short-toed lark, shrikes, swallows, and hoopoe, crows, pipits, kestrel and buzzard species inhabit. Passerine species usually use Project site course and its surroundings for the resting and feeding purposes during the spring and autumn migration. Because of their ability to maneuver and flight characteristics, this group of birds are not expected to be negatively affected from wind farm.

The quantity of turbines is important when the turbines are planned to be constructed on a limited size areas. It is important that the turbines not to prevent the migration of birds and not being constructed on the high altitudes along important migration routes. In addition they should be carefully sited and painted against collisions.

5.8.3.2 Mitigation Measures for the Construction Phase

In the first phase of the Project activities, the trees and shrublands in the sites will be stripped for the construction. During this phase, a risk will arise for the fauna elements which use these flora

formations. For this reason, visual controls will be carried out before stripping and the fauna elements will be removed from these areas. When it is not certain that all the animals leave the site and if necessary, high volume noise will be used to make these animals disturb and leave the area.

Before the stripped material is removed from the area, a visual control will be made for the possibility that vertebrates such as tortoises, hedgehogs, lizards and snakes may enter these stripped materials. If any fauna element is found, it will be put into a cloth bag and transferred to a nearby habitat and released carefully.

After the stripping, the Project site will be leveled or excavated. If there are animals inhabiting under the soil near to the surface, they may come out to the surface because of the excavation. They will be removed from the Project site by appropriate means of methods or make them leave the site.

It is not possible for the animals nesting on the plants or soil in the Project site to inhabit these areas again after the stripping. It is the case especially for the wind farm project units, roads and the feet of pylons. The individuals leaving their habitats will have to find similar habitats around. In this period, since these animals will be under stress and in an adaptation process, anyone should not approach; and try to capture or any other attempt, which increases their stress.

The vegetation in the areas where the turbines will be installed will be removed in the construction phase. Especially road construction in wind farm projects constitutes the majority of the destruction. Therefore, a habitat loss will occur. For that reason the existing access roads will be used in the area for the construction activities and no construction will be conducted additional side roads as much as possible. The species using these areas for various purposes will not be able to use these areas again. The time period of the removal of vegetation could be carefully arranged so that the species inhabiting these areas will be protected. These species will migrate to other similar habitats for nesting and nourishment in their breeding periods.

The degree of effects of these activities on the fauna elements not only depends on the type of the activity, but also the mobility of the animal. If the mobility of the animal is high enough, its reaction to the threats will also be quick. Birds which have the highest ability to move – if they are not breeding when the activity starts – will not be affected considerably because of the stripping and excavation activities. The most important point is that the stripping is started either before the breeding season or after the young birds are able to take care of itself. This is valid for all vertebrate animal groups. Because, the breeding seasons of these animals are close to each other. This period is between the middle of April and June. In this way, the species, which will breed in the next spring, will choose the most appropriate habitats for nesting.

If the stripping will have to coincide the breeding period, the animals should be prevented to reach the potential nests or breeding areas. One of the easily applied measures is to mark the nests and breeding areas with shiny bands before the breeding period and to put a barrier in the entrance of the nests. Objects to make the animals leave their nests can also be used for this purpose. However, blocking the entrance of the nest is a more effective method.

During the construction phase of the Project, the vehicles carrying construction material and personnel to the Project site will cause a traffic load in the close vicinity of the Project site. After the installation of the facility, the fauna elements inhabiting near the access roads may face to various risks resulting from these vehicles.

Noise is one of the factors affecting the fauna elements. Many fauna species are adversely affected by lower noise levels compared to humans. As a result of the project related activities, especially in construction phase, animals may have a break or quit some of their daily activities such as nutrition, and seasonal activities, particularly breeding. For that reason, working at night hours will be avoided as much as possible to decrease disturbance.

During construction and operation phases, the noise level resulting from various sources will be much higher than the background noise levels in the Project site. Some local fauna elements may leave their habitats temporarily or permanently due to these high noise levels.

The most vulnerable fauna elements to wind farm projects are the birds. Another vertebrate group that could be affected from the projects are bats. No migratory bat species has been listed in the Project area. The bats can be affected from the air currents that result from the turbines. For this reason, the habitats of bats may be searched in the surrounding area of the Project.

The reptile species will most probably leave their habitats due to the disturbance resulting from the construction activities. Yet, there will be some species which will return to their habitats in time. Therefore, unscheduled stripping may result in damage on the protected species. In order to prevent this, the start of the construction activities should be arranged carefully.

According to the Bern Convention, Common Tortoise (*Testudo graeca*) is included in the list of strictly protected fauna species. However, this species is in the list of species that are not protected by Turkey since it is abundant in Turkey. The individuals of this species spend their time during winter season in the holes that they dig into the soil. The individuals of common tortoise can be identified by means of visual inspection before the construction phase begins. In order to protect them, they can be removed from the Project site to the similar habitats in the surrounding.

In order not to have an adverse impact on the other vertebrates, some mitigation measures should be taken during the construction activities of the Project. The main mitigation measure is to make these animals leave the Project site or remove them by means of appropriate equipments. It is not always easy to remove fauna elements which have been living in their habitats for a long time. Unfortunately, some fauna elements may return to their habitats after they are removed. Because of these possibilities, it is required to take all necessary mitigation measures depending on the type of activity to be carried out. Moreover, all wastes will be collected during construction and disposed of properly to decrease the impact on fauna.

5.8.3.3 Mitigation Measures for the Operation Phase

An ornithological monitoring study will be carried out covering the spring and autumn migration periods in 2013. Depending on the results of this monitoring, there may be other monitoring afterwards.

Besides monitoring, in order not to have an adverse impact on the fauna elements, there are some other mitigation measures. One of these mitigation measures is the selection of the turbines. Recently, the turbines are designed and produced to be more silent and have blades with smooth lines. By this way, the risk of collision with the birds significantly decreases.

Another mitigation measure is to paint the blades in appropriate colors. The blades may be painted with noticeable colors when needed. The most appropriate color is orange/red color which is easily seen by the birds. The birds are able to see this color from the long distances especially during high visibility days. As a common practice, instead of painting the whole blade, the tips of the blades are painted with orange/red color in one or two bands. In this way, the colored blades will draw the attention of the birds during both migrating and daily flights. Therefore, birds will be able to notice the turbines from a distant location and adjust their routes accordingly. Within the Project, the tip of the blades will be painted red and the turbines will have the aviation light to minimize the risk of bird and aircraft collision.

5.9 Cultural and Historical Resources

Although there are no archeological and historical resources within the Project site, there is always a chance of discovering archeological artifacts or remains during construction related excavations in Turkey. During construction, if any archeological remains are discovered, as the national law requires, the Project will cease excavation at this location and inform the local Department of Culture and Tourism immediately. After inspection by the experts from the local Department of Culture and Tourism, a decision will be given to continue or reposition the excavation. With these precautions, the local cultural and historical resources will not be adversely impacted due to the construction activities.

5.10 Visual Impacts

5.10.1 Construction

During the construction phase, it will be a typical construction site where various earth handling and construction equipment and machinery will be operating. This equipment will include cranes, trucks, graders, loaders, etc. The size of this equipment will be chosen such that it will provide efficient construction operation and at the same time will not create an interference with surrounding landscape. During the construction phase, there will be temporary and reversible effects on the landscape of the site due to ground disturbance. However, any debris or other wastes produced during such activities will be collected and disposed in an orderly manner to prevent any lasting impacts to the area. The construction camp site will be located near the project area and will have single story structures and painted in color consistent with the environment. During the construction,

the contractor will make sure that the camp will be well maintained and cleaned regularly. The camp site will not create any adverse visual impact.

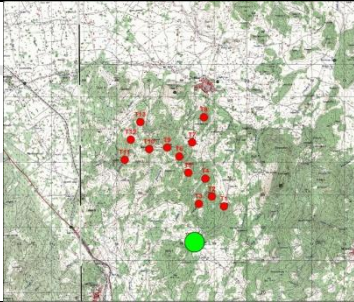
5.10.2 Operation

Visual or aesthetic resources refer to those natural and cultural features of an environmental setting that are of visual interest to people. The Project site is not located in a protected area or a tourist/resort area; it is located on a hilly topography and not considered as an aesthetically significant place. Thus, a visual impact is not considered as significant. However, the visual impact associated with the Project will be permanent for those residing at the closest settlements.

The potential visual impact of the Project will primarily result from changes to the visual character of the area within the view catchment. The nature of these changes will depend on the level of the visual contrast between turbine structures and the existing landscape within which they would be viewed. The degree of contrast between the turbines and the surrounding landscape will result from one or more of the visual characteristics such as; color, shape or scale, texture and reflectivity. Since the Project site has a hilly topography and the closest settlements are located at lower elevations or far away from the site, the turbines will be viewed against the sky.

In order to demonstrate the visual impact, views of the Project site from three different locations have been prepared. Three dimensional models were used in order to represent wind turbines, towers and blades and these models were located on photographs of the Project site. The dimensions of the models were same as the project dimensions; 98.3 m hub height and 103 m rotor diameter.

- The first view, which is given in Figure 5-5, is looking to the Project site from Tütenli Village in south of the Project site. The view is looking in north direction and the viewpoint is situated about 1.1 km away from Turbine 3 (T3) at 241 m altitude.
- The second view in Figure 5-6 shows the Project site from the east of İlyaslar Town in north of the Project site. The viewpoint is 1.2 km away from Turbine 8 (T8) at 220 m altitude.
- The last view, given in Figure 5-7 shows the Project site from Akhisar-Bergama Road in southwest of the Project site. The viewpoint is about 2.6 km away from the Turbine 11 (T11) location at 232 m altitude.



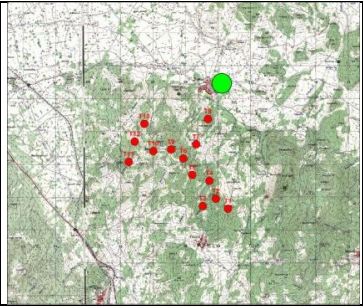
Viewpoint Information

Viewpoint Coordinates : 568393E 4321550N
View Direction : North
Viewpoint Elevation : 241 m
Distance to Nearest Turbine : 1.1 km (T3)

GÖKRES-2 WF
Viewpoint 1 (Tütenli Village)

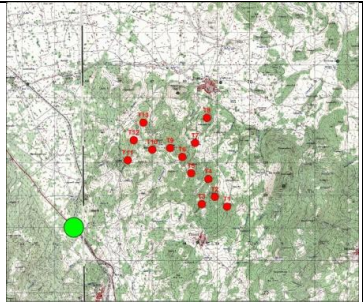


Figure 5-5 View of the Project Site from Tütenli Village



Viewpoint Information		GÖKRES-2 WF
Viewpoint Coordinates	: 569102E 4326466N	Viewpoint 2 (İlyaslar Town)
View Direction	: South	
Viewpoint Elevation	: 220 m	
Distance to Nearest Turbine	: 1.2 km (T8)	

Figure 5-6 View of the Project Site from İlyaslar Town



Viewpoint Information Viewpoint Coordinates : 564590E 4322011N View Direction : Northeast Viewpoint Elevation : 232 m Distance to Nearest Turbine : 2.6 km (T11)	GÖKRES-2 WF Viewpoint 3 (Akhisar-Bergama Road)
	

Figure 5-7 View of the Project Site from Akhisar-Bergama Road

The residents living in Tütenli Village located in south of the Project site will see seven turbines that are located on the southern part of the Project site, as shown in Figure 5-5. Since other turbines are situated on the northern side of the Project site, they will not be in the view shed of the residents.

As can be seen in Figure 5-6, the turbines situated in the northern part of the Project Site will be seen from the Viewpoint 2 which is located in İlyaslar Town in north of the Project site. The turbines that will not stay in the view shed of the viewpoint are positioned on the southern part of the Project site.

The view that will be obtained by the drivers travelling on Akhisar – Bergama Road is given in Figure 5-7. Ten out of thirteen turbines will be visible to the drivers passing from the Viewpoint 3 whereas the remaining turbines will not be in the view shed of the drivers. In addition to the views of the Project site from three different locations, several photographs of the turbine locations were applied of photomontage by using turbine models and given in Appendix A.

Visual impact is a subjective issue, a significant number of people in Turkey associate wind farms with clean energy and view the towers as symbols of modern and civilized living. There is no known public opposition on wind farms in terms of potential visual effects. Moreover, there are a number of operating wind power plants located in Manisa Province and one of these wind power plant is located approximately 3.7 km northeast of the Project Site. Therefore, residents of the settlements around the Project Site are familiar with wind farms and after the conversations with local people, it was understood that they do not have any objection or negative attitude about the visual impact of wind towers. Thus, it is expected that public and NGOs will view this development favorably and visual impacts will not considered as significant.

Nevertheless, the finish of the Project will be colored so as to blend in with the receiving landscape and background. It is likely that turbines will have a light grey matt (non-reflective) finish.

5.10.3 Decommissioning

During the decommissioning phase, visual impacts will be temporarily similar to the construction phase. It is expected to preserve the natural image of the location.

5.11 Shadow Flicker and Blade Glint

Wind turbines, like all other tall structures will cast a shadow on the neighboring area when the sun is visible. The major difference between a tall structure and a wind turbine regarding their shadow casting potential is the rotating blades of the wind turbine. As the rotor blades rotate, shadows pass over the same point causing an effect termed as shadow flicker. Shadow flicker occurs when the sun passes behind the wind turbine and thus casts a shadow. This phenomenon is regarded as an environmental impact and can create a disturbance/nuisance if the wind farm is not situated and/or planned accordingly.

A modeling study was performed in order to estimate the shadow casting areas by WindPRO software and to create a shadow model for each of the wind turbines. The shadow flickering occurs

in east-west direction; however, there is no permanently or temporarily used dwelling in east-west direction to the Project Site. Therefore, the closest residences to the Project site from Tütenli Village, İlyaslar Town and the neighborhood situated in the west of Tütenli Village on the Akhisar-Bergama Road. The map showing location of the shadow receptors is given in Figure 5-8. As can be seen in Figure 5-8, the Shadow Receptor 1 is the residence chosen in İlyaslar Town located in the north of the Project Site. Shadow Receptor 2 is located in the north of Tütenli Village in south of the Project site. Shadow Receptor 3 is positioned in east of the neighborhood situated in the west of Tütenli Village on the Akhisar-Bergama Road.

The coordinates of the shadow receptors (UTM Projection, ED 50 datum Zone 35) are given in Table 5-12 below.

Table 5-12 UTM Coordinates of Shadow Receptors

	East	North	Elevation
Shadow Receptor 1	568820	4326030	231
Shadow Receptor 2	568521	4321871	249
Shadow Receptor 3	565147	4322117	240

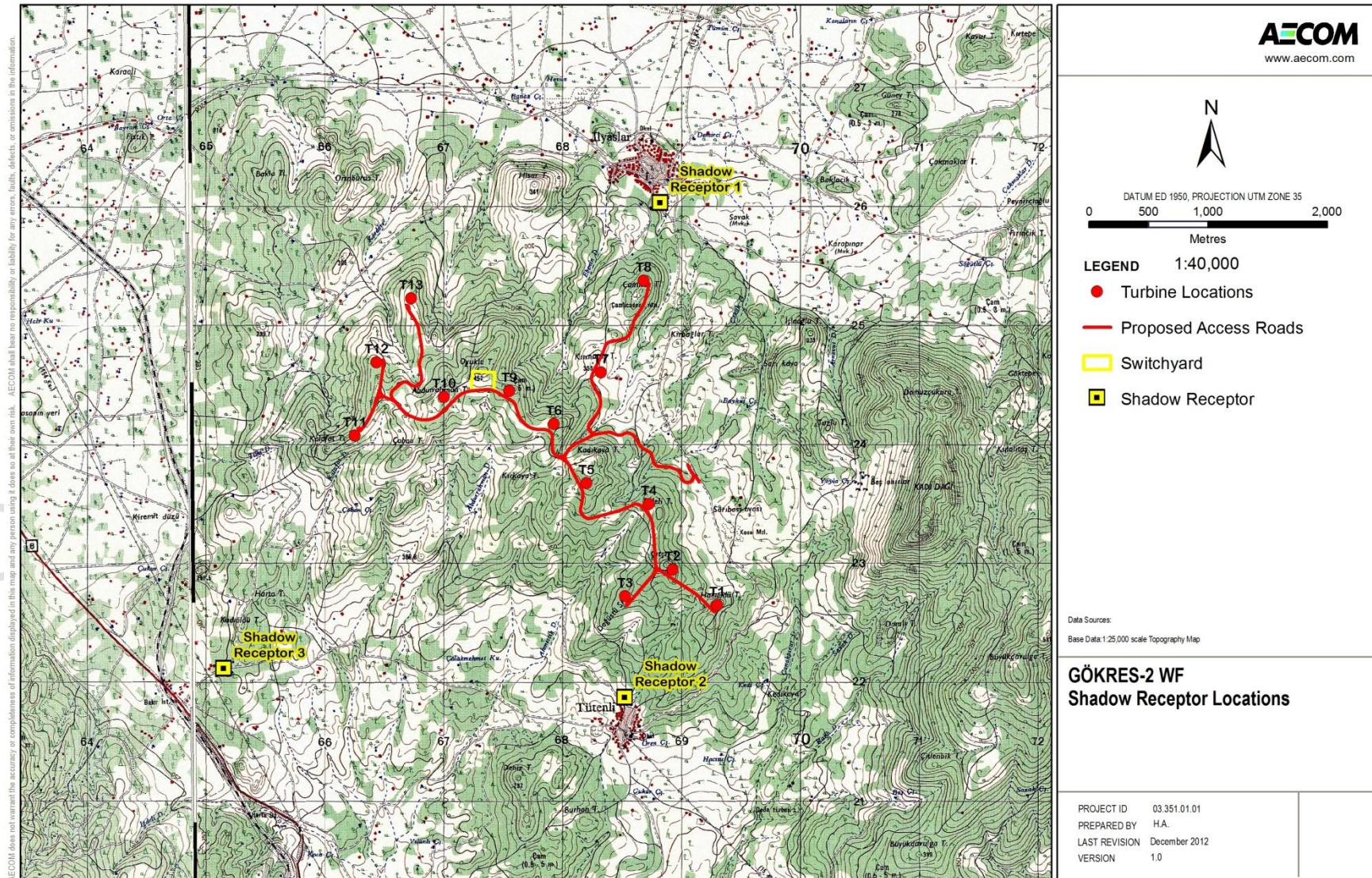


Figure 5-8 Location of Shadow Receptors

Model Inputs

Shadow module of WindPRO software requires several parameters for the calculation of the shadow model. These parameters are terrain data, sun shine probabilities for each month, annual operational times of turbines for each of 12 wind sectors, maximum distance of influence, and minimum sun height over horizon for influence.

