SANKO GEOTHERMAL POWER PLANT PROJECT

Environmental and Social Impact Assessment Report

March 2018

ANKARA

SANKO GEOTHERMAL POWER PROJECT

ENVIRONMENTAL and SOCIAL IMPACT ASSESSMENT REPORT

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ABBREVIATIONS

2U1K	2U1K Engineering and Consultancy Inc.
AoI	Area of Influence
CO_2	Carbon Dioxide
EA	Environmental Assessment
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EPRP	Emergency Preparedness and Response Plan
ESA	Environmental and Social Assessment
ESDD	Environmental and Social Due Diligence
ESMMP	Environmental and Social Management and Monitoring Plan
GD NCNP	General Directorate of Nature Conservation and National Parks
DSI	General Directorate of State Hydraulic Works
GPP	Geothermal Power Plant
HS	Health and Safety
H_2S	Hydrogen Sulphide
IFC	International Finance Corporation
MoEU	Ministry of Environment and Urbanization
NGO	Non-Governmental Organization
NCG	Non-Condensable Gas
OHS	Occupational Health and Safety
ORC	Organic Rankine Cycle
PDR	Project Description Report
PPE	Personal Protective Equipment
PS	Performance Standards
SEP	Stakeholder Engagement Plan
TEDAŞ	Turkish Electricity Distribution Corporation

EXECUTIVE SUMMARY

Sanko Enerji Sanayi ve Ticaret A.Ş. (Sanko) has committed to operate Sanko Geothermal Power Plant (the Project) with capacity of 15 MW in Salihli District of Manisa Province. The Project is planned to provide contribution to the national grid with generation of 118.7 GWh electricity annually. This Environmental and Social Impact Assessment report has been prepared for this Project development and includes project description, project components, schedule and alternatives, legal framework, ESIA methodology, environmental and social baseline conditions, impact assessment, institutional arrangements and environmental and social mitigation and monitoring plan. Along with the ESIA report a Stakeholder Engagement Plan (SEP) and Cultural Heritage Management Plan have been prepared for the Project.

The Project is expected to have environmental and social impacts for which the details are discussed in the following sections. Main environmental issues focused in the report are; impacts on ecology, air quality, surface water, groundwater and soil, landscape, noise impacts, climate change, water supply and wastewater generation. After the impacts are defined, mitigation measures are described related to the impacts. Mitigation measures have been defined for environmental issues that may occur during geothermal power plant generation:

- An impermeable collection pond of 1,400 m^3 was constructed to be used in case of any failure during reinjection, operation of the power plant or during maintenance of the wells. If the volume of the collection pond is exceeded due to malfunction, extraction of geothermal fluid will be stopped in order to prevent adverse impact of geothermal fluid on soil and groundwater.
- Reinjection is employed provided leak-proof well casings.
- H_2S emissions will be monitored regularly in order to determine compliance with legislation requirements.
- Drilling mud generated during drilling is stored in mud ponds covered with impermeable material.
- Emergency Response Plan has been developed and implemented for Project activities.

The Project is established on privately owned agricultural lands therefore most significant social impact of the Project is land acquisition. Sanko used voluntary purchase method for land take of the area required for the Project. Land take process and payment for the purchased lands have been completed and there will be no more land acquisition for the Project. There has been no physical displacement occurred for the Project.

Sanko has secured geothermal resource operation license for an area of 2,267.97 hectares. The Project will be located on an area of 84,841 m^2 within the license area. The license area comprises of Ancient City of Sardis which is at a distance of 4 km to the Project area.

Although any impact on the Ancient City of Sardis due to Project activities is not expected, a Cultural Heritage Management Plan has been developed for the Project and will be implemented during the life span of the Project. Also, the requirements of Chance Find Procedure which is prepared for the Project will be met in case archaeological remains are met during Project activities. Therefore impact on cultural heritage is expected to be insignificant.

Legally protected and internationally recognized areas close to the Project area are Gölcük Lake Wetland, Marmara Lake Wetland, Ovacık Wildlife Development Area, Spil Mountain National Park, Kula Fairy Chimney Nature Monument at a distance of 10 km, 10 km, 34 km, 48 km and 63 km respectively. Impact is not expected on these areas due to Project activities.

The Project is located in a modified habitat, under intense human pressure due to animal grazing and agricultural activities. Although excavation and drilling activities might cause dust and noise impact on flora and fauna, impact is expected to be insignificant since there are no critical habitats or species and existing species will be able to adapt changes.

Effective community engagement for the Project will be assured through the implementation of SEP prepared for the Project. The stakeholders of the Project will be informed and also be involved in identifying important issues of the Project through the implementation of SEP.

1. INTRODUCTION

1.1 Objectives

2U1K has been appointed by Sanko Enerji Sanayi ve Ticaret A.Ş. (hereinafter the Project Company) for the Environmental and Social Impact Assessment (ESIA) of the Sanko Geothermal Power Plant Project (hereinafter The Project). The Project is planned to be realized in three phases; in the first phase, 15 MWe energy is planned to be generated. In the second phase, additional 15 MWe and, finally with additional 20 MWe a total of 50 MWe will be achieved.

The Project Company seeks for potential financing for the first phase with 15 MW capacity from Türkiye Kalkınma Bankası (TKB), the financial intermediary. Therefore this ESIA study is conducted by 2U1K on behalf of the Project Company to identify potential impacts of the proposed project and to recommend appropriate mitigation measures to reduce adverse potential impacts.

The ESIA process is comprised of baseline environmental and social assessment, environmental and social impact assessment, designation of mitigation measures, stakeholder consultations and cumulative impact assessment.

Baseline information in the Report is supported with field studies that include:

- Overall site observations of drilling wells, mud-pits, storage conditions of chemicals and fuels and waste management;
- Observations for the flora and fauna assessments;
- Sampling for air quality measurements, groundwater sampling, and environmental noise measurements;
- Social surveys including household surveys, focus group meetings, interviews with mukhtars;
- Consultations with key stakeholder groups.

Results of field tests and measurements are provided in Annex-1. Stakeholder Engagement Plan prepared for the Project is given in Annex-2.

1.2 Scope of the Report

The Report is comprised of 10 Sections. Brief description about these sections is as follows:

- Section 1 is an introductory part that gives overall objectives of the ESIA Report, its contents and limitations in undertaking the associated studies.
- Section 2 describes the Project components that are subject to assessment of environmental and social impacts.
- Section 3 gives the legal framework including national and international legislative requirements as related with geothermal drilling and power generation. National frame compiles the Project-related laws and regulations on the basis of concerns of

the environmental and social assessment. EHS, permits, energy generation, land use and biodiversity conservation. International legal frame focuses on requirements of the World Bank operational procedures and the pertinent risk categorization for the specific Project.

- Section 4 defines the methodology of data collection and impact assessment.
- Section 5 gives environmental baseline situation to be considered in the long term monitoring process as well as the scoping of impact assessment process.
- Section 6 gives social baseline situation to be considered in the long term monitoring process as well as the scoping of impact assessment process.
- Section 7 is assessment of impacts on the environment. Focus is given on soil and groundwater contamination from discharge of geothermal drilling and operation stages, from mud pits opened during drilling stage and H_2S emissions during operation.
- Section 8 is assessment of impacts on the communities. Social and economic impact assessment is backed up by a Stakeholder Engagement Plan (SEP) and the Community Profile of Social Surveys. The SEP prepared by 2U1K is available in Annex-2 of the Report.
- Section 9 discusses cumulative impacts of the Project in conjunction with other geothermal projects in the region.
- Section 10 presents the mitigation plan and the monitoring plan for environmental and social aspects to be complied with during both construction and operation stages.

1.3 Limitations of the Study

Besides site observations performed by 2U1K, the ESIA Report is limited to the statements of Project Company representatives and former reports (EIA Report for the proposed geothermal power plant) prepared during the course of project planning and license applications. In this respect, no modeling studies are performed in relation to environmental and social parameters. The ESIA process builds upon the available reports and supports them with additional baseline measurements of critical parameters and social surveys.

Potential financing will apply for only Phase-1 of 15 MW capacity, therefore this ESIA study focuses on the impacts of Phase-1 activities.

Energy Transmission Line (ETL) which will transmit the generated energy by the Power Plant to the national grid is under the responsibility of Turkish Electricity Distribution Corporation (TEDAŞ). Expropriation process for the lands required for the ETL is on-going, therefore not finalized yet. Potential impacts of the ETL and mitigation measures are provided in the impact assessment section.

2. PROJECT DESCRIPTION

2.1 Purpose of the Project

Sanko Enerji Sanayi ve Ticaret A.Ş. (Sanko Enerji) plans to develop and operate Sanko Geothermal Power Plant with a capacity of 15 MWe electric power by means of utilizing geothermal water in Salihli District of Manisa Province.

The Project will generate 118.7 GWh electricity annually. The power generated by the Project will be connected to the national grid through 34.5 kVa energy transmission line between the Project site and Salihli Substation.

Sanko Enerji secured Geothermal Resource Operation License for an area of 2,267.97 hectares with license no.143 from Manisa Provincial Administration on May 21, 2009 for the purpose of geothermal energy production for 30 years. Although the operation period is planned as 30 years at this stage of the Project, with maintenance and rehabilitation of the system and equipment, drilling of new wells and preservation of geothermal resources life span of the plant could be longer than 30 years. The license can also be extended for 10 years period after the expiration. Drilling studies for the Project started on 2010 at the licensed area in order to make use of the energy potential of the region therefore the Project was subject to the former Regulation on Environmental Impact Assessment (EIA) (dated June 17, 2008; No: 26939). According to the former EIA regulation geothermal power plants with thermal power capacity of and higher than 5 MWt were subject to preparing a Project Description Report and submit to the former Provincial Directorate of Environment and Forestry for Environmental Impact Assessment decision. The Project secured “EIA is not required” decision on May 21, 2010 for 3 production and 2 reinjection wells with a capacity of 29 MW. During the development of the Project the resources from the existing wells have been found insufficient therefore the company applied for the development of additional 5 drilling wells for the same capacity in the scope of the EIA Regulation. “EIA exclusion decision” for the additional wells was secured from the Provincial Directorate of Environment and Urbanization on January 01, 2016.

In the course of site investigations in the area, energy generation of 50MW has been considered at the licensed area. According to the EIA Regulation in force (dated November 25, 2014; No: 29186 and amended on May 26, 2017; No: 30077) geothermal power plants with a thermal capacity of and higher than 25 MWt are subject to preparing “Environmental Impact Assessment” Report and submit to the Ministry of Environment and Urbanization. National EIA procedure for the Project was started in August, 2016. Public Participation Meeting according to the EIA Regulation took place on August 27, 2016 at Yılmaz Neighbourhood, Salihli District. EIA report was submitted to the Ministry of Environment and Urbanization and “EIA positive” decision was secured on February 14, 2017.

Sanko Enerji has already secured Production License” for 15 MW capacity from the Energy Market Regulatory (EPDK).

84,841 m^2 of the licensed area in Sıraağaçlar Quarter, Yılmaz Neighbourhood, Salihli District, Manisa will be utilized for the Project activities. Land acquisition for the area required for the Project has been completed. Voluntary purchase method has been applied by the Project Company for land acquisition.

The Project comprises of drilling and operation of 4 geothermal production wells and 2 reinjection wells in the license area for the first phase. Apart from the production and re-injection wells, the Project also comprises of a power plant, energy distribution center, pipelines and energy transmission line. The coordinates of the production and reinjection wells are provided below in Table 2-1.

Table 2-1. Project Reinjection and Production Wells

Well no	Type of Use	Coordinates (WGS84)
SAN-3	Reinjection	38.497200°:28.091983°
SAN-8	Reinjection	38.484597°:28.094202°
SAN-4	Production	38.491547°:28.090448°
SAN-5	Production	38.491638°:28.090444°
SAN-6	Production	38.491455°:28.090445°
SAN-7	Production	38.484507°:28.094177°

Sanko Enerji plans for capacity increase of the Power Plant in the future and to achieve 50 MW power generation in total. Planned capacity and number of wells for different phases of Sanko GPP Project are provided below in Table 2-2.

Table 2-2. Future Planned Capacity Increase

Phases	Capacity	No of Production Wells	No of Reinjection Wells
Phase-I	15 MW	4	2
Phase-II	15 MW (additional)	5	2
Phase-III	20 MW (additional)	6	2
Total	50 MW	15	6

The location and type of wells have been described in the EIA Report of the Project but on the other hand, during the course of Project development both the location and type could be changed based on the outcomes of drilling activities. In case new wells are required in the upcoming phases of the Project, all required permits will be obtained from pertinent official authorities such as General Directorate of State Hydraulic Works (DSİ), Directorate of Cultural Heritage Protection Committee and Provincial Directorate of Food, Agriculture and Livestock.

The coordinates of the wells planned to be utilized in latter phases are provided below in Table 2-3.

Table 2-3. Future Planned Wells

Well no	Type of Use	Coordinates WGS84
1	Production	38.4955: 28.0831
2	Production	38.5011: 28.0942
3	Production	38.5075: 28.0970
4	Production	38.4936: 28.0977
5	Production	38.4825: 28.0997
6	Production	38.4825: 28.0997
7	Production	38.4749: 28.0967
8	Production	38.4763: 28.0856
9	Production	38.4849: 28.0755
10	Production	38.4973: 28.0775
11	Production	38.4844: 28.0890
12	Reinjection	38.4896: 28.0774
13	Reinjection	38.5011: 28.0668
14	Reinjection	38.4775: 28.0775
15	Reinjection	38.4690: 28.0896

2.2 Energy Production Technology

Power generation process will be based on Air Cooled Binary Production Technology, which makes 100% re-injection possible and enables renewability of the energy source and also minimizes the environmental impacts aboveground. Operation will include air-cooled condenser therefore no white plume will be emitted in contrast to flash power plants that uses geothermal steam directly. Environmental impacts of an air cooled binary technology power plant are very low compared to flash technologies.

In a geothermal power plant using air cooled binary system, geothermal fluid, is extracted from the underground reservoir and flows from the wellhead through a gathering system of insulated steel pipelines to a heat exchanger, which heats a secondary working fluid which has a low boiling point. In this system secondary working fluid is n-pentane, and is vaporized and used to drive the turbine. The organic fluid is then condensed in a condenser which is cooled by air. The condensed fluid is then recycled back to the heat exchanger, closing the cycle within the sealed system. The cooled geothermal fluid is then reinjected back into the reservoir.

2.3 Project Location

The Project area is located in the Yılmaz neighbourhood of the Salihli District of Manisa (see Figure 1-1). Project Company has secured Geothermal Resource Operation License for an area of 2,267.97 hectares with license no.143 and the Production area of the Project covers

an area of 84,841 m^2. The Project area is within the boundaries of “Caferbeyli Jeothermal Area” which is the most significant potential geothermal energy areas of Turkey.

Yılmaz neighbourhood at northeast is the closest settlement at a distance of 600 m to the Project area. The Project site is surrounded with agricultural lands at east, west and north and İzmir-Uşak highway (E-96) and Manisa-Salihli-Turgutlu Railway at the south. Project area with the associated facilities and the license area is provided in Figure 2-1 below:

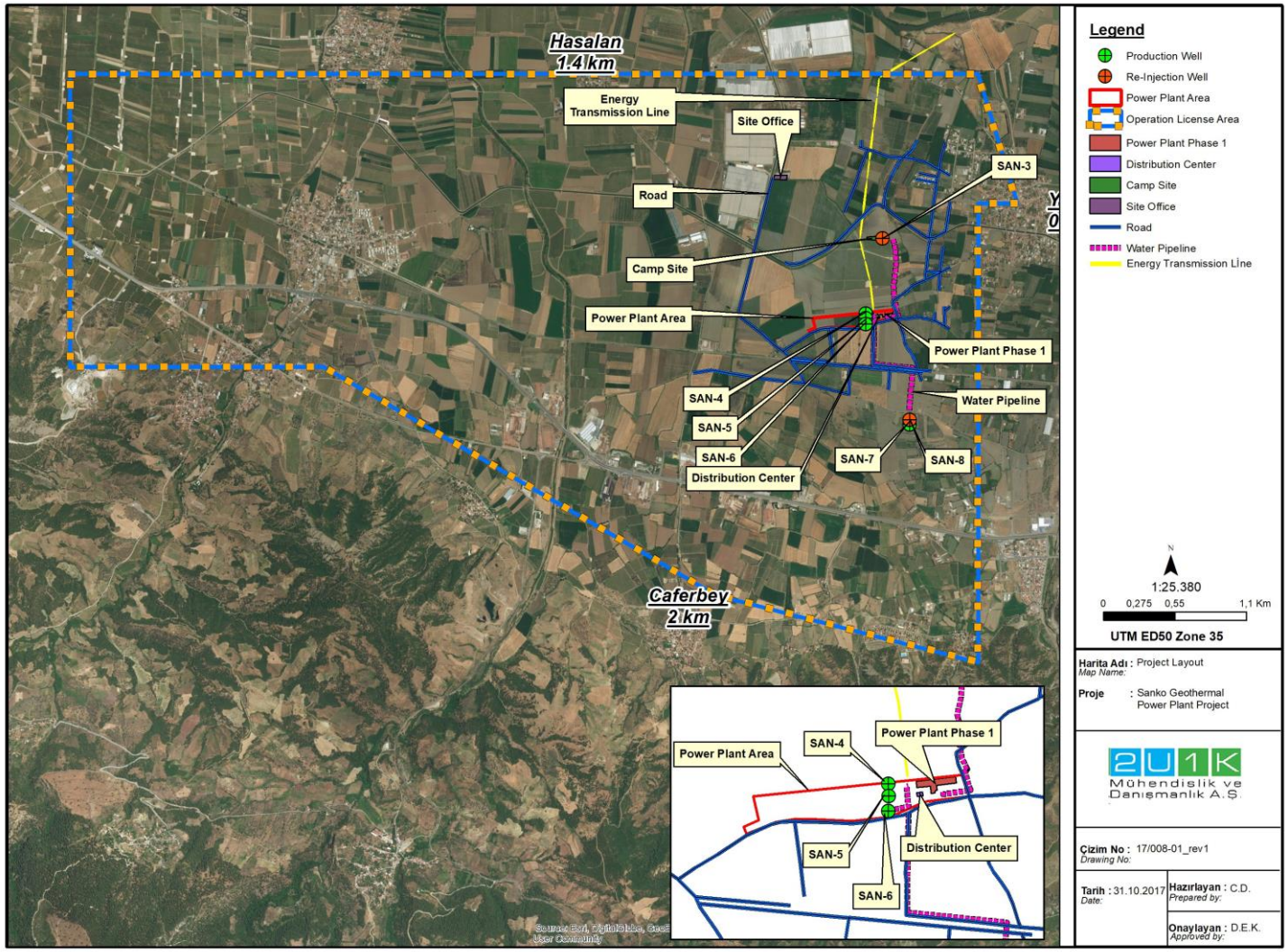

Figure 2-1. Project Area and Associated Facilities

General view from the Project site is provided below in Photo 2-1 to Photo 2-3.

Photo 2-1. General View of the Project Site-1

Photo 2-2. General View of the Project Site-2

Photo 2-3. General View of the Project Site-3

2.4 Project Components

2.4.1 Drilling of Geothermal Wells

Exploration and reservoir evaluation activities include geological, geophysical, and drilling surveys for exploratory drilling and reservoir testing.

Production field development involves drilling steam or hot water production wells and re-injection wells and processing of the reservoir output for use in the power plant. Drilling will continue throughout the life of the project, as production and injection wells need to be periodically updated to support power generation requirements (IFC EHS Guidelines Geothermal Power Generation, 2007)

There are several methods for the removal of rock fragments and mud during drilling process which are cable tool drilling, rotary drilling and air/foam rotary drilling. Rotary drilling is used by Sanko Enerji for the Project. Rotary drilling is a commonly used method operating without interruption since employs a circulation fluid to remove rock fragments.

Generally drilling process includes site and pit preparation, erection of drilling tower, mud pond, drilling surveys for exploratory drilling and reservoir testing and laying of the transmission pipes respectively.

The tower height which is used for drilling process of the Project is 45 meters. Rotary drill with the capacity of 3,500 m has been employed for the existing wells for 2,500 meters depth

so far. Geothermal fluid which is at 250 °C at the bottom of the well is expected to reach the surface at 150-160 °C and at 100-150 ton/h capacity.

There will also be mud ponds near each drilling location for collecting the drilling mud with about 1,170 m^3 capacity. The dimensions of the ponds will be approximately 60m*6.5m*3m and covered with impermeable materials such as geomembrane liners preventing leakage. Material collected in the settlement ponds will be analyzed and will be disposed accordingly.

2.4.2 The Power Plant

Power plant construction activities include construction of the power plant facility and associated infrastructure, including air cooled condenser, pipelines, and facilities for treatment and reinjection of wastewaters and gases.

The Project will operate with air cooled binary system where, geothermal fluid is extracted from the underground reservoir and flows from the wellhead through a gathering system of insulated steel pipelines to a heat exchanger, which heats a secondary working fluid which has a low boiling point. In this system secondary working fluid is n-pentane, and is vaporized and used to drive the turbine. The organic fluid is then condensed in a condenser which is cooled by air. The condensed fluid is then recycled back to the heat exchanger, closing the cycle within the sealed system. The cooled geothermal fluid is then reinjected back into the reservoir. Since the system is planned as closed loop, interference of n-pentane with the geothermal fluid will be avoided. Air-cooled technology will avoid extensive use of water and wastewater discharge.

The flow diagram for the system is provided below in Figure 2-2.

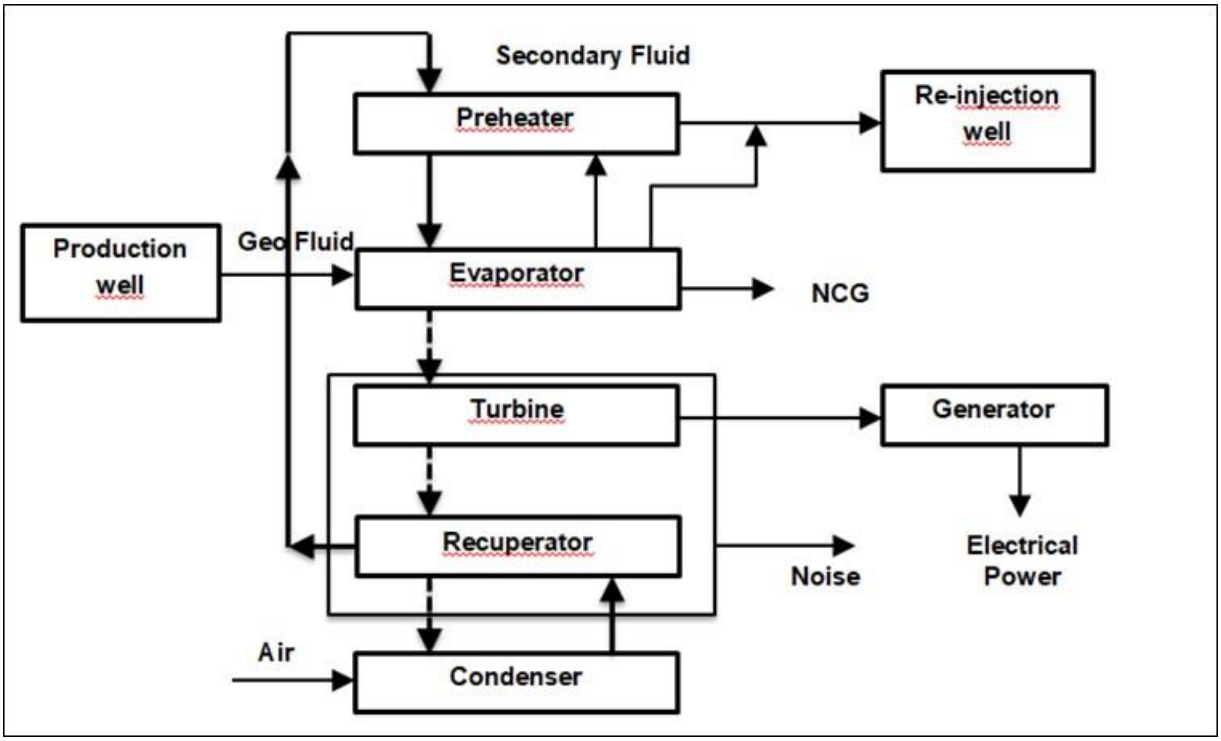

Figure 2-2. Process Flow Chart

The power plant is planned to operate 360 days/year with 3 shifts. Planned energy production with regards to months is provided below in Table 2-4.

Table 2-4. Energy Production of the Project with Regards to Months

Months	Average Temperature (°C)	Capacity (MW)	Gross Production (MWh)	Reinjection Temperature (°C)
January	6.4	14.8	11.017,69	70.5
February	7.5	14.7	9.874,34	71.0
March	10.5	14.4	10.705,87	72.1
April	15.3	13.9	9.978,28	74.3
May	20.6	13.1	9.770,40	77.1
June	25.2	12.5	8.938,88	79.7
July	27.5	12.1	8.938,88	81.1
August	26.9	12.2	9.042,82	80.7
September	22.6	12.9	9.250,70	78.2
October	16.9	13.7	10.082,22	75.2
November	11.5	14.3	10.290,11	72.6
December	7.9	14.7	10.809,81	71.1

2.4.3 Energy Transmission Line

The energy produced by the Project will be connected to the national grid through 34.5 kV transmission line of about 6.5 km between Distribution Center/switchyard between the Project Area and Salihli Substation. The official letter from TEDAS and Gediz Elektrik (local electricity distribution company) for the connection of energy generated by the Project has been secured. TEDAS is the responsible authority for the energy transmission line (ETL) and also responsible for the expropriation process for the lands on the ETL route. Since expropriation process is on-going, Project Company has gone to agreements with the land owners to secure access right to the lands before the completion of the expropriation process. According to the agreements negotiated prices for early access have been paid to the land owners.

Substation will not be established for the Project with 15 MW capacity.

2.4.4 Access Roads

Access to the Project site will be provided through the existing site roads from İzmir-Uşak Highway to the agricultural lands around the Project Area. İzmir-Uşak Highway is at a distance of 1,450 m to the Project Site and new access roads will not be constructed. Project Company will avoid damaging the roads however if any damage occurs due to Project activities, maintenance will be provided.

2.4.5 Pipeline

The pipeline route to two reinjection wells (SAN-3 and SAN-8) will be about 700 m and 1100 m respectively. The pipeline to SAN-4 and SAN-7 production wells will be 150 m and 1100 m respectively. Directional drilling has been applied for SAN-5 and SAN-6 in order to minimize the length of aboveground pipeline providing minimum environmental impact in line with the clean production policy requirements of Sanko Enerji.

2.5 Project Proponents

Key proponents of the Project are:

- Project Company (Sanko Enerji),
- Development Bank of Turkey,
- International Financing Institution (World Bank),
- Contractors.

2.6 Project Schedule

The Project comprises of construction and operation phases of the geothermal power plant. The construction of phase of the Project is estimated for 8 months. A total number of 100 workers are planned to be employed during different periods during construction activities. 27 personnel is planned to be working during the operation phase.

The Project including pre-engineering design, EIA studies and construction is planned to be completed in 14 months. In other words, the plant will start operating with 15 Mwe capacity at the end of 14 months. Project schedule is provided below in Table 2-5.

Table 2-5. Project Schedule

	PHASE 1														ENERGY GENERATION
	Months														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	30 Years
PRE-CONSTRUCTION PHASE															
Pre-Engineering Design															
EIA Process and Permits															
Drilling															
Structural Design															
Mechanical Design															
Electrical Design															
I&C Design															
Fluid Collection System and Injection															
CONSTRUCTION PHASE															
Procurement															
Fluid Collection System and Injection															
Construction of the Plant															
Installation of Mechanical Infrastructure															
Installation of Electrical and I&C Infrastructure															
Commissioning of Fluid Collection System															
Commissioning of the Power Plant															
OPERATION															

2.7 Project Alternatives

Project alternatives were considered for the aspects listed below:

- Site Location;
- Technology;
- Other Energy Generation Alternatives; and
- No Project Alternative.

2.7.1 Site Location

The Project is located on an area of 84,841 m^2 within the borders of Geothermal Resource Operating License Area with the license no 143. The licensed area is included in “Caferbeyli Geothermal Area” which is acknowledged as “Geothermal Reserve Area” by MTA, therefore is one of the most appropriate areas for geotechnical operations. The region has proved geothermal resources through various research and development studies and accomplished drillings by governmental authorities, academic institutions and private companies as well.

The Project area is planned in a proximity to the previous drillings in the licensed area (no. 143), for which the permit had been secured for 2,267.97 hectares on May, 2009. Existing drilling wells and availability to access similar geothermal resources through additional wells have gained importance during project location selection.

Project location is at a distance of 1,450 m from İzmir-Uşak Highway. Access to the Project Site will be provided through the existing roads which had been opened from İzmir-Uşak Highway to the lands around the Project Site. Thus, construction of additional roads will not be required and related emissions will not occur.

2.7.2 Technology Alternatives

Geothermal power plants use steam produced from geothermal reservoirs to generate electricity. There are three geothermal power plant technologies being used to convert hydrothermal fluids to electricity - dry steam, flash steam and binary cycle (U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy).

Resource characteristics such as temperature, pressure, volumes of fluid produced, and chemical properties of the geothermal reservoir are the primary determinants of the size and type of power conversion equipment (Kaplan and Serpen, 2010). Dry steam plants use hydrothermal fluids that are primarily steam. The steam flowing directly through a turbine drives a generator that produces electricity. Hence, the steam eliminates the need to burn fossil fuels to run the turbine (also eliminating the need to transport and store fuels). These plants emit only excess steam and very minor amounts of gases.

In flash steam plants, on the other hand, fluid at temperatures greater than 182°C is pumped under high pressure into a tank at the surface held at a much lower pressure, causing some of the fluid to rapidly vaporize, or "flash". The vapor then drives a turbine, which drives a generator. If any liquid remains in the tank, it can be flashed again in a second tank to extract even more energy.

Binary cycle geothermal power generation plants differ from dry steam and flash steam systems in that the water or steam from the geothermal reservoir never comes in contact with the turbine/generator units. Heat from the low to moderately heated (below 204°C) geothermal fluid passing through a heat exchanger causes the secondary (hence, "binary") fluid with a much lower boiling point to flash to vapor, which then drives the turbines and subsequently, the generators. Binary cycle power plants are closed-loop systems, and virtually nothing (except water vapor) is emitted to the atmosphere (U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy). With respect to air emissions, in closed-loop systems, which are, binary cycle power plant systems, the geothermal fluid extracted from the well are not exposed to the atmosphere and are injected back into the ground after utilization of their heat, so air emissions are minimal. In contrast, open-loop systems, which are, namely, dry steam and flash steam power plants systems, emit hydrogen sulfide (H_2S), carbon dioxide (CO_2), ammonia (NH_3), methane (CH_4), and boron (B_2) among which hydrogen sulfide is the most common emission. Once in the atmosphere, hydrogen sulfide transforms into sulfur dioxide (SO_2). This contributes to the formation of small acidic particulates that can be absorbed by the bloodstream and cause heart and lung diseases. Sulfur dioxide also causes acid rain, which damages crops, forests, and soils, and acidifies lakes and streams. However, SO_2 emissions from geothermal plants are approximately 30 times lower per megawatt-hour than from coal plants.

Some open-loop geothermal power plants systems also produce small amounts of mercury emissions, which must be mitigated using mercury filter technology. Scrubbers can reduce air emissions, but they produce a watery sludge composed of the captured materials, including sulfur, vanadium, silica compounds, chlorides, arsenic, mercury, nickel, and other heavy metals. This toxic sludge often must be disposed of at hazardous waste sites.

In terms of greenhouse gas emissions, approximately 10 percent of the air emissions are carbon dioxide, and a smaller amount of emissions are methane in open-loop geothermal systems. The amount of greenhouse gas emissions for open-loop systems is estimated as 0.045 kilograms of carbon dioxide equivalent per kilowatt-hour, approximately. In closed-loop systems, these gases are not released into the atmosphere, but there are still some emissions associated with construction of plant and surrounding infrastructure (Union of Concerned Scientists).

Currently in Turkey, single flash, double flash and binary cycle power plants are in operation. Since binary cycle is more feasible for low-and medium- enthalpy geothermal fields because of high concentration of calcium carbonate and NCG content of geothermal fluids, it is the most common cycle applied in Turkey (Kaplan and Serpen, 2010).

Air-Cooled Binary System will be used in Sanko GPP. In this system geothermal fluid, is extracted from the underground reservoir and flows from the wellhead through a gathering system of insulated steel pipelines to a heat exchanger, which heats a secondary working fluid which has a low boiling point. In this system secondary working fluid is n-pentane, and is vaporized and used to drive the turbine. The organic fluid is then condensed in a condenser

which is cooled by air. The condensed fluid is then recycled back to the heat exchanger, closing the cycle within the sealed system. Cooled geothermal fluid is then reinjected back into the reservoir. Since the system operates in close loop neither the geothermal fluid nor the secondary working fluid has contact with the environment or each other. Therefore binary systems have a longer economical life than the flash type plants. Because of the closed loop there is no loss of working fluid to the environment which is another advantage of the binary systems over flash type systems in terms of environmental impact.

In a typical single-phase (pumped) binary power plant, the geothermal fluid is kept in liquid phase throughout the entire process. Usually, the geothermal fluid will have to be pumped from the well, but in exceptional cases, the wellhead pressure is high enough for the well to be self-flowing. To keep the NCGs in the liquid, it is necessary to maintain high pressure through the heat exchanging process. It is also possible to use chemical inhibitors to avoid precipitation of minerals such as calcite that can clog equipment and wells, resulting in additional repair costs. Full reinjection and “zero-emission” is possible for this cycle. If gas emission is to be prevented, the operating pressure needs to be kept high enough to prevent the NCGs from coming out of solution. The NCGs can be vented from the heat exchanger if reinjection is not preferred.

In a two-phase (flash) binary power plant, the geothermal fluid is flashed in a separator. The steam and NCGs are used to boil the working fluid in the vaporizer. It may involve a preheater where the brine is used to heat the working fluid before it enters the vaporizer. Another common design is to have brine and steam both enter the vaporizer directly but keeping them separated through the process. As the steam passes through the vaporizer, it condenses and the NCGs are vented out of the vaporizer to prevent pressure build-up (Thráinn Fridriksson, 2016).

Two-phase (flash) binary system will be used at Sanko GPP Project where full reinjection and minimization of CO_2 emissions is aimed. CO_2 release from the Project is calculated and presented in Section 7.2.9.

2.7.3 Other Energy Generation Alternatives

According to the Strategic Plan of Turkey for 2015-2019 published by the Ministry of Energy and Natural Resources, it is in significance importance to utilize the renewable energy resources of Turkey. Therefore increasing the use of renewable energy for electricity generation as well as for heating purposes is an objective of the Strategic Plan.

Geothermal power plants based on geothermal resources provide renewable energy generation with low CO_2, NOx and SOx gas emissions compared to fossil fuel combustion plants. Geothermal resources also enable various uses such as heating, mineral derivation besides energy generation.

If the Project had not been located on a geothermal reserve, development of a solar power plant or thermal power plant could have been considered for the area. Although there would be less environmental issues to govern for a solar power plant much larger area would be

required for the same power generation by the solar power plant i.e. approximately 24 ha would be required for the solar power plant project as compared to 7 ha to be used for the proposed project. Larger areas required for the realization of a solar power plant would lead to considerably high land acquisition costs. Regarding the opportunity for employment, less number of people would be employed during the construction and operation phases. Moreover considering the Project is located in an important geothermal resource area, establishing a solar power plant would lead to potential economic loss.

Considering establishment of a coal fired power plant there are several environmental issues including cooling water requirement, disposal of ash, high cost for coal supply along with the need for coal storage areas and also emission control systems.

2.7.4 No Project Alternative

The “no project” alternative would result in the continuation of the current situation, which would comprise of agricultural areas and unexploited geothermal water resources, and no development of the power plant planned in the Project. The Project is geared to meeting Turkey’s growing energy demand by means of renewable energy. Therefore, the “no project” alternative would result in a negative impact on national energy policies.

The Project is located within a rural agricultural area with no species of conservation status. The level of economic development in the area is poor, so without the Project, there would be no new source of employment for the local communities. On the other hand the Project has environmental and social impacts which would not have occurred in the absence of the Project.

3. LEGAL FRAMEWORK

This ESIA study is carried out based on relevant national legislation as well as the lender's guidelines. The main legislation and guidelines are mentioned in the following sections together with their implications for the Project stages.

3.1 Turkish Legislation

The key national laws and regulations presented in this section include the legal requirements to reduce the potential environmental impacts that may arise from the construction and operational activities of the Project. Turkish Legislation related to the Project is presented in the following sections under relevant subtopics.

3.1.1 Turkish Environmental, Health and Safety (EHS) Legislation

"Environmental Law", which is ratified in August 1983 (amended with the Law July 7, 2015; No: 6486), is one of the principal legislation related to the Project. Several by-laws and decrees are enforced under the Environmental Law.

The "Regulation on Environmental Impact Assessment (dated November 25, 2014; No: 29186 and amended on May 26, 2017; No: 30077)" defines the administrative and technical procedures and principles to be followed throughout the EIA process. It should be noted that the Project was previously listed under Annex-II, Article 49-a of the Regulation, and a Project Description Report was prepared accordingly. Therefore an EIA report was prepared for the Project and submitted to the Ministry of Environment and Urbanization. "EIA positive" decision was secured on February 14, 2017.

The rest of the national EHS legislation that the Project will comply with is presented as Table 3-1 below.

Table 3-1. Turkish EHS Legislation Related to the Project

Legislation	Official Gazette Date	Official Gazette Issue	Implications for the Project Stages
Waste Management Regulation	02.04.2015 23.03.2017	29314 30016	• Disposal of wastes generated by construction staff during construction stage and by operation staff during the operation stage • Hazardous wastes generated at construction and operation stages
Water Pollution Control Regulation	31.12.2004 10.01.2016	25687 29589	• Discharge of wastewater generated by site staff at construction stage and by operation staff during the operation stage
Regulation on Landfill of Wastes	26.03.2010 11.03.2015	27533 29292	• Drilling mud generated during the construction stage
Waste Oil Control Regulation	30.07.2008 05.11.2013	26952 28812	• Waste oils generated at construction and operation stages
Waste Vegetable Oil Control Regulation	06.06.2015	29378	• Waste vegetable oils generated at construction and operation stages
Packaging Waste Control Regulation	24.08.2011	28035	• Packaging wastes generated at construction and operation stages
Medical Waste Control Regulation	22.07.2005 21.03.2014	25883 28948	• Medical wastes generated at construction and operation stages
Regulation on the Control of End-of-life Tires	25.11.2006 11.03.2015	26357 29292	• End-of-life tires generated at construction and operation stages
Regulation on the Control of Waste Batteries and Accumulators	31.08.2004 23.12.2014	25569 29214	• Waste batteries and accumulators generated at the construction and operation stages
Regulation on the Construction of Septic Tanks at Places Where Sewer Construction is Not Feasible	19.03.1971	13783	• Septic tanks for the collection of domestic wastewater generated at construction and operation stages
Regulation on the Noise Emission in the Environment from Equipment for Outdoor Use	30.12.2006 06.06.2017	26392 30088	• Noise levels caused by noise sources within the Project site at the construction and operation stages
Industrial Air Pollution Control Regulation	03.07.2009 20.12.2014	27277 29211	• Dust emissions at the construction stage and CO_2 emissions at the operation stage
Regulation on Assessment and Management of Air Quality	06.06.2008 05.05.2009	26898 27219	• Emissions originating from the Facility during the operation stage
Regulation on the Control of Odorous Emissions	19.07.2013	28712	• Odorous emissions generated during the operation stage

Legislation	Official Gazette Date	Official Gazette Issue	Implications for the Project Stages
Regulation on Assessment and Management of Environmental Noise	04.06.2010	27601	• Noise emissions at construction and operation stages
Regulation on Soil Pollution Control and Point Source Polluted Areas	08.06.2010 11.07.2013	27605 28704	• Risks of soil contamination at construction and operation stages
Regulation on the Control of Excavation Soil, Construction and Debris Wastes	18.03.2004 26.03.2010	25406 27533	• Transportation and disposal of excavation waste and construction debris at the construction stage
Law on Occupational Health and Safety (6331) (as amended with the Law numbered 7033)	20.06.2012 01.07.2017	28339	• Health and safety measures to be taken during construction and operation stages
Regulation on Buildings to be Constructed within the Seismic Zones	06.03.2007 03.05.2007	26454 26511	• Construction works within the scope of the Project

3.1.2 Turkish Energy Legislation

Project-related Turkish energy legislation is presented below in Table 3-2.

Table 3-2. Turkish Energy Legislation Related to the Project

Legislation	Official Gazette Date	Official Gazette Issue	Implications for the Project Stages
Electricity Market Law No. 6446 (as amended with the Law numbered 6639) and relevant regulations	30.03.2013 15.04.2015 01.07.2017	28603	Rights and responsibilities of the Project Company regarding electricity production and transmission Expropriation of private properties
The Law No. 5346 on the Use of Renewable Resources for the Generation of Electrical Energy (as amended with the Law numbered 6446) and relevant regulations	18.05.2005 30.03.2013	25819	Procedures and principles of the conservation and utilization of renewable energy resource areas Certification of the energy generated from the utilization of these resources
Geothermal Resources and Natural Mineral Water Law No. 5686 (as amended with the Law numbered 6527) and relevant regulations	13.06.2007 01.03.2014	26551	Monitoring requirements regarding geothermal resource preservation and being the right-holder for these resources

3.1.3 Turkish Legislation on Land Use

The Project site is located on privately owned agricultural lands and agricultural lands and houses. According to the official letter from Provincial Directorate of Food, Agriculture and Livestock (PDoFAL) (dated 26.09.2016); required lands for the Project are in the scope of "Law on Soil Protection and Land Use". According to the law agricultural lands cannot be used other than agricultural purposes other than the plans and investments with public interest consent from the Board of Ministry and investments on renewable energy resource areas providing compliance to soil conservation projects. It was stated in the official letter of the PDoFAL that the Project development in the subject area could be consented with the approval of Provincial Board of Soil Conservation. According to the statement of PDoFAL, receiving the required Land-use permits is an obligation for the Project Company. The Project secured public interest consent for Project development on agricultural lands as required on August 23, 2016 from the Energy Market Regulatory (EPDK) (Annex-4)

Expropriation did not occur for the Project of 15 MW capacity and land purchase has been completed through voluntary purchase method.

On the other hand land acquisition for the ETL is on-going through expropriation under the authority of TEDAŞ. The Project Company has issued agreements with the land owners for access authority to the lands before the completion of the expropriation process. According to the agreements negotiated prices for early access have been paid to the land owners.

Project-related Turkish Legislation on Land-use is presented in Table 3-3.

Table 3-3. Project-related Turkish Legislation on Land-use

Legislation	Official Gazette Date	Official Gazette Issue	Implications for the Project Stages
Regulation on Geothermal Area Use for Electricity Generation	14.10.2008	27024	Land acquisition and use
Expropriation Law No. 2942 (as amended with the Law numbered 6645) (as amended with the Law numbered 6754) and relevant regulations	08.11.1983 23.04.2015 24.11.2016	18215	Expropriation of private properties
Pasture Law No. 4342 (as amended with the Law numbered 6552) (as amended with the Law numbered 6824) and relevant regulations	28.02.1998 31.01.2015 08.03.2017	23272	Permission(s) required for land use
Law on Soil Conservation and Land Use No. 5403 (as amended with the Law numbered 6537) and relevant regulations	19.07.2005 15.05.2014	25880	Permission(s) required for land use
Law on Aquaculture Resources No. 1380 (as amended with the Law numbered 5996)) (as amended with the Law numbered 5957)and relevant regulations	04.04.1971 13.12.2010 01.01.2012	13799	Permission(s) required for land use

Legislation	Official Gazette Date	Official Gazette Issue	Implications for the Project Stages
Law on Reclamation of Olive Cultivation and Inoculation No. 3573 (as amended with the Law numbered 4086) (as amended with the Law numbered 5728) and relevant regulations	07.02.1939 28.02.1995 08.02.2008	4126	Permission(s) required for land use

3.1.4 Turkish Legislation on Conservation of Nature and Wildlife

Project-related Turkish legislation on Conservation of Nature and Wildlife is presented below in Table 3-4.

Table 3-4. Project-related Turkish Legislation on Conservation of Nature and Wildlife

Legislation	Official Gazette Date	Official Gazette Issue	Implications for the Project Stages
Wetland Conservation Regulation	04.04.2014	28962	Conservation of the stream beds located within the boundaries of the project site
Regulation on the Management of Natural Assets, Natural Protected Areas, and State-Owned Lands Located on Environmental Conservation Lands	02.05.2013	28635	Measures to be taken during chance finds at the construction stage
Law on Conservation of Cultural and Natural Assets No. 2863 (as amended with the Law numbered 6552) (as amended with the Law numbered 6745) and relevant regulations	23.07.1983 20.08.2016 07.09.2016	18113	Measures to be taken during chance finds at the construction stage
Land Hunting Law No. 4915 (as amended with the Law numbered 6527) and relevant regulations	11.07.2003 01.03.2014	25165	Monitoring requirements regarding hunting and terrestrial wildlife

The Project Company is required to secure the permits mentioned below in Table 3-5.

Table 3-5. Permits Required for the Project

Permit/License	Date	Progress
"EIA Positive" decision for the Power Plant	February, 2017	EIA Decision secured from the Ministry of Environment and Urbanization.
"EIA Not Required" for 3 production and 2 reinjection wells	May, 2010	Decision secured from the Provincial Directorate of Environment and Urbanization
"EIA exclusion decision" for additional 5 drilling wells	January, 2016	Decision secured from Provincial Directorate of Environment and Urbanization.
Land-use Permit	August 23, 2016	Consent secured from the the Energy Market Regulatory (EPDK)

3.2 International Standards

Since the potential lender for the Project is Development Bank of Turkey (TKB), the Project must be in compliance with good international practice, including World Bank (WB) Safeguard Policies, guides, performance standards and best practices documents alongside the National EHS Legislation.

World Bank governs projects and activities by the Safeguard Policies in order to assure that they are conducted in an environmentally, financially and socially sound manner. Safeguard Policies include Environmental Assessments and other policies that define environmental and social adverse effects of the projects as well as their reduction and prevention. These policies are enlarged upon in “The World Bank Operations Manual”, which also provides guidance on compilation with the Operational Policies (OP), Bank Procedures (BP) and Good Practices (GP). OPS are defined as statements of policy objectives and operational principles including the roles and obligations of both the Borrower and the Bank, while BP are compulsory procedures to be followed by both the Borrower and the Bank and GP are non-compulsory advisory material. Specific policies related to the Project are listed below:

Environmental Policies

- OP/BP 4.01 Environmental Assessment
- OP/BP 4.04 Natural Habitats

Social Policies

- OP/BP 4.11 Physical Cultural Resources

BP 17.50 Bank Disclosure Policy

The main objectives and tasks of the Project-related WB Safeguard Policies are explained below:

OP/BP 4.01 Environmental Assessment

- To ensure the proposed projects’ environmental and social sustainability and soundness
- To inform decision-makers about the environmental and social risks
- To increase transparency by providing stakeholder engagement in the decision-making process

OP/BP 4.04 Natural Habitats

- To conserve natural habitats and their biodiversity
- To avoid significant conversion/degradation of critical natural habitats
- To ensure the sustainability of services and products provided to human society by natural habitats

OP/BP 4.11 Physical Cultural Resources

- To ensure the identification and protection of Physical Cultural Resources (PCR), including archaeological and historical sites, historic urban areas, sacred sites, graveyards, burial sites and unique natural values
- To ensure the compliance with national legislation regarding the protection of physical cultural property

OP/BP 4.12 Involuntary Resettlement

- To avoid or minimize involuntary resettlement where feasible, exploring all viable alternative project designs;
- To assist displaced person in improving their former living standards; it encourages community participation in planning and implementing resettlement;
- To provide assistance to affected people, regardless of the legality of title of land.

BP 17.50 Bank Disclosure Policy

- To support the decision-making process by allowing public access to information on environmental and social aspects of projects.

Under the Operational Policy for Environmental Assessment (OP 4.01), WB conducts an environmental scanning and classifies the proposed projects under Categories A, B and C, based on the level of their likely environmental impacts. Furthermore, Category B projects divide in two within its structure as B and B+, based on the special circumstances of the project in question.