Terrain data used in the model is 10 m contour data which provides accurate elevation values for both turbines and shadow receptors. Monthly sun shine probability values are acquired from long term meteorology data (1975-2009) of Akhisar Meteorological Station. Annual operational times of turbines for each of 12 wind sectors are obtained from data from MAST tower situated in the Project site. Monthly sun shine probability values as average daily sun shine hours and annual operational times for each of 12 wind sectors are given in Table 5-13 and Table 5-14, respectively.

Table 5-13 Average Daily Sun shine Hours

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Probability	3.49	4.38	6.01	7.58	9.02	10.28	11.09	10.31	9.3	7.09	4.4	3.13

Table 5-14 Annual Operation Times for 12 Wind Sectors

	N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW
Hour (hr)	4404	1644	79	35	46	139	1078	673	118	53	85	266

Regarding the maximum distance for influence of shadow flickering, various attempts and experiments have showed that the shadow impact is irrelevant at the areas which are seven times rotor diameter distance away from the wind turbine (windpower.org). Although the influence distance is 721 m according to this assumption, to be on the safe site, the distance of 2,000 m is used as the maximum distance of influence for shadow flickering. The minimum sun height over horizon is used as 3° in the model.

Model Results

Shadow modeling calculates the shadow flickering impact in two different scenarios; worst case and realistic case. The worst case scenario assumes that the sun is shining for all day from dusk to dawn with no cloud cover and the heading of the turbines is following the movement of the sun during the shining hours. The realistic case scenario is based on the inserted data into the model such as; annual operation hours of turbines in 12 wind sectors and monthly sunshine probabilities.

Shadow modeling calculates the shadow flickering for each minute of a day throughout a year. The results of WindPRO software include several reports and graphical demonstrations. These reports are given in Appendix B.

The modeling results demonstrate that no shadow flickering will be observed at the shadow receptors for both worst case and realistic case scenarios since the shadow receptors are situated to the north and south of the turbine locations. Moreover, the distance between the shadow receptors and some turbines are greater than 2 km. The map showing the shadow contours (hour/year) for realistic case is given in Figure 5-9.

There is no limit stated in both Turkish legislations and IFC/World Bank guidelines regarding to shadow flickering. The modeling results show that no shadow flickering will be observed at the shadow receptors and it can be stated that the Project will not cause shadow flickering impact on the closest settlements. In addition, blade glint is not expected to be an important issue since the blades will be made of and painted non reflective materials.

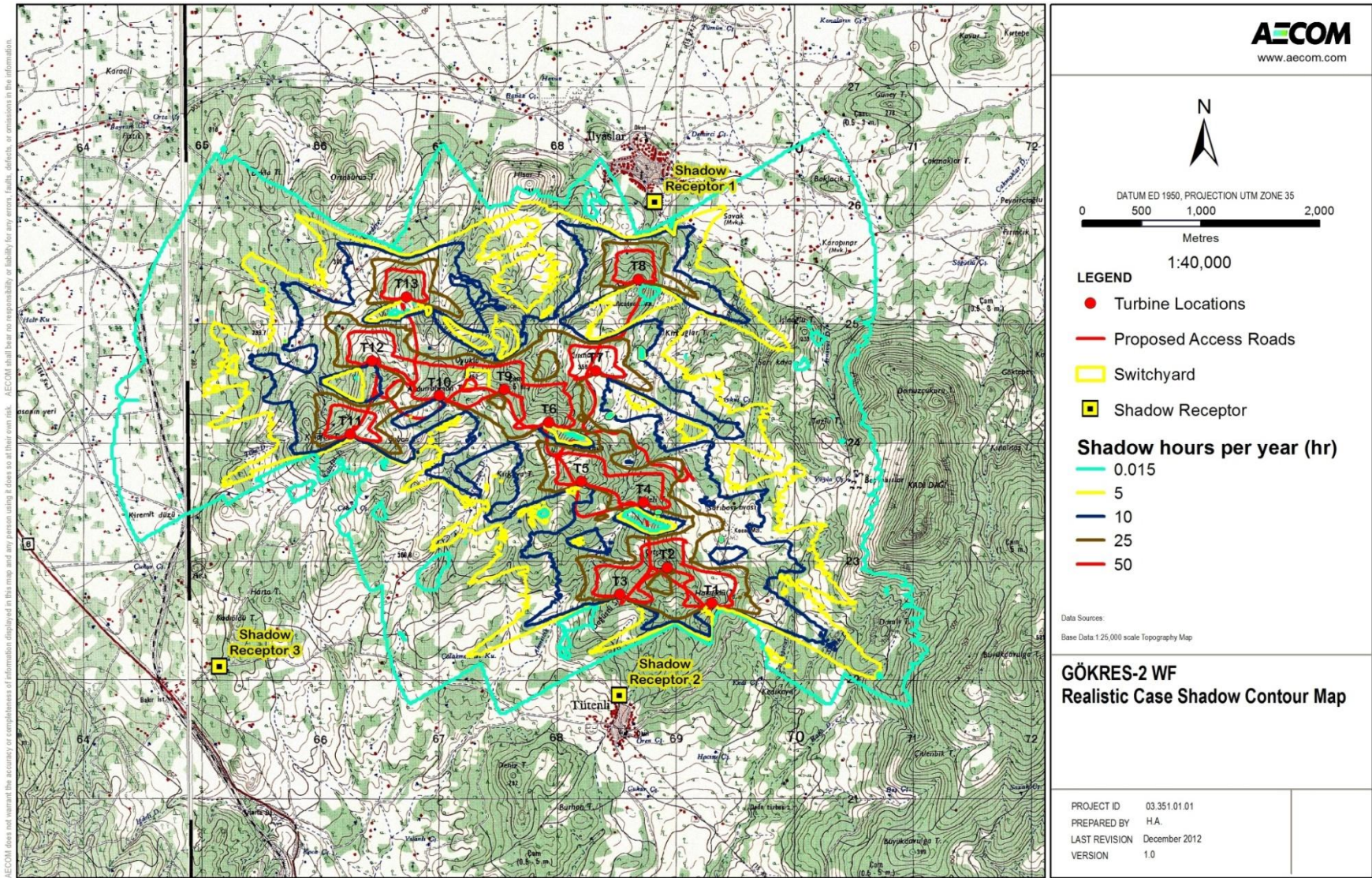


Figure 5-9 Realistic Case Shadow Contour Map

5.12 Cumulative Impact Assessment

Since there are wind farm projects operating or in the planning phase around the Project site, a cumulative impact assessment was performed by taking the other projects into consideration in order to predict whether there will be any additional impacts at the close settlements associated with the other projects located around the Project.

There are several wind farm projects in operation or in planning phase in the vicinity of the Project site in in Akhisar District of Manisa Province. According to information obtained from EMRA, there are two licensed wind farm projects around the Project. These projects are Karakurt Wind Farm and Kırkağaç Wind Farm. The turbine coordinates of both projects were obtained from EMRA. The map showing the turbine locations of the projects together with the Project is given in Figure 5-10.

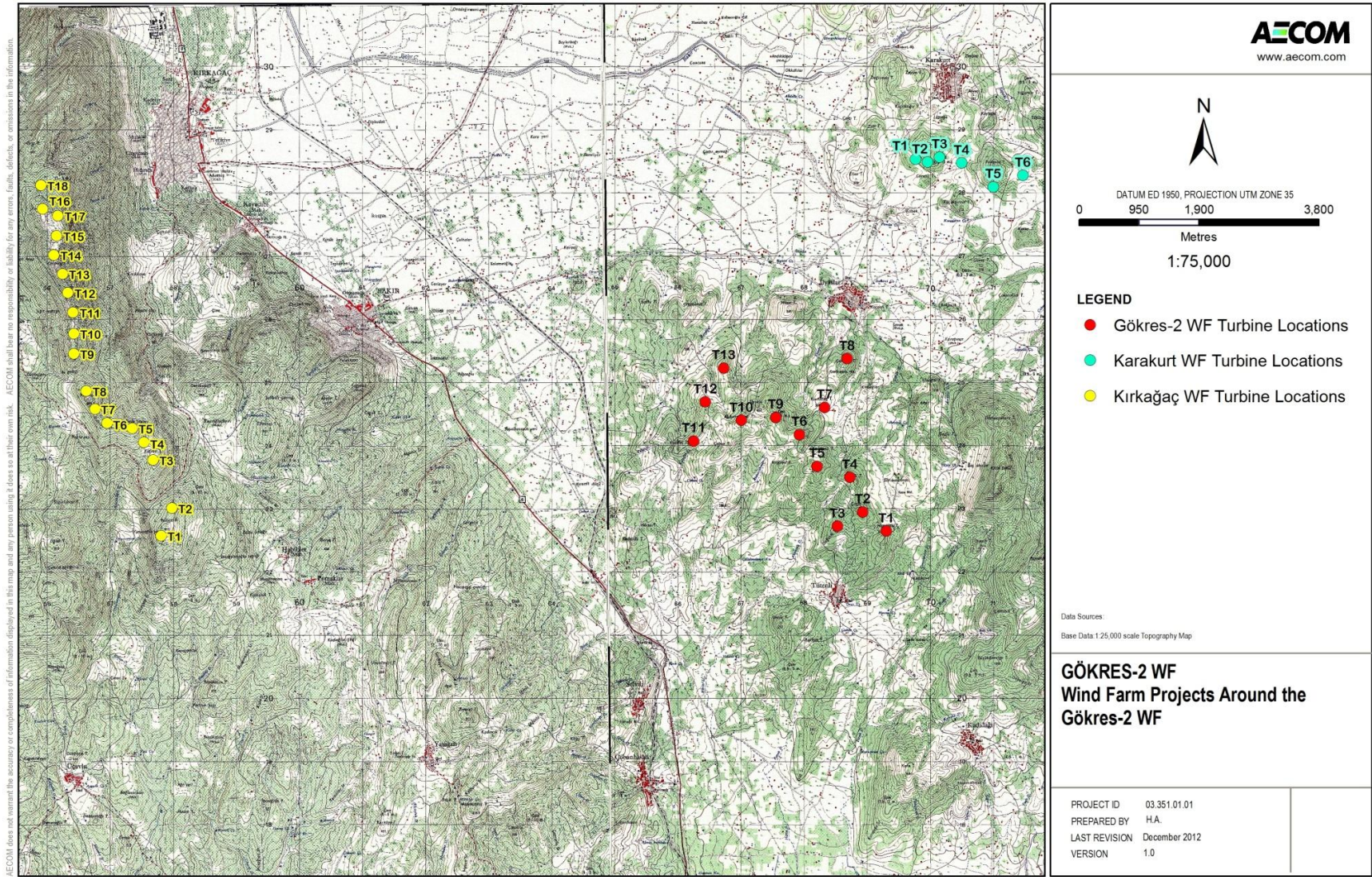


Figure 5-10 Wind Farm Projects around the Project

The closest wind farm project to the Project site is Karakurt WF (10.8 MW) having 6 Vestas 1.8MW V90 turbines in operation. As can be seen in Figure 5-10, Karakurt WF is situated in the northeast of the project site. The second closest wind farm project to the project site is Kırkağaç WF (45 MW) which is in planning phase. There are 18 turbines (18x2.5 MW) in Kırkağaç WF. Kırkağaç WF is located approximately 8.3 km away in west of the project site.

The cumulative impacts of the Project and the projects mentioned above are evaluated based on the distances between each project. Since the Project is far away from Kırkağaç WF, it can be stated that there will be no additional impact on the settlements around each existing project. However, Karakurt WF is situated in the close vicinity of the project site and İlyaslar Town is located between these two projects. Therefore, a quantitative cumulative noise impact assessment was performed in order to estimate whether the cumulative noise levels at İlyaslar Town comply with both the Turkish RAMEN limits and IFC/WB Guidelines.

Cumulative Noise Impact Assessment

Since the Karakurt WF is situated in the close vicinity of the project site and İlyaslar Town, it is likely that the noise levels caused by both the Project and Karakurt WF will be observed at İlyaslar Town. The map showing the turbine locations of both projects is given in Figure 5-10, below. The closest turbines of Karakurt WF and the Project are T1 of Karakurt WF and T8 of the Project. The distance between the two turbines is about 3300 m.

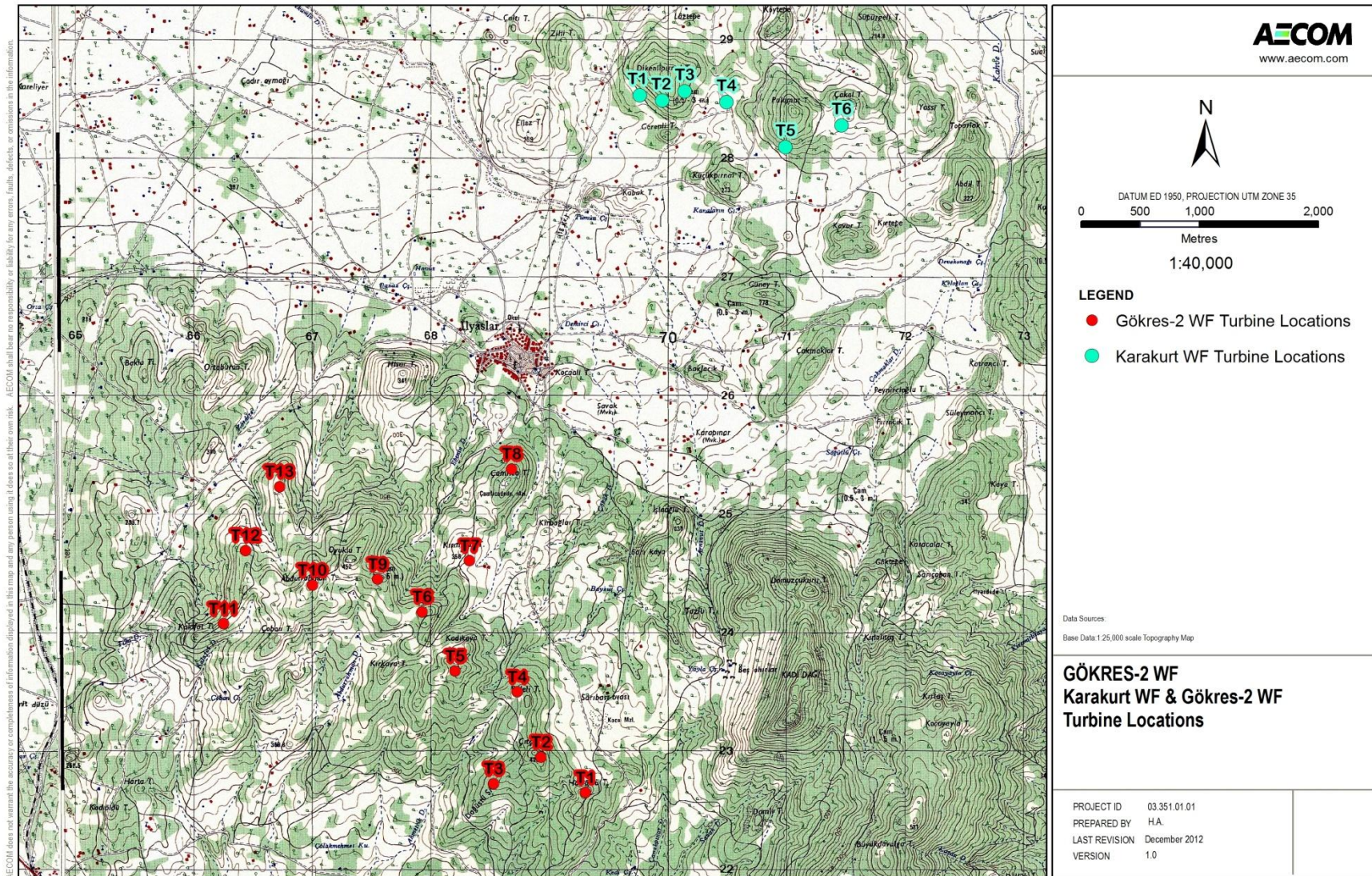


Figure 5-11 Turbine Locations of Karakurt WF and Gökres-2 WF

In the “Noise Impact” section of this report, the maximum predicted noise level of the Project at Tütenli Village was determined since the maximum predicted noise levels were calculated in Tütenli Village. However, the maximum cumulative predicted noise level of the Project and Karakurt WF will be expected at İlyaslar Town which is situated between the two projects. Therefore, the predicted noise levels of Karakurt WF at the dwelling in İlyaslar Town, which is the closest house to Turbine 8 (T8) of the Gökres-2 WF, is calculated together with the noise levels of the Project.