4. METHODOLOGY

4.1 Area of Influence

The Area of Influence (AoI) is an important element in assessing environmental and social impacts of a proposed development since it lets us know the physical and/or social extent in which the assessment should be performed. According to the definition given in Performance Standard 1 of the IFC, the AoI encompasses, as appropriate:

- The area likely to be affected by: (i) the project[1] and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project; [2] (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.
- Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.[3]
- Cumulative impacts[4] that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.

The AoI of the Project is provided below in Figure 4-1.

[1] *Examples include the project's sites, the immediate airshed and watershed, or transport corridors.*

[2] *Examples include power transmission corridors, pipelines, canals, tunnels, relocation and access roads, borrow and disposal areas, consruction camps, and contaminated land (e.g., soil, groundwater, surface water, and sediments).*

[3] *Associated facilities may include railways, roads, captive power plants or transmission lines, pipelines, utilities, warehouses, and logistics terminals.*

[4] *Cumulative impacts are limited to those impacts generally recognized as important on the basis of scientific concerns and/or concerns from Affected Communities. Examples of cumulative impacts include: incremental contribution of gaseous emissions to an airshed; reduction of water flows in a watershed due to multiple withdrawals; increases in sediment loads to a watershed; interference with migratory routes or wildlife movement; or more traffic congestion and accidents due to increases in vehicular traffic on community roadways.*

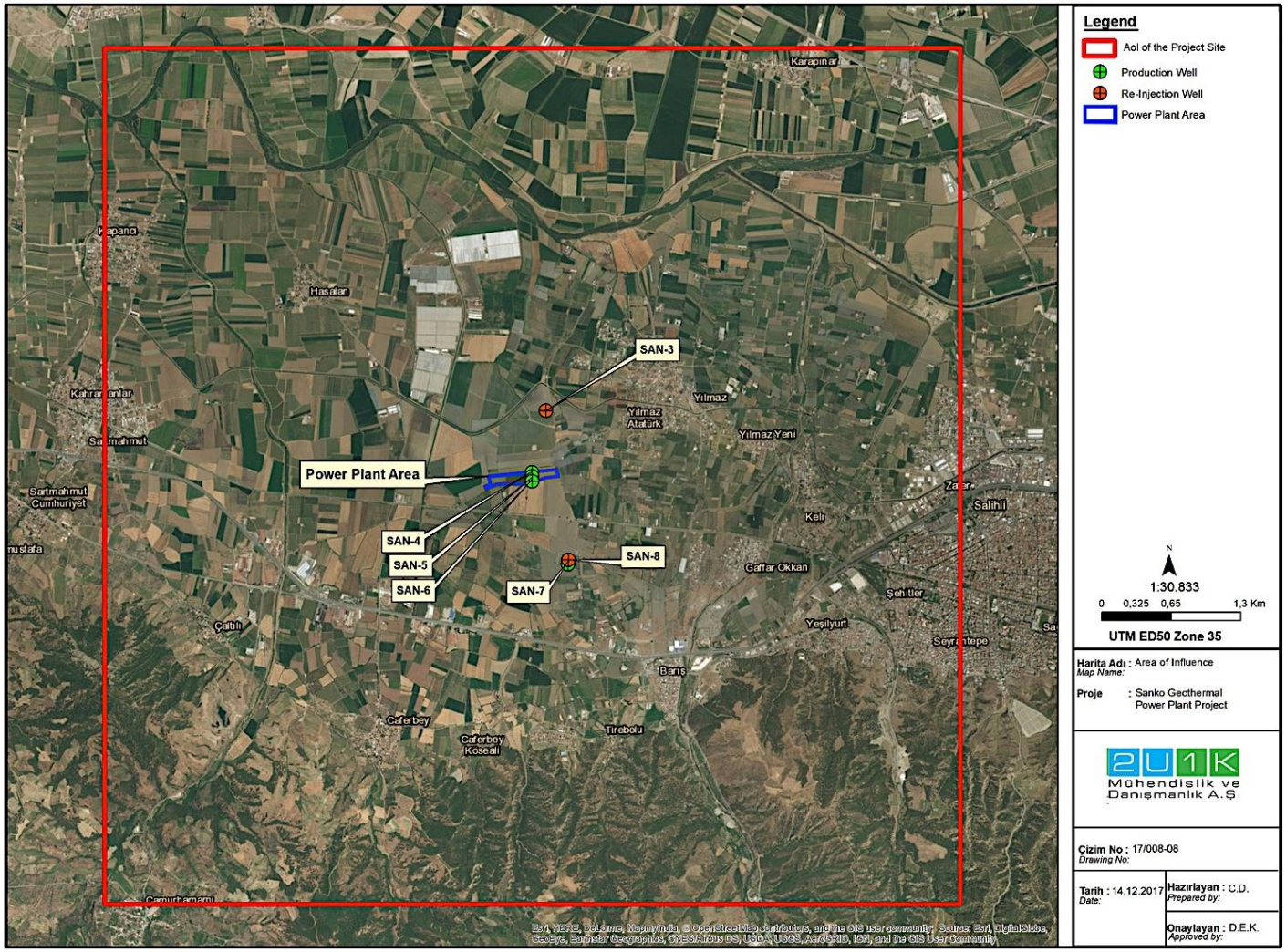

Figure 4-1. AoI of the Project

AoI for Environmental Impacts

The AoI was determined mainly to cover the impacts on the footprint and the vicinity of the Project as well as the impact area regarding air emissions. In this respect a 8x8 km impact area was selected for H_2S emissions assessment which also covers the area for the closest sensitive noise receptor. For the assessment of construction and operation noise levels due to the Project the closest sensitive receptor which is Yılmaz Neighbourhood at a distance of 600 m was included in the AoI. With regards to groundwater quality, sampling from the existing two wells at the Project site close to the production well SAN-4 has been conducted. Baseline data on soil quality assessment and the ecological surveys were also included in the AoI.

AoI for Social Impacts

The AoI for social impacts is determined by considering the impacts sourced from land acquisition, workers' accommodation, noise during construction and operation phase, labour influx, changes on dust and air quality.

The settlement in which experienced land allocation due to Project activities and / or the closest settlement to the Project Site that may experience primarily environmental impacts of the Project will be considered as the first impact zone. In other words, the first impact zone may experience direct impacts of the Project. Therefore, Yılmaz neighbourhood, being the closest settlement in which may experience direct environmental and social impacts and experienced almost all land acquisition for the first phase of the Project, is considered within the first impact zone. Sanko used voluntary purchase method for land take of the area required for the Project. Land take process and payment for the purchased lands have been completed and there will be no more land acquisition for the Project. Further information on Project's land allocation can be found in Section 8.2 of this Report. Last, it is important to note that, there has been no physical displacement caused due to Project activities.

Second impact zone may cover majority of the indirect Project impacts such job opportunities, providing of goods and service. Therefore, the second impact zone will cover the settlements as Gaffar Okan, Hasalan and Caferbey. Also, changes on dust and air quality may be experienced in the second zone as well since the most distant settlement, Caferbey, is 2 km away from the Project Site.

4.2 Methodology for the Baseline Assessment

Environmental baseline data have been compiled through available reports, literature review and onsite measurements performed by 2U1K. Onsite sampling and measurements include the following:

- Background noise measurements at Yılmaz Neighbourhood.
- PM10 sampling and analysis at Yılmaz Neighbourhood.

- Passive sampling at Yılmaz Neighbourhood, Power Plant area, Well no: SAN-3, Near Lider Tarım, Caferbey Neighbourhood, Çatılı Neighbourhood, Gaffar Okan Neighbourhood, Karapınar Neighbourhood, Hasalan Neighbourhood, Near the Power Plant
- Groundwater analysis

Quantitative and qualitative data have been compiled for social baseline of the Project. Primary data obtained for the Project

Community level assessments were conducted between July 4-6, 2017 for the purpose of gathering primary data, and include the following:

- 4 focus group meetings held for each neighbourhood,
- 5 in-depth interviews with the government agencies and non-governmental organizations in the district and the province.
- 2 in-depth interviews with the locals who sold their lands to the Project Company,
- Community level surveys with the Mukhtars of the AoI.

Female Focus Group Discussions were not able to conduct due to cultural conditions of the AoI. All of the Mukhtars of the AoI declined to set a meeting with for female focus group.

Secondary data was collected and prepared through regional and national statistics, newspaper archives and project documents. Secondary data holds an important role in reaching key stakeholders and project affected people before designing the field study. Information gathered from the secondary data increases the quality of field study and time efficiency during the field study.

Sources of information generally used for the SIA are:

- Data from Turkish Statistical Institute (TURKSTAT),
- Information from Salihli Municipality,
- Evaluation reports of Non-Governmental Organizations,
- National EIA Report and its appendices dated on 02.01.2017,

Information on social parameters, gathered during public participation meetings.

4.3 Methodology for the Impact Assessment

Identification and evaluation of impacts begin with the stage of scoping process. Impact assessment is a result of determining the possible impacts of project related activities within the aspects of physical, biological and social environment. During the impact assessment of the Project, possible interactions between the Project and surrounding environment have been defined, in order to provide the entire potential Project related impacts. In that aspect, impact is defined as changes originated from project and project related activities. In order to recognize impacts, the baseline study of the AoI has been established. General nature and types of the impacts categorized in Table 4-1 shown below.

Table 4-1. Impact Types and Definitions

Impact Type	Definition
Positive	Impacts that make positive changes over the current conditions.
Negative	Impacts that leads to new and undesirable changes over the current conditions.
Direct	Direct impacts occur through direct interaction of an activity with an environmental, social, or economic component.
Indirect	Impacts which are not a direct result of the project, often produced away from or as a result of a complex impact pathway.
Cumulative	Impacts that consist of an impact that is created as a result of the combination of the project evaluated in the current project together with other projects causing related impacts.

As seen in Table 4-2, impacts may occur as positive, negative, direct, indirect and cumulative. Determination of the type of impact is the important step of the assessment process. The determination of the impact type is based on geographical size, duration, significance and likelihood of the impact. Table 4-2 below provides information regarding the process of determining impact significance, respectively.

Table 4-2. Impact Criteria

Impact Extent	***Project Area:*** potential impacts that only cover the borders within the construction site**.** ***Local:*** potential impacts area that covers 20 km within the construction activities of the project. ***Regional:*** potential impacts that cover the throughout the district level. ***National:*** potential impacts that expected to create changes in national level.
Impact Duration	***Temporary:*** extend of the impacts expected to be less than 6 months. ***Short-term:*** impacts that are expected to only occur during the construction phase of the project. ***Long-term:*** impacts that are expected to occur throughout the operation phase of the project. ***Permanent:*** impacts that are expected to be permanent to the project affected people.
Likelihood of Impact	***Not likely:*** impacts that are not likely to occur. ***Likely:*** impacts that are likely to occur in most circumstances. ***Certain:*** the outcome of impacts will certainly occur.
Impact Magnitude	***Negligible:*** There is perceptible change to people's lives ***Low****:* Communities are able to adapt with relative ease ***Medium****:* Communities are able to adapt with some difficulty ***High:*** Affected people/communities will not be able to adapt *to changes*

For the determination of impact significance, the matrix below is used:

Table 4-3. Significance Rating

Likelihood		**Unlikely**	**Likely**	**Certain**
Impact Magnitude	**Negligible**	Insignificant	Insignificant	Insignificant
	Low	Insignificant	Minor	Minor
	Medium	Minor	Moderate	Moderate
	High	Moderate	Major	Major

Impact reversibility is used in order to finalize overall impact assessment. Reversibility can be applied with the use of the matrix below:

Table 4-4. Overall Impact Rating

Impact Reversibility		**High Reversibility**	**Medium Reversibility**	**Low Reversibility**	**Irreversible**
Impact Significance	**Insignificant**	Insignificant	Insignificant	Insignificant	Insignificant
	Minor	Insignificant	Insignificant	Low	Medium
	Moderate	Low	Low	Medium	High
	Major	Low	Medium	High	Critical

5. ENVIRONMENTAL BASELINE

Baseline assessment is comprised of field studies and desk-top review of various sources of information. Baseline assessment is focused on a series of environmental components, as listed below:

- Geology and earthquake risks
- Climate
- Hydrology and surface water quality
- Groundwater quantity and quality
- Noise
- Air quality
- Soil quality
- Ecology

Given that the Project is categorized as a Category B+ investment with limited significant impacts, a partial impact assessment is performed by 2U1K. In this respect, the ESIA Report is based on onsite baseline measurements and social surveys, as well as environmental and social reports developed formerly for the Project.

Table 5-1. Scoping of Environmental Issues

Project Activities	Environmental Issue	Possible Impacts	Baseline Parameters
Drilling	Effluent discharge	• Discharge of drilling fluids including extracted water from exploration and operational wells during testing. • Discharge of domestic wastewater from camp site	• Groundwater quality • Soil quality • Surface water quality
Drilling	Drilling Mud	• Storage and disposal of drilling mud including cuttings	• Groundwater quality • Soil quality
Drilling	Groundwater contamination	• Contamination of groundwater resources in case of percolation of thermal groundwater during drilling and testing.	• Groundwater quality
Drilling	Solid Waste	• Storage and disposal of solid waste.	• Soil quality • Groundwater quality
Drilling	Noise	• Drilling rig, generators, traffic, etc.	• Environmental noise
Drilling, Construction,	Air Emissions	• Possible toxic gas emissions during drilling and well testing (hydrogen sulfide) • Dust emission due to site activities, arrangement of drilling rig area, traffic etc.	• Climate • Air Quality (PM10, H_2S)
Drilling and Construction	Ecosystem	• Disturbance of natural habitats from construction, e.g. dust, noise, un-seasonal working, poor siting of new works, disposal of untreated wastes, etc.	• Flora • Fauna

Project Activities	Environmental Issue	Possible Impacts	Baseline Parameters
Drilling and Construction	Soil	• Loss of topsoil during preparation of rig sites, or disposal of excavated materials • Damage to soil structure due to material storage, traffic, etc. • Erosion due to uncontrolled surface run-off where vegetation is cleared	• Soil quality
Drilling	Emergency and environmental safety	• Well blowout during drilling	-
Drilling and Operation	Water Resources	• Possible over flow from mud pit. • Contamination/pollution of resource, drilling chemicals, fuel & oil, hazardous wastes, wastewater, etc.	• Soil and groundwater quality

5.1 Geology and Earthquake Risks

Geology and earthquake risks for the Project area is assessed in the following section based on the information compiled from the EIA report and Geological-Geotechnical Survey report of the Project area.

The Project area is located at the west of Salihli District Center at both sides of İzmir-Ankara Highway. The Project area falls into the southern part of Gediz Graben. Geological feature around Salihli is quite plain: The region is made up of metamorphic rocks and karstic marbles belonging to the Mesozoic Menderes Massif.

Gediz Graben is a WNW – ESE trending half graben with a length of 140 km, at the north of Menderes Massif lying between Kemalpaşa-Sarıgöl. Gediz Graben is considered to have an uncommon graben structure and the evolution of the graben is based on late detachment of Menderes Massif under tensile stress. Regional geology is provided below in Figure 5-1.

The Project is located on a flat topography without natural disaster risks such as landslide risks, rock fall and avalanche. It is stated in the EIA report that landslide risk is not defined for the Project area according to Turkey Landslide Inventory Map published by The General Directorate of Mineral Research and Exploration (MTA).

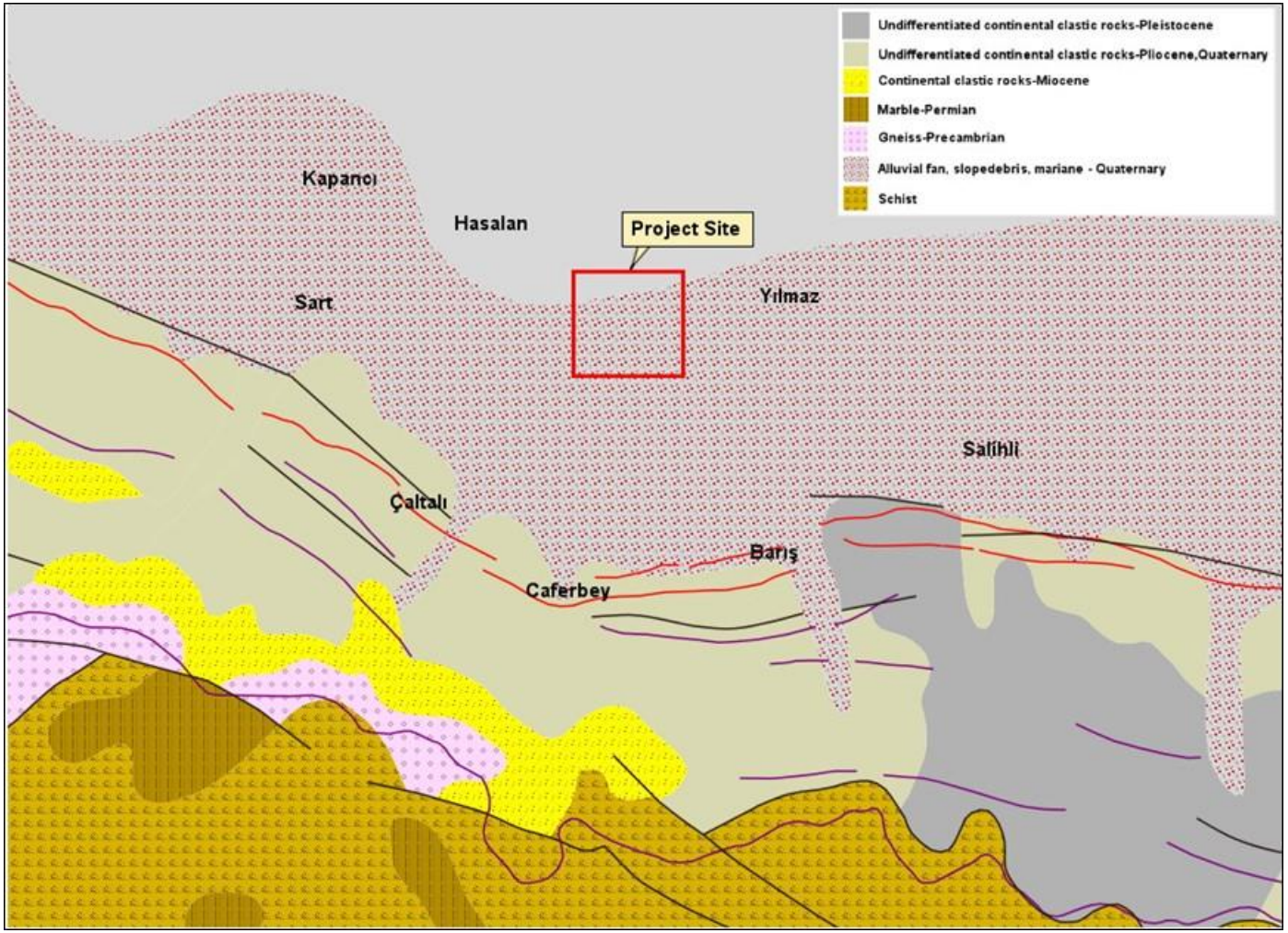

Figure 5-1. Geology in the Region

Manisa Province is within 1. Degree Earthquake Risk Zone. There have been 482 earthquakes recorded in West Anatolian Region and around belonging to historical period. 73% of the earthquakes is recorded with a magnitude of 5.5 M and below.

Although Gediz Graben is quite explicit morphologically between Sarıgöl-Salihli, faults which restrict the area, intersect metamorphic rocks, Myosene, Pliosene and Quaternary rocks.

Detachment fault which restrain the graben along the southern side is the main structural element of the system. There is a series of synthetic and antithetic fault laying broadly parallel along the of the southern border of the graben. On the northern border of the detachment fault, there is the antithetic structure. Graben with WNW-ESE elongation widens to west direction after passing Salihli and separated into branches.

Manisa fault passes at a distance of approximately 2,000 m from the south of the Project area. Manisa fault falls within the northwest branch of Gediz Graben. Closest active fault is Manisa Active Fault at a distance of approximately 2,500 m to the southern border of the Project area according to the MTA Active Faults Map. Topographical map of the region is provided in Figure 5-2.

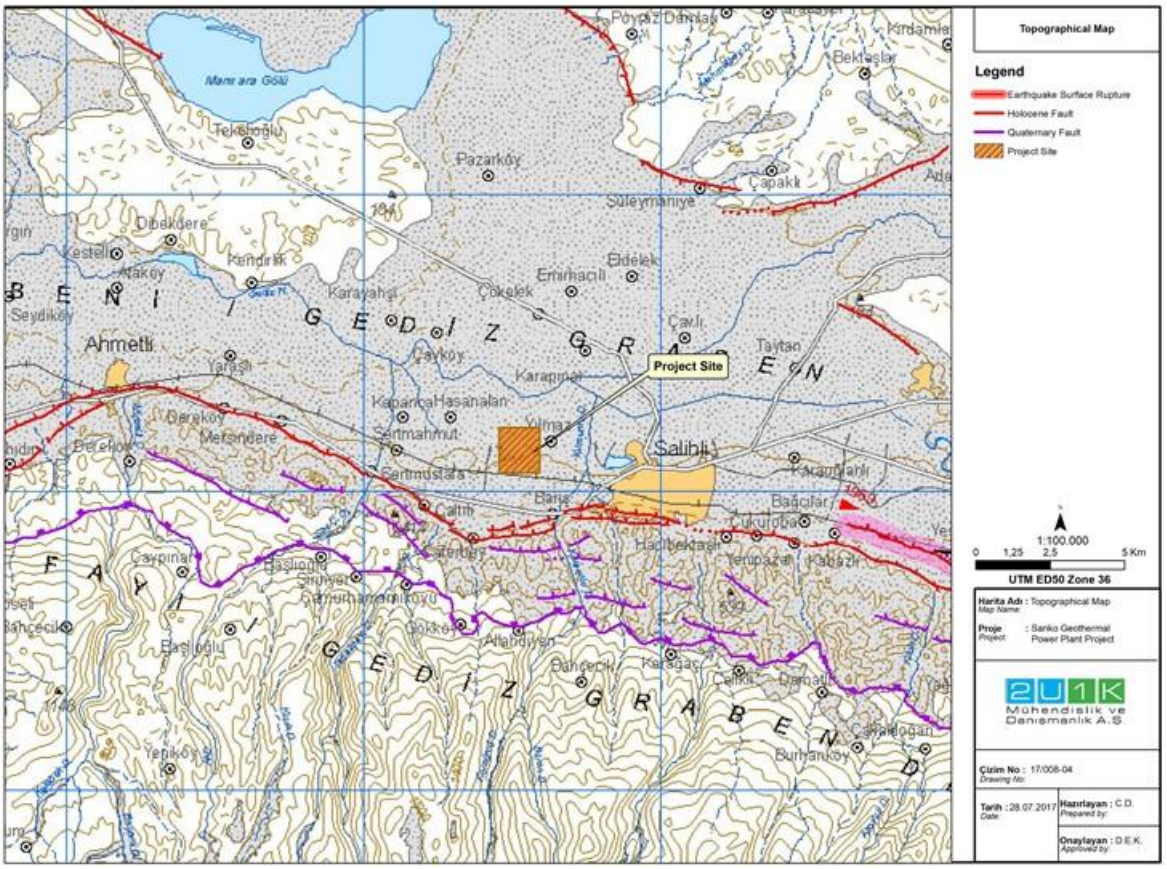

Figure 5-2. Topographical Map of the Region

A Geological-Geotechnical Survey was conducted for the Project Area in October, 2016. Geophysical survey was also conducted for the Project area within the abovementioned study. Seismic tests were performed in order to calculate S and P waves and then ground dynamic elastic parameters are determined using the measured velocity.

Earthquake risk analysis was also conducted within the scope of Geological-Geotechnical Survey for the Project area. 100 km radius area between 27.30°-29.36° E and 37.43°-39.24° N is investigated for possible earthquake impacts on the Project area. Seismic risk analysis has been conducted based on 53 earthquakes which occurred between 1900-2010 with magnitude of 4.5 and higher. Data on earthquakes were based on Boğaziçi University, Kandilli Observatory databank.

Linear relation between earthquake number and magnitude is determined using Gutenberg-Richter (a and b coefficient) parameters obtained from frequency-magnitude linear regression. Gutenberg-Richter parameters obtained are given below Table 5-2.

Table 5-2. Gutenberg-Richter Parameters

LogN=a-bM results	
a	4.90
b	1.11
Coefficient	0.62

Earthquake number-magnitude relation based on Gutenberg-Richter parameters is determined as Log (N)=4.90-1.11M.

The probability of earthquake occurrence with a magnitude of higher than 5.0, 5.5 and 6.0 in 5 and 10 years is given below in Table 5-3.

Table 5-3. Earthquake Occurrence Probability

Magnitude	Earthquake Occurrence Probability		N1	Earthquake Return Period
	5 years	10 years		
5.0	65.9	88.4	0.53	5
5.5	25.8	44.9	0.1	17
6.0	7.9	15.3	0.04	60

As can be seen at the table, the probability of occurrence of an earthquake with 6.0 magnitude in 10 years is 15% in the project area.

The exposure risk to earthquake for the buildings in the investigation area is high regarding the lifetime of the buildings. Therefore all the buildings will be constructed in line with the required structure standards and the outputs obtained from geotechnical study. Since the project area is within the 1st Degree Earthquake Zone all structures will be constructed in compliance with the provisions of the Regulation on the Buildings to be Constructed at

Earthquake Zones. The requirements of the regulation apply for the power plant building but not for drilling wells, pipeline or the ETL. However the drillings of deep wells are performed based on critical geotechnical parameters.

It was also stated in the report that the investigation area has not been classified as “Zone with Exposure to Disaster”.

The Project is located on a flat topography with 1° %-10°% slope. Project area is made up of Quaternary Alluvium (Qal) unit according to MTA 1/25000 scale geological map. Drilling works for the study comprised of 5 geotechnical drilling of 15 meters and 2 geotechnical drillings of 20 meters. Topsoil of 50 cm, and below silty sand up to 20 meters and silty gravel units were observed along with low plasticity inorganic silt. Groundwater level is observed at 10 meters depth.

Liquefaction is expected between 13.50-20 meters at SK-1, 13.5-15 meters at SK-2, 12-15m at SK-3, 10.50-15m at SK-4, 10.5-15 at SK-5, 12m-20m at SK-6 and at 12-15 m at SK-7. According to the liquefaction analysis, liquefaction at 10.5 m-20 meters is expected. The area is classified as Areas with Preventive Measures with regards to availability for settlements.

The area is suggested to be improved by methods such as injection techniques, jet grouting, cement injection for avoiding liquefaction.

5.2 Surface Water and Groundwater Quality

The Project area is within “Gediz River Basin”. According to the topographical map provided in the EIA report, there are 2 rivers, 1 lake and 1 dam pond around the Project area. Gölmarmara Lake is about 11.5 km to the Project area. Demirköprü Dam is at about 24 km. Gediz River and Kurşunlu Stream which is a branch of Gediz River is at about 2 km and 2.2 km respectively. Since the Project area is located in agricultural lands there are irrigation channels close to the Project area. An irrigation channel which connects to Tabakçayı Stream passes at a distance of 1,800 m and another irrigation channel at a distance of 360 m from the west and north of the Project Area respectively. These two channels merge at a distance of 2,350 m northwest. There is also a drying channel at the west of the Project area with a distance of 500 m.

No impact is expected on surface water due to the Project activities according to the EIA report of the Project, nevertheless all Project activities will be conducted with compliance to the requirements of the Regulation on Regulation on Conservation of Wetlands (Official Journal Issue: 27684, Date: 26.08.2010). Any intervention to stream beds in or within the vicinity of the Project area will be avoided, cadastral and existing bed widths will be protected and no activity restraining the flow of the water source will be prevented. The borders of the study area will be determined and drying canals or stream beds will not be used in any case.

There are 2 groundwater wells within the Project area at a distance of approximately 50 m and 80 m to well SAN-4 respectively. Existing two groundwater wells were selected for

sampling in order to determine the baseline groundwater quality conditions at the Project site. Groundwater analysis has been conducted for physical, chemical and microbiological properties of the groundwater regarding the "Regulation on Water for Human Consumption" (Official Journal Issue: 25730, Date: 17.02.2005) and Regulation on Monitoring of Surface Water and Groundwater (Official Journal Issue: 28910, Date: 11.02.2014) Annex-2 "Minimum Monitoring Parameters" during the EIA process of the Project. Comparison according to the requirements of the "Regulation on Water for Human Consumption" is provided in Table 5-4 below:

Table 5-4. Groundwater Analysis Results regarding "Regulation on Water for Human Consumption"

Parameter	Unit	Limit	Results (Well 1)	Results (Well 2)
Fungucites				
Pencanazole	µg/L	0.1	Not detected	Not detected
Metalaxyl	µg/L	0.1	Not detected	Not detected
Tebuconazole	µg/L	0.1	Not detected	Not detected
Diniconazole	µg/L	0.1	Not detected	Not detected
Herbicites				
Simazin	µg/L	0.1	Not detected	Not detected
Atrazin	µg/L	0.1	Not detected	Not detected
Carbamates				
Aldicarb	µg/L	0.1	Not detected	Not detected
Propoxur	µg/L	0.1	Not detected	Not detected
Oxamyl	µg/L	0.1	Not detected	Not detected
Methomyl	µg/L	0.1	Not detected	Not detected-
Methiocarb	µg/L	0.1	Not detected	Not detected
Carbofuran-3-hydroxy	µg/L	0.1	Not detected	Not detected
Carbofuran	µg/L	0.1	Not detected	Not detected
Carbaryl	µg/L	0.1	Not detected	Not detected
Aldicarb-sulfoxide	µg/L	0.1	Not detected	Not detected
Aldicarb-sulfane	µg/L	0.1	Not detected	Not detected
Chemical analysis				
Boron	mg/L	1	1.959	2.045
Manganese	µg/L	50	Not detected	9.2
Iron	µg/L	200	25,3	34.3
Nickel	µg/L	20	Not detected	Not detected
Mercury	µg/L	1	Not detected	Not detected
Lead	µg/L	10	Not detected	Not detected
Aluminium	µg/L	200	21,2	24.4

Parameter	Unit	Limit	Results (Well 1)	Results (Well 2)
Selenium	µg/L	10	Not detected	Not detected
Copper	mg/L	2	Not detected	Not detected
Chromium	µg/L	50	Not detected	Not detected
Cadmium	µg/L	5	Not detected	Not detected
Arsenic	µg/L	10	Not detected	Not detected
Antimony	µg/L	5	Not detected	Not detected
Color (Physical)	-	Acceptable by consumers and there is no anomaly.	Compliant	Compliant
Odor (Physical)	-	Acceptable by consumers and there is no anomaly.	Compliant	Compliant
Turbidity (Physical)	--	Acceptable by consumers and there is no anomaly.	Compliant	Compliant
Oxidizability	mg/L	5	0.8	0.6
Sodium	mg/L	200	49,4	57.7
Ammonium	mg/L	0,5	Not detected	Not detected
Sulfate	mg/L	250	81,6	97.7
Chloride	mg/L	250	34,1	38.4
Nitrate	mg/L	50	68,1	85.1
Fluoride	mg/L	1,5	0,13	0.14
Nitrite	mg/L	0,5	Not detected	Not detected
Conductivity	20ºC'de µS/cm	2500	688	824
Bromate	µg/L	10	Not detected	Not detected
Total Cyanide	µg/L	50	Not detected	Not detected
pH	pH unit	6,5 – 9,5	6.9	7
Microbiological Analysis				
Total germ count in 22ºC	kob/mL	-	8	>300
Enterococci/Fecal Streptococci	kob/100mL	0	0	1
Escherichia Coli	kob/100mL	0	0	0
Coliform Bacteria	kob/100mL	0	0	0
Monomer Compounds				
Vinyl Chloride	µg/L	0,5	Not detected	Not detected
Epichlorhydin	µg/L	0,1	Not detected	Not detected
Organophosphorus Compounds				
Chlopyriphos-methyl	µg/L	0,1	Not detected	Not detected

Parameter	Unit	Limit	Results (Well 1)	Results (Well 2)
Parathion-ethyl	µg/L	0,1	Not detected	Not detected
Quinalphos	µg/L	0,1	Not detected	Not detected
Chlorpyriphos-ethyl	µg/L	0,1	Not detected	Not detected
Methamidophos	µg/L	0,1	Not detected	Not detected
Malathion	µg/L	0,1	Not detected	Not detected
Ethion	µg/L	0,1	Not detected	Not detected
Disulfoton	µg/L	0,1	Not detected	Not detected
Diazinon	µg/L	0,1	Not detected	Not detected
Azinphos-ethyl	µg/L	0,1	Not detected	Not detected
Azinphos-methyl	µg/L	0,1	Not detected	Not detected
Organochloride Compounds				
Total DDT (op-DDT. Pp-DDT.pp-DDD.pp-DDE)	µg/L	0,1	Not detected	Not detected
Beta-Endusulfan	µg/L	0,1	Not detected	Not detected
Alpha-Endosulfan	µg/L	0,1	Not detected	Not detected
Dieldrin	µg/L	0,03	Not detected	Not detected
Aldrin	µg/L	0,03	Not detected	Not detected
Heptachloreposide(Endo)	µg/L	0,03	Not detected	Not detected
Heptachlor	µg/L	0,03	Not detected	Not detected
Gamma-HCH (Lindane)	µg/L	0,1	Not detected	Not detected
Alpha-HCH (BHC)	µg/L	0,1	Not detected	Not detected
HCB	µg/L	0,1	Not detected	Not detected
Beta BHC	µg/L	0,1	Not detected	Not detected
Endrin	µg/L	0,1	Not detected	Not detected
Chlorfenvinphos	µg/L	0,1	Not detected	Not detected
Total Pesticide	µg/L	0,5	Not detected	Not detected
Polycyclic Aromatic Hydrocarbons				
Fluoranthene	µg/L		Not detected	Not detected
Total PAH	µg/L	0,1	Not detected	Not detected
Indeno(1.2.3-cd)pyrene	µg/L		Not detected	Not detected
Benzo (ghi)perylene	µg/L		Not detected	Not detected
Benzo (k) fluoranthene	µg/L		Not detected	Not detected
Benzo (b) fluoranthene	µg/L		Not detected	Not detected
Benzo (a) pyrene	µg/L	0,01	Not detected	Not detected
Volatile Organic Compounds				
Bromodichloromethane	µg/L		Not detected	Not detected
Dibromochloromethane	µg/L		Not detected	Not detected

Parameter	Unit	Limit	Results (Well 1)	Results (Well 2)
Bromoform	µg/L		Not detected	Not detected
Chloroform	µg/L		Not detected	Not detected
Total Trihalomethanes	µg/L	100	Not detected	Not detected
1,2 – Dchloroethane	µg/L	3	Not detected	Not detected
Benzene	µg/L	1	Not detected	Not detected
Tetrachloroethene and trichloroethene	µg/L	10	Not detected	Not detected

According to the analysis report groundwater from Well 1 does not comply with the regulation requirements in terms of Boron and Nitrate. Groundwater from Well 2 does not comply with the requirements of the regulation in terms of Boron, Nitrate and Enterococcus/Faecal StreptococciProject is located within agricultural lands, where the use of fertilizers with nitrate content is likely. Nitrate levels in the samples might be considered to be elevated due to the on-going agricultural activities around the Project area.

Along with the agricultural areas around the Project area, there are also settlements of which the closest are Yılmaz, Hasalan and Caferbey neighborhoods. Domestic wastewater of Yılmaz and Caferbey neighborhoods is discharged to the sewer system and domestic wastewater of Hasalan neighbourhood is discharged to septic tank. Enterococcus/Faecal Streptococci observed in the samples might be originating due to the anthropogenic activities in the area.

Although Boron is found within Manisa Province borders according to the EIA report, there is no information of Boron mining activities in Salihli District. According to the “Background document for development of WHO Guidelines for Drinking-water Quality” the borate content of surface water can be significantly increased as a result of wastewater discharges, because borate compounds are ingredients of domestic washing agents. Naturally occurring boron is present in groundwater primarily as a result of leaching from rocks and soils containing borates and borosilicates. Therefore boron concentration might also be caused due to anthropogenic activities in the region.

Comparison of the analysis results with Regulation on Monitoring of Surface Water and Groundwater is provided in Table 5-5 below:

Table 5-5. Results of Ground Water Quality Analysis regarding "Regulation on Monitoring of Surface Water and Groundwater"

Parameter – Unit	Test Results (Well 1)	Test Results (Well 2)
Ammonium (mg/L)	<0.05	<0.055
Dissolved Oxygen (mg/L)	5.06	5.11
Conductivity (µS/cm)	591	679
Nitrate(mg/L)	37.10	70.55
pH	7.07	7.04

It should be noted that the results of analyses are not indicative of contamination, but only a presentation of the baseline groundwater. Hence, the results cannot be attributed to any interpretation of Project impacts.

5.3 Climate

Climate properties of the Project region are summarized in the following section based on the information provided in the EIA report. Climate in the region is dominated by Mediterranean climate characteristics, hot and dry summers and warm and rainy winters. The Menderes river valley enhances the warmth of the sea and winds that bring rain towards the inner land.

Although different climate characteristics can be observed at the same region in Turkey, temperature and precipitation characteristics are similar both at the coastal parts and the inner parts of Aegean Region. The effects of the sea reach also to the inner parts. However precipitation amount significantly differs seasonally. Precipitation is densely observed as rain at the coasts and as snow at the inner parts in winter. In summer, precipitation is rarely observed due to high temperature and evaporation. Meteorological and climate properties of the Project area have been evaluated based on the data for the years 1960-2015 obtained from Salihli Meteorological Station. It was observed that the average temperature

According to the long term data; average annual temperature is 16.6 °C, average highest temperature is 23.1°C and lowest temperature is 10.2 °C. Highest measured temperature is 48°C in July and lowest measured temperature is -13.5 °C in February. Average annual precipitation is 457.9 mm and the highest recorded daily precipitation is on January with 71.2 mm. The highest average precipitation is recorded in December with 78.5 and lowest precipitation is recorded in August with 4.8 mm.

Dominant wind direction is West at the Project area. West direction is followed by West-Northwest and West-Southwest directions. Annual average wind speed is 1.5 m/sn with the highest value in July and the lowest value in November.

5.4 Soil Quality

During the EIA process of the Project soil quality analysis has been conducted at the Project area in order to define baseline soil conditions regarding the "Regulation on Soil Pollution Control and Point Source Polluted Areas" Annex-1: Limit Values for Generic Pollutants.

Range of parameters analysed in soil samples include: total organic halogens, antimony, arsenic, copper, barium, boron, mercury, cadmium, zinc, chromium, lead, molybdenum, selenium and total petroleum hydrocarbons. Test results are given below in Table 5-6. Detailed laboratory reports are available in Annex-1.

Table 5-6. Results of Soil Quality Analysis

Parameters	Test Results	Limit Values				
		Absorbtion by Ingestion and Through Skin	Inhalation of Volatile Substances	Inhalation of Fugitive Dust	Transport of Pollutants to Groundwater and Ingestion of Groundwater	
		(mg/kg dry soil)			DF*=10	DF=1
Arsenic (mg/ kg)	5.78	0.4	-	471	3	0.3
Antimony (mg/ kg)	<2.5	31	-	-	2	0.2
Copper (mg/ kg)	57.06	3129	-	-	514	51
Barium (mg/ kg)	86.39	15643	-	433702	288	29
Zinc (mg/ kg)	87.49	23464	-	-	6811	681
Mercury (mg/ kg)	<0.025	23	3	-	3	0.6
Cadmium (mg/ kg)	0.49	70	-	1124	27	3
Lead (mg/ kg)	4.18	400	-		135	14
Molybdenum (mg/ kg)	<2.5	391	-	-	14	1
Selenium (mg/ kg)	6.98	391	-	-	14	1
Total Chromium (mg/ kg)	16.75	235	-	24	900000	1
Total Petroleum Hydrocarbons (Aliphatic) (EC5-EC8) (mg/ kg)	9.9	4693	-	-	4	0.4
Total Petroleum Hydrocarbons (Aliphatic) (EC8-EC16) (mg/ kg)	32.29	7821	-	-	7	0.7
Total Petroleum Hydrocarbons (Aliphatic) (EC16-EC35) (mg/ kg)	5.44	156429	-	-	146	15
Total Organic Halogens (TOX) (mg/ kg)	31.47	-	-	-	-	-
Boron (mg/ kg)	1209	0.4	-	471	3	0.3

*Dilution Factor

5.5 Air Quality

2U1K has performed air quality analyses in order to define baseline parameters related with PM10 and H_2S impacts of the Project. PM 10 measurement was conducted at one location at Yılmaz Neighbourhood on 05-06 July 2017 and 08-09 July 2017 including both weekdays and weekend. Test results for PM10 are presented in Table 5-7, which indicate that the current dust emissions are slightly above limits designated in the Regulation on Control of Industrial Air Pollution (Table 2.2 of Annex-2 of the Regulation). The area is comprised of agricultural lands without any industrial facilities close to the measurement location. Although construction is on-going at the Project area, dust generating activities are limited. İzmir-Uşak highway passes at the south of the project area which may be considered as the dust emission source at the area. The increase on the weekends also might be the indication of the increased traffic on the road.

Table 5-7. Results of PM_{10} Measurements

Measurement Location	Coordinates (UTM ED50)	Measurement Period	PM10 Concentration ($\mu g/m^3$)	Industrial Air Pollution Control Regulation Air Quality Limits for 2017 ($\mu g/m^3$)	
				24-hour value	1-year value
Yılmaz Mahallesi	E: 0595381 N: 4261099	Weekday	71	70	48
		Weekend	68		

Within the scope of air quality sampling studies for the Project, passive sampling for H_2S was conducted between 05.07.2017-04.08.2017 and 04.08.2017-03.09.2017 at 10 points for which the coordinates and analysis results are provided below in Table 5-8 and Table 5-9, respectively.

Table 5-8. Coordinates of H_2S Sampling Points

No	Sampling Location	Coordinates(UTM ED50)	
		E	N
1	Yılmaz Neighbourhood	595368	4261090
2	Power Plant Area	595321	4260939
3	Well no: SAN-3	595272	4261561
4	Lider Tarım	594224	4261502
5	Caferbey Neighbourhood	593700	4259049
6	Çatılı Neighbourhood	592412	4259617
7	Gaffar Okan Neighbourhood	596594	4260404
8	Karapınar Neighbourhood	597102	4264803
9	Hasalan Neighbourhood	593196	4262601
10	Near the Power Plant	594378	4260716

Table 5-9. Results of H_2S Measurements

No	Sampling Location	H_2S Concentration		Industrial Air Pollution Control Regulation Air Quality Limits for 2017 (µg/m^3)	
		1st Period (µg/m^3)	2nd Period (µg/m^3)	1-hour value	STV* value
1	Yılmaz Neighbourhood	0.27	0.05	100	20
2	Power Plant Area	0.30	0.08		
3	Well no: SAN-3	0.39	0.07		
4	Lider Tarım	0.38	0.07		
5	Caferbey Neighbourhood	0.33	0.05		
6	Çatılı Neighbourhood	0.37	0.14		
7	Gaffar Okan Neighbourhood	0.35	-**		
8	Karapınar Neighbourhood	0.34	0.08		
9	Hasalan Neighbourhood	0.42	0.08		
10	Near the Power Plant	0.42	0.05		

*STV: Short Term Value ; **: Sampling tube missing

Table 5-9 above, H_2S concentrations at all sampling locations are below the limit values of Industrial Air Pollution Control Regulation.

5.6 Environmental Noise

2U1K performed noise measurements on July, 2017 in order to define baseline parameters as related with noise impacts of the Project. Measurements were conducted on weekdays and weekend days at the nearest settlement unit of Yılmaz Neighbourhood for 24 hours. The coordinates of the noise sensitive receptor is given below in Table 5-10.

Table 5-10. Coordinates of Noise Sensitive Receptor

Noise Sensitive Receptor	Name of the Settlement	Coordinates(UTM ED50)	
		E	N
1	Yılmaz Neighbourhood	595368	4261092

Satellite image showing the power plant and the closest noise receptor is provided below in Figure 5-3.

Figure 5-3 Closest Noise Receptor

Distance of the closest noise receptor to the Project units are provided below in Table 5-11.

Table 5-11 Distance of Noise Sensitive Receptor to the Project Area

Well No.	Distance of the Noise Sensitive Receptor
Power Plant	179 m
Distribution Centre	237 m
SAN-3	479 m
SAN-4	320 m
SAN-5	316 m
SAN-6	326 m
SAN-7	952 m
SAN-8	942 m

Noise surveys were conducted on 05-06 July and 08-09 July, 2017 for 24 hours in order to determine existing background noise level at the nearest sensitive receptor. The results of the measurement were compared with the limits of IFC/World Bank Group Environmental, Health and Safety Guidelines and Turkish Regulation on Assessment and Management of Environmental Noise (RAMEN). Since construction works are on-going at the Project area

background noise measurements included the noise generated by Project activities. Therefore measured noise levels are compared with construction noise limit level of 70 dBA of the RAMEN.

Table 5-12. Background Noise Measurement Results (daytime, evening and nighttime)

Date	Period	Hours	Measured Noise Level L_{eq} (dBA)	Average Measured Noise Level L_{eq} (dBA)
Weekday	Day-time (07:00-19:00)	07:00-08:00	49.4	44.3
		08:00-09:00	52.3	
		09:00-10:00	51.7	
		10:00-11:00	51.8	
		11:00-12:00	50.7	
		12:00-13:00	47.8	
		13:00-14:00	51.9	
		14:00-15:00	50.5	
		15:00-16:00	52.1	
		16:00:17:00	55.3	
		17:00-18:00	56	
		18:00-19:00	55.8	
	Evening (19:00 – 23:00)	19:00-20:00	51.7	51.4
		20:00-21:00	52.7	
		21:00-22:00	55.9	
		22:00-23:00	51.6	
	Night (23:00 – 07:00)	23:00-00:00	52.6	50.6
		00:00-01:00	59.6	
		01:00-02:00	46.5	
		02:00-03:00	43.7	
		03:00-04:00	40.7	
		04:00-05:00	46.1	
		05:00-06:00	48.5	
		06:00-07:00	47.9	
Weekend	Day-time (07:00-19:00)	07:00-08:00	51.2	64.0
		08:00-09:00	49.9	

Date	Period	Hours	Measured Noise Level L_{eq} (dBA)	Average Measured Noise Level L_{eq} (dBA)
		09:00-10:00	47.6	
		10:00-11:00	47.4	
		11:00-12:00	48.6	
		12:00-13:00	45.4	
		13:00-14:00	46.8	
		14:00-15:00	48.8	
		15:00-16:00	57.8	
		16:00:17:00	70.9	
		17:00-18:00	70.3	
		18:00-19:00	67.5	
	Evening (19:00 – 23:00)	19:00-20:00	75.6	72.1
		20:00-21:00	74.6	
		21:00-22:00	49.5	
		22:00-23:00	47.3	
	Night (23:00 – 07:00)	23:00-00:00	49.2	47.8
		00:00-01:00	45.8	
		01:00-02:00	44.0	
		02:00-03:00	43.8	
		03:00-04:00	45.5	
		04:00-05:00	45.6	
		05:00-06:00	47.4	
		06:00-07:00	52.6	

According to the results above background noise levels at the nearest receptor are above RAMEN limits for evening-time on weekends.

The IFC/WB noise guideline provides limits for daytime (07:00-22:00) and nighttime (22:00-07:00). Noise limit is 55 dBA for daytime and 45 dBA for nighttime. Measurement results for daytime and nighttime is provided below in Table 5-13.