The turbine coordinates of Karakurt wind farm is taken from the license obtained from EMRA. The type of turbines of Karakurt WF are Vestas 1.8MW V90. The noise levels of Vestas 1.8MW V90 are obtained from the wind turbine database of WindPRO software and that noise levels are used in the cumulative noise modeling.

The cumulative predicted noise levels at the dwelling situated in İlyaslar Town are given together with the maximum predicted noise levels of Gökres-2 WF and Karakurt WF in Figure 5-11 below. In addition, cumulative predicted noise level contour map is given in Figure 5-12 below.

Table 5-15 Cumulative Predicted Noise Levels at İlyaslar Town

	Predicted Noise Levels @ 10 m/s wind speed, dBA
Gökres-2 WF	38.7
Karakurt WF	27.0
Cumulative	39.0

As it is presented in Table 5-15, the cumulative noise level at 10 m/s wind speed at İlyaslar Town is determined as 39.0 dBA which is below the Turkish RAMEN daytime, eveningtime and nighttime noise limits. In addition, the calculated cumulative noise level is below the IFC/WB Guideline noise limits of both daytime and nighttime. As a result, the calculated cumulative noise level at İlyaslar Town caused by the operation of Karakurt WF and the Project will be in compliance with both Turkish RAMEN and IFC/WB Guideline and it can be stated that the cumulative noise impact at İlyaslar Town will be negligible.

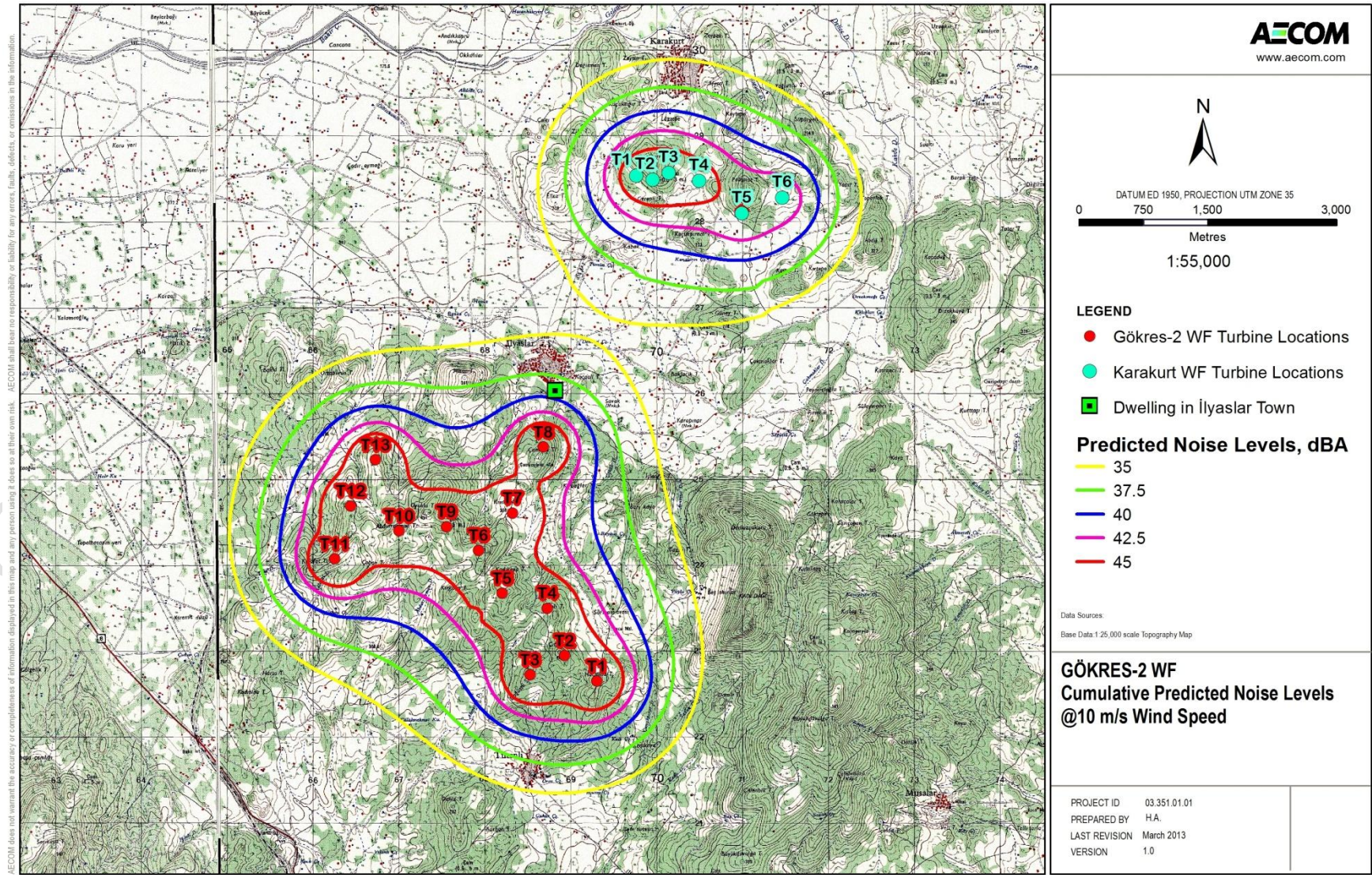


Figure 5-12 Cumulative Noise Contour Map

6.0 SOCIO-ECONOMIC IMPACTS

Potential impacts onto local socio-economy may arise during construction, operation and decommissioning phases of the Project. A public consultation meeting will be held in order to inform affected people about the Project and its potential impacts. In this meeting concerns and questions of the local people about the Project will be discussed. Probable socio-economic impacts and mitigation measures are described in the following sections.

6.1 Construction Phase

- Employment;

Impact: There might be employment opportunities during construction phase of the Project.

Mitigation: A recruitment approach to hire construction workers from region and especially from project-affected communities will provide a positive socio-economic impact.

- Community Relations;

Impact: There might be tension/dispute between local resident and workers during construction period.

Mitigation: This impact can be minimized by managing any disputes between the contractors and local residents, showing respect to local people and customs, implementing an alcohol and drug policy for the construction workers, having zero tolerance of illegal activities by construction personnel, providing cultural awareness training to construction workers.

- Safety Risk for Local Community;

Impact: There might be temporary increase in traffic flow in the region during construction.

Mitigation: In order to minimize the impact, local residents will be informed about the traffic flow.

Impact: Open trenches during construction of the Project might pose a safety risk to the local community.

Mitigation: There will be no access to open trench area for unauthorized personnel. The security guards will prevent access to unauthorized personnel to the construction area.

- Disruption to Local Infrastructure;

Impact: There might be disruption to roads during the construction of the Project.

Mitigation: All of the construction works are planned and managed properly to eliminate and minimize health and safety risks. Transportation and construction works will be done properly to minimize damage to local infrastructure.

6.2 Operation Phase

- Employment;

Impact: There might be employment opportunities during operation phase of the Project.

Mitigation: A recruitment approach to hire safety guards from region and especially from project-affected communities will provide a positive socio-economic impact to the Project.

- Safety Risk for Local Community;

Impact: Access of unauthorized people to high voltage parts and equipments might result in health and safety risks.

Mitigation: In order to prevent unauthorized access to the wind turbine area and high voltage parts and equipment, security personnel will be employed during the operation period. All of the project personnel will be trained for health and safety issues.

6.3 Decommissioning Phase

The socio-economic impacts of the Project during decommissioning phase are similar to that of during construction phase. However, there might be some additional impacts due to change in the demography of the project area at the time of decommissioning. Negative impacts will be minimized by taking necessary mitigations and compensations will be given when required. Positive impacts such as employment opportunity will be maximized by applying necessary policies and mitigations.

7.0 OCCUPATIONAL and COMMUNITY HEALTH AND SAFETY

7.1 Working at Heights

Working at height is a major occupational health and safety (OHS) issue while assembly of wind tower components and general maintenance activities during operations. Prior to the construction works, a Health and Safety Plan (HASP) including issues relevant to working heights will be prepared and implemented. As the details will be included in the HASP, the safety harness will be used to secure persons during ascent to and descent from the nacelle of the wind turbine generator system and when carrying out work in areas where there is a falling hazard. In addition, employees will be trained in climbing techniques and fall protection measures and fall protection equipment will be inspected, maintained and replaced regularly. Furthermore, tower installation and maintenance works will not be carried out during poor weather conditions.

All the precautions related with working at heights will be taken throughout the construction and operational phases of the Project in accordance with the Turkish Health and Safety laws and regulations and IFC/WB Guidelines. With the proper implementation of the HASP and taking the necessary precautions given in the regulations, potential accidents associated with working height would be eliminated.

7.2 Air Craft and Marine Navigation Safety

In accordance with the 2920 numbered Civil Aviation Law, it is forbidden to construct buildings and structures that will prevent air traffic, aviation security, and telecommunication and endanger the navigation and court security around the airports and related facility or equipments. In addition, according to the Regulation on Construction, Operation and Certification of Airports published in the Official Gazette No. 24755 dated May 14, 2002, Ministry of Transport, Maritime Affairs and Communication was authorized to remove buildings and structures that will endanger the aviation safety. Also Ministry of Transport, Maritime Affairs and Communication could ask for locating visible signs and radio and electrical signs on the defined obstacles and areas.

International Standards and Recommended Practices (Annex 14) published by the International Civil Aviation Organization (ICAO) recommends that the obstacles or fixed objects listed below should be marked or lightened according to the defined methods;

- A fixed obstacles that extend above a take off climb surface within 3,000 m of the inner edge of the take-off climb surface;
- A fixed object, other than a obstacles adjacent to the take-off climb surface;
- A fixed obstacles that extends above an approach or transition surface within 3,000 of the inner edge of the approach surface;
- A fixed obstacle above a horizontal surface; and
- A fixed object that extends above an obstacle protection surface.

There are two military airports in Akhisar District. One of them is located 9 km southeast and the other one is 25 km southeast of the Project site. The closest civilian airport is located 60 km north of the Project site. In accordance with the with the recommendations published by ICAO, the tip of the blades will be painted and lighting system will be installed to minimize the risk of aircraft collision. In the scope of this Project, 2920 numbered Civil Aviation Law and related international laws will be complied with.

7.3 Blade/ Ice Throw

As indicated in Section 4.1, the coldest months are December, January and February with average temperatures of 7.5, 6 and 6.8 °C, respectively and average minimum temperatures of 3.3, 1.8 and 2.1 °C, respectively. Therefore; it is foreseen that blade/ice throw will not be a potential risk to threat public safety. However, the turbines will be maintained regularly in case of a blade/ice throw risk.

7.4 Electromagnetic Interference

Wind turbines could lead electromagnetic interference with aviation radar and telecommunication systems. There is no aviation radar in the close vicinity of the project site. In addition, wind blades are made of synthetic light material which will reduce the impacts of electromagnetic interference caused by wind turbines. Although the Project is not expected to interfere with the telecommunication systems, it is planned to apply to the Scientific and Technological Research Council of Turkey (TUBITAK) for the assessment of the Project regarding electromagnetic interference on the military radar and navigation system.

7.5 Public Access

The Project will not cause any risk in terms of public access. All the necessary precautions will be taken in order to prevent un-authorized access to Project site. In order to prevent unauthorized access to the wind turbine area, security personnel will be employed during the operation period. In addition, the switchyard, turbines and administrative buildings will be surrounded by fences

8.0 ANALYSIS OF ALTERNATIVES

8.1 Technology Alternatives

Power plants can produce electricity using a renewable resource, such as water, wind or solar, or a nonrenewable resource such as coal, oil/gas or nuclear energy. Coal fired or gas fired thermal power plants are generally built as close as possible to their fuel resources or close to their transportation routes.

The coal fired or oil/gas fired thermal power plants have high air emission rates although their stack air emissions are significantly reduced by modern treatment technologies. In thermal power plants, various types of hazardous wastes are generated due to their processes. Thermal power plants generally require a considerable amount of water for their cooling systems, which creates another environmental concern to overcome.

Hydropower plants are constructed at the main tributaries of rivers. These projects occupy significantly large surface areas due to the water reservoir created behind the dams. Thus, impacts on biological resources, wildlife and natural habitat are generally considered significant during the construction and operation of hydro power plants.

Wind power is a renewable power source as it only uses the movement energy of the air currents for power production. Here are some advantages of wind power:

- Wind facilities produce electricity without requiring the extraction, processing, transportation, or combustion of fossil fuels.
- Wind power production is an environmentally friendly power generation source, as it does not produce any air emissions or hazardous wastes.
- Unlike fossil-fueled power plants, wind farms emit no greenhouse gases.
- Wind project operation does not consume surface or groundwater, or discharge wastewater containing heat or chemicals.
- Wind turbines take up less space than the average power station. Windmills only have to occupy a few square meters for the base. This allows the land around the turbine to be used for many purposes, for example agriculture.
- Wind turbines are a great resource to generate energy in remote locations, such as mountain communities and remote countryside. Wind turbines can be a range of different sizes in order to support varying population levels.

- The wind power generation industry has a proven record of safety. Accidents related to wind power are reported to occur only during construction and maintenance.

In addition to the advantages of wind power, wind power generation has been recommended that due to the limited fossil fuel resources, a gradual shift from fossil fuels to renewable resources should be considered seriously in Turkey (Ediger and Kentel, 1999).

As stated in previous paragraphs there are various technical alternatives of producing electricity from different energy resources. However, in order to combat with the global warming problem, sustainable and renewable energy resources must be used as much as possible. The Gökres-2 WF aims at utilizing wind energy, which is a renewable energy, potential of Turkey via wind turbine technology to generate electricity. Hence, the wind farm will not only provide benefit to Turkey by producing electricity but also to global atmosphere by reducing CO₂ emissions.

8.2 Alternative Sites

General Directorate of Renewable Energy (former General Directorate of Electrical Power Resources Survey and Development Administration) evaluated the natural wind energy potential for most parts of Turkey using monthly wind speed and direction data from the State Meteorological Service. As a result of these studies, Turkish Wind Energy Potential Atlas, presented in Figure 8-1, had been prepared in order to evaluate the wind energy potential (REPA, 2007). The figure has been created by WAsP model based on the collected wind data at several locations around Turkey. As seen in the figure, the location of the Project in Manisa Province is within moderate wind energy potential regions in Turkey. The project site is selected in this region in order to utilize this wind energy potential in this region.

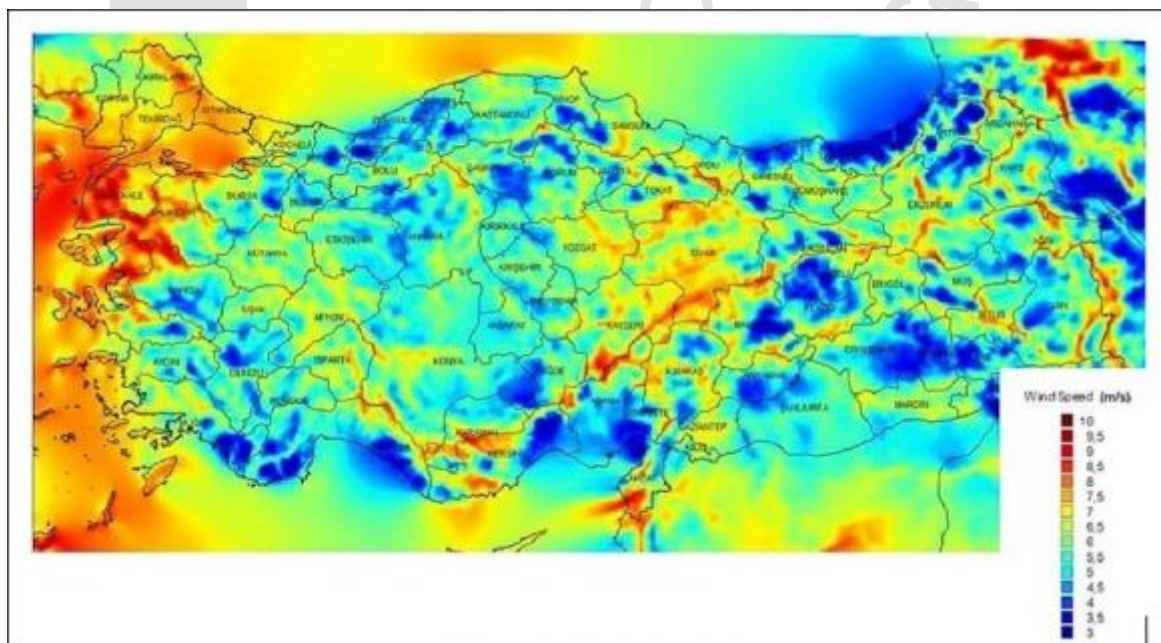


Figure 8-1 Wind Atlas for Turkey

(Source: General Directorate of Renewable Energy)

9.0 ENVIRONMENTAL MANAGEMENT PLAN

The environmental and onsite health and safety management plans regarding construction and operation phases of the Project are given below in Table 9-1 and Table 9-2, respectively.

Table 9-1 Environmental Management Plan

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
WATER AND SOIL QUALITY - Construction Phase						
Groundwater, Surface water and Soil Contamination	Minor to Moderate	Any wastewater discharge to the environment will be prohibited.	Contractor	Visual inspection	Periodically	Part of best working practice
	Minor	Construction management of excavations will avoid the generation of drainage pathways to underlying aquifers.	Contractor	Visual inspection	During the activity	Part of best working practice
	Moderate	All chemical storage containers, including diesel fuel, and hazardous liquid waste drums/containers will be placed in concrete areas with proper secondary containments during construction. When necessary, absorbent pads or materials will be provided near the storage areas. Drums and canisters containing fuel, oil or other chemicals must always be placed in a sealed reservoir with the capacity of 110% of the stored substances.	Contractor	Visual inspection	Periodically	Part of best working practice
	Minor to Moderate	Domestic wastewater from the personnel will be stored in sealed septic tanks or treated in a package treatment plant to be constructed in the construction site depending on the personnel number. (if the number is 84 and less, septic tank is required, if it is larger than 84 then a package treatment plant is required). The septic tanks will be leak proof and the level will be checked periodically. The wastewater will be transported and disposed periodically by the Kırkağaç Municipality (another alternative is Akhisar Municipality). In case a package wastewater treatment plant is constructed, treated waters will be discharged into a receiving environment. The effluent water of WWTP will be regularly monitored in accordance with the limits stated in WPCR Table 21.1.	Contractor	Visual inspection to ensure the effectiveness of the mitigation measure	Periodically	Part of best working practice
	Minor to Moderate	Siting and bunding of temporary fuel and oil storage will take into account proximity to water resources.	Contractor	Visual inspection to ensure the effectiveness of the	-	Inherit in Design

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
				mitigation measure		
	Minor to Moderate	An Oil Spill Contingency Plan will be prepared and implemented.	Contractor	-	-	Part of best working practice
	Minor to Moderate	Any spill from construction activities will be monitored and controlled; waste materials which are unsuitable for reuse on-site will be disposed at an appropriately licensed sanitary landfill site.	Contractor	Visual inspection and keeping the shipment records on the site	Periodically	Part of best working practice
Erosion and Sedimentation	Minor	Construction activities will be carried out in accordance with Erosion Control Plan prepared for the site specific activities for the construction of crane pads and access roads.	Contractor	Visual inspection	Periodically	Part of best working practice
WATER AND SOIL QUALITY - Operation Phase						
Groundwater and Soil Contamination	Moderate to Major	All chemical storage tanks and drums, including those containing fuel and oil will be placed on concrete areas with proper secondary containments. If necessary, absorbent materials will be purchased and placed near the chemical storage tanks.	Operator	Visual inspection	Periodically	Part of best working practice
	Moderate to Major	Any leakage oil will be collected in the bottom part of the nacelle enclosure. The wind turbine generator system will also be equipped with a series of smaller oil collection systems for individual system components.	Operator	-	-	Inherit in Design
	Moderate to Major	Any residues and leftover oil following maintenance work will be collected in leak-proof containers and removed to a recycling facility by licensed transporters.	Operator	Visual inspection and keeping the shipment records on the site	During the activity	Part of best working practice
	Minor to Moderate	Regular maintenance of the turbines will minimize the potential for fluid leaks.	Operator	-	-	Part of best working practice
	Moderate to Major	Transformers will be provided with pits to retain 110% of the coolant capacity of the transformers.	Operator	-	-	Inherit in Design
	Moderate to Major	Waste oils will be temporarily stored, handled and disposed in separate tanks/containers according to the	Operator	-	-	Part of best working

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
		categories referred in the Waste Oil Control Regulation.				practice
	Moderate to Major	Waste oils will be collected inside the tanks/containers placed on an impermeable surface. Different tanks/containers will be used for waste oils of different categories. Waste oil temporary storage tanks/containers will be red and bear "Waste Oil" sign.	Operator	Visual inspection and keeping the shipment records on the site	Periodically	Part of best working practice
	Moderate to Major	Emergency Response Plan will be prepared and implemented.	Operator	-	-	Part of best working practice
	Moderate to Major	Waste oils will be transported by licensed transporters to the licensed processing and disposal facilities and National Transportation Form will be filled in the case of transporting the waste oil out of the facility and waste oil declaration form will be submitted to relevant authorities annually.	Operator	Visual inspection and keeping the shipment records on the site	Periodically	Part of best working practice
Wastewater Disposal	Minor to Moderate	Wastewater generated during the operation phase will be collected into the septic tanks; then transported and disposed by the Kirkağaç Municipality (another alternative is Akhisar Municipality).	Operator	Visual inspection	Periodically	Minimal
NOISE - Construction Phase						
Noise Control	Minor	All construction vehicles will be maintained regularly so that their noise emissions do not cause nuisance to workers or local people.	Contractor	Visual inspection to ensure the effectiveness of the mitigation measure	Periodically	Part of best working practice
	Minor	Exhaust mufflers will be employed on engine-powered construction equipment and vehicles.	Contractor	Visual inspection	Before using the vehicle or equipment	Part of best working practice
	Negligible to Minor	The use of vehicles during construction will be optimized as much as possible to reduce number of vehicles and thus reduce the potential for traffic noise.	Contractor	-	-	Part of best working practice
	Minor	All vehicles will be driven responsibly and below 30 km/h within the construction site.	Contractor	Visual inspection	Periodically	Part of best working practice

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
	Negligible to minor	The site personnel will be provided with proper personal protective equipments in order not to expose to high noise levels that can be generated at the site.	Contractor	Visual inspection to ensure the effectiveness of the mitigation measure	Periodically	Part of best working practice
	Negligible	Site personnel will be trained in the proper use and maintenance of tools and equipment, and the positioning of machinery on site to reduce noise emissions to neighboring communities.	Operator	-	-	Part of best working practice
	Minor	Noise levels will be monitored and recorded in case of a complaint from the local people.	Operator	Noise measurement during the activity	In case of a complaint	Part of best working practice
NOISE - Operation Phase						
Noise Control	Minor to Major	Noise mitigation measures will be incorporated into the design of the turbines, including: - The turbines with reduced noise operation system will be chosen in order to minimize noise emissions, - The turbines are properly positioned in terms of possible noise emissions., - The turbines are equipped with optional noise reduced power operation modes to accommodate noise restrictions, - The necessary physical and structural actions will be taken at the residential units to reduce the noise levels (in case of a complaint after conducting necessary noise assessment at these units).	Contractor	Noise monitoring around the noise sensitive receptor during daytime and nighttime	In case of a complaint	Inherit in Design
VISUAL IMPACT – Construction Phase						
Waste Management	Minor	All debris and wastes will be collected, stored, and transported in an orderly manner to prevent any adverse visual impact on the surrounding area.	Contractor	Visual inspection	Periodically	Part of best working practice

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
Visual Management	Minor	Construction site will be compact, kept clean and well maintained. Building material at the site will be well maintained and newly painted to match with the local environment.	Contractor	Visual inspection	Periodically	Part of best working practice
	Minor	Project equipment storage area will be maintained properly to prevent adverse visual impact.	Contractor	Visual inspection	Periodically	Part of best working practice
	Minor	Construction site and equipment lay down area will be reinstated to original after the construction.	Contractor	Visual inspection	Periodically	Part of best working practice
VISUAL IMPACT – Operation Phase						
Visual Management	Moderate	Blades of the turbines will be painted and aviation lights will be installed at the top of the turbines in order to minimize the risk of bird and aircraft collision.	Contractor	-	-	Inherit in Design
	Minor to Moderate	Proper landscaping will be provided around the control and operations area.	Contractor	-	-	Inherit in Design
	Minor to Moderate	Lettering, company insignia, advertising, or graphics on the turbines will be avoided.	Operator	-	-	Part of best working practice
	Moderate	Turbines will be painted a uniform color, typically matching the sky (white, light gray or pale blue).	Contractor	-	-	Inherit in Design
AIR QUALITY - Construction Phase						
Dust	Minor	Where possible, the contractor will select the equipment design to minimize the dust emissions	Contractor	Visual inspections	Periodically	Part of best working practice
	Minor	Activities that produce significant dust emissions will be monitored during periods of high winds and dust control measures implemented as appropriate.	Contractor	Visual inspections	Periodically and during the high winds	Part of best working practice
	Minor	Stockpiles of soil and similar materials will be carefully managed to minimize the risk of windblown dust, e.g. water spray dampening soils and spoil and during	Contractor	Visual inspections	Periodically	Part of best working practice

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
		delivery and dumping of sand and gravel during periods of dry weather.				
	Minor	Loading and unloading of material that could generate dust will be carried out in a careful manner to minimize dust generation.	Contractor	Visual inspections	Periodically	Part of best working practice
	Minor	Where possible, drop heights for material transfer activities, e.g. unloading of friable materials, will be minimized and carefully managed.	Contractor	Visual inspections	Periodically	Part of best working practice
	Minor	On-site and access roads will be well maintained through mechanical means (sweeping or vacuuming) or spraying with water.	Contractor	Visual inspections	Periodically	Part of best working practice
	Minor	Vehicle speeds on un-surfaced roads will be limited to 30 km/h.	Contractor	Visual inspections	Periodically	Part of best working practice
	Minor	Lorries used for the transportation of friable construction materials and spoil off-site will be covered/sheeted.	Contractor	Visual inspections	Periodically	Part of best working practice
Gaseous Pollutants	Minor	Best control technology will be adopted to reduce emissions from fuel storage, combustion emissions from engines and any other temporary equipment.	Contractor	-	-	Part of best working practice
	Minor	Engines will not be left running unnecessarily. Engines will be switched off when not in use.	Contractor	Visual inspections	Periodically	Part of best working practice
	Minor	Regular maintenance of vehicles will be undertaken to ensure that vehicles are safe and that emissions are minimized.	Contractor	-	-	Part of best working practice
	Minor	All vehicles will be maintained so that their exhaust emissions do not cause nuisance to workers or local people.	Contractor	Visual inspection and keeping the maintenance records on the site	Periodically	Part of best working practice
HAZARDOUS WASTE - Construction Phase						
Hazardous Waste	Moderate to	Hazardous wastes will be segregated from non-	Contractor	Visual inspections	Periodically	Part of best

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
Management	Major	hazardous wastes and its management will focus on the prevention of harm to health, safety, and the environment.				working practice
	Moderate to Major	Hazardous wastes will be stored in containers that are non-damaged, leak-proof, safe and appropriate for the international standards, on concrete place within the land of the facility. A dedicated hazardous waste storage area will be constructed.	Contractor	Visual inspections	Periodically	Part of best working practice
	Moderate to Major	The hazardous waste containers will be checked routinely in order to determine whether they are damaged.	Contractor	Visual inspections	Periodically	Part of best working practice
	Moderate to Major	Hazardous waste containers will be kept closed and wastes will be stored in a way that they will not go in chemical reactions.	Contractor	Visual inspections	Periodically	Part of best working practice
	Moderate to Major	The hazardous liquid wastes will be collected in metal or plastic drums and stored in an area with a concrete surface and a proper secondary containment to prevent potential spills and leakages reaching to soil or groundwater.	Contractor	Visual inspections	Periodically	Part of best working practice
	Moderate to Major	Transportation of the wastes will be done by the persons and entities that are licensed for this work and by the vehicles appropriate for the properties of the transported waste. The hazardous wastes will be sent to a licensed disposal facility.	Contractor	Visual inspection and keeping the shipment records on the site	When required	Part of best working practice
HAZARDOUS WASTE - Operation Phase						
Hazardous Waste Management	Moderate to Major	Waste oils resulting from yearly maintenance works will be collected. These wastes will be removed from the project site in accordance with the Waste Oil Control Regulation.	Operator	Visual inspection and keeping the shipment records on the site	Periodically	Part of best working practice
	Minor to Moderate	Waste battery and accumulators will be collected separately from household wastes and will be delivered to the collection points to be established by enterprises engaged in the distribution and sales of battery products,	Operator	Visual inspection and keeping the shipment records on the site	Periodically	Part of best working practice

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
		or by municipalities within six months after they are generated.				
	Minor to Moderate	"Hazardous waste" label will be placed on to the containers and this label will indicate the amount of stored waste as well as the storage time of the hazardous waste. Hazardous solid wastes generated during construction will be collected and stored in a concrete area with proper labeling.	Operator	Visual inspections	Periodically	Part of best working practice
	Moderate to Major	Any hazardous waste will be collected in leak-proof containers and removed to a licensed disposal facility by licensed transporters. The hazardous wastes will be handled, stored, transported and disposed of according to the Turkish Hazardous Wastes Control Regulation, Waste Oils Control Regulation and Waste Batteries and Accumulators Control Regulation, and the IFC guidelines.	Operator	Visual inspection and keeping the shipment records on the site	Periodically	Part of best working practice
NON-HAZARDOUS WASTE - CONSTRUCTION & OPERATION						
Non-Hazardous Waste Management	Minor	The wastes will be characterized according to composition, source, types of wastes produced, generation rates, or according to local regulatory requirements.	Contractor / Operator	Visual inspections	Periodically	Part of best working practice
	Minor	Feasible waste prevention, reduction, reuse, recovery and recycling measures will be taken, waste materials will be treated and disposed of and all measures will be taken to avoid potential impacts to human health and the environment.	Contractor / Operator	Visual inspections	Periodically	Part of best working practice
	Minor	Solid wastes that could be recycled, like paper, plastic and glass, cement bags, metal scraps, packing boxes and wooden crates, etc. will be separated and stored temporarily on site for eventual recycling process.	Contractor / Operator	Visual inspections	Periodically	Part of best working practice
	Minor	The non-recyclable solid wastes will be collected in leak proof, non-contaminating drums and properly disposed in a waste disposal site by the Kırkağaç Municipality (another alternative is Akhisar Municipality).	Contractor / Operator	Visual inspections	Periodically	Part of best working practice

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
	Minor	The excavation, construction and demolition wastes will be reused where possible. In case they cannot be used they will be disposed to the places approved by the Kırkağaç Municipality or relevant authorities according to the Excavation, Construction and Demolition Waste Control Regulation.	Contractor	Visual inspection and keeping the shipment records on the site	Periodically	Part of best working practice
BIOLOGICAL RESOURCES AND HABITAT ALTERATION - Construction Phase						
Flora	Moderate	Topsoil will be removed and stored on site for future landscaping purposes.	Contractor	-	-	Part of best working practice
	Moderate to Major	Since the Project site is forest area, trees will be cut to clear the site for construction. Only necessary cuttings will be carried out in order to minimize the impacts on forests.	Contractor	-	-	-
Fauna	Moderate to Major	Hunting of animals and collecting ground nests for resident birds will be prohibited.	Contractor	Visual inspections	Periodically	Part of best working practice
	Moderate	All solid and liquid wastes during construction will be collected and disposed in the nearest disposal sites to decrease the impact on fauna	Contractor	Visual inspections	Periodically	Part of best working practice
	Moderate	Turbines will be made in a tubular structure, which will deter birds from landing or perching on them.	Contractor	-	-	Part of best working practice
	Moderate	Visual controls will be carried out before land stripping and the fauna elements will be removed from these areas.	Contractor	Visual inspections	Periodically	Part of best working practice
	Moderate	Before the stripped material is removed from the area, a visual control will be made for the possibility that vertebrates such as tortoises, hedgehogs, lizards and snakes may enter these stripped materials. If any fauna element is found, it will be put into a cloth bag and transferred to a nearby habitat and released carefully.	Contractor	Visual inspections	Periodically	Part of best working practice
	Moderate	Adjacent habitats will be protected from disturbance by	Contractor	Visual inspections	Periodically	Part of best

ENVIRONMENTAL ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
		the construction workforce, e.g. by fencing off of unused areas, warning signs and training of workers				working practice
BIOLOGICAL RESOURCES AND HABITAT ALTERATION - Operation Phase						
Flora	Moderate	Vehicle movement will be restricted to the existing roads that connect the project site with the surrounding areas. Off road driving will be avoided.	Operator	-	-	Part of best working practice
Fauna	Moderate to High	Hunting will be prohibited at and around project site by the workers	Operator	-	-	Part of best working practice
	Moderate	An ornithological monitoring study will be carried out covering the spring and autumn migration periods in 2013. Depending on the results of this monitoring, there may be other monitoring afterwards.	Operator	-	Seasonal monitoring (migration periods)	Part of best working practice
	Moderate	Low intense and blinking lights will be preferred as obstruction lights in order to minimize the risk of avian collision.	Operator	-	-	Part of best working practice
CULTURAL HERITAGE - Construction Phase						
Cultural and Archeological Resources	Negligible	Construction works will be monitored for archaeological remains.	Contractor	Visual inspections	Periodically	Part of best working practice
	Negligible	If any archeological remains are discovered, as the national law requires, the project will cease excavation at this location and the local Department of Culture and Tourism will be informed immediately.	Contractor	Visual inspections	Periodically	Part of best working practice

Table 9-2 On Site Health and Safety Plan

ON SITE HEALTH AND SAFETY ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
OCCUPATIONAL HEALTH AND SAFETY – Construction and Operation Phases						
Working at Height	Major	The safety harness will be used to secure persons during ascent to and descent from the nacelle of the wind turbine generator system and when carrying out work in areas where there is a falling hazard. Together with the safety harness, the traveling safety hook constitutes a safety device for ascent/descent via the ladder inside the tower. All the precautions related with working at heights will be taken throughout the construction and operational phases of the Project in accordance with the IFC Guidelines and the local regulations.	Contractor, Operator	Inspection to ensure the effectiveness of the mitigation measure	Continuously	Part of best working practice
Emergency Exit	Moderate to Major	The wind turbine generator system is provided with an emergency exit system consisting of an emergency descending device. The emergency exit consists of a hatch located at the back of the nacelle.	Contractor	Inspection to ensure the effectiveness of the mitigation measure	-	Inherit in design
Noise	Minor to Moderate	Heavy machinery that used in the construction activities will be provided with good rubber insulation for windows and doors to protect the drivers.	Contractor	Inspection to ensure the effectiveness of the mitigation measure	Daily	Part of best working practice
	Minor to Moderate	Ear protection equipment will be used in all areas of a potential source of high noise.	Contractor	Inspection to ensure the effectiveness of the mitigation measured	Daily	Part of best working practice