Table 5-13. Background Noise Measurement Results (daytime and nighttime)

Date	Period	Hours	Measured Noise Level Leq (dBA)	Average Measured Noise Level Leq (dBA)
Weekday	Day-time (07:00-22:00)	07:00-08:00	49.4	53.0
		08:00-09:00	52.3	
		09:00-10:00	51.7	
		10:00-11:00	51.8	
		11:00-12:00	50.7	
		12:00-13:00	47.8	
		13:00-14:00	51.9	
		14:00-15:00	50.5	
		15:00-16:00	52.1	
		16:00:17:00	55.3	
		17:00-18:00	56	
		18:00-19:00	55.8	
		19:00-20:00	51.7	
		20:00-21:00	52.7	
		21:00-22:00	55.9	
	Night-time (22:00 – 07:00)	22:00-23:00	51.6	52.2
		23:00-00:00	52.6	
		00:00-01:00	59.6	
		01:00-02:00	46.5	
		02:00-03:000	43.7	
		03:00-04:00	40.7	
		04:00-05:00	46.1	
		05:00-06:00	48.5	
		06:00-07:00	47.9	
Weekend	(07:00-22:00)	07:00-08:00	51.2	68.0
		08:00-09:00	49.9	
		09:00-10:00	47.6	
		10:00-11:00	47.4	
		11:00-12:00	48.6	

Date	Period	Hours	Measured Noise Level Leq (dBA)	Average Measured Noise Level Leq (dBA)
		12:00-13:00	45.4	
		13:00-14:00	46.8	
		14:00-15:00	48.8	
		15:00-16:00	57.8	
		16:00:17:00	70.9	
		17:00-18:00	70.3	
		18:00-19:00	67.5	
		19:00-20:00	75.6	
		20:00-21:00	74.6	
		21:00-22:00	49.5	
	(22:00 – 07:00)	22:00-23:00	47.3	47.7
		23:00-00:00	49.2	
		00:00-01:00	45.8	
		01:00-02:00	44	
		02:00-03:000	43.8	
		03:00-04:00	45.5	
		04:00-05:00	45.6	
		05:00-06:00	47.4	
		06:00-07:00	52.6	

According to the background noise measurement results noise level at the nearest receptor is above IFC/WB noise limits at night on weekdays and daytime and nighttime on weekends. Construction activities will not be performed at night therefore nuisance due to noise will not occur at nights. İzmir-Uşak highway passes at the south of the project area on which traffic is increased on the weekends. It may be considered that the noise level during weekend might be due to the increased traffic on the road.

5.7 Ecology

Literature search and field surveys have been conducted for the determination of baseline flora-fauna characteristics of the Project area. Field surveys were conducted between 4 and 6 July 2017 at the Project area and its vicinity by 2U1K.

The bibliographic references used during the desktop study included:

- IUCN Red List Database;
- Turkish Red Data Book of plant species;
- Important Bird Areas for Turkey;
- CORINE Land Cover database;
- Documents and studies conducted by the Turkish Government, scientific Institutions and Associations;
- Satellite images and aerial photos; and

Scientific literature available in public databases and from Universities.

A thorough literature research was performed for endemic, restricted-range critically endangered, endangered, congregatory and migratory species (collectively referred to as species of conservation concern) identified.

The results of the analysis enabled to identify the presence of habitats with the potential for hosting species in the Study Area (i.e. site located within the species range and ecologically suitable to its habitat requirements). A set of species potentially present in the Study Area was identified for the different taxon (plants, mammals, birds, reptiles and amphibians).

The outputs of the field surveys were compared with literature references in order to make an inventory of flora-fauna species present in the Study Area.

The Flora list was prepared in accordance with the phylogenetic order in Turkish flora; ferns, open seed plants (*Gymnospermae*) and closed-seeded plants (*Angiospermae*). Families under each group were also listed according to the phylogenetic order in the Turkish flora. Species were listed with their Latin name, English name (if available), phytogeographic regions, endemism, threat categories for endemic and rare species, and their abundance in the region. Samples collected in the Project Areas were transformed into herbarium material and identified by using the “Flora of Turkey and the East Aegean Islands” by Davis, 1965-1988.

Threat status of endemic and rare flora species was determined according to the Red Data Book of Turkish Plants (Ekim et al., 2000), which had been prepared in accordance with the IUCN 1994 criteria.

Fauna surveys started early in the morning and continued until sunset.

Animal species and the existence of habitats apt for the choices of fauna have been determined through several indicators such as nest-youngster-vomit-footprint of these species (especially in the determination of the bird and large mammal species), faeces-food residues-burrow hole (especially in determination of mammals), skin-horn-shield and bone pieces. No hunting-capture-killing has occurred during the identification of species.

Observations of non-living material in nature (especially dead reptile individuals and/or skin, shield pieces found on site) are used particularly for reptile and small mammalian species and literature information on fauna elements of these areas, previously collected museum materials and locals contributed to the prepared species lists.

The general criteria and their explanations that are used while evaluating the status of the species are given below.

CITES

CITES is the Convention on International Trade in Endangered Species of Wild Fauna and Flora. CITES is an international agreement between 164 nations (including Turkey) and its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. CITES principles depend on the sustainable trade fundamental that is significant for protection of the ecologic resources (a vast array of wildlife products derived from a great quantity of live animals and plants, products additive to the food, exotic leather goods, etc.) in the future

Appendix I lists species that are the most endangered among CITES-listed animals and plants. They are threatened with extinction and CITES prohibits international trade in specimens of these species except when the purpose of the import is not commercial, for instance for scientific research. In these exceptional cases, trade may take place provided it is authorized by the granting of both an import permit and an export permit (or re-export certificate).

Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. It also includes so-called "look-alike species", i.e. species whose specimens in trade look like those of species listed for conservation reasons. International trade in specimens of Appendix-II species may be authorized by the granting of an export permit or re-export certificate. No import permit is necessary for these species under CITES. Permits or certificates should only be granted if the relevant authorities are satisfied that certain conditions are met, above all that trade will not be detrimental to the survival of the species in the wild.

Appendix III is a list of species included at the request of a Party that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation. International trade in specimens of species listed in this Appendix is allowed only on presentation of the appropriate permits or certificates.

IUCN Red List of Threatened Species

International Union for Conservation of Nature (IUCN) Red List is published to draw attention to the species whose population is under risk or threatened. IUCN includes the species to the Red List after researching the reasons causing decrease in its population. IUCN Red List categories are given below:

EX: Extinct

EW: Extinct in the Wild

CR: Critically Endangered

EN: Endangered

VU: Vulnerable

NT: Near Threatened

LC: Least Concern

DD: Data Deficient

NE: Not Evaluated

EXTINCT (EX) A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

EXTINCT IN THE WILD (EW) A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

CRITICALLY ENDANGERED (CR) A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild.

ENDANGERED (EN) A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered and it is therefore considered to be facing a very high risk of extinction in the wild.

VULNERABLE (VU) A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable and it is therefore considered to be facing a high risk of extinction in the wild.

NEAR THREATENED (NT) A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

LEAST CONCERN (LC) 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.

DATA DEFICIENT (DD) A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

NOT EVALUATED (NE) A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

5 different observation points were determined for the surveys of the Project area and its vicinity. Observation points were selected considering their proximity to the Project components, representation of the Project area, capability to create frequency, and ecological characteristics. The coordinates of the observation points are presented below in Table 5-14.

Table 5-14. Ecological Survey Points

Observation Points	UTM-ED50 (Zone 35)	
	X	Y
1	595383	4261100
2	595311	4261719
3	594927	4262479
4	595188	4263467
5	595204	4260466

The map showing the observation points for ecological survey is provided below in Figure 5-4.

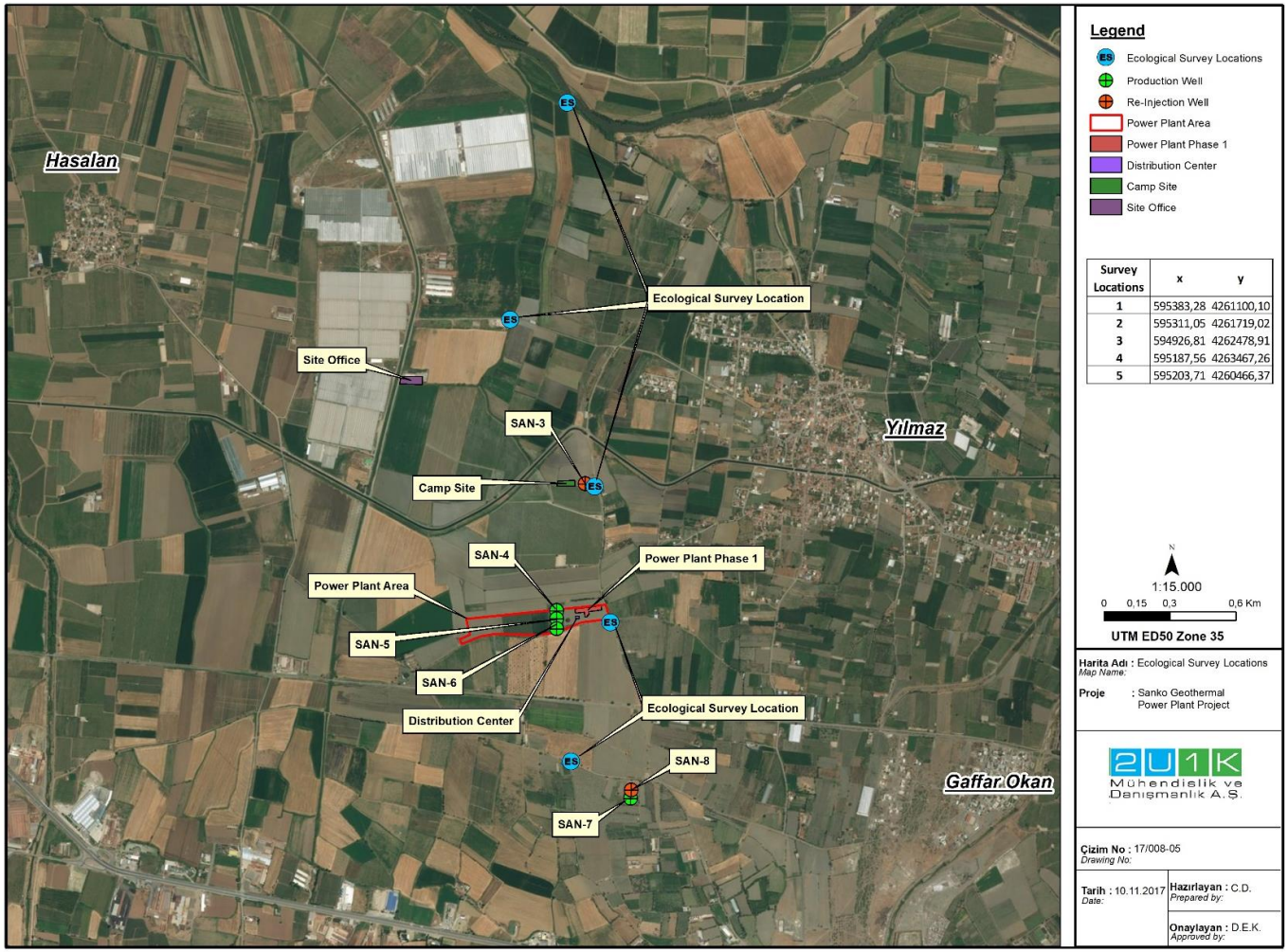

Figure 5-4. Ecological Survey Point

5.7.1 Flora

Vegetation and plant species of the Project site and its immediate environment have been assessed as a result of field studies and literature survey. The entire flora species of the region that is included in the resource “Flora of Turkey and the East Aegean Islands, Volume 1-11, University Press, Edinburgh, 1965-1988 by Davis P.H.” have been reviewed in order to eliminate any potential errors. Endemic species with possible existence due to their habitat characteristics have been considered in particular.

Field studies have been conducted in addition to previous studies for determining the plant species within the Project site, and the information obtained have been supported by literature data. Determination of flora species has been based on field investigations while studies in the literature have been made use of for undefined plant species.

The Project area is within the Mediterranean phyto-geographical region, and is located in B2 square according to Davis’s Grid System as can be seen in Figure 5-5.

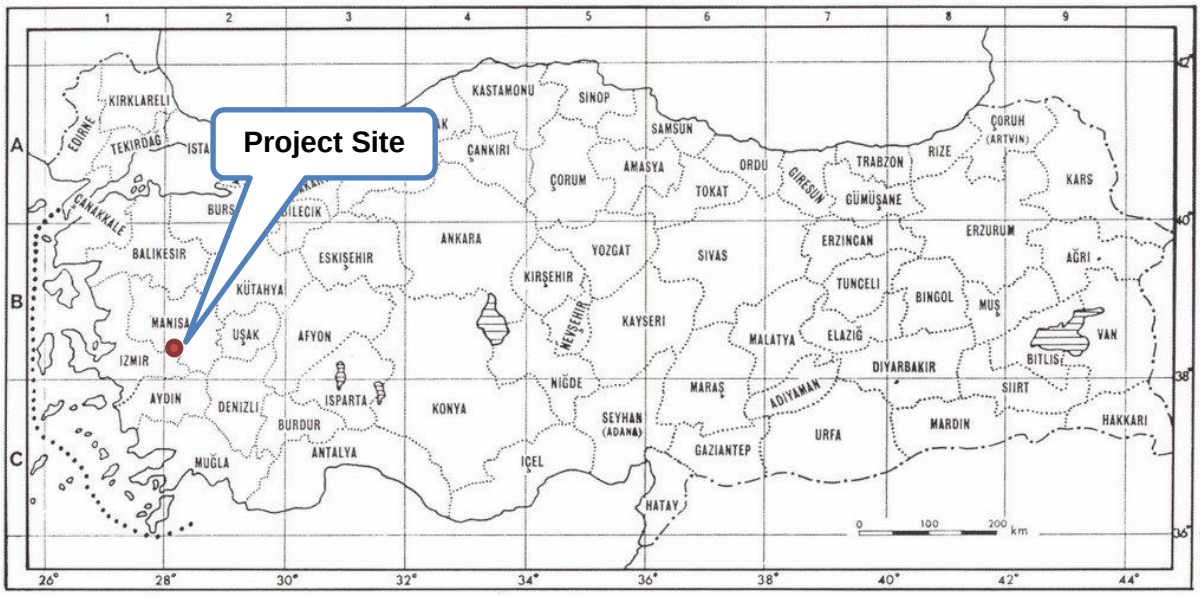

Figure 5-5. Grid System for Flora of Turkey

The Project area is dominated by agricultural lands and has the characteristics of a flat topography.

The surroundings of the Project area are also composed of highly modified habitats surrounded by road networks, residential buildings and agricultural lands as seen in Photo 5-1 to Photo 5-3 below.

Photo 5-1. Agricultural Areas Around the Project Site

Photo 5-2. Agricultural Areas Around the Drilling Well

Photo 5-3. Agricultural and Residential Areas Around Power Plant

Legally protected and internationally recognized areas in the region have been determined as a result of field surveys and literature review. Closest legally protected and internationally recognized areas are Gölcük Lake Wetland, Marmara Lake Wetland, Ovacık Wildlife Development Area, Spil Mountain National Park, Kula Fairy Chimney Nature Monument at a distance of 10 km, 10 km, 34 km, 48 km and 63 km respectively. In this context, the protected area network of the region has been examined and the possible effects of the Project to these wildlife sanctuaries have been checked to prove that the Project area and the influence zone sufficiently far from the protected area network of Manisa. Protected areas around the Project area is provided in the Figure 5-6 below.

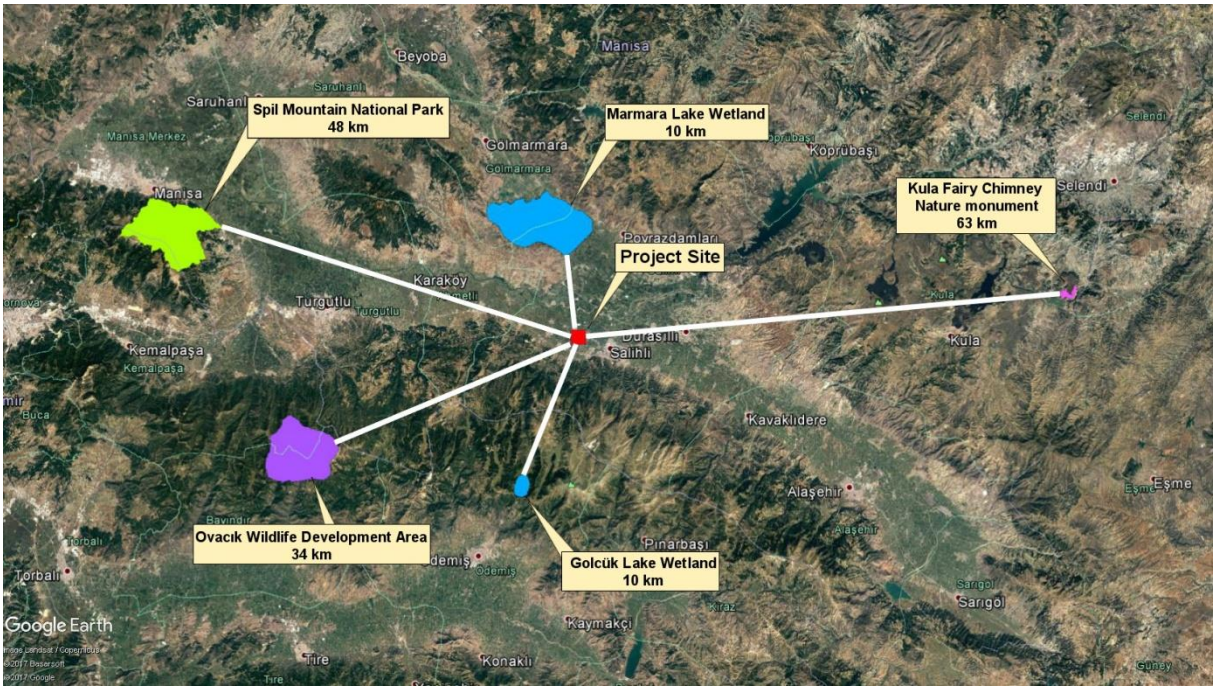

Figure 5-6. Project Area and Protected Areas

The floristic structure of the project site and its immediate environment was determined by a detailed literature research and field surveys. According to the results of the surveys it can be seen that the area is covered with ruderal herbaceous plants and cultivated plants.

Table 5-15 below lists possible flora in the project area and its environs as a result of the field observations and literature survey. Field surveys indicate that the natural vegetation has been destructed by anthropogenic impacts and has been replaced by cultivated plants. The herbaceous vegetation on the Project Site was not in good form, being quite degenerated.

The vast majority of the flora elements that identified during the studies area are wide spread species for the Aegean Region. The region is located phytogeographically in the vicinity of the Mediterranean phytogeography.

As Table 5-15 shows below, no endemic taxa, nor significance in terms of categorizations of IUCN, CITES and the Bern Convention, are detected among the listed species. In the overall, the flora and the vegetation of the project area are not vulnerable in terms plant biodiversity.

Table 5-15. Flora in the Project Area and its Environs

Scientific Name	Common Name	Turkish Name	Endemism	IUCN	CITES	BERN convention
SPERMATOPHYTA						
GYMNOSPERMA						
PINACEAE						
Pinus pinea	Stone Pine	Fıstık Çamı	-	LC	-	-
ANGIOSPERMAE						
DICOTYLEDONAE						
AMARANTHACEAE						
Amaranthus chlorostachys.	Amaranth	Tilki Kuyruğu	-	LC	-	-
Amaranthus deflexus	Large-Fruit Amaranth	Sarkıkibik	-	LC	-	-
APIACEAE						
Daucus carota	Wild Carrot	Yabani Havuç	-	LC	-	-
Scandix pecten-veneris	Shepherd's-Needle	Kişkiş	-	LC	-	-
ASCLEPIADACEAE						
Cynanchum acutum subsp. Acutum	-	Bacırgan	-	LC	-	-
ASTERACEAE						
Anthemis chia	Chamomile	Garga Çiçeği	-	LC	-	-
Bellis perennis	Common Daisy	Koyungözü	-	LC	-	-
Calendula arvensis	Field Marigold	Portakal Nergisi	-	LC	-	-
Centaurea solstitialis susbs solstitialis	Golden Starthistle	Çakırdikeni	-	LC	-	-
Chondrilla juncea var. juncea	Rush Skeletonweed	Karakavuk	-	LC	-	-
Cichorium intybus	Common Chicory	Hindiba	-	LC	-	-
Conyza canadensis	Horseweed	Selviotu	-	LC	-	-
Pulicaria dysenterica	Common Fleabane	Yaraotu	-	LC	-	-
Silybum marianum	Milk Thistle	Devedikeni	-	LC	-	-
Senecio vulgaris	Groundsel	Taşakçılotu	-	LC	-	-
Xanthium strumarium subsp. Strumarium	Clotbur	Pıtrak	-	LC	-	-
BORAGINACEAE						
Buglossoides arvensis Johnston	Field Gromwell	Koyunotu	-	LC	-	-
Myosotis lithospermifolia..	Forget-Me-Not	Taş Boncukotu	-	LC	-	-
BRASSICACEAE						
Capsella bursa-pastoris.	Shepherd's Purse	Çobançantası	-	LC	-	-
Erophila verna Chevall subsp. Verna	Spring Draba	Çirçir Otu	-	LC	-	-
Raphanus raphanistrum	Wild Radish	Turp	-	LC	-	-
Sinapis alba	White Mustard	Mamanık	-	LC	-	-
CAMPANULACEAE						
Legousia pentagonia	Venus' Looking	Kadınaynası	-	LC	-	-

Scientific Name	Common Name	Turkish Name	Endemism	IUCN	CITES	BERN convention
	Glass					
CARYOPHYLLACEAE						
Cerastium anomalum	-	Tarla Boynuzotu	-	LC	-	-
Silene conoidea	Weed Silene	Şıvanan Otu	-	LC	-	-
Stellaria media subsp. Pastii	Chickweed	Kuşotu	-	LC	-	-
CHENOPODIACEAE						
Chenopodium album	Lamb's Quarters	Aksirken	-	LC	-	-
CONVOLVULACEAE						
Convolvulus arvensis	Field Bindweed	Tarla Sarmaşığı	-	LC	-	-
DIPSACACEAE						
Scabiosa sicula	Scabious	Ada Uyuzotu	-	LC	-	-
EUPHORBIACEAE						
Euphorbia helioscopia	Sun Spurge	Sütleğen	-	LC	-	-
FABACEAE						
Coronilla varia subsp.varia	Crownvetch	Yabani Fiğ	-	LC	-	-
Lathyrus aphaca var. aphaca.	Yellow Pea	Sarı Burçak	-	LC	-	-
Medicago orbicularis	Blackdisk Medick	Yonca	-	LC	-	-
Melilotus officinalis	Yellow Sweet Clover	Kokulu Yonca	-	LC	-	-
Trifolium angustifolium var. gustifolium	Narrow Clover	Nefel	-	LC	-	-
Trifolium campestre.	Field Clover	Üçgül	-	LC	-	-
Trifolium hirtum	Rose Clover	Deli Yonca	-	LC	-	-
GERANIACEAE						
Erodium cicutarium subsp. Cicutarium	Redstem Filaree	Dönbabaotu	-	LC	-	-
JUGLANDACEAE						
Juglans regia	Walnut	Ceviz	-	LC	-	-
LAMIACEAE						
Mentha spicata subsp. Tomentosa	Spearmint	Eşek Nanesi	-	LC	-	-
MALVACEAE						
Malva sylvestris	Common Mallow	Ebegümeci	-	LC	-	-
MORACEAE						
Ficus carica subsp. Carica	Common Fig	İncir	-	LC	-	-
OLEACEAE						
Olea europaea var europaea	Olive	Kültür Zeytin	-	LC	-	-
PAPAVERACEAE						
Papaver rhoeas	Common Poppy	Gelincik	-	LC	-	-
PLANTAGINACEAE						
Plantago lanceolata	Narrowleaf Plantain	Damarlıca	-	LC	-	-

Scientific Name	Common Name	Turkish Name	Endemism	IUCN	CITES	BERN convention
POLYGONACEAE						
Polygonum persicaria	Lady's Thumb	Köyotu	-	LC	-	-
Polygonum longipes.	-	Tirşon	-	LC	-	-
Rumex acetosella	Sheep's Sorrel	Kuzukulağı	-	LC	-	-
Rumex patientia	Patience Dock	Efelek	-	LC	-	-
PORTULACACEAE						
Portulaca oleracea	Verdolaga	Semizotu	-	LC	-	-
PUNICACEAE						
Punica granatum	Pomegranate	Nar	-	LC	-	-
RANUNCULACEAE						
Anemone coranaria	Poppy Anemone	Manisa Dağ Lalesi	-	LC	-	-
Ranunculus arvensis	Corn Buttercup	Mustafa Çiçeği	-	LC	-	-
ROSACEAE						
Rosa canina	Dog Rose	Kuşburnu	-	LC	-	-
Rubus sanctus	Holy Bramble	Böğürtlen		LC	-	-
RUBIACEAE						
Galium aparine	Cleaver	Çobansüzgeci	-	LC	-	-
SCROPHLARIACEAE						
Veronica arvensis	Wall Speedwell	Ekin Mavişi	-	LC	-	-
SOLANACEAE						
Solanum alatum	-	İtüzümü	-	LC	-	-
Solanum melongea	Eggplant	Patlıcan	-	LC	-	-
Datura stromarium	-	Boruçiçeği	-	LC	-	-
URTICACEAE						
Urtica dioica	Common Nettle	Isırganotu	-	LC	-	-
VIOLACEAE						
Viola alba Besser subsp. Dehnhardtii	White Violet	Meşe Menekşesi	-	LC	-	-
ZYGOPHYLLACEAE						
Tribulus terrestris	Goat's-Head	Çobançökerten	-	LC	-	-
MONOCOTYLEDONAE						
CYPERACEAE						
Cyperus rotundus	Java Grass,	Topalak	-	LC	-	-
LILIACEAE						
Allium atroviolaceum.	Broadleaf Wild Leek	Lifli Körmen	-	LC	-	-
Gagea peduncularis	-	Karga Sarımsağı	-	LC	-	-
Muscari comosum	Tassel Hyacinth	Morbaş	-	LC	-	-
Ornithogalum umbellatum	Garden Star-Of-Bethlehem	Sunbala	-	LC	-	-
POACEAE						
Aegilops biuncialis.	Goatgrass	İki Kılçık	-	LC	-	-
Arundo donax	Giant Cane	Kargı	-	LC	-	-
Bromus tectorum subsp.	Drooping	Kır Bromu	-	LC	-	-

Scientific Name	Common Name	Turkish Name	Endemism	IUCN	CITES	BERN convention
Tectorum	Brome					
Cynodon dactylon var. dactylon	Vilfa Stellata	Köpek Dişi	-	LC	-	-
Digitaria sanguinalis.	Hairy Crabgrass	Kızıl Çatalotu	-	LC	-	-
Eleusine indica	Yard-Grass	Bahçeçimi	-	LC	-	-
Hordeum bulbosum	Barley	Boncuk Arpa	-	LC	-	-
Phragmites australisn.	Common Reed	Kamış	-	LC	-	-
Poa bulbosa	Bulbous Bluegrass	Yumrulu Salkım Otu	-	LC	-	-
Piptatherum holciforme	Ricegrass	Azizi Çimi	-	LC	-	-
Polypogon monspeliensis.	Annual Beard-Grass	Hıtır	-	LC	-	-
Setaria glauca	Millet	Darı	-	LC	-	-
Sorghum halepense var. muticum	Johnson Grass	Ekin Süpürgesi	-	LC	-	-
Zea mays	Corn	Mısır	-	LC	-	-

5.7.2 Fauna

Fauna inventory was prepared based on conducted fieldwork and a wide literature research. The status of the fauna in the region was evaluated according to the biological and ecological perspectives. Risk categories of fauna species were determined according to the IUCN red list categories which were published in Version 2017.1. In the fauna list that has been provided, species are written with the family names to which they belong to.