ON SITE HEALTH AND SAFETY ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
Hazardous Chemicals and Waste	Moderate to Major	Material Safety Data Sheets for all chemicals used at the plant will be available at site and in easy reach to concerned employees. Employees will be trained on the proper handling of chemicals and be informed of their hazards. Such material data sheet will be included within a safety manual for this operation. Proper and approved Personal Protective Equipment (PPE) will be provided to all employees handling chemicals and will be trained on their use and maintenance.	Operator	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Part of best working practice
Accidents	Moderate	A first aid box will be located in the nacelle of the wind turbine system for the treatment of minor injuries.	Operator	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Part of best working practice
	Moderate to Major	A Safety Manual will be prepared for the construction and operation activities.	Operator	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Part of best working practice
Fire Hazards	Moderate to Major	Two fire extinguishers will be available in the wind turbine generator system. One fire extinguisher will be mounted on the down tower assembly in the tower base, the other one on the top box in the nacelle. Employees will be trained on the use of fire fighting systems and equipment.	Operator	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Part of best working practice
Fire Hazards	Major	The wind turbine will be equipped with lightning protection systems which have the task of diverting the lightning currents arising from lightning strikes and the energy associated with the lightning into the ground in a controlled manner. The turbine will be equipped with receptors, e.g. on the blades, that receive the lightning current and divert it through predefined paths within the turbine to the ground.	Contractor	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Inherit in design
HS Monitoring Program	Major	A comprehensive Occupational Health and Safety monitoring program will be prepared prior to start of the project.	Operator	Inspection to ensure the effectiveness of the mitigation measure	-	Part of best working practice

ON SITE HEALTH AND SAFETY ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
PUBLIC HEALTH AND SAFETY - Construction Phase						
General Public Health and Safety	Minor to Moderate	Information boards about public safety hazards and emergency contact information will be available in the wind farm.	Operator	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Part of best working practice
	Moderate to Major	The transport of equipments, turbines and materials will be undertaken in an appropriate manner.	Contractor, Operator	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Part of best working practice
	Minor to Moderate	Project vehicles and equipment will be well maintained and project related traffic will be requested to travel no faster than the speed limit.	Contractor, Operator	Inspection to ensure the effectiveness of the mitigation measure	As necessary	Part of best working practice
Traffic Management	Moderate	Safety and traffic signs will be clearly placed near and around the project site on the road to the project site.	Contractor	Visual inspections	During the activity	Part of best working practice
	Moderate	Scheduling of traffic will be undertaken to avoid the peak hours on the local road network wherever practicable.	Contractor	Visual inspections	During the activity	Part of best working practice
	Moderate	Special loads will adhere to prescribed routes to be agreed with the appropriate authorities - these will be scheduled to avoid peak hours on local roads and published well in advance to minimize possible disruption.	Contractor	Visual inspections	During the activity	Part of best working practice
	Moderate	Road safety training and adherence to speed limits will be stressed to all drivers.	Contractor	Visual inspections	During the activity	Part of best working practice
	Moderate	Prescribed routes for construction traffic will be agreed with the appropriate authorities, particularly with respect to tanker and truck traffic and special loads.	Contractor	Visual inspections	During the activity	Part of best working practice
	Moderate	Entrance to the site will be clear and properly designed.	Contractor	Visual inspections	During the activity	Part of best working practice

ON SITE HEALTH AND SAFETY ISSUE/IMPACT	IMPACT SIGNIFICANCE	MITIGATION MEASURE	RESPONSIBILITY	MONITORING	MONITORING / INSPECTION FREQUENCY	COST
	Moderate	To protect the roads, trucks which will be used for transporting activities should have a gross weight within the axial permissible load	Contractor	Visual inspections	During the activity	Part of best working practice
PUBLIC HEALTH AND SAFETY - Operation Phase						
Traffic Management	Minor	Road safety training and adherence to speed limits will be stressed to all drivers	Operator	Visual inspections	Periodically	Part of best working practice
	Minor	Safety and traffic signs will be clearly placed near and around the project site on the way to project site.	Operator	Visual inspections	Periodically	Part of best working practice
	Minor	To protect the roads, trucks should have a gross weight within the axial permissible load	Operator	Visual inspections	Periodically	Part of best working practice

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10.0 SOCIAL IMPACT ASSESSMENT STUDY

10.1 Aim of the Study

This section of the report identifies the social impact of Gökres-2 Wind Farm Project on the surrounding communities. The main objective of the study is to identify the potential social impacts associated with the construction and the operation of the proposed Project.

This social impact assessment (SIA) intends to determine whether the proposed project has the positive and adverse effects on individuals, households and institutions. It also explores the unintended consequences, whether positive or negative on the local people. Some of the questions addressed include the following: “How will the project affect the local people?” “Are there any improvements in income or job opportunities as a direct result of the project?”

10.2 Methodology

10.2.1 Assessment Objectives

The key objectives of the study of Gökres-2 Wind Power Plant are to:

- Identify existing social and economic condition of the households around the project area;
- Evaluate the social-economic impact of the proposed interventions on the households and investigate whether certain social groups would be adversely affected; and
- Examine the impact of cumulative effects of the proposed wind energy on local communities.

10.2.2 Assessment Criteria

Vanclay (2002) defines social impact assessment as follows:

“Social impact assessment is the process of analyzing (predicting, evaluating and reflecting) *and managing* the intended and unintended consequences on the human environment of interventions (policies, plans, programs, projects and other social activities) and social change processes so as to create a more sustainable biophysical and human environment”.

Social impacts may be defined as “impacts on the lives of individual people or groups or categories of people, or forms of social organization” (Adams, 2000). In the Guidelines and Principles for Social Impact Assessment (2003) prepared by The Interorganizational Committee in 2003 the notion of social impacts is defined as follows: “The consequences to human populations of any public or private actions-that alter the ways in which people live, work, play, relate to one another, organize to meet their needs and generally cope as members of society”.

The term also embodies all human impacts including cultural impacts, community impacts, infrastructural impacts, gender impacts, resource issues, political impacts etc.

According to Vanclay (2002) social impacts may cause one or more of the following changes:

- People's way of life
- Their culture;
- Their community;
- Their natural environment;
- Their health and wellbeing; and
- Their fears and aspirations.

The project was assessed against five main criteria listed in Table 10-1. They were used to establish a baseline test of the communities of interest, and as a measure of potential impacts should the project proceed. The criteria draw upon the social impact assessment prepared by Interorganizational Committee for Guidelines and Principles for Social Impact Assessment.

Positive and negative social and economic impacts/costs of any projects are rarely distributed evenly. As the impacted communities are themselves heterogeneous, there can be significant disparities in impacts, particularly among different socio-economic groups/categories.

All potential impacts; negative/positive, long term/short term, planned/unplanned, expected/unexpected should be taken into consideration together in a social impact assessment. Interdependency and mutual interaction among all sorts of impact complicates impacts to be separately assessed.

Relevant criteria for social impacts included the following:

- Duration of the impact: Short-term, Long-term and Construction Phase & Operation Phase;
- Significance: Positive or Negative; and
- Intensity: Severe, Major, Moderate, Minor, and Negligible.

Table 10-1 Social Impact Assessment Criteria

Issue	Potential Impacts
Demographic	
Migration	• In-migration • Presence of temporary workers
Economic	
Employment	• Short term employment for unskilled workers in construction phase • Medium/long term employment for skilled workers • Direct/indirect employment for local people in operation phase
Land and land based livelihoods	• Permanent expropriation of land • Temporary loss of land and impacts on income etc. • Temporary/permanent damage to crops • Damage to infrastructure (property, irrigation canals, etc)
Socio-cultural	
Construction workers and local community relations	• Potential community discontent from the construction activities • Conflict between workers and community
Community safety	
Infrastructure and resources	• Dust/noise • Damage to infrastructure, loss of resources or loss of access to infrastructure and resources • Improvements to infrastructure, particularly roads, needed for construction. • Open Trench during construction of the transmission line connection poses a safety risk to people and livestock
Noise and visual impacts	
Noise and visual impacts	• Shadow flicker and glint on neighboring properties • Noise

10.2.3 Data Collection

In this social impact assessment study, a variety of methods are used. These include:

- Sample surveys (household questionnaire);
- Focus group discussion; and
- Interviews with headmen (muhtar).

10.2.3.1 Household Questionnaire

A household survey interviews with 31 randomly selected households in the project area were conducted on December 27-28, 2012. The purpose of the survey was to obtain information about households in the Project area (The household questionnaire is given in Appendix C). The survey focused on a number of specific issues, including the main sources of livelihood, the social and economic problems in the project area and people's attitudes towards the proposed Project. The settlements that would be potentially affected from the Project are Tütenli and İlyaslar villages. There are approximately 470 households. The social and economic characteristics of households are similar.

10.2.3.2 Individual interviews with key informants

Depth-interviews included interviews with women in the villages, representatives of Municipality and Department of Forestry.

10.2.3.3 Interviews with Headmen

Village background information was gathered through questionnaire and discussion with headmen.

Training of the Survey Team

The training of the surveying team took one day. Training took more the form of orientation rather than intensive training. The training consisted of the following:

- Introduction to the research and its objectives;
- Distribution of the materials;
- Discussion of the questionnaire;
- Review of the questionnaire;
- Review of note taking; and
- Familiarization with the reading materials provided.

Data Entry

Pre-prepared editing and coding instructions were used. This activity was performed by a team that was located in the headquarters of survey research group.

Data entry activities were carried in Ankara. Questions were constructed mostly as close-ended. However, few open-ended questions were inevitable and used in this study. Coding was carried out together with interviewing. SPSS was used for data entry.

10.3 Project Area

10.3.1 Geographic Location and Population

Gökres-2 Wind Farm Project is located in Manisa Province of Turkey in the Aegean Region. The Project site is located on a series of hills located approximately 10 km southeast of Kırkağaç District Center and 15 km north of Akhisar District Center. The Project site is approximately 58 km to the Manisa city center.

The closest settlement to the Project site is İlyaslar Town (town in Turkey is larger than a village and has a municipality) at the North and Tütenli Village at the South.

Figure 10-1 shows the Project area and the nearest villages.

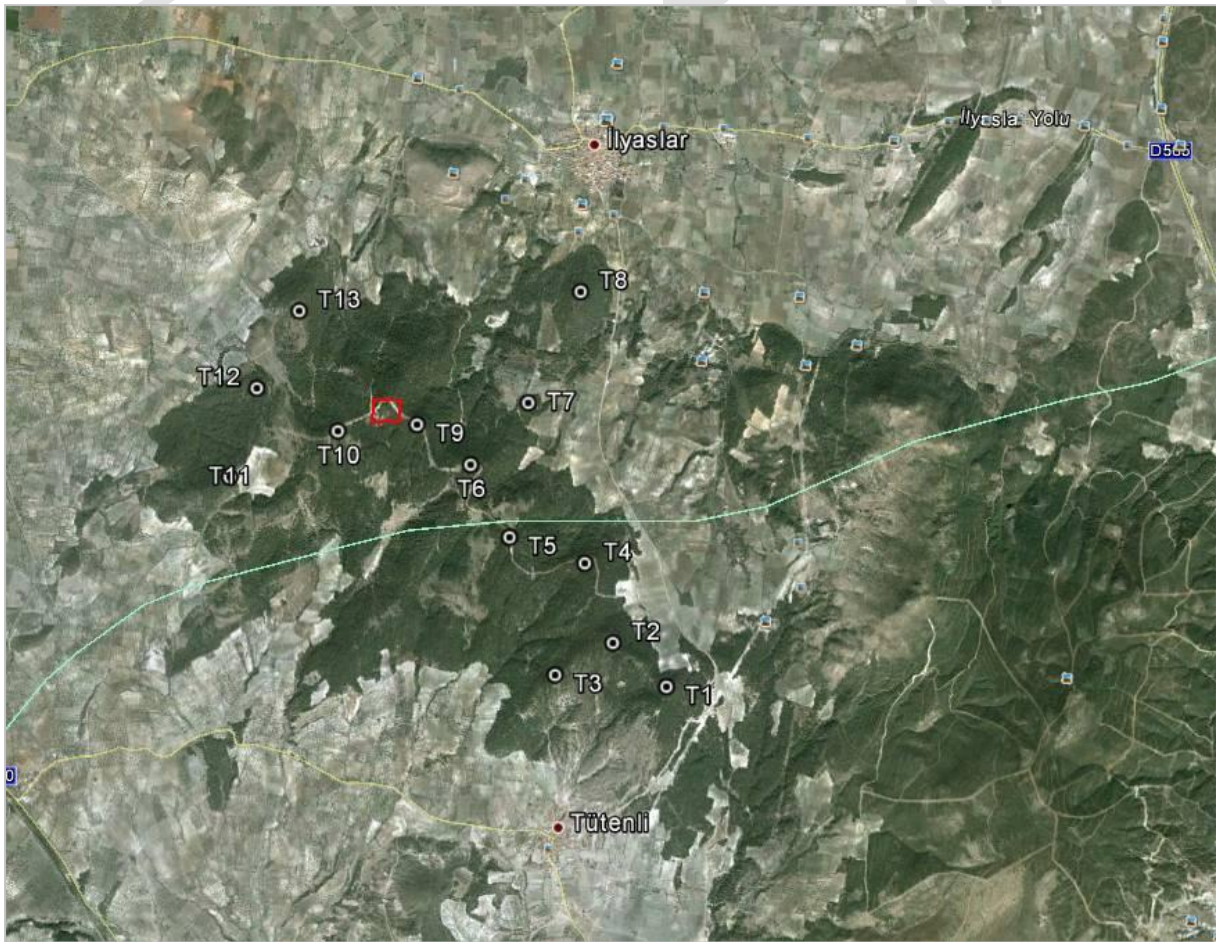


Figure 10-1 Wind Turbines and Villages around the Project Area

Two settlements are likely to be affected by the proposed Project. These settlements are İlyaslar and Tütenli Villages. According to the Address Based Population Census of 2012, the total general population of these villages is 2111. There are 1045 male and 1066 female persons. The population of the villages is presented in Table 10-2.

Table 10-2 Population of the Villages

Settlements	Total	Male	Female
İlyaslar	1451	724	727
Tütenli	660	312	339
Total	2111	1045	1066

Source: Address Based Population Registry Database (TurkStat, 2012),
<http://tuikapp.tuik.gov.tr/adnksdagitapp/adnks.zul>

10.3.2 Socio-Demographic Characteristic of the Population

This section provides social and demographic characteristics of the households in the nearest villages located around the Gökres-2 WF.

Table 10-3 provides the household status of the people resulting from the household surveys. Among responders, 77.4% stated that they were the heads of their households, 3.2% were spouses of household heads and 19.4% were daughter/son of the household heads. "Head of household" is defined as the person who leads his/her family and makes decisions on behalf of household.

Table 10-3 Status of Interviewed People (number of people)

	Count	%
Head of household	24	77.4
Spouse	1	3.2
Daughter/son	6	19.4
Total	31	100.0

Source: SIA Household Questionnaire, 2012

There are total 134 people in surveyed households and the average household size was 4.32 persons per household. With increase of urbanization, there is proportionate decrease in the extended families and a rise in the nuclear families in Turkey. In this survey, the smallest household had only 1 member whereas the largest one had 12 persons. Household size distribution and average household size are given in Table 10-4.

Table 10-4 Household Size (number of people)

Household Size	Count	%
1	2	6.5
2	10	32.3
3	3	9.7
4	3	9.7
5	6	19.4
6	2	6.5
8	1	3.2
9	2	6.5
11	1	3.2
12	1	3.2
Total	31	100.0

Source: SIA Household Questionnaire, 2012

Most of the members of households were primary school graduates (64.5%); secondary school graduates consisted of 25.0% but there were still some illiterate people in these villages (8.1%) (See Table 10-5). The literacy rate in Turkey shows a continuous increase for both genders. Even though the literacy rate of females has increased more than that of the males, the gap between genders still exists. Traditional values are still strong and families still do not want to send their daughters to the school. In 1998 the Turkish education system has changed and compulsory primary education increased from five years to eight years. However, there are some problems for the rural areas. School age children living in peripheral villages have started to be transported to the schools of central towns and cities and this resulted in disadvantage for the girls.

Table 10-5 Education Level

	Count	%
Illiterate	10	8.1
Literate	11	8.9
Primary school	80	64.5
Secondary school	14	11.3
High school	8	6.5
University	1	0.8
Total	124	100.0

Source: SIA Household Questionnaire, 2012

Most of the respondents (87.1 percent) lived in the region since their birth and about 12.9 percent of the respondents lived at their current place more than 16 years (Table 10-6).

Table 10-6 Number of Years in the Village/Town (years)

	Count	%
Since birth	27	87.1
More than 16 years	4	12.9
Total	31	100.0

Source: SIA Household Questionnaire, 2012

10.3.3 Economic Characteristics: Employment and Income Sources

The average monthly income of the study area is 1270 TL. Income disparities among households are quite significant in the study area. For example, the highest average monthly income is 3,000 TL; while the lowest income is 500 TL. 58.3 percent of respondents stated that their monthly income was between 500-1000 TL (see Table 10-7).

Table 10-7 Monthly Income (TL)

	Count	%
500	2	6.5
600	4	12.9
650	2	6.5
670	1	3.2
700	2	6.5
835	2	6.5
900	2	6.5
1000	3	9.7
1500	2	6.5
2000	5	16.1
2100	1	3.2
2500	1	3.2
3000	2	6.5
Total	29	93.5

Source: SIA Household Questionnaire, 2012

The rate of households that are engaged in agricultural production is the highest. The main income sources of the respondents were agriculture (64.5%) and income from permanent job (29.0%) (see Table 10-8).

Table 10-8 Main Source of Income

	Main income sources	
	Count	%
Agriculture	20	64.5
Income from permanent job	9	29.0
Business (commerce)	2	6.5
Total	31	100.0

Source: SIA Household Questionnaire, 2012

The survey also studied the number of people in each family who earn some income and contribute to household subsistence. In the study area, the person who makes a living, which is 38.7% of households, consists of only one person. 16.1% of the households have two of such members. Approximately 13% of the respondent stated that there were no employed persons in their households (see Table 10-9).

Table 10-9 Number of Employed People

	Count	%
Nobody employed	4	12.9
1 person	12	38.7
2 persons	5	16.1
3 persons	4	12.9
4 persons	6	19.4
Total	31	100.0

Source: SIA Household Questionnaire, 2012

5 respondents stated that there was an unemployed person in their households. In this study unemployed people defined as follows: unemployed persons were not employed and had actively sought work during the last six months. Unemployment rate (%) was 9.1 and non-agricultural unemployment rate (%) was 11.4 in October 2012 (TurkStat, 2012). Many experts say the figure does not reflect the overall picture because of widespread undeclared or hidden unemployment.

Table 10-10 Unemployment Person in the Households (number of people)

	Is there any person in your household who is looking for job?	
	Count	%
Yes	5	16.1
No	26	83.9
Total	31	100.0

Source: SIA Household Questionnaire, 2012

A total of 61.3% of the respondent stated that there was a retired person in their households. The high level of retired people in the area shows that most of the population is old. In Turkey, there is significant out-migration from the rural areas; especially young people leave their homes to have better job opportunities and income elsewhere. Hence, the rural areas lose especially the young and skilled population. As these younger people leave villages, their older relatives stay in the villages. Moreover, people who migrated from these villages returned their home town when they retired.

Table 10-11 Retired Persons in the Households (number of people)

	Count	%
Yes	19	61.3
No	12	38.7
Total	31	100.0

Source: SIA Household Questionnaire, 2012

The respondents' perceptions on their household incomes in comparison with the regional evaluation can be figured as follows: 61.3% of the households see themselves at the average level; 29.0% of the households see themselves below the average level, and; 9.7% see themselves above the averages (See Table 10-12).

Table 10-12 Comparison of Income Level (number of people)

	Count	%
Above the average	3	9.7
Average	19	61.3
Below the average	9	29.0
Total	31	100.0

Source: SIA Household Questionnaire, 2012

10.3.4 Agriculture and Land Use

Agriculture is the main economic activity in the region. People in these two settlements are engaged in crop production. It is possible to note that there is no significant differentiation among villages in this respect. Approximately 84 percent of households in the villages have agricultural land (see Table 10-13). Although some households have agricultural lands and engage agricultural production, they have some temporary or permanent job in near provinces such as Akhisar and Manisa.

According to information provided by headmen, villagers in the area face marketing problems and the leading complaint of the villagers is the low prices of agricultural produce.

Table 10-13 Agricultural Land

	Owning Agricultural Land	
	Count	%
Yes	26	83.9
No	5	16.1
Total	31	100.0

Source: SIA Household Questionnaire, 2012

92.6% of households use their own lands and only 3.7% of households lease land from others.

Table 10-14 Status of Land Used for Agriculture

	Count	%
Own land	25	92.6
Rented from another owner	1	3.7
Belongs to a relative	1	3.7
Total	27	100.0

Source: SIA Household Questionnaire, 2012

On average, households had 27.30 decare (da) of land. While the size of land owned by household ranges from 3 decare to 150 decare. As seen in the Table 10-15, only one household's agricultural land is 150 decare.

Table 10-15 Size of Land (decares)

Size	Count	%
No land	5	16.1
3	1	3.2
4	1	3.2
5.5	1	3.2
6	2	6.5
8	1	3.2
8.5	1	3.2
9	1	3.2
10	4	12.9
13	1	3.2
13.2	1	3.2
14	1	3.2
15	2	6.5
20	1	3.2
35	1	3.2
37	1	3.2
38	1	3.2
40	2	6.5
60	1	3.2
75	1	3.2
150	1	3.2
Total	31	100.0

Source: SIA Household Questionnaire, 2012

Both rain-fed and irrigated farming are observed in the project area. Although olive is the major crop in the project area, tobacco, tomato, pepper, eggplant are cultivated. The basic crops are sold at the market. However, the common character of other produce (fruit and vegetable) is their contribution for the subsistence needs of the households. When the crops cultivated, part of it kept for the subsistence and the rest are sold at the market. 34.6% of the respondents stated that they sell their entire production at market (See Table 10-16).

Table 10-16 Agricultural Production

	Count	%
Sell at market	9	34.6
Consume at home	1	3.8
Both sell and consume	16	61.5
Total	26	100.0

Source: SIA Household Questionnaire, 2012

10.3.5 Animal Husbandry

Approximately 13% of the households have animal stock. Animal products contribute significantly for the subsistence food needs for these households. All of the respondents who have livestock stated that they consume their entire production at home. Animal stock of the households in the project area is composed of sheep and poultry.

Table 10-17 Livestock Property

	Count	%
Owning Livestock	4	13.3
Not owning Livestock	26	86.7
Total	30	100.0

Source: SIA Household Questionnaire, 2012

10.3.6 Household Equipment

Availability of some modern household equipment and appliances is an indicator of standard of living as well as tendency and openness to new attitudes and practices. Majority of houses in the survey area had major electrical appliances. All percent of houses had refrigerator, 93.5 percent had washing machine and 61.3 percent of houses had telephone. Approximately 90 percent of houses had satellite TV but only 12.9 percent of houses had dishwasher (see Table 10-18).

Table 10-18 The Most Important Problem

	Count	%
Unemployment	7	22.6
Low income	11	35.5
Marketing problems	2	6.5
Low price for agricultural crop	6	19.4
Insufficient transportation	1	3.2
Insufficient drinking water	1	3.2
Unfit dwelling	1	3.2
No place for garbage	2	6.5
Total	31	100.0

Source: SIA Household Questionnaire, 2012

10.3.7 Infrastructure and Community Services

Information about the infrastructure and community services in these villages was obtained from the headmen. There are coffee-houses, mosques, grocery stores, an elementary school and a local health center in these two villages. All villages had electricity, drinking water and sewage system. The existing sewage system in these villages is not connected to a central sewage system and is poor and requires upgrading at both the community and household levels. All settlements had telephone connection and located inside of a GSM operating area. The summary of the infrastructure conditions of the closest villages is given in Table 10-19 below.

Table 10-19 Infrastructure Existence of the Closest Villages

Name of village	Electricity	Water Supply	Sewage System	Telephone
İlyaslar	+	+	+	+
Tütenli	+	+	+	+

Source: Interview with the headmen

10.4 Opinion About The Project

77.4 percent of respondents stated that they had some information about the Project before the field research. 50.0 percent of the respondents were informed about the project by relatives and friends and 45.8 percent were informed by the government officers.

Table 10-20 Source of Information about the Project

	Count	%
Friends and relatives	12	50.0
Government officers	1	4.2
Other	11	45.8
Total	24	100.0

Source: SIA Household Questionnaire, 2012

In general, the overall attitude to the Project is positive in the study area. Many agree that the Project is important and will bring important economic benefits to Turkey; approximately 90 percent of the respondents stated that they supported the project in their area as stated in Table 10-21. During the interviews and informal conservation, it is observed that the people in the villages have positive idea about renewable energy. Renewable energy sources tend to have more credibility with public than non-renewable energy sources such as fossil fuels and nuclear power. It is possible to say that public support for renewable energy sources in general is very high.

Table 10-21 Support of Residences to the Project

	Count	%
Yes	28	90.3
No	3	9.7
Total	31	100.0

Source: SIA Household Questionnaire, 2012

51.6 percent of the surveyed people do not have any idea about negative impacts of the wind power project on environment. However, 54.8 percent respondents agree that “wind energy does not have any negative impacts on environment. Thus it should be used more.” 64.5 percent of respondents state that the wind power project provides job opportunities for local people. Most of them agree that the energy source should be used for the development of country (77.4%) and wind is important source to provide energy (67.7 percent) as given in Table 10-22.

Table 10-22 Opinions of the Energy and Environment (%)

	I agree	I have no idea	I don't agree
Wind is an important source to provide energy	67.7	32.3	-
For the development of country energy sources should be used	77.4	22.6	-
Wind energy has some negative impacts on environment	6.5	51.6	41.9
Wind energy does not have any negative impacts on environment. Thus it should be used more.	54.8	41.9	3.2
Wind power plant provides job opportunities for local people	64.5	22.6	12.9
The wind power plant has some negative social and economic impacts on local people	3.2	48.4	48.4

Source: SIA Household Questionnaire, 2012

The data collected after disclosure about all potential impacts of the Project. The respondents believe that it will bring important economic benefits to Turkey. Approximately 35.7 percent of the respondents state that the project provides energy for our country and 53.6 percent of them state that the project will provide job opportunities for local people.

Table 10-23 Positive Impacts of the Project

	Count	%
Provide energy our country	10	35.7
Provide job opportunities for local people	15	53.6
Contribute to development	1	3.6
Protection of environment	1	3.6
Other	1	3.6
Total	28	100.0

Source: SIA Household Questionnaire, 2012

It was observed that the headmen were positive towards the Project. The headmen were informed of the Project and expected positive impacts such as job opportunities and development of infrastructure (roads).

During the interviews and informal conversation with women it was observed that women had positive attitudes about the Project. Two women have said that they have never heard of the concept “renewable energy” but they have an idea about wind power project. It is possible to summarize their ideas as follows: “we are not educated people. We do not have any idea about

renewable energy. We heard that wind energy is clean and do not have any negative impacts” (Interview with woman). “As far as I know the wind energy is good for us and our country. If it is clean and safe, why don't we use” (Interview with woman). “I know our country needs energy and we should use wind and solar energy. We want only one thing: They should take into account our needs” (Interview with woman)”.

Most of the surveyed people do not think that the project causes any environmental and social problems but some of them had some concerns. The main concerns of these people are the impacts of the project on agricultural land and production. Considerable concern was expressed about potential noise problems with the wind farm. Main concerns cited by those surveyed in the project area include:

- Land and resource damage;
- Negative impacts on agricultural land and production; and
- Noise and visual impacts of the project.

According to the households, the biggest concern about the project impact is the noise. They believe that both the increasing traffic and the maintenance / repair works will make the area very noisy. Additionally, they fear that their vegetable and other agricultural production will be negatively affected from the dust during the construction process.

The local communities have not had previous experience with the construction process of wind power plants. Most of the local people think that the project provides some benefits for Turkey but no direct benefits for the local communities. The main perceived benefit of the project is direct employment. The level of support may be understood in the context of high expectation for employment. The survey, interviews and informal conservation support this idea. It is known that unemployment rate in Turkey is high. Despite the project's efforts to maximize the number of local people employed, the numbers of people who will gain employment are likely to be lower than local expectation. This point should be taken into consideration by project planners to prevent disappointment of local people.

10.5 Projected Impacts

The social impacts of wind power project are diverse. The positive impacts of a wind power project contribute to the national economy, and extend in time for many years. However, there are some negative social impacts as well. Therefore, it is important to understand the meaning of social impact and what kind of impact will be experienced by local communities in the project area.

10.5.1 General

The primary community of interest for the Gökres-2 Wind Farm Project includes İlyaslar and Tütenli Village which the wind farm is visible and the level of noise. Proximity to the wind farm should not be taken to indicate that the wind farm is visible from a residence, as topography, vegetation and

the orientation of the residence are all factors in determining visibility. The Project site is not located in a protected area or a tourist/resort area; it is mostly rural and not considered as an aesthetically significant place.

10.5.2 Demographic Impacts

It is considered that construction or operation of the project may affect the demographic structure of local communities. Indirectly, the results of the development activities, population growth and activities might be affected. However, such growth will involve the continuation of pre-existing trends. It is predicted that the following demographic processes will take place:

In-migration: People from other areas will move to the area in search of new opportunities.

Presence of temporary workers: There will be a short term influx of construction workers during the construction phase of the project. Another important factor to consider is that in Turkey, with its high levels of unemployment, any new project will lead to an influx of people to the area. It is therefore most likely that the area will experience an influx of people looking for jobs and new opportunities.

Table 10-24. Demographics of the Project.

Process	Phase	
	Construction	Operation
In-migration	√	
Presence of new comers	√	
Presence of temporary workers	√	

10.5.3 Economic

The economic impact of the proposed Gökres-2 Wind Farm reflects expenditures related to the construction and operation of the wind farm. These activities will increase economic activity. The assessment assumes approximately 30 months construction period and 49 years of operation period.

Employment: 55 jobs during construction and 15 jobs during operation phase will be available. These jobs highly likely will be sourced from local communities as much as possible and practicable. An added benefit would be that using local labor would obviate the need for temporary housing for construction workers. Apart from direct opportunities that will be created, a number of indirect jobs will also be created in the construction phase and operation phase. In the operational phase, main job opportunities will be created for local communities.

Agricultural Land: As pointed out before, the Project site is located on a rural area. There are no privately owned lands within the Project area. Based on existing knowledge, no-one would be required to physically move from their homes or villages as a result of the Project. Therefore there will be no resettlement.

It is possible to say that there will be unavoidable disruption due to the use of some of agricultural land during the construction period of the project. Since the majority of the residents rely on the

land for subsistence and there is generally high level of unemployment rate in rural areas, temporary or permanent loss of the agricultural land may cause major potential impacts on the villagers. It is important to note that most of surveyed households are engaged in agriculture either for cash income or subsistence.

Farmers will experience production losses during construction and the operation of the wind power project. These losses will be higher during the construction period because of the movement of vehicles on site. There are no landscape elements of particular importance to be stated in the people of the project area.

While a review of the likely impacts of the wind farm on land prices in the area indicated that there may be a change in sale prices or “salability” of land, this factor represents a capital item, which was not able to be quantified. Thus, this possible impact was not incorporated in the impact analysis.

Forest: As pointed out before some forestland will be affected by the Project. Today the General Directorate of Forestry, responsible for the protection and sustainable management of forests, is a part of Ministry Environment and Forestry. The Forests in Turkey are managed according to Forest Management Plan. Permits will be taken before the construction phase for the forest areas to be used within the Project in accordance with the Article No. 17/3 (amended by Law No. 5192) of Forestry Law No. 6831. The officials state that the people who are working in the forest are hired from other towns such as Kemalpaşa. Local people collect some wood from the forest and they do not have any income from the forest.

Displacement/dispossession: The construction activities might cause problems to access roads and division of land.

The project has a positive impact on economic activity and the performance of other industries in the project region.

Table 10-25 Economic process of the Project

Process	Phase	
	Construction	Operation
Waged labor –Employment opportunities	√	√
Temporary loss of land and impacts on income	√	

10.5.4 Sociocultural

Sociocultural processes are those that affect the culture of a society, that is, all aspects of the way that people live together. There is a risk that the presence of the construction workers may cause conflict between workers and residents.

Table 10-26 Socio-cultural process of the Project

Process	Phase	
	Construction	Operation
Conflict	√	
Potential community discontent from the construction activities	√	

10.5.5 Visual and Noise

The impact of the project on the visual landscape was one of the key negative social issues identified through our research. The positive aspects of visual amenity related to some people viewing wind turbines as attractive additions to the landscape. Considerable concern was expressed about potential noise problems with the wind farm. Potential impact is discussed in the environmental impact assessment section of this report.

10.5.6 Community Safety

During the construction phase, the project could affect amenity and lifestyle including air quality (i.e. dust, plant and vehicle pollutants), noise (on-site from plant and vehicles and off-site from vehicles), aesthetics or increases in traffic levels.

Existing management and safety practices will be implemented during the construction and operation of the project. Community or passenger safety would not be affected by the construction phase of the project.

Table 10-27 Community safety of the Project

Process	Phase	
	Construction	Operation
Safety risk to people and livestock	√	
Improvement to infrastructure, particularly roads	√	
Loss of access to infrastructure and resources	√	
Heavy traffic, noise and dust	√	

10.5.7 Summary of Findings

Table 10-28 shows the summary of the social impacts of the project.

Table 10-28 Social Impact Assessment Summary Matrix

Impacts	Description of impacts	
	Construction phase	Operation phase
Migration	Negligible	Negligible
Employment	Negligible ST, +	Negligible LT, +
Conflict	Negligible	Negligible
Health and safety	Negligible	Negligible
Change in community infrastructure such as road	Moderate, LT, +	Moderate, LT +
Impacts to agricultural resource	Moderate adverse, LT	No impact
Impact on property/land value	Minor adverse, LT	Minor adverse, LT
Public services	No impact	No impact
Visual impact	Negligible	Minor, LT -
Support large commercial or residential development	Negligible	Negligible
An increase in traffic	Moderate adverse, ST	No impact

Severe, Major, Moderate, Minor, Negligible

+ = positive, (-) = negative

ST = short-term, LT = long-term

10.5.8 Cumulative impacts

The following potential cumulative impacts have been identified:

- greater potential to establish a local wind turbine manufacturing and/or assembly industry, in the Project area, and
- increased community dissatisfaction of wind farms.