Fifty-one species and sub-species are known to exist in the Project Area and in its surrounding. A fauna inventory was prepared on a large scale so that it also includes many species not observed directly in the Project Area. Endemic species are sensitive in terms of risk status. However, during the site visits it was found that the immediate area of the facility and the close environs are not used by the target species which are known to be endemic.

The Project Site includes water courses and rocky areas which are suitable for reptiles and amphibians, which makes the area suitable habitat for both groups. Possible species to be seen in the Project Area are listed in Table 5-16.

Table 5-16. Species of Reptiles and Amphibians in the Project Region

Scientific Name	Common Name	Turkish Name	IUCN	CITES	BERN
BUFONIDAE					
Bufotes variabilis	European Green Toad	Gece kurbağası	LC	-	Ann-3
RANIDAE					
Pelophylax bedriagae	Levant Water Frog	Ova kurbağası	LC	-	Ann-3
TESTUDINIDAE					
Testudo graeca	Spur-Thighed Tortoise	Adi tospağa	LC	-	Ann-2
GEOEMYDIDAE					

Scientific Name	Common Name	Turkish Name	IUCN	CITES	BERN
Mauremys rivulata	Western Caspian Turtle	Çizgili kaplumbağa	LC	-	Ann-2
GEKKONIDAE					
Hemidactylus turcicus	Turkish Gecko	Geniş parmaklı keler	LC	-	Ann-3
ANGUIDAE					
Pseudopus apodus	European Legless Lizard	Oluklu kertenkele	LC	-	Ann-3
LACERTIDAE					
Lacerta trilineata	Green Lizard	İri yeşil kertenkele	LC	-	Ann-2
Ophisops elegans	Snake-Eyed Lizard	Tarla kertenkelesi	LC	-	Ann-2
COLUBRIDAE					
Dolichophis caspius	Large Whipsnake	Hazer yılanı	LC	-	Ann-2
Dolichophis jugularis	Black Whipsnake	Karayılan	LC	-	Ann-2
Eirenis modestus	Ring-Headed Dwarf Snake	Uysal yılan	LC	-	Ann-3
Natrix natrix	Grass Snake	Yarı sucul yılan	LC	-	Ann-3

Regarding Table 5-16 , the scale of IUCN risk category LC stands for “Least Concern”.

For the fauna species taken under protection by Appendix – II and Appendix – III of the Bern Convention, measures stated in Article 6 and 7 of the Bern Convention have to be taken. In particular, the following issues will be considered for the species listed in Appendix II in accordance with the 6th Article of the Bern Convention.

The species listed in Appendix II of the Bern Convention are strict. The species listed in Appendix III are periodically under protection.

Field data and literature research shows that the project area and surroundings are occupied by species which are known to exist in habitats altered by anthropogenic activities.

The bird species which were identified through literature and observed from field survey have been presented in Table 5-17.

Table 5-17. Bird Species in the Region

Scientific Name	Common Name	Turkish Name	IUCN	CITES	BERN
CICONIIDAE					
Ciconia ciconia	White Stork	Beyaz leylek	LC	-	Ann-2
ACCIPITRIDAE					
Accipiter gentilis	Northern Goshawk	Büyük atmaca	LC	-	Ann-2
Buteo buteo	Common Buzzard	Şahin	LC	-	Ann-2
FALCONIDAE					
Falco naumanni	Lesser Kestrel	Küçük kerkenez	LC	-	Ann-2
COLUMBIDAE					
Streptopelia decaocto	Eurasian Collared	Kumru	LC	-	Ann-3

Scientific Name	Common Name	Turkish Name	IUCN	CITES	BERN
	Dove				
STRIGIDAE					
Athene noctua	Little Owl	Kukumav	LC	-	Ann-2
MEROPIDAE					
Merops apiaster	European Bee-Eater	Arıkuşu	LC	-	Ann-2
UPUPIDAE					
Upupa epops	Hoopoe	Çavuşkuşu	LC	-	Ann-2
ALAUDIDAE					
Alauda arvensis	Eurasian Skylark	Tarla kuşu	LC	-	Ann-3
Galerida cristata	Crested Lark	Tepeli toygar	LC	-	Ann-3
HIRUNDINIDAE					
Hirundo rustica	Barn Swallow	Kır kırlangıcı	LC	-	Ann-2
Delichon urbicum	Common House Martin	Ev kırlangıcı	LC	-	Ann-3
MOTACILLIDAE					
Motacilla cinerea	Grey Wagtail	Dağ kuyrukkakanı	LC	-	Ann-2
Motacilla alba	White Wagtail	Ak kuyrukkakan	LC	-	Ann-2
SYLVIIDAE					
Sylvia rueppelli	Rüppell's Warbler	Maskeli ötleğen kuşu	LC	-	Ann-2
TURDIDAE					
Turdus merula	Common Blackbird	Karatavuk	LC	-	Ann-3
Turdus pilaris	Fieldfare	Tarla ardıç kuşu	LC	-	Ann-3
MUSCICAPIDAE					
Erithacus rubecula	European Robin	Nar bülbülü	LC	-	Ann-2
Saxicola torquatus	Common Stonechat	Taşkuşu	LC	-	Ann-2
SITTIDAE					
Sitta europaea	Eurasian Nuthatch	Sıvacı kuşu	LC	-	Ann-2
EMBERIZIDAE					
Emberiza caesia	Cretzschmar's Bunting	Kızıl kiraz kuşu	LC	-	Ann-2
FRINGILLIDAE					
Carduelis carduelis	Goldfinch	Saka kuşu	LC	-	Ann-3
PLOCEIDAE					
Passer domesticus	House Sparrow	Serçe	LC	-	Ann-3
STURNIDAE					
Sturnus vulgaris	Common Starling	Sığırcık	LC	-	Ann-3
CORVIDAE					
Garrulus glandarius	Eurasian Jay	Kestane kargası	LC	-	-
Corvus corax	Common Raven	Karakarga	LC	-	Ann-3
Corvus cornix	Hooded Crow	Leşkargası	LC	-	-
Pica pica	Eurasian Magpie	Saksağan	LC	-	-

The project area is located on agricultural areas with low fertility and thus its anthropogenic impacts have made the area unsuitable for mammal species, especially larger mammals which require considerably wide ranges.

Table 5-18. Mammals in the Project Region

Scientific Name	Common Name	Turkish Name	IUCN	CITES	BERN
ERINACEIDAE					
Erinaceus concolor	Hedgehog	Kirpi	LC	-	-
SORICIDAE					
Crocidura leucodon	Bicolored Shrew	Bahçe sivrifaresi	LC	-	-
LEPORIDAE					
Lepus europaeus	European Hare	Yabani tavşan	LC	-	-
SCIURIDAE					
Sciurus anomalus	Caucasian Squirrel	Kafkas sincabı	LC	-	-
SPALACIDAE					
Spalax leucodon	Lesser Mole-Rat	Körfare	DD	-	-
MURIDAE					
Rattus rattus	Black Rat	Ev Sıçanı	LC	-	-
MURIDAE					
Mus musculus	House Mouse	Ev Faresi	LC	-	-
CANIDAE					
Vulpes vulpes	Red Fox	Kızıl tilki	LC	-	-
MUSTELIDAE					
Mustela nivalis	Least Weasel	Gelincik	LC	-	-
Meles meles	European Badger	Porsuk	LC	-	-
SUIDAE					
Sus scrofa	Wild Boar	Yabani domuz	LC	-	-

5.7.3 Habitat Assessment

Habitats are divided into modified, natural and critical for the implementation of PS6 requirements. Critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.

With regards to the above criteria; there are no species identified as endangered or critically endangered or endemic in the area. The Project is not located within an area of importance for migratory or congregatory species nor situated on a major migratory route. Migratory birds were observed quite rarely and no potential resting places for migratory birds were identified. The habitats identified during the field survey were not considered to be “Highly Threatened and/or Unique Ecosystems”.

Turkey is located at the junction of three distinct phytogeographical regions and houses 3 of 25 hotspots that are significantly important in terms of biodiversity in global scale. The Project area and its vicinity are not located in the borders of the hotspots in Turkey and do not support key evolutionary processes. Therefore the Project area does not include critical habitats.

As explained above the Project area and its surrounding comprises of agricultural lands; defined as modified habitat.

6. SOCIAL BASELINE

In this section, baseline data for the socio-economic aspects of the Area of Influence (AoI) is presented in order to provide a current situation against which the impacts of the Project can be assessed. The baseline takes into account present conditions, as well changing conditions (i.e. population, education) apparent in the baseline.

The baseline description has the following main objectives to:

- focus on receptors that were identified during scoping as having the potential to be significantly affected by the Project,
- describe and, where possible, quantify their characteristics (demography, economy, education, health, etc.),
- provide data to aid the prediction and evaluation of possible impacts and,
- inform judgments about the sensitivity, vulnerability and/or importance of resources/receptors.

The aim of the socio-economic baseline study is to describe the socio-economic conditions and trends in the areas potentially affected by the Project to understand potential effects and to develop appropriate mitigation measures. The socio-economic baseline defines the socio-economic issues of importance of provincial and local communities and establishes a baseline of socio-economic data that can be used for monitoring changes in the affected communities after the Project.

The following variables were selected for the discussion of the socioeconomic indicators of the settlements area around the Project site:

- Demography and Population
- Livelihoods and Employment
- Education
- Health
- Infrastructure and Services
- Vulnerable Groups

Socio-economic data was collected using a combination of research methods. The baseline section was conducted by collecting, reviewing, and analysing a range of secondary data, including data originating from the Turkish Statistical Agency (TURKSTAT), Salihli Municipality, local and provincial Governorates' Database.

In order to provide baseline information on the neighbourhood level, national statistics are supported with information obtained from primary data collected through interviews with Mukhtars which were carried out between the July 4 and 6, 2017.

The area of influence of the Project calls for Yılmaz, Gaffar Okkan, Hasalan and Caferbey neighbourhoods.

Table 6-1. Scoping of Social Issues

Project Activities	Social Issue	Possible Impacts	Baseline Parameters
Operation	National Economy	• The Project is expected to address the electricity needs of people nationally	• Annual national energy production
Drilling and Construction	Land Acquisition	• Loss of agricultural land	• Livelihood and employment • Number of lands that have been purchased • Number of affected people
Construction and Operation	Local Employment	• Employment opportunities	• Livelihood and employment • Number of the local employees
Construction	Labor influx	• Pressure on local infrastructure • Change in population	• Demography and population
Construction	Transportation / Traffic	• Safety concerns • Damage on existing roads • Increase in traffic • Dust	• Number of vehicles used for the construction phase • Air Quality
Drilling and Construction	Community Health and Safety	• Increase of noise and dust due to Project activities • Increase in traffic	• Noise level • Air quality
Construction and Operation	Occupational Health and Safety	• Potential for exposure to geothermal gases, confined spaces and heat • Noise exposure during well drilling, steam flashing and venting	• Air quality • Noise level
Drilling and Construction	Cultural Heritage	• Damage on cultural assets within or around the Project area.	Existing cultural heritage assets and archaeological areas in or around the Project area.

6.1 Demography and Population

This section presents general demographical information of Manisa Province and Salihli District respectively and move on to further details within the borders of the AoI.

Manisa, situated in Aegean Region of Turkey, covers an area of 13,810 km^2 and has been recorded as the 14th most populated city in Turkey with a population of 1,396,935 (Turkish Statistical Institute , 2016). Manisa holds the second place in terms of population density after Izmir within Aegean Region. The annual population growth rate in 2015 was 9.2 per thousand, whereas, the same indicator was 6.2 per thousand in 2014.

There are 17 districts within the Province borders and the majority of the population lives in the province and district centres, whereas, remaining population lives in towns and neighbourhoods. The most populous district in Manisa is Yunusemre with 211,673

inhabitants, on the other hand the least populous district is Köprübaşı with 13,586 inhabitants. Salihli district is placed in fourth in terms of population density within the Province with a population of 158,568 (Turkish Statistical Institute , 2016).

As mentioned above, there are four neighbourhoods within the limits of AoI (Yılmaz, Gaffar Okkan, Hasalan and Caferbey). According to social field study, Hasalan neighbourhood has the lowest population figures, whereas, Yılmaz neighbourhood has the highest population figures. Further information regarding the demography of the AoI can be found in Table 6-2.

Table 6-2 Population Figures of the Area of Impact

Neighborhood	Distance to Manisa Province	Distance to Salihli District	Neighborhood Population (2016)
Yılmaz	69 km	4 km	6017
Gaffar Okkan	45 km	1 km	1453
Hasalan	45 km	10 km	269
Caferbey	65 km	6 km	828

Source: Field Study, 2017

The age distribution of each neighbourhood has been received through field study and can be found Figure 6-1 in the below. Before getting into analysing, it is important to note that the population of Yılmaz is higher compared to rest of the neighbourhoods within the borders of AoI. Overall, majority of the community members falls within the age group between 19 to 39. The number of individuals who are aged 65 and over seems to be high in Caferbey, whereas, Gaffar Okkan has the highest number of individuals who are aged between 0 to 5.

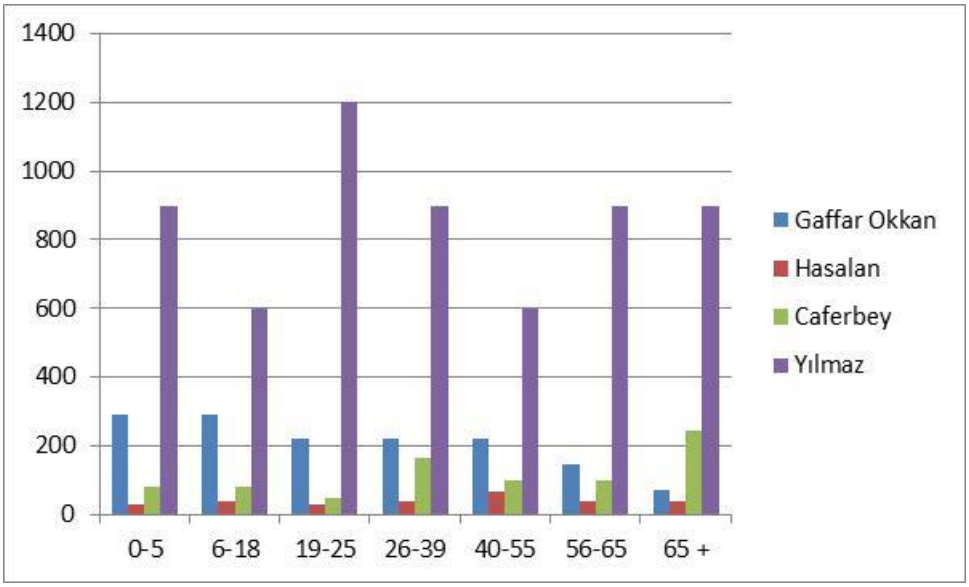

Figure 6-1. Age Distribution of Survey Population on the Basis of Neighbourhoods

Majority of the population figures of the AoI have changed due to various reasons over the course of five years, Table 6-3 below presents the population changes of the neighbourhoods and its reasons within the five years respectively.

Table 6-3. Population Dynamics

Neighborhood	Population Change within the Last 5 Years	Reasons
Yılmaz	Increased	No particular reason
Gaffar Okkan	Increased	Financial difficulties
Hasalan	Remained the same	-
Caferbey	Remained the same	-

Source: Field Study, 2017

6.2 Livelihoods and Employment

According to information gathered from Manisa Provincial Culture and Tourism Directorate database, the economy of the Manisa is generally based on agriculture, in other words, 35% of the gross income is derived from agriculture.

Nearly all of the Province's population is involved in agriculture as Manisa having the largest vineyard area of Turkey with a viniculture area of 75.401 hectares. Furthermore, Manisa is the source of the grapes in Turkey by having 85% of the national grape production. The other fruits growing in Manisa are peach, cherry, apricot, olive, almond, pear, walnut and pomegranate (Manisa Provincial Culture and Tourism Directorate).

According to the information obtained during field studies conducted within the settlements of the AoI, agriculture is the common economic activity in the four neighbourhoods in the AoI of the Project, as well. According to interviews with the locals, the main sources of local income are farming, retirement pensions, sheep breeding and paid workforce. The common products from agriculture within the AoI are grape, wheat, corn, eggplant and tomato. It is important to note that, Gaffar Okkan neighbourhood has the least agriculture activities among the other settlements in the AoI.

The social team conducted Community Level Surveys with the neighbourhood mukhtars in terms of the type of lands within the neighbourhood borders.

Table 6-4 below presents the information gathered from the mukhtars on approximate size of the lands of each neighbourhood, respectively.

Table 6-4. Type of the lands within the AoI

Neighborhood	Hasalan	Gaffar Okkan*	Yılmaz	Caferbey
Pasture land	56 decare	N/A	15,000 decare	95 decare
Forest	-	N/A	-	4,000 decare
Treasury	205 decare	N/A	4,000 decare	3 decare
Private	6,5000 decare	N/A	13,000 decare	2,000 decare

Source: Field Study, 2017

*The Mukhtar of Gaffar Okkan neighbourhood did not have information on size and type of the lands.

The land to be used for the Project activities are agricultural lands, owned by private owners and were acquired by voluntary purchase method. During the social field study, two households surveys were conducted with the locals who sold and rented their land to the Project Company. According to both of the locals statement, they have received their payment from the Project Company. Further information on land allocation of the Project Company can be found in Section 8.2 of this Report.

In terms of livestock breeding, Yılmaz, Hasalan and Caferbey neighbourhoods use animal husbandry mainly for household purposes. Table 6-5 below presents the top three economic activities of each neighbourhood, respectively.

Table 6-5. Common Economic Activities within the AoI

Neighborhood	Hasalan	Gaffar Okkan	Yılmaz	Caferbey
First Common Economic Activity	Viticulture	Construction Works	Retirement Pension	Farming
Second Common Economic Activity	Animal Husbandry	Paid Workforce	Farming	Retirement Pension
Third Common Economic Activity	Retirement Pension	Retirement Pension	Paid Workforce	Animal Husbandry

Source: Field Study, 2017

According to interviews with Mukhtars of the AoI, Yılmaz neighbourhood is observed to have higher economic standards, whereas, in terms of family income, Caferbey neighbourhood has a decreasing trend of economic standards due to decreasing number of market opportunities for agricultural products.

6.3 Education

According to National Education Statistics Database of 2016 prepared by Turkish Statistical Institute, the literacy rate of Manisa has increased by 1.4% in 2016 which has resulted the Province to have 97.4% literacy rate in general. Continuing with the 2016 statistics, the highest literacy rate within the Province is located in Sarıgöl district, furthermore, the literacy rate of Salihli district is 97.1%.

In terms of comparing education conditions within the AoI through the field study, Yılmaz, Gaffar Okkan and Caferbey neighbourhoods have primary education facilities within their borders (1st through 8th grade), on the other hand, for high school education, students use means of transportation services to the closest high school located in Salihli District. Figure 6-2 presents the education indicators of the people from the AoI, respectively.

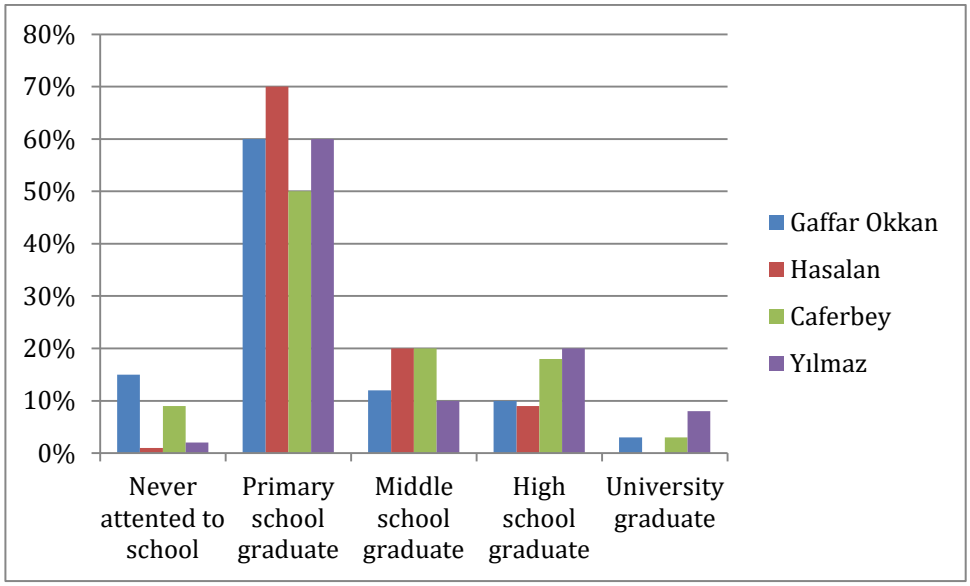

Figure 6-2 Education indicators of the community members within the AoI

As can be seen from the chart above, Gaffar Okkan has the highest percentage for the community members whom never attended to school, whereas, Yılmaz neighbourhood has the highest percentage when it comes to university graduates within their settlement. Furthermore, according to the interviews conducted with the Mukhtar interviews, almost all portion of the AoI are literate with Caferbey neighbourhood having the highest illiterate figures among the settlements within the AoI.

6.4 Health

According to Manisa Provincial Health Directorate, there are 14 State hospitals, 8 private hospitals, 9 medicine centres, 4 oral and dental centres, 20 District Health Directorates, 17 Community Health Centres and 26 Emergency Health Services Station in Manisa (Manisa Provincial Health Directorate, 2017).

In terms of health services within the AoI, Yılmaz, Gaffar Okkan and Caferbey neighbourhoods have local health clinic, which other neighbourhoods within the AoI prefers to access for minor health issues. For further health services, community members have access to hospitals within the District or Province.

6.5 Infrastructure and Services

Infrastructure and services within the AoI can be found in the given list below.

- Village rooms and coffee houses available in Yılmaz, Hasalan and Caferbey neighbourhoods provide place for community gatherings.
- All the neighbourhoods are connected to the national electricity grid.
- Drinking water is received mainly through groundwater and spring water.

- Hasalan neighbourhood uses septic tanks; others use sewer system for wastewater discharge.
- Solid wastes are collected from the four neighbourhoods by Salihli District Municipality.
- All four neighbourhoods have access to tele-communication services including telephone, mobile communication and internet.
- Transportation is through either private vehicles or mass transportation by minibuses to the Salihli District centre.

In terms of the economic issues, all four neighbourhoods experienced unemployment which affected income of the families negatively. In terms of economic issues, all four neighbourhoods experienced unhealthy drinking water and malfunctioning sewer system. In terms of health issues, Yılmaz neighbourhood reported cancer as the most common health problem.

6.6 Vulnerable Groups

Social baseline study also seeks to identify any potentially vulnerable or disadvantaged group or individuals in the local community. The social team conducted, through community level interviews, that there are number of vulnerable groups within the AoI and they include seasonal workers, females, low income groups, illiterates and mental or physical disabled persons.

Seasonal agricultural workers: Informal employment in Turkey is very common, especially in the agriculture sector. This group is considered as vulnerable since their income is seasonal.

Females: The patriarchal structure is predominant, and women do not have equal opportunity in education, workplace and inherit issues in the rural areas. It is seen that the women observed in Manisa province are generally employed as daily paid agriculture workers.

Low-income groups: In Turkey, the poverty line for a family of four in 2016 is set at about 4500 TL and about 7 million people are employed with a minimum wage of 1400 TL. According to information gathered from muhtars approximately 200 households were defined in the area of influence living with the assistance of district governor of Salihli.

Illiterate: The most common group of illiterates is the elderly female population. It was seen that literate rate of the Manisa is higher when compared to the average of Turkey but still there are illiterate population in the settlements.

Handicapped: This group is likely to experience the impacts of the Project due to their physical or mental characteristics.

Syrian Refugees: According to the Ministry of Interior's Office of Immigration (2016), there are approximately 5,000 Syrian refugees in Manisa Province. According to consultations with the muhtars, it is stated that about 20 households are living in Yılmaz neighbourhood**.**

Majority of the vulnerable groups in the three neighbourhoods comprise mainly of seasonal workers and illiterate people.

Yılmaz neighbourhood has the highest figures in terms of individuals with low income and families with female as the head of household. Further information regarding the vulnerable groups is given in Table 6-6 below.

Table 6-6. Vulnerable Groups

Settlement	Seasonal Worker	Low Income Group	Female Household Head	Illiterate People	Mentally Handicapped	Physically Handicapped
Yılmaz	500	80	300	100	20	50
Caferbey	150	52	5	50	4	6
Hasalan	50	30	13	6	1	3
Gaffar Okkan	250	4	30	300	10	5

Source: Socioeconomic Survey, 2017

Further information regarding the vulnerable groups in AoI can be found in Section 5.1.1. of the Stakeholder Engagement Plan.

It should be noted that the vulnerable groups is not expected to receive additional Project impacts in the AoI.

6.7 Project Information Level

During the social field study, Focus Group Meetings have been conducted at Caferbey, Yılmaz ,Hasalan and Gaffar Okan Neighbourhoods. On each Focus Group Meetings, brief introduction of the Project's purpose and the Project Company has been presented to the attendees by the social team.

Almost all land acquisition has been conducted at Yılmaz Neighbourhood (except for one parcel at Caferbey neighbourhood), where the project information level was observed to be relatively higher than the others. The result of social surveys related to Project information level is presented respectively for each settlements below.

- Caferbey: According to the Focus Group Meeting, almost all of the participants stated that they had no specific information regarding the Project. They have overheard that the Project Company has purchased lands from the locals but do not have further information regarding that. Therefore, during the meeting, they requested to receive further information and potential impacts of the Project.

- Hasalan: According to Focus Group Meeting, almost all of the participants stated that they did not have detailed information regarding the Project. During the meeting, they were eager to receive further information regarding the potential social and environmental impacts on the neighbourhood.
- Yılmaz: According to Focus Group Meeting, majority of the participants stated that they did not have any information regarding the Project. They have overheard there was a public participation meeting in August 2016, for the National EIA purposes, however, mentioning they have not been informed sufficiently, none of the attendees of this Focus Group Meeting attended. Even so, information level of Yılmaz was considerably higher than other settlements.
- Gaffar Okkan: According to Focus Group Meeting, some of the participants overhead about the Project with no detailed information. They are requesting for Project officials to visit the neighbourhood and inform the locals.

The information given above shows that, there is request for Project information disclosure regarding the Project from the participants of Focus Group Meeting.

Respondents recommended following suggestions to raise their level of knowledge regarding the Project. Different expectations of each settlement and suggested grievance mechanism are presented below.

Table 6-7 Suggested Information Disclosure and Grievance Tools

Name of the Neighborhood	Information Disclosure Tool	Suggested Grievance Tool
Caferbey	• Project personnel should provide brief information in the neighborhood including the impacts and grievance mechanism for the Project. • Brochures can be used to inform phases of the Project. • Telephone number of the Project representative should be posted on the Coffee shop of the neighborhood.	• Phone –line • Community liaison officer should be hired • Project authorities should visit the settlement.
Hasalan	• Project personnel should provide brief information in the neighborhood including the impacts and grievance mechanism for the Project. • Brochures can be used to inform phases of the Project..	• Community liaison officer should be hired • Project authorities should visit the settlement. • Phone –line
Yılmaz	• Project personnel should provide brief information in the neighborhood including the impacts and grievance mechanism for the Project. • Brochures can be used to inform phases of the Project.	• Community liaison officer should be Project authorities should visit the settlement. • Phone –line
Gaffar Okkan	• Project personnel should provide brief information in the neighborhood including the impacts and grievance mechanism for the Project. • Brochures can be used to inform phases of the Project.	• Community liaison officer should be hired • Project authorities should visit the settlement. • Phone –line

7. ENVIRONMENTAL IMPACT ASSESSMENT

Based on an overview of baseline parameters, impact assessment is comprised of the following elements:

Assessment of impacts on surface waters and groundwaters:

- Degradation of surface water quality affecting local users
- Impacts on ecosystems from vegetation clearance and earth moving during construction;
- Pollution of surface water from drilling muds or water from testing wells;
- Surface and/or groundwater contamination from chemical spills and leaks from storage, transportation and use of chemicals and fuel on Project site;
- Cross-contamination of surface aquifer from drilling of new geothermal wells
- Surface water impacts from discharges of effluents from reinjection;

Assessment of noise impacts on communities:

- Noise from construction and drilling activities from site preparation, excavation and foundations, construction and drilling;

Assessment of impacts on soil:

- Degradation of soil by contamination from drilling mud and cuttings and other potential hazardous wastes,
- Degradation of land and soil by contamination from fuel or chemical storage facilities or spent oils, lubricants storage,
- Soil contamination from fuel or chemical storage facilities or spent oils, lubricants storage, etc.

Assessment of impacts on air quality:

- Health effects of hydrogen sulphide (H_2S) on the surrounding communities from operational emissions from Power Plant site;
- Release of CO_2 and other GHGs at operation

7.1 Construction Stage Impacts

7.1.1 Impacts on Ecology

Site observations clearly indicate that the flora has been largely deteriorated due to anthropogenic activities.

The Project area is located within the Mediterranean phyto-geographical region and therefore has the characteristics of diverse vegetation along its coastal region. There are numerous fields within the Project area and its immediate environment due to the flat topography and alluvial deposits. Within the Project site, there are ruderal plants along the roadsides and around the irrigation and drainage channels as well as the dominant vegetation of field crops. Although it seems as a rich flora, it has lost its natural vegetation cover due to agricultural fields and gardens.

A certain amount of biomass will be lost during excavation works at the construction site. Top soil that will be skimmed from the surface will be reserved and used in site restoration and redevelopment of flora. Up to 300 mm of topsoil will be stripped and stored in appropriate conditions providing loss and degradation. Mitigation measures for the preservation of topsoil are provided below and also in the ESMP.

A large amount of the geothermal fluid that is required for energy production will be passed above the ground; therefore, the biomass loss will be minimized during the operations along the pipeline route. The Project pipeline is a fully enclosed system which does not create any adverse effects on the existing vegetation during the transportation of geothermal fluid to the facility.

Cooled water that will be generated as a result of the closed-circuit production will directly be pumped back to the thermal reservoir without being discharged to any receiving body.

The Project site and its vicinity are under intense human pressure due to animal grazing and agricultural activities. Certain fauna species have previously moved away from the region due to such anthropogenic impacts. The existing fauna species are the ones that have adapted themselves to these impacts. Therefore, there are no species that may be damaged due to the facility construction.

Within this framework, noise-induced impact of the facility on the fauna is in question, because of which the faunal elements may abandon their nesting area. However, once the facility construction is over, faunal elements may use the region as their nesting area again. Mitigation measures which are provided below and the ESMP will be in place during construction works in order to avoid nuisance to species which may occur at the site.

The cooled water to be generated as a result of the closed-circuit production will directly be pumped back to the thermal reservoir without being discharged to any other receiving body.

Table 7-1: Impacts of Construction Stage on Ecology

Impact Type	Positive	**Negative**	**Direct**	**Indirect**	Cumulative
	Impacts of construction activities on the ecology is negative and both direct and indirect.				
Impact Duration	**Temporary**	Short Term	Long Term	Permanent	
	The impact is temporary as species will possibly adapt to post-construction conditions.				
Impact Extent	Project Area	**Local**	Regional	National	
	The impact is local, limited to the Project Site and environs.				
Impact Magnitude	**Negligible**	Low	Medium	High	
	Impact is negligible as there are no critical habitats or species and the existing species will be able to adapt to the changes.				
Likelihood of Impact	Unlikely	**Likely**	Certain		
	Impacts are likely as excavation works will remove some vegetation and top soil; and drilling activities will cause unfavorable conditions with dust and noise.				
Impact Significance	**Insignificant**	Minor	Moderate	Major	
	Impact is insignificant as there are no critical habitats or species and the existing species will be able to adapt to the changes.				
Reversibility of Receptor	High	Medium	**Low**	Irreversible	
	General ecology will recover in time but it is evident that some species will move to new habitats.				
Final Impact Assessment	**Insignificant**	Low	Medium	High/Critical	
	Overall ecological impact is insignificant; thereby mitigation measures will not be necessary.				

Indirect impacts on ecology through emissions of noise and air quality or through discharges of effluent will be mitigated in a large extent through the mitigation measures identified:

- Topsoil will be stripped up to 300 mm depth and stored in designated storage areas for further site restoration works.
- Storage areas will be prevented from the accumulation of storm water, provided with drainage.
- Weed growth in stockpiles of topsoil will be prevented and the stockpiles will be seeded if required.
- Existing access roads will be used for Project purposes and off-road driving will be prohibited.
- Project activities will be limited in the construction area and construction sites will be surrounded with fences to prevent wild animals intrusion to the site.
- Hunting or collection of animals and will be strictly prohibited within the Project area.
- Awareness among all construction workers will be provided during the lifetime of the Project for especially the fauna species with limited mobility. If these species, are observed, they will be translocated to undisturbed but similar areas.

The residual impacts will be insignificant with the implementation of the mitigations.

7.1.2 Water Supply

During the construction stage, water demand will consist of potable water and water to be used for dust emission prevention. Potable water will be supplied as demijohns. Domestic water for the workers and water for dust suppression will be provided by the two wells established by the former owner of the land within the Project area. Sanko Enerji has applied to DSİ for the transfer of the ownership of the wells.

A total of 100 personnel is planned to be working in the scope of the construction phase for various works and periods, however number of personnel working at the same time will not exceed 84.

Total number of persons engaged: 84

Water required: 0.203 m^3/person/day (Turkish Statistical Institute, 2014)

Total water requirement: 0.203 m^3/person/day x 84 persons = 17.52 m^3/day

It is assumed that approximately 52.5 m^3 water per day will be used for construction activities for preventing dust emission.

Regarding the drilling works; 48 personnel is expected to be operating daily.

Total water requirement: 0.203 m^3/person/day x 48 persons = 9.744 m^3/day

Water is also required during drilling works. Exact amount of required water cannot be determined due to various factors such as drilling fluid and geological units, however based on the previous drilling studies 630 m^3 water is estimated to be used during drilling according to the EIA report. The drilling fluid will be stored in mud storage tanks after solid material is removed and the fluid is re-used afterwards. Therefore water consumption of 14 m^3/day will occur in order to supplement the required water during drilling activities. Water required for drilling works are supplied from available wells or surface water sources at the drilling locations after DSI consent and if there are no wells available, water will be transferred by tankers.

7.1.3 Wastewater Generation

Only domestic wastewater will be generated during construction stage activities. Considering domestic waste requirement is 17.52 m^3/day for 84 personnel, wastewater generated is estimated to be below 17.52 m^3/day. Domestic wastewater generated at the construction stage will be collected in a septic tank in compliance with the Regulation on the Construction of Septic Tanks at Places Where Sewer Construction is Not Possible. If the number of employees exceeds 84, wastewater treatment plant will be established for the Project according to the requirements of the Regulation on Water Pollution Control. Below

parameters are expected for the domestic waste water generated during construction phase of the Project according to the EIA report:

Table 7-2: Expected Domestic Wastewater Parameters

Parameter	Concentration (mg/lt)
pH	6-9
Suspended Solids	200
BOD	200
COD	500
Total Nitrogen	40
Total Phosphorous	10

7.1.4 Impacts of Geothermal Fluid

Test drillings are conducted in order to prove the commercial viability of potential resources. Drilling works are the same for both the production wells and reinjection wells. Type of the wells is decided according to the efficiency assessment of the wells based on properties such as temperature, flow rate and pressure. During the drilling works, liquid drilling mud which is the mixture of different type of chemicals with water will be employed in order to carry rock cuttings to the surface and also lubricate and cool the drill bit. Impacts of drilling mud are provided in the following section. .

Rotary drilling is used for the wells within the scope of the Project. Casings of three different diameters were employed during drilling of wells which have diameters of 20'', 13 3/8'' and 9 5/8''. At the end 7'' production pipes are employed to convey the geothermal fluid to the surface. Cement is applied around the casings and in this way in order to order to contain the geothermal fluid is contained and uncontrolled generation of geothermal fluid or vapour is prevented. The casings at shallow depth prevent loose near-surface material collapsing into the well and casings with intermediate diameter will support successive wellheads.. Casings and concrete wall around casings prevent groundwater and geothermal fluids intervene with each other. No discharge to aquifer will occur due to Project activities.

It is planned to extract 420 tonnes/hour geothermal fluid for 15 MW capacity from wells with a depth of 2500-3000 m. Geothermal fluid extracted from the production wells will be reinjected to the original reservoir through reinjection wells. An impermeable collection pond to be used in case of any failure during reinjection, operation of the power plant or during maintenance of the wells has been constructed. The capacity of the collection pond is 1400 m^3 with the estimation of use of 1400 tonnes/hour geothermal fluid at maximum for a potential capacity increase of the power plant to 50 MW. The capacity of the pond is calculated based on the estimation that the system will stop maximum for 1 hour duration. As mentioned a total of 1400 tonnes/hour geothermal fluid will be extracted for potential capacity of 50 MW and the collection pond has been constructed to contain the volume of extracted geothermal fluid for

one hour. If the volume of the collection pond is exceeded due to malfunction, extraction of geothermal fluid will be stopped. Geothermal fluid collected in the pond will be reinjected back to the system by reinjection pump. Geothermal fluid discharge to any kind of environment will be prevented during the whole Project lifetime. Groundwater quality monitoring will be conducted at downstream of geothermal fluid storage ponds and reinjection wells quarterly.

Upon DSİ approval two locations will be established within the license area and temperature and EC will be monitored in groundwater through installed automated monitoring systems.

Table 7-3: Impacts of Drilling Effluents

Impact Type	Positive	**Negative**	Direct	**Indirect**	Cumulative
	Impacts of discharging geothermal test water into the environment in case of a malfunction during reinjection.				
Impact Duration	**Temporary**	Short Term	Long Term	Permanent	
	The impact is temporary as limited to the construction stage.				
Impact Extent	Project Area	**Local**	Regional	National	
	The impact is limited to the impermeable collection pond, thereby local.				
Impact Magnitude	Negligible	**Low**	Medium	High	
	Impact magnitude could be considered low regarding the duration will be temporary and potential impact is local. Yet collection ponds will be established for the Project.				
Likelihood of Impact	Unlikely	**Likely**	Certain		
	Impacts of geothermal fluid on soil and groundwater resources are likely at construction stage based on risks of mud-pit overflows or improper waste handling.				
Impact Significance	**Insignificant**	**Minor**	Moderate	Major	
	Significance of impact is minor.				
Reversibility of Receptor	High	Medium	**Low**	Irreversible	
	Soil and groundwater quality can be reversed by restoration activities, at some cost.				
Final Impact Assessment	Insignificant	**Low**	Medium	High/Critical	
	Impact is low. Mitigation measures are required in the form impermeable collection pond.				

7.1.5 Impacts of Solid Wastes on Soil and Groundwater

Hazardous and non-hazardous solid wastes expected to be generated during the construction stage are domestic solid waste from construction staff, excavation debris, packaging wastes, recyclable solid waste end-of-life tires, waste batteries and accumulators and drilling mud.

Non-hazardous Solid Waste

Domestic solid waste is generated by the construction personnel in the construction stage as a result of various consumptions of the field staff. Considering that the number of field staff

will be 84 and taking the daily waste generation per capita value as 1.25 kg/person-day, as indicated by Turkish Statistical Institute's 2014 data for Manisa province, the total domestic solid waste generation by the field staff will be 105 kg/day.

Recyclable wastes such as glass, paper and plastics will be segregated from other wastes and stored temporarily on site for eventual recycling process. Non-hazardous solid waste other than recyclables will be stored in containers and will be disposed by Salihli Municipality. All solid non-hazardous wastes will be disposed according to the Waste Management Regulation.

Excavated soil will be re-used for backfilling, landscaping and site leveling purposes. Hence, no excavated soil will be transported and stored outside the Project area. Temporary storage of the excavated material will be performed providing the generation of drainage pathways to underlying aquifers. The height of the stockpiles will not exceed 5 m and the stockpiles will be dampened especially during dry and windy weather in order to prevent dust emissions. If excess material occurs it will be disposed in a landfill approved by Manisa Municipality.

Hazardous Waste

During the construction phase of the Project hazardous waste will mainly be contaminated packaging wastes, contaminated protective material and waste oil. 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. Oil change of the vehicles will be conducted by machine experts or service staff on leak-proof surface within the construction site, therefore a possible soil contamination will be prevented Generated waste oil will be collected in safe leak-proof containers, 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. Waste oil will be disposed in accordance with the Waste Oil Control Regulation.

Hazardous waste generated due to Project activities will be waste drilling muds in case they are determined as hazardous according to the analysis.

Packaging Waste

Packaging waste generated during the construction stage will comprise of recyclable materials such as metal, paper, plastics and glass and will be stored separately.

Waste Batteries and Accumulators

Waste batteries generated during the construction stage will be collected separately in the waste battery containers located at the Project site. Waste batteries will be sent to a Waste Battery Recycling Plant as stated in Section 2, Article 13 of the Regulation on the Control of Waste Batteries and Accumulators

Medical Waste

There will be an infirmary established at the Power Plant for the personnel. Besides health institutions close to the Project area will be applied if required. Salihli State Hospital is at a distance of 4.5 km to the Project area.

According to the EIA Report 10 kg/year medical waste is estimated to be generated. Medical waste which will be generated as a result of on-site first aid applications for injuries; they will be collected, transferred, stored and disposed of in compliance with the Medical Waste Control Regulation.

Drilling Mud

Drilling mud will be generated as a result of drillings. Drilling mud will be elevated to the ground collecting solid particles. Drilling mud will be sieved for foreign substances and then passed through solid-liquid separator (decanter). Liquid part is pumped back to the mud tankers to be reused. Solid substances on the other hand, are sent back to waste mud pond. The solid material passing through the decanter has some amount of water content therefore collected as liquid waste in the drilling mud pond. Liquid drilling mud is settled in the pond providing solid substances to deposit.

For the Project 100 lt of drilling mud is expected to be generated for 1 m drilling. Average depth of the drilling wells is estimated to be 2,500 m therefore the amount of drilling mud at each drilling location is calculated as follows:

Amount of drilling mud: 100 lt/m x 2500 m=250,000 lt= 250 m^3

Mud ponds with dimensions 60 m x 6.5 m x 3 m with side slope are established for storage of mud at each drilling location. Each pond is covered with impermeable material such as geomembrane and has 1,170 m^3 capacity which is above the calculated value above. Mud collected in the pond is settled providing the deposition of solid substances. Waste mud is analyzed for categorization according to the requirements of the Circular on the Disposal of Drilling Mud and Wastes Generated from the Physical Treatment of Chromium Minery (dated 2012/15) and the Regulation on Landfill of Wastes (Official Gazette dated 26.03.2010, no: 27533). If the waste is deemed hazardous waste, it will be disposed according to the requirements of the Circular on the Disposal of Drilling Mud and Wastes Generated from the Physical Treatment of Chromium Minery.

If the waste mud is determined as inert and/or non-hazardous waste then the mud ponds will be filled with excavation debris and covered with the vegetative soil which was stripped and stored separately during land preparation.

After the drilling mud is deposited, remaining water on the mud is evaporated or discharged by vacuum truck if drilling mud is determined as non-hazardous or inert. If the mud is classified as hazardous then the water on the mud is collected into IBC tank and disposed according to the requirements the Regulation on Waste Management.

Table 7-4: Impacts of Waste Storage

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impacts of mud-pits and hazardous waste storage are negative and direct. Improper storage of hazardous waste would cause infiltration of hazardous components into sub-layers of soil and the shallow aquifers.				
Impact Duration	Temporary	Short Term	**Long Term**	Permanent	
	The impact will be long-term if the impact is not detected on-time and cleaning procedures are not applied.				
Impact Extent	Project Area	**Local**	Regional	National	
	The impact is limited to local soils and the shallow aquifer.				
Impact Magnitude	Negligible	Low	**Medium**	High	
	Groundwater in the shallow aquifer is not used by local people. Still any contamination is not allowed by regulations.				
Likelihood of Impact	Unlikely	**Likely**	Certain		
	Impacts of waste storage on soil and groundwater resources are likely at construction stage based on risks of mud-pit overflows or improper waste handling.				
Impact Significance	Insignificant	Minor	**Moderate**	Major	
	Significance of impact is moderate as oil contamination from oil based drilling muds can cause long term or permanent changes.				
Reversibility of Receptor	High	Medium	**Low**	Irreversible	
	Soil and groundwater quality can be reversed by restoration activities, at certain costs.				
Final Impact Assessment	Insignificant	Low	**Medium**	High/Critical	
	Impact is moderate and requires mitigation measures.				

7.1.6 Impacts on Air Quality

The emissions during the construction stage will consist of the dust and exhaust gas emissions resulting from operation of onsite diesel vehicles, skimming of topsoil layers, and excavation of mud pits, transportation of ready-mixed concrete for the power plant construction and H_2S emissions during drilling although in low concentrations due to the use of binary technology. According to the baseline H_2S measurements in the AoI of the Project, it was observed that H_2S concentrations are below the regulation limits. Air quality measurements will be conducted in terms of H_2S concentrations during drilling works and operation phase in order to prove compliance to the regulation requirements. H_2S detectors will also be placed at well heads for monitoring H_2S levels.

Dust emissions

Excavation will be conducted for the power plant, mud pits, administrative building, workshop and storage area and septic tank location. According to the calculation in the EIA report, the amount of excavated material for the Project is estimated as 24,064 m^3.