10.5.9 Mitigation

The project tries to minimize the negative impacts of the project and necessary mitigation measures will be taken into consideration. The purpose of adopting and/or employing mitigation measures is to remove, minimize and/or compensate for adverse effects to a reasonably feasible extent. Table 10-29 shows the suggested mitigation measures:

Table 10-29 Mitigation Measures

Social Impacts	Mitigation Measures
Employment	
Job opportunities	➤ Recruitment / hiring of workers from the Project area by applying local and national recruitment policy with the contractor ➤ Transparency of recruitment / hiring procedure
<u>Construction Phase</u>	
Expropriation of Agricultural Land	
Temporary loss of agricultural land	➤ Compensation will be paid for temporary acquisition of land. ➤ Owners/users will be compensated based on the discounted net income of temporarily acquired land.
Loss of Trees / Perennial Crops	➤ The compensation for trees.
Loss of Annual / Seasonal Crops	➤ Affected farmers will be compensated for the duration of construction (approximately 1 year) plus an additional year to allow for the proper reinstatement of land.
Injury to Livestock	➤ Compensation for loss
Impact on Community Relations	
Tension/dispute between local resident and workers	➤ Provide regular information on the progress of the project and works, ➤ Manage any disputes between the Contractors and local residents ➤ Respect for local people and customs ➤ An alcohol and drug policy ➤ Zero tolerance of illegal activities by construction personnel ➤ Cultural awareness training
Safety and Risk	
Temporary increases in traffic flows	➤ Provide information about the traffic flow for local residents ➤ Develop Traffic Management Plan
Open trench	➤ No access to open trench area for non-authorized personnel
<u>Operation Phase</u>	
Land Use	
Inspection and maintenance activities	➤ Awareness of safety issues for settlements

10.6 Public Hearing

10.6.1 Identification of Stakeholder

Stakeholder identification can be defined as a process to determine who will be directly or indirectly affected, positively or negatively, by a project (commonly called project affected people or project-affected groups), and who can contribute to or hinder its success (commonly called other relevant stakeholders). The stakeholder for Gökres-2 Wind Farm consists of the general public, national regulatory authorities, local regulatory authorities, local agencies, non-governmental organizations, and local landowners. The key stakeholder list for the project is presented in Table 10-30, below.

Table 10-30 Key Stakeholder List for Gökres-2 Wind Farm Project

Stakeholder Organization (SO) Name	SO Responsibilities/Roles in Organizations	Stakeholder Type
Manisa Governorate	Representative of the central government	Local Authority
Kırkağaç District Governorate	Representative of the central government in district level	Local Authority
Kırkağaç District Gendarmerie Command	Responsible for the maintenance of the public order	Local Agency
Akhisar/kırkağaç Forestry Operation Directorate	Responsible for the operation of forests	Local Agency
İlyaslar Municipality	Provision of public services for İlyaslar District	Local Authority
Tütenli Village Headmanship	Provision of public services for Tütenli Village.	Local Authority
TEMA Manisa	Turkish Foundation for Combating Soil Erosion, Reforestation & the Protection of Natural Habitats	Local NGO
WWF Turkey	NGO of the protection of the environment	International NGO
REC Turkey	NGO of the protection of the environment	International NGO

10.6.2 Public Hearing and Public Disclosure

In the scope of the Gökres-2 Wind Farm Project EIA study, public participation meetings were held in İlyaslar Town Wedding Ceremony Hall at 19:00 on December 27, 2012. The aim of these meeting was to involve stakeholders in a discussion which focuses on the local social and environmental impacts.

The meeting was announced in one local newspaper before the meeting time. In this meeting, a brief project description was given and environmental issues regarding the project were presented.

The participants were the headman of Tütenli Village, the representatives of the Forestry Directorate and the local people from mostly İlyaslar Town, Tütenli Village.

The proposed Project was presented including information about project developers, the technology and operation of the wind farm. During the meeting all concerns, opinions and recommendations of the local people were recorded and, name of participants are collected (the list is given in Appendix-D). During and after presentation some questions were raised by participants. In general, people wanted to know the job opportunities due to the Project and location of the Project.

Flyers including information about the project and phone numbers and address of project owner are given to participants in order to ensure that complaints of the people affected by the Project are considered and resolved with corrective actions by Garet Enerji.



Figure 10-2 Public Participation Meeting

10.7 Recommendation

The following recommendations are made on the basis of the Social Impact Assessment:

- Local people should be utilized in the construction and operation of the project as far as possible.
- In order to create a successful and sustainable development model for the region, all individuals, organizations and agencies must work together in a coordinated manner. Some of household heads are willing and ready to take part in the project. When we examine the socio-economic conditions of the region, it can be seen that agriculture sector is main source of employment. Unemployment is an important problem. Residents in the project region are willing to support an activity to create jobs opportunities.
- During the field research, participants state that their information sources are very limited and irregular. Providing information for the villagers have major role. If the villagers do not have enough information about project activities, they will not be a part of the activities.

Muhtars would play more active role to provide information about the project for the villagers.

- It is clear that the project will affect communities who live close to the project area and their attitudes to the project vary. The project planners would consult with these communities and their concern or expectation should be understood. A consultation plan may be applied at each phase of the construction and implementation of the project.
- Agriculture is the main income sources for these families and permanent or temporary loss of agricultural land is an important impact on income. This point should be in consideration.

11.0 REFERENCES

1. Adams, W. (2000) The Social Impacts of Large Dams: Equity and Distribution Issues. Thematic Review I.1 prepared as an input to the World Commission on Dams, Cape Town.
2. Akalın, Ş., Büyük Bitkiler Kılavuzu. Tarım Bakanlığı Köyişleri Şubesi Müdürlüğü, Ankara, (1952).
3. Akman, A.Ü., Tüfekçi, K., Determination and Characterisation of Fault Systems and Geomorphological Features by RS and GIS Techniques in the WSW Part of Turkey, MTA Geology Department, 2005.
4. Baytop, T., Türkçe Bitki Adları Sözlüğü. Türk Dil Kurumu Yayınları, Ankara, (1997).
5. BERN, Avrupa Yaban Hayatı ve Yaşama Ortamlarını Koruma Sözleşmesi, (1984)
6. Byfield A., Özhatay N., Atay S., 2005. Türkiye'nin 122 Önemli Bitki Alanı, Doğal Hayatı Koruma Derneği, İstanbul.
7. Coode M.J.E. & Cullen J Viola L. in Davis PH (ed.), Flora of Turkey and the East Aegean Islands 1: 526. Edinburgh: Edinb. Univ. Press, (1965).
8. Davis P. H. & Tan K, Mill RR (eds), Flora of Turkey and the East Aegean Islands, Vol. 10. Edinburgh: Edinb. Univ. Press, (1988).
9. Davis P. H. (ed), Flora of Turkey and the East Aegean Islands. Vols. 1-9. Edinburgh: Edinb. Univ. Press(1965-1985).
10. Demirsoy A., Genel ve Türkiye Zoocoğrafyası. Meteksan, Ankara, 2002.
11. Demirsoy A., Yaşamın Temel Kuralları, Omurgalılar/Amniota (Sürüngenler, Kuşlar ve Memeliler). Cilt 2/3. Meteksan, Ankara, 1992.
12. Demirsoy A., Yaşamın Temel Kuralları, Omurgalılar/Amniota. Cilt 1/3. Meteksan, Ankara, 1988.
13. Eken, G., Bozdoğan, M., İsfandiyoğlu, S., Kılıç, DT., Lise, Y. (editors) 2006. Türkiye'nin Önemli Doğa Alanları, Doğa Derneği, Ankara.
14. Ekim, T., Koyuncu, M., Vural, M., Duman, H., Aytaç, Z., Adıgüzel, N., Türkiye Bitkileri Kırmızı Kitabı (Pteridophyta ve Spermatophyta), Türkiye Tabiatını Koruma Derneği ve Van 100. Yıl Üniversitesi, Yayın No: 18, Ankara (2000).

15. Environmental, Health and Safety Guidelines, 2007, Wind Energy, IFC
16. Frankfort-Nachmias, C. and Nachmias, D. 1992. Research Methods in the Social Sciences. St. Martin Press, New York.
17. General Directorate of Meteorology, Long-term meteorological data (1975-2009) of Akhisar Meteorological Station,
18. Gipe, P., 1995 Wind Energy Comes of Age , New York.
19. Guidelines and Principles for Social Impact Assessment (1994) Prepared by The Inter-organizational Committee on Guidelines and Principles for Social Impact Assessment.
20. Güner A, Özhatay N, Ekim T & Bafler KHC (eds), Flora of Turkey and the East Aegean Islands. Vol. 11, Edinburgh: Edinb. Univ. Press (2000).
21. Heinzel, H., Fitter R. F. ve. Parslow J, Birds of Britain ve Europe with North Africa and the Middle East. Collins Pocket Guide. 1992.
22. <http://kad.org.tr/>
23. <http://turkherb.ibu.edu.tr/index.php>
24. http://www.biltek.tubitak.gov.tr/bilgipaket/canlilar/TR_tur_listesi/liste_surungen.htm
25. <http://www.cites.org/eng/resources/species.html>
26. <http://www.ogm.gov.tr/>
27. <http://www.tramem.org/memeliler/?fsx=@>
28. İnci, U., Koçyiğit, A., Bozkurt, E., Arpalıyığıt, İ., Soma ve Kırkağaç Grabenlerinin Kuvaterner Jeolojisi, Batı Anadolu, İstanbul Teknik Üniversitesi Avrasya Yer Bilimleri Enstitüsü, Kuvaterner Çalıştay 4, 2003.
29. IUCN (2001). Red List Categories: Version 3.1. Prepared by the IUCN Species Survival Commission. Gland, Switzerland, and Cambridge, UK: IUCN.
30. Kence, A. ve Bilgin, C., 1996, Türkiye Omurgalıları Tür Listesi, Ankara, 183 s
31. Kızıroğlu, İ. (1993): The Birds of Türkiye. (Species List in Red Data Book). Ankara. TTKD Publication Nr: 20. Desen Ofset A.S.: 48 pp. 50, 1993.
32. *Manisa Environmental Status Report*, (2010), Manisa Provincial Directorate of Environment and Urbanization
33. *Official Website of Gama Enerji* (2012), retrieved from <<http://www.gama.com.tr>>

34. *Official Website of General Directorate of Disaster Affairs*, (2012), Retrieved from <http://www.deprem.gov.tr/>
35. *Official Website of Turkish Wind Energy Association (TWEA)*, (March 2011), Retrieved from <http://www.ruzgarenerjisibirliđi.org.tr/>
36. *Official Website of TurkStat*, Address Based Population Census 2012, Retrieved from <http://www.tuik.gov.tr/>
37. S. Damborg, Public Attitudes Towards Wind Power, Danish Wind Industry Association
38. Satellite Images from Google Earth Software, 2009.
39. Rappaport, R. A. (1994) "Human Environment and the Notion of Impact" in Who Pays the Price? Socio-cultural Context of Environmental Crisis, Barbara Rose Johnston (ed.), Washington, D.C. & Covelo, California: Island Press.
40. Turkey Geological Map Series, Balıkesir G-5 Sheet, General Directorate of Mineral Research and Exploration (MTA), 1989.
41. *Turkish Electricity Transmission Corporation (TEİAŞ)*, (2011), Turkish Electrical Energy 10-Year Generation Capacity Projection Report.
42. The World Bank. 2001. Sociological and Beneficiary Assessment of Potential Low-Income Housing Micro-Project.
43. USEPA, AP42, Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I
44. USEPA, AP-42, Emission Factors for Stationary Internal Combustion Sources, 1996
45. Vanclay, F.2002, Social Impact Assessment

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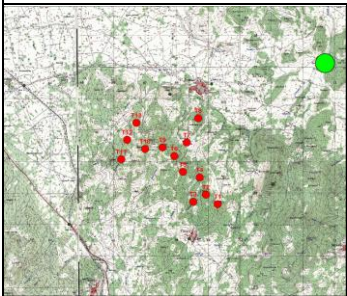
gmetin@ifc.org

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Appendix A

PHOTOMONTAGE



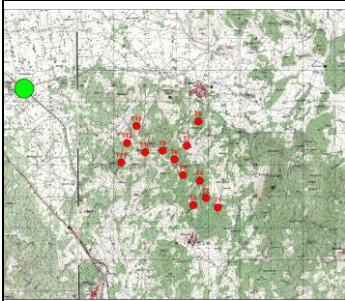
Viewpoint Information

Viewpoint Coordinates : 572693E 44327122N
View Direction : Southwest
Viewpoint Elevation : 247 m
Distance to Nearest Turbine : 4.4 km (T8)

GÖKRES-2 WF

View of the Project Site from D565 Balıkesir – Manisa Road

AECOM



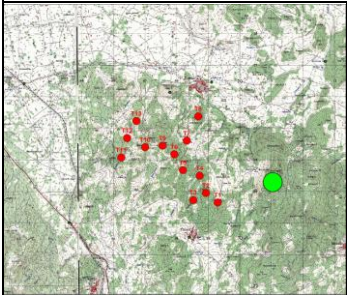
Viewpoint Information

Viewpoint Coordinates : 563175E 4326416N
View Direction : Southeast
Viewpoint Elevation : 181 m
Distance to Nearest Turbine : 3.7 km (T12)

GÖKRES-2 WF

View of the Project Site from İlyaslar – Bakır Road and Railway Intersection

AECOM



Viewpoint Information

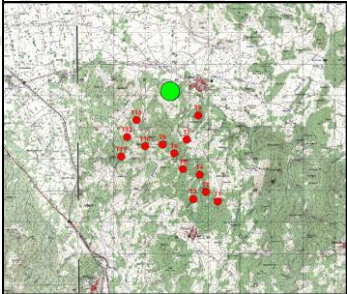
Viewpoint Coordinates : 571037E 4323290N
View Direction : East
Viewpoint Elevation : 559 m
Distance to Nearest Turbine : 1.8 km (T1)

GÖKRES-2 WF

View of the Project Site from Kaletepe (KADI DAĞI)

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Viewpoint Information		GÖKRES-2 WF
Viewpoint Coordinates	: 567786E 4326144N	View of the Project Site from Hisartepe
View Direction	: South	
Viewpoint Elevation	: 325 m	
Distance to Nearest Turbine	: 1.2 km (T8)	

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gmnetin@ifc.org

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Appendix B

SHADOW MODELING RESULTS

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Main Result Report

WindPRO version 2.7.490 Sep 2011

Project:
GOKRES2 WF

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Licensed user:
AECOM Turkey Danışmanlık ve Mühendislik Ltd. Sti.
Mustafa Kemal Mah. Dumlupınar Bulvarı No: 266 Tepe Prime B Blok Suite No: 51
TR-06800 Cankaya Ankara
+90 (312) 442 98 63

AECOM

Calculated:
30/03/2013 20:45/2.7.490

SHADOW - Main Result

Calculation: Shadow Modeling

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) []
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
3.49 4.38 6.01 7.58 9.02 10.28 11.09 10.31 9.30 7.09 4.40 3.13

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
4,404 1,644 79 35 46 139 1,078 673 118 53 85 266 8,620
Idle start wind speed: Cut in wind speed from power curve

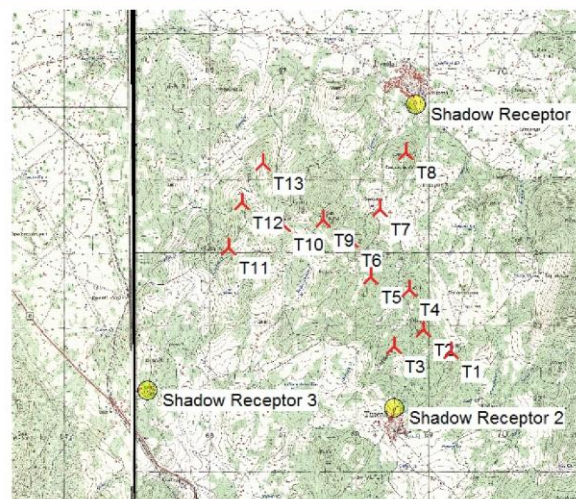
A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

Height contours used: Elevation Contours

Obstacles used in calculation

Eye height: 1.5 m

Grid resolution: 10 m



Scale 1:90,000
New WTG Shadow receptor

WTGs

UTM ED50 Zone: 35				WTG type		Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
East	North	Z	Row data/Description	Valid	Manufact.					Calculation distance [m]	RPM [RPM]
UTM ED50 Zone: 35											
T1	569,300	4,322,650	350.0 T1	Yes	GE WIND ENERGY	GE 2.75-103-2,750	2,750	103.0	98.3	2,000	0.0
T10	567,000	4,324,400	420.0 T10	Yes	GE WIND ENERGY	GE 2.75-103-2,750	2,750	103.0	98.3	2,000	0.0
T11	566,250	4,324,075	370.0 T11	Yes	GE WIND ENERGY	GE 2.75-103-2,750	2,750	103.0	98.3	2,000	0.0
T12	566,434	4,324,692	368.3 T12	Yes	GE WIND ENERGY	GE 2.75-103-2,750	2,750	103.0	98.3	2,000	0.0
T13	566,724	4,325,230	347.0 T13	Yes	GE WIND ENERGY	GE 2.75-103-2,750	2,750	103.0	98.3	2,000	0.0
T2	568,925	4,322,950	384.3 T2	Yes	GE WIND ENERGY	GE 2.75-103-2,750	2,750	103.0	98.3	2,000	0.0
T3	568,525	4,322,725	360.0 T3	Yes	GE WIND ENERGY	GE 2.75-103-2,750	2,750	103.0	98.3	2,000	0.0
T4	568,725	4,323,500	380.0 T4	Yes	GE WIND ENERGY	GE 2.75-103-2,750	2,750	103.0	98.3	2,000	0.0
T5	568,200	4,323,675	400.0 T5	Yes	GE WIND ENERGY	GE 2.75-103-2,750	2,750	103.0	98.3	2,000	0.0
T6	567,925	4,324,175	400.0 T6	Yes	GE WIND ENERGY	GE 2.75-103-2,750	2,750	103.0	98.3	2,000	0.0
T7	568,322	4,324,607	333.2 T7	Yes	GE WIND ENERGY	GE 2.75-103-2,750	2,750	103.0	98.3	2,000	0.0
T8	568,680	4,325,379	316.4 T8	Yes	GE WIND ENERGY	GE 2.75-103-2,750	2,750	103.0	98.3	2,000	0.0
T9	567,550	4,324,450	411.1 T9	Yes	GE WIND ENERGY	GE 2.75-103-2,750	2,750	103.0	98.3	2,000	0.0

Shadow receptor-Input

UTM ED50 Zone: 35				Z	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
No.	Name	East	North							
Shadow Receptor 1	Shadow Receptor 1	568,820	4,326,030	231.4	1.0	1.0	1.0	-180.0	90.0	"Green house mode"
Shadow Receptor 2	Shadow Receptor 2	568,521	4,321,871	249.3	1.0	1.0	1.0	-180.0	90.0	"Green house mode"
Shadow Receptor 3	Shadow Receptor 3	565,147	4,322,117	239.7	1.0	1.0	1.0	-180.0	90.0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case			Shadow, expected values	
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]	
Shadow Receptor 1	Shadow Receptor 1	0:00	0	0:00	0:00	
Shadow Receptor 2	Shadow Receptor 2	0:00	0	0:00	0:00	

To be continued on next page...

Project:

GOKRES2 WF

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Calculated:

30/03/2013 20:45/2.7.490



SHADOW - Main Result

Calculation: Shadow Modeling

...continued from previous page

No.	Name	Shadow, worst case			Shadow, expected values	
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]	
Shadow Receptor 3	Shadow Receptor 3	0:00	0	0:00	0:00	

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
T1	T1	0:00	0:00
T10	T10	0:00	0:00
T11	T11	0:00	0:00
T12	T12	0:00	0:00
T13	T13	0:00	0:00
T2	T2	0:00	0:00
T3	T3	0:00	0:00
T4	T4	0:00	0:00
T5	T5	0:00	0:00
T6	T6	0:00	0:00
T7	T7	0:00	0:00
T8	T8	0:00	0:00
T9	T9	0:00	0:00

Shadow Calendar Graphs

WindPRO version 2.7.490 Sep 2011

Project:
GOKRES2 WF

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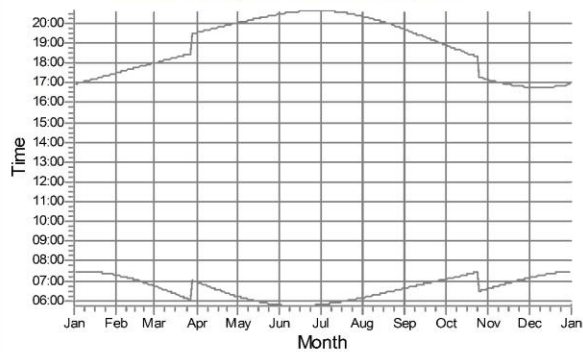
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Mustafa Kemal Mah. Dumlupınar Bulvarı No: 266 Tepe Prime B Blok Suite No: 51
TR-06800 Cankaya Ankara
+90 (312) 442 98 63

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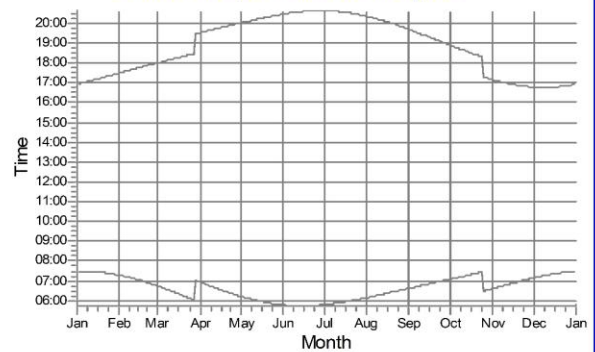
SHADOW - Calendar, graphical

Calculation: Shadow Modeling

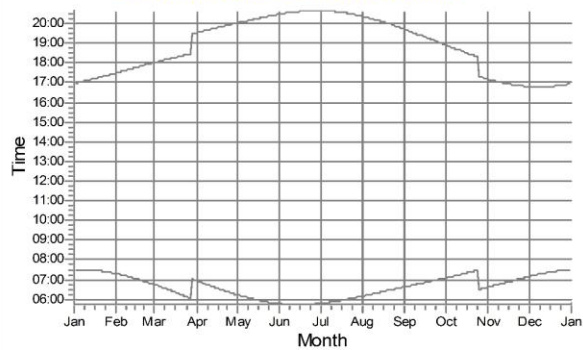
Shadow Receptor 1: Shadow Receptor 1



Shadow Receptor 2: Shadow Receptor 2



Shadow Receptor 3: Shadow Receptor 3

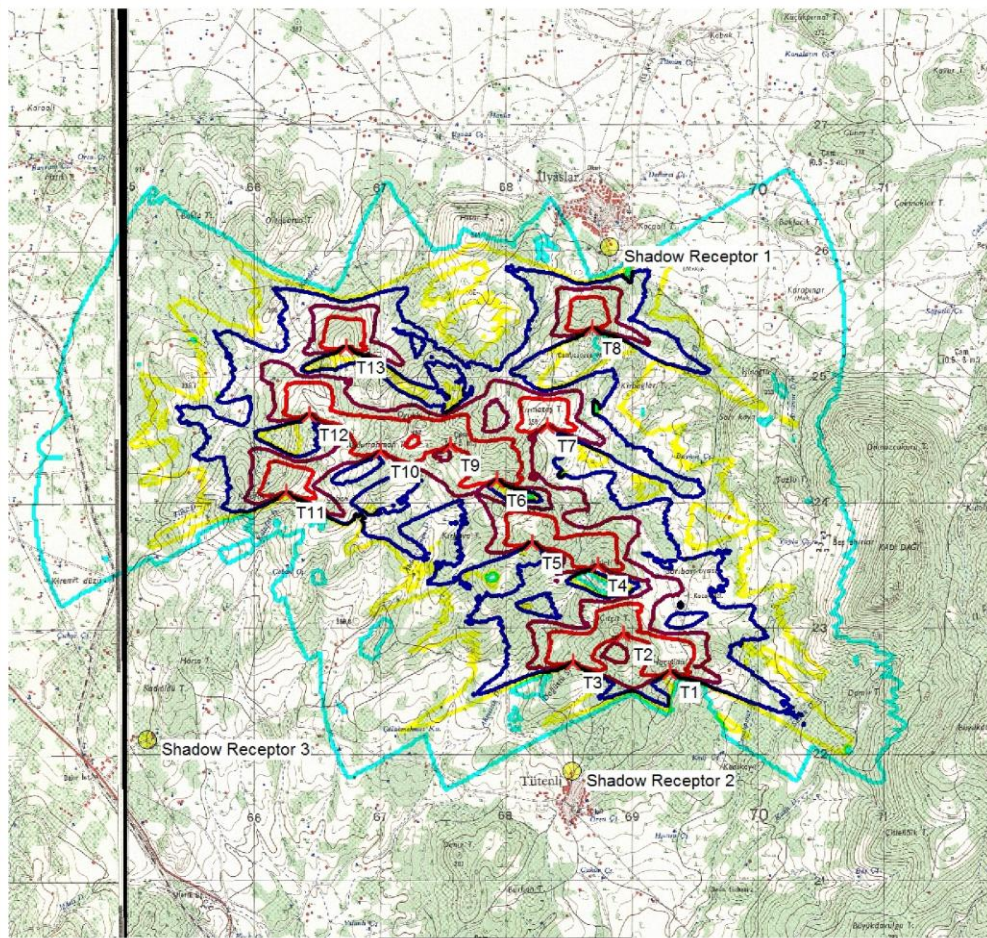


WTGs

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Shadow Contour Map

WindPRO version 2.7.490 Sep 2011



New WTG

Map: , Print scale 1:50,000, Map center UTM ED50 Zone: 35 East: 568,025 North: 4,324,346

Shadow receptor

Isolines showing shadow in Hours per year, real case

0

5

10

25

50

Project:
GOKRES2 WF

SHADOW -
Map

Calculation:
Shadow Modeling

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Appendix C

HOUSEHOLD QUESTIONNAIRE

GÖKRES-2 WIND FARM PROJECT
SOCIAL IMPACT ASSESSMENT
HOUSEHOLD QUESTIONNAIRE

INTRODUCTORY INFORMATION
PROVINCE
DISTRICT
VILLAGE

Interview Information	
DATE (Day/Month/Year)	_ / _ / _
NAME and SURNAME of INTERVIEWER	_____

Information about the household

1. How many people live in your household?(.....) people
2. Could you give us the following information about the people living in your household?

	Relationship to head of the household	Gender	Age	Education Level	Working or not working in a paid job? (For age 15+)	Occupation
1.						
2.						

3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
	1.Head of the household 2.Wife 3.Son / Daughter 4. Father / Mother 5.Sister. 6.Father-in-law / Mother-in-law 7.Son-in-law / Daughter-in-law 8.Grand child 9-Other (specify)	1-Woman 2-Man		1. Illiterate 2. Literate 3. Primary school graduate 4. Secondary school graduate 5. High school / vocational high school graduate 6. University graduate 7. Postgraduate	1-Working 2-Not working	(Housewife, student, retired are included)

General information about household

3. How long have you been living here?	1. Since birth 2. 1-5 years 3. 6-10 years 4. 11-15 years 5. More than 16
4. If it is 1-5 years (please ask the question on the right side)	Where have you been living before?
	What is the reason for moving here?
5. . Is there any household studying or working in another city / district?	1. Yes 2. No
6. If Yes,	Why?.....
	Number of people.....
	Where does he/she live?

Economical Information about the household

7. What are the main sources of income of your household? (Order as 1,2,3 according to importance level)	1. () Agricultural production 2. () Salary from permanent job 3. () Trade 4. () Animal husbandry 5. () Rent 6. () Salary from temporary jobs 7. () Tourism 8. () Financial support from relatives 9. () State assistance (foundation, municipality etc) 10.() Other (specify).....
8. How many householders are working?	1. No one is working 2. 1 person 3. 2 people 4. 3 people 5. More than 4 people
9. Is there any unemployed householder? (only job seekers)	1 Yes 2 No If Yes , number of people.....
10. Is there any retired householder?	1 Yes 2 No If Yes , number of people.....
11. What is the average monthly income of your household?	TL
12. How would you describe your income state in comparison with your relatives?	1. () Better than them 2. () At the same level 3. () Worse than them

13. Which of the following items do you have in your house?

		Have	Don't Have
Refrigerator			
Washing machine			
Dishwasher			
Telephone			
Computer			
Vacuum cleaner			
Satellite TV antenna			
Internet access			

14. Which of the following vehicles do you have?

		Have	Don't Have
Car			
Truck			
Tractor			
Machines used for animal husbandary(Specify.....)			

Agricultural Production

15. Do you have any agricultural land you use?

1. Yes 2. No (If No, jump to question 23)

16. Is the land used for agricultural activities yours?	1) Owner of the land
	2) Leased land
	3) Treasury land
	4) Land used without payment (Land of a relatives)
	5) Other (Specify)

17. How many acres agricultural land do you have?

Total area	Acres
Area of irrigated farming	
Area of dry farming	
Total	

18. What are the agricultural products you produce last year?

Products	Irrigated		Dry
1. product		1. product	
2. product		2. product	
3. product		3. product	
4. product		4. product	

19. How do you utilize your agricultural products?

1. Selling
2. Consuming
3. Both selling and consuming
4. Other (Specify).....

Animal Husbandry

20. Do you have any animals belong to your household?

1. Yes
2. No (If No, jump to question 28)

21. If Yes, how many animals do you have?

	Number
Bovine animal	
Sheep or Goat	
Fowl	
Hive	
Animal for carrying	

22. How do you utilize your animal husbandry products?

1. Selling
2. Consuming
3. Both selling and consuming
4. Other (Specify).....

23. Do you graze your animals close to place you living?

1. Yes
2. No

24. What is the source of the water used for your animals?

1. River close to the village
2. Lake
3. Place close to the village
4. Other (specify)

Problems

25. What are the most important three problems households faces with in your town?
(Order as 1,2,3 according to importance level!)

		Priority Level
Unemployment		
Low income		
Marketing problem		
Low product price		
Inadequate access roads		
Inadequate health care		
Inadequate drinking water		
Inadequate potable water		
Inadequate energy sources		
Absence of sewerage system		
Inadequate housing		
Problems to tourism		
Inadequate education opportunities		
No waste disposal place		
Other (Specify)		

Thoughts about Wind Energy

26. Do have any information about wind energy / do you hear anything related to subject?
1. Yes
 2. No
27. If Yes, from whom?
1. Friends / relatives
 2. Newspaper / media
 3. Governmental officials
 4. Headmen
 5. Company workers
 6. Other (specify)

28. Please state whether you agree the following opinions or not?

	I agree	I don't know	I don't agree
WFPs play an important role in providing energy			
Energy resources need to be used for the development of the country.			
WFPs have negative effects on the environment			
WFPs increase the life quality of local people.			
There is no adverse impact of WFP on the environment and therefore, they must be used more frequently.			
WFPs may have social and economic negative effects on local people.			
WFPs provide job opportunities to local people.			

Opinions about the Project

29. Do you know that WFP is going to be constructed in the place you are living?

1. Yes
2. No

30. If Yes, from whom? **(Only one option)**

- 1 () Friends / relatives
- 2.() Newspaper / media
- 3 () Governmental officials
- 4.() Headmen
- 5.() Other (specify)

31. Do you support WFP related protects carried out in your region?

- 1 () Yes
- 2 () No

32. If Yes, what would be the benefits? **(Order as 1,2,3 according to importance level)**

- 1 () Supplies energy to the country
- 2 () Creates job opportunities
- 3 () Helps the development of the country
- 4 () Beautifies the environment we are living
- 5 () Other (specify)

33. If No, what kind of problems would be caused? (Order as 1,2,3 according to importance level)

1. Damages the environment
2. Negatively affect the social life of locals
3. Negatively affect the agriculture
4. Negatively affect the livelihoods of the locals
5. Other (specify)

34. If No *Is it possible to minimize or remove that negative affects?

- a. Yes b. No

If Yes, what is your suggestions?

35. From whom, you learn the WFP and their effects? (Order as 1,2,3 according to importance level)

Relative and friends	
Newspaper – TV	
Governmental officials	
NGO workers	
Headmen	
Other (specify)	

36. Do you find this information reliable and do you think this information is correct?

1. Yes 2. No

37. Do you want the information related to the project given to you?

1. Yes 2. No

38. If Yes, who should give you these information? (Order as 1,2,3 according to importance level)

Local media / newspaper	
Headmen	
Governmental officials	
Project owners	
Other (specify)	

39. What kind of information do you need?

.....

.....

Is there anything you want to add?

THANK YOU FOR YOUR TIME

Appendix D

LIST OF THE PARTICIPANTS

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gmetin@ifc.org

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GÖKRES-2 HALKIN KATILIMI TOPLANTISI

MANİSA - İLYASLAR BELDESİ

27.12.2012

KATILIMCI LİSTESİ

Adı Soyadı	Meşleği	Yaşadığı Yer	İmza
Mehmet ALASBAY	çiftçi	ilyaslar	
Ömer AKIN	~~çiftçi~~ kahveci	ilyaslar	
Süleyman Şentürk	çiftçi	ilyaslar	
Hilmi KIRAN	İns.müh	İzmir	
Necdet güneş	Tütenliköyü muhtarı		
Reşit İnci	Tütenli Çiftçi		
Ali Osman Yetin	ilyaslar kas. çiftçi		
Süleyman ELEKLER	ilyaslar kas. çiftçi		
Ecevit Durmaz	Tütenli ky çiftçi		
Nazmi Gelir	Tütenliköyü çiftçi		
Turgut Dereliler	Çiftçi		
Emin Kavak	Çiftçi		
Tahsin DİRAC	Ziraat Tetkisyen'i -	İLYASLAR	
Mehmet Eğrioglu	Çiftçi		
Ethem Şentürk	Serbez		
HAŞİF Gürcer	Çiftçi		
Osman Şentürk	Çiftçi		
Ferdi Şentürk	Çiftçi		

Adı Soyadı

Mesleği

Yaşadığı Yer

İmza

Mustafa Bayram Çiftçi
Mehmet Kalkan eufci
Hüseyin Cürük i
İlhan Eğriboz

Pezcan ÖZDEMİR

Belçirya BORAZAN

Belenor GİRAX =

Mustafa Tekin =

A. İlyas Sakin =
Erdal Yıldırım

Mahmet USTA

Orman İqletme Şefi

Kırkajay

Mustafa Karapınar

Mehmet Emekçi

Remzi Kocak

Mehmet Özdemir

Fazıl Maman

Ahmet GÜLİL

AECOM

Ezgi Güler

AECOM

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