Dust emissions caused by each activity of each construction phase are calculated according to the information provided in the EIA Report. 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 7-5 below:

Table 7-5: Controlled Dust Emission Factors according to Turkish IAPCR

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

Dust emission caused by construction activities is calculated using controlled dust emissions:

Table 7-6: Construction Phase Dust Emissions

Activity	Construction Phase
Excavation	0.1671
Transport of excavated material to the trucks	0.0156
Loading	0.0668
Transport of the trucks to the landfill	0.0468
Unloading	0.668
Total Hourly Dust Emissions	**0.3632**

According to Turkish IAPCR, it is stated that if total dust emission from fugitive sources is higher than 1 kg/hr, air quality dispersion modeling should be performed for both total suspended particles and PM_{10}. As seen in the table below dust emissions calculated for construction phase of the proposed project, do not exceed the limit value of 1 kg/hr. Therefore, no dispersion modeling was performed as it is stated in the Turkish IAPCR.

Dust emission impacts will be temporary, limited to the construction period. Mitigation measures are currently in place in order to suppress dust emissions by means of water spraying and improvement of road conditions. With the measures taken to minimize nuisance o communities, dust impact will be negligible.

Exhaust emissions

Diesel fuel will be used by construction vehicles during construction phase. For the calculation of the exhaust emissions from the construction vehicles, it is estimated that the fuel consumption is 15 lt per vehicle in an hour and all the vehicles operate at the same time. Therefore hourly diesel fuel consumption is estimated as 75 lt.

The USEPA AP-42 Emission Factors are used in order to calculate emissions generated by the diesel fueled vehicles. Since the emissions, generated due to operation of these vehicles, will include sulphur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), particulate

matter (PM_{10}) and total organic carbon/volatile organic carbon (TOC/VOC), hourly mass flow of these pollutants were calculated individually as can be seen below.

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

Emissions from construction vehicles are calculated as follows;

Carbon monoxide;
0.95 lb/(10^6BTU) x 30,135.8 BTU/l x 75 l/hr x 0,4536 kg/1 lb = 0.975 kg/hr

Sulfur oxide;
0.29 lb/(10^6BTU) x 30,135.8 BTU/l x 75 l/hr x 0,4536 kg/1 lb = 0.3 kg/hr

Total Organic Carbon;
0.35 lb/(10^6BTU) x 30,135.8 BTU/l x 75 l/hr x 0,4536 kg/1 lb = 0.36 kg/hr

Nitrogen oxides;
4.41 lb/(10^6BTU) x 30,135.8 BTU/l x 75 l/hr x 0,4536 kg/1 lb = 4.53 kg/hr

Dust (PM_{10});
0.31 lb/(10^6BTU) x 30,135.8 BTU/l x 75 l/hr x 0,4536 kg/1 lb = 0.31 kg/hr

Table 7-7. Impacts of Construction Activities on Air Quality

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	The impacts of dust , H_2S and exhaust emissions during construction are direct and negative.				
Impact Duration	**Temporary**	Short Term	Long Term	Permanent	
	The impact is limited to the construction stage.				
Impact Extent	Project Area	**Local**	Regional	National	
	The impact is limited to nearby settlements, thereby local.				
Impact Magnitude	Negligible	**Low**	Medium	High	
	Impact is low as there will be some perceptible changes in people's livelihoods, but they will adapt with some relative ease.				
Likelihood of Impact	Unlikely	Likely	**Certain**		
	Dust emissions during construction stage are certain due to operation of construction vehicles and drilling equipment.				
Impact Significance	Insignificant	**Minor**	Moderate	Major	
	Significance of impact is minor as the impact is temporary and mitigation measures are in place.				
Reversibility of Receptor	**High**	Medium	Low	Irreversible	
	Communities will be free from dust exposure once the construction stage is complete.				
Final Impact Assessment	**Insignificant**	Low	Medium	High/Critical	
	Impact is insignificant, thereby there is no need for additional mitigation measures.				

7.1.7 Noise Impact

Noise will be emitted from the onsite vehicles and machinery during the construction stage. However, construction noise is temporary and transient in the environment. Noise impact during construction on 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. Environmental noise measurements have been conducted for the Project within the scope of ESIA studies while construction activities were on-going for which the details are provided in Section 5.6. According to the measurement results noise levels exceed RAMEN limit value of 70 dBA for construction activities at evening time during weekend.

The IFC/WB noise guideline provides limits for daytime (07:00-22:00) and nighttime (22:00-07:00) 55 dBA, and 45 dBA respectively. According to the measurement results IFC/WB noise guideline limits are exceeded during night time at weekdays and daytime and nighttime during weekends. It is possible that the increase of the noise levels on weekends is due to the traffic increase on İzmir-Uşak highway which passes on the south of the project area. Besides Construction activities will not be performed at night therefore nuisance due to noise is not expected to occur at nights. Moreover construction noise is temporary and can be controlled through good site working practices and limiting working hours.

Table 7-8. Noise Impacts of the Construction Stage

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Noise impact during construction is direct and negative.				
Impact Duration	**Temporary**	Short Term	Long Term	Permanent	
	The impact is limited to the construction stage.				
Impact Extent	Project Area	**Local**	Regional	National	
	The impact is limited to nearby settlements, thereby local.				
Impact Magnitude	Negligible	Low	**Medium**	High	
	Impact is medium as communities can adapt with difficulty.				
Likelihood of Impact	Unlikely	Likely	**Certain**		
	Noise during construction stage is certain due to operation of construction vehicles and drilling equipment.				
Impact Significance	Insignificant	Minor	**Moderate**	Major	
	Significance of impact is moderate as the impact is temporary and mitigation measures are in place.				
Reversibility of Receptor	**High**	Medium	Low	Irreversible	
	Communities will be free from noise once the construction stage is complete.				
Final Impact Assessment	Insignificant	**Low**	Medium	High/Critical	
	Impact is low, yet good practices and proper scheduling of construction activities will be applied for decreasing noise levels. .				

7.2 Operation Phase Impacts

7.2.1 Impacts on Ecology

Adverse impacts on terrestrial ecology and biodiversity imposed during the construction stage will disappear at the operation stage. No project-related major adverse impacts on the ecology are anticipated for the operation stage.

7.2.2 Water Supply

During the operation stage, water demand will consist of domestic water and drinking water for the personnel and for the cleaning of the facility and irrigation of the green area. Process water will not be required for cooling since the plant is designed as air-cooled system.

Drinking water will be supplied in demi-johns and Groundwater from the wells within the Project area will be used for domestic purposes after treatment at the treatment facility which will be established at the Project area. Irrigation water will be used from the wells as well.

It is planned to employ a total of 27 personnel during the operation phase of the Project.

Water required: 0.203 m^3/person/day (Turkish Statistical Institute, 2014)

Total water requirement: 0.203 m^3/person/day x 27 persons = 5.481 m^3/day.

It is planned to use 1.0 m^3/day of water for cleaning purposes of the administrative building and 2.0 m^3/day of water for cleaning purposes of the power plant. Also 3.0 m^3 of water will be required for irrigation of green area at the Project area. Total water required for the operation phase is estimated as 11,481 m^3/day.

7.2.3 Wastewater Generation

There will be no wastewater generation due to the process during the operation phase of the Project.

Domestic wastewater generated during operation phase is expected to be 5.481 m^3/day. Wastewater from cleaning of the administrative building will be 1.0 m^3/day. Wastewater generated from the cleaning of the power plant will be collected separately for potential waste oil and/or hazardous material contamination. Also stormwater will be collected in drainage channels established within the power plant area and discharge to the receiving body will be provided after necessary treatment. Interception channels will also be established around the Project area in order to prevent access of stormwater to the area.

Total amount of wastewater generated due to operation activities is expected to be 8.481 m^3/day of which 6.481 m^3/day is domestic wastewater.

Domestic wastewater generated at the operation stage will be collected in a septic tank in compliance with the “Regulation on the Construction of Septic Tanks at Places Where Sewer

Construction is Not Feasible". A protocol will be issued with MASKI and discharge of the waste water collected in the septic tank will be provided periodically.

Contaminated wastewater from plant cleaning will be collected separately and discharged according to the requirements of Water Pollution and Control Regulation.

7.2.4 Impacts of Spent Geothermal Fluid

Geothermal fluid extracted from the production wells will be reinjected to the original reservoir through reinjection wells. With the use of reinjection system, the residual impact associated with operational discharges of brine geothermal fluid is assessed as having negligible significance. It is planned to construct an impermeable collection pond of 1,400 m^3 to be used in case of any failure during reinjection, operation of the power plant or during maintenance of the wells. If the volume of the collection pond is exceeded due to malfunction, extraction of geothermal fluid will be stopped. Geothermal fluid collected in the pond will be reinjected back to the system. Geothermal fluid discharge to any kind of environment will be prevented during the whole Project lifetime.

Groundwater quality monitoring will be conducted at downstream of geothermal fluid storage ponds and reinjection wells quarterly.

Table 7-9. Impacts of Spent Geothermal Fluid

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impact of reinjection failure is direct and negative.				
Impact Duration	**Temporary**	Short Term	Long Term	Permanent	
	The impact is temporary.				
Impact Extent	Project Area	**Local**	Regional	National	
	Failure of a surface pipeline would lead to contamination of a limited area, including soil and groundwater.				
Impact Magnitude	Negligible	Low	Medium	**High**	
	According to the Regulation on Control of Soil Contamination, it is compulsory to restore contaminated soil. Furthermore, communities have a tendency to fear that spillage from the reinjection system may harm their crops and react to the Project Company.				
Likelihood of Impact	**Unlikely**	Likely	Certain		
	Critical failure of the pipeline is unlikely with a good design and good operation practices including system monitoring. Yet it can happen at any time as an out-of-control aspect.				
Impact Significance	Insignificant	Minor	**Moderate**	Major	
	Significance of impact is moderate.				
Reversibility of Receptor	High	Medium	Low	**Irreversible**	
	In case of temporary discharge into a creek, local community distress would rise. Discharge of geothermal fluid would destroy aquatic life in the surface water.				
Final Impact Assessment	Insignificant	Low	Medium	**High**/Critical	
	Impact is high and requires mitigation measures for preventing impacts on soil and groundwater.				

Mitigation Measures

Spent geothermal fluids generated during operation will be re-injected to the host rock formation, resulting in minor effluent volumes involving reject waters. Potential contaminants in geothermal effluents will vary according to the mineralogy of the host geological formation, temperature of the geothermal water, and site-specific facility processes (IFC EHS Guidelines for Geothermal Power Generation).

Potential for contamination of groundwater will be minimized by installation of leak-proof well casings in the injection wells to a depth to the geological formation hosting the geothermal reservoir.

In case of failure of reinjection line, system will be shut down. Project Company is developing an Effluent Management Plan to minimize risk of effluent discharges before the start of operation. In the event of emergency discharge of geothermal water to surface waters, geothermal water will be discharged into a retained in a thermal pond, where the temperature of water will drop to allowable limits set by the Water Pollution Control Regulation. The storage pond will be lined and of sufficient size to allow for storage and required cooling to be carried out for the potential duration of the reinjection failure.

Groundwater sampling will be conducted from the existing wells at the downstream of the reinjection wells for groundwater quality monitoring purposes.

The impact of any potential failure of the reinjection system within the Project area can be effectively managed through good design, regular monitoring and development of appropriate emergency responses. Given that a critical failure of the pipeline is extremely unlikely and with a well-prepared management and monitoring plan in place, the residual impacts can be assessed as low.

7.2.5 Impacts of Solid Wastes

Hazardous and non-hazardous solid wastes expected to be generated during the operation stage are domestic solid waste from operation staff, medical waste, packaging wastes, end-of-life tires and waste batteries and accumulators. A Waste Management Plan will be prepared by the Project Company for the different types of waste as described below.

There will be no solid waste generation from process.

Domestic Solid Waste

Domestic solid waste in the operation stage is generated as a result of various consumptions of the operation personnel. According to the EIA Report domestic solid waste generation for 27 personnel will be 33.75 kg/day.

Domestic solid waste will be collected and stored in the Project area and disposed by Salihili Municipality according to the requirements of Waste Management Regulation. Furthermore, recyclable waste (i.e. glass, plastics, glass) will be collected separately at source as indicated in Article 5 of the Waste Management Regulation.

Packaging Waste

Packaging waste generated during the operation stage are composed of recyclable materials such as metal, paper, plastics and glass. Packaging waste will be collected in separate containers in order to be reintegrated into the economy without exposed to any chemical or biological process. In addition, compliance with the Packaging Waste Control Regulation will be ensured for their management during the operation stage.

End-of-life Tires

Maintenance of the vehicles to be used during the operation stage will be performed at authorized technical stations therefore end-of-life tires are not expected to occur at the Project area. In case there are in the area tires will be sent to licensed companies for disposal in accordance with the Regulation on the Control of End-of-life Tires.

Waste Batteries and Accumulators

Waste batteries generated during the operation stage will be separately collected in the waste battery containers found at the Project site and periodically will be sent to a Waste Battery Recycling Plant. Compliance will be ensured with the Regulation on the Control of Waste Batteries and Accumulators.

There will be no accumulator replacement within the Project area. Empty accumulators generated in compulsory cases will be sent to firms to be replaced with full ones as stated in the Regulation on the Control of Waste Batteries and Accumulators.

Waste Oils

Waste oil is expected to be generated due to transformer oil used in the switchyard and substation. Maintenance of the transformers will be provided by authorized service companies and disposal of the waste oil will be conducted according to Waste Oil Control Regulation.

Waste oil is generated as a result of maintenance of vehicles and equipment. In case of waste oil generation during an oil change, it will be stored and disposed off in accordance with the Waste Oil Control Regulation. Vehicle maintenance will be conducted periodically on a daily, weekly and monthly basis, and oil leakage will be avoided by using drip pans.

Waste vegetable oil is not expected to be generated since food service will be outsourced during operation phase of the Project. In case of waste vegetable oil generation compliance with the Waste Vegetable Oil Control Regulation will be provided.

Hazardous Wastes

Hazardous wastes to be generated during operation phase of the Project is expected to be contaminated materials due to maintenance activities, contaminated packaging material wastes, waste electronics, fluorescent and waste toner and cartridge.

A Waste Management Plan will be prepared by the Project Company before operation phase in order to mitigate impacts from storage of different streams of waste. The Waste Management Plan will comprise of mitigation measures on the basis of different lines of waste generation, and emergency response measures against possible emergency conditions associated with hazardous wastes particularly.

Table 7-10. Impacts of Waste Generation and Storage at Operation Stage

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impact of waste generation without waste management is direct and negative on soil and groundwater.				
Impact Duration	Temporary	Short Term	**Long Term**	Permanent	
	The impact is long term.				
Impact Extent	Project Area	**Local**	Regional	National	
	The extent of impact is local.				
Impact Magnitude	Negligible	Low	Medium	**High**	
	Impact will be high if no mitigation measures are taken and direct contact with ground would cause soil and groundwater contamination.				
Likelihood of Impact	Unlikely	**Likely**	Certain		
	Impacts are likely if no waste management is implemented.				
Impact Significance	Insignificant	Minor	Moderate	**Major**	
	Significance of impact is major as lack of waste management practices would cause contamination of soil and groundwater				
Reversibility of Receptor	High	Medium	**Low**	Irreversible	
	Soil and groundwater has low reversibility (depending on the contents of waste).				
Final Impact Assessment	Insignificant	Low	Medium	**High/**Critical	
	Impact is high and requires mitigation measures.				

Without any mitigation measures, risks of particularly hazardous waste storage would be high. Given the possible impacts, it is significant to implement well established waste management practices mainly for proper storage of hazardous wastes. Through the implementation of the waste management plan, the impact level will be lowered to minor.

7.2.6 Impacts of Storage of Chemicals

During the operation stage; fuels, lubricants and other chemicals may pose risks of soil contamination due to poor storage conditions and practices.

Chemical dosing systems will be applied in order to prevent clogging of the transmission pipeline caused by the geothermal fluid. Calcification and corrosion prevention inhibitor will be employed in the system through the chemical dosage systems which will be stablished at each drilling well. It is estimated to inject 1 lt/h inhibitor via the dosage system where the amount will be 3 L/h. The chemical will be supplied domestically therefore it is planned to store an amount of 500 L for a use of 1 week on the site. The use and storage of the

chemical will be conducted according to the Material Safety Data Sheet of the chemical which will be available for the operators at the Project site. Pentane will be used as secondary fluid for the Project in a closed loop system therefore there will be no contact with the geothermal fluid. It is planned to store 100 m^3 of n-pentane at the Project site. 73 m^3 of 100 m^3 n-pentane will be recirculated in the system and the remaining 27 m^3 will be stored in storage tanks. The notifications of the chemicals will be done according to the requirements of the Regulation on Prevention of Major Industrial Accidents and Mitigation of Impacts (Date: 30.12.2013, no: 28867). When the operation starts risk category of the facility will be defined and relevant documentation such as Major Industrial Accidents Policy, Emergency Action Plan and Safety Plan.

The magnitude of potential change in groundwater quality is assessed to be moderate, because the impact would cause a significant change in water chemistry but would be short lived and the impact highly localized. This could impact on water abstraction close to the site for both local residents. The impact of this risk is therefore assessed to be high without mitigation.

Table 7-11. Impacts of Chemicals Storage

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impact of improper chemicals storage is direct and negative on soil and groundwater.				
Impact Duration	Temporary	Short Term	**Long Term**	Permanent	
	The impact is long term.				
Impact Extent	Project Area	**Local**	Regional	National	
	Failure of a surface pipeline would lead to contamination of a limited area.				
Impact Magnitude	Negligible	Low	Medium	**High**	
	Impact is high if no mitigation measures are taken as leakages and spills would cause soil and groundwater contamination.				
Likelihood of Impact	Unlikely	**Likely**	Certain		
	Impacts are likely if no measures are taken against soil and groundwater contamination.				
Impact Significance	Insignificant	Minor	Moderate	**Major**	
	Significance of impact is major.				
Reversibility of Receptor	High	Medium	**Low**	Irreversible	
	Soil and groundwater has low reversibility (depending on the chemicals spilled or leaked).				
Final Impact Assessment	Insignificant	Low	Medium	**High**/Critical	
	Impact will be high if no mitigations are taken.				

The Project Company will prepare and implement a Hazardous Chemicals Management Plan, supported with a Spill Response Plan. Appropriate containers will be used for segregation and permanent storage of chemicals and fuels on site. Suitable sized storage and well maintained containers with appropriate labelling will be ensured.

Through the development and implemented Hazardous Chemicals Management Plan, the impact level will be lowered to minor.

According to the pentane use and storage requirements of the Regulation on Prevention of Major Industrial Accidents and Mitigation of Impacts will be complied with and relevant documentation such as Major Industrial Accidents Policy, Emergency Action Plan and Safety Plan will be developed and established according to the risk category of the facility.

7.2.7 Impacts on Air Quality and Odor Impacts

The major gaseous emissions from the geothermal power generation processes are CO_2 and H_2S. The Site will be required to comply with limits indicated in the Regulation on Control of Industrial Air Pollution. The release of the H_2S gases during the drilling works and operation stage usually accompanies the severe odor problems in the settlements close to the geothermal plants. Given the binary process of the geothermal power generation, the H_2S emissions will be minimal as compared to the other technologies. Still, the Project Company will conduct regular air quality measurements for H_2S emissions and commit to taking additional measures if the measurements indicate high levels of H_2S concentrations. There will be also H_2S detectors at the wellheads.

Table 7-12. Air Quality and Odor Impacts During the Operation Stage

Impact Type	Positive	**Negative**	**Direct**	Indirect	**Cumulative**
	Odor impacts and H_2S emissions on communities are direct and negative, and cumulative.				
Impact Duration	Temporary	Short Term	**Long Term**	Permanent	
	The impact is long-term throughout operation stage.				
Impact Extent	Project Area	Local	**Regional**	National	
	Impact can be regional together with cumulative impacts from other projects in the region.				
Impact Magnitude	Negligible	Low	**Medium**	High	
	Impact is medium given that communities in the Area of Influence will have to adapt to the exposure to nuisance. Communities are sensitive about the odor issue, as it also gives them an indication for their crops exposed to air pollution caused by geothermal power generation.				
Likelihood of Impact	**Unlikely**	Likely	Certain		
	The impact is unlikely as the Project will employ closed-circuit system which will minimize odor emissions, except for temporary odor release at times of maintenance and testing that odor will be emitted.				
Impact Significance	Insignificant	**Minor**	Moderate	Major	
	Significance of impact is minor.				
Reversibility of Receptor	Insignificant	Low	Medium	**High**	
	Reversibility of impact is high as odor will diminish once the source is closed down.				
Final Impact Assessment	**Insignificant**	Low	Medium	High/Critical	
	Overall impact is insignificant and does not require additional mitigation measures.				

7.2.8 Environmental Noise Impacts

Noise sources during the operational phase of the Project will be mainly the cooling fans along with the auxiliary equipment. According to the EIA Report sound power levels of the equipment to be used during operation phase will be as follows in Table 7-13 below:

Table 7-13: Operation Equipment and Sound Power Levels

Equipment	Number	Sound Power Level (dBA)
Pump	1	99.2
Fan	1	102.6
Air Compressor and Equipment	1	93.7
Reinjection Pump and Equipment	6	110.2
Fire System	1	98.1
Auxiliary Equipment	1	101.3

IFC/WB Guidelines noise levels at the noise sensitive receptor which should not be exceeded are given in Table 7-14.

Table 7-14: IFC/WB 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

RAMEN sets limit noise levels according to the location of the facility and the type of structures at the vicinity of the facility. Limits applicable for the Project are 60 dBA, 55 dBA and 50 dBA for daytime, eveningtime and nighttime respectively.

EIA report predicts equivalent noise levels according to distance as follows in Table 7-15:

Table 7-15: Noise Levels for Operation Phase

Distance (m)	Ldaytime (dBA)
10	78
20	72
30	68
40	65
50	64
100	58
200	52
300	48
400	45
500	44
600	**42**
1,000	38
2,000	32
3,000	28

As seen in the table, predicted noise level at the nearest receptor comply with the daytime, evening-time and nighttime noise limits of Turkish RAMEN and also IFC/WB Guidelines. Regarding the closest dwelling at Yılmaz village which is at 179 m to the plant site the sound level is calculated as 52.94 dBA which exceeds RAMEN limit of 50 dBA and IFC guideline value of 45 dBA. Therefore environmental noise measurements will be conducted after the start of the operation in order to determine if the noise levels comply with limits. If noise levels are above limits mitigation measures such as establishment of sound barriers will be taken.

Table 7-16. Noise Impact of the Operation Stage

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Noise impacts on communities are direct and negative.				
Impact Duration	Temporary	Short Term	**Long Term**	Permanent	
	The impact is long-term throughout operation stage.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impact is local, limited to the settlements in the Area of Influence.				
Impact Magnitude	Negligible	**Low**	Medium	High	
	Impact is low given that communities in the Area of Influence will have to adapt to the exposure to nuisance.				
Likelihood of Impact	Unlikely	**Likely**	Certain		
	The impact is likely.				
Impact Significance	Insignificant	**Minor**	Moderate	Major	
	Significance of impact is minor.				
Reversibility of Receptor	Insignificant	Low	Medium	**High**	
	Reversibility of impact is high as noise will diminish once the source is closed down.				
Final Impact Assessment	Insignificant	**Low**	Medium	High/Critical	
	Overall impact is low and monitoring will be conducted.				

7.2.9 Climate Change Impacts

Release of non-condensable gases from the geothermal reservoir raises the issue of impacts that cause climate change. Non-condensable gases are mainly composed of CO_2, which has no direct impact on local air quality.

As greenhouse gas (GHG) CO_2 is associated with combustion of fossil fuels. The Project will lead to releases of greenhouse gases. During tests but mostly during operation, CO_2 and methane (CH_4) will be released.

The worldwide calculations show that the total amount of CO_2 avoided by implementing geothermal energy in place of coal proves that a beneficial impact of major significance is gained from geothermal power plants.

It should be recalled that binary power plants retain non-condensable gases in a closed circle system. The thermal water is reinjected after utilizing its heat at the heat exchanger resulting in near-zero emissions during the power production process as the non-condensable gases are never released to the atmosphere. However if gas separation occurs within the circulation loop, some minor gas extractions and emission are likely. According to the information obtained from the Project Company CO_2 release during operation is calculated for 2 reinjection wells (SAN-3 and SAN-8) and 4 production wells (SAN-4, SAN-5, SAN-6 and SAN-7). Operation with geothermal fluid of 420 ton/hour consisting 2.05 % NCG, 99.0 % of which is CO_2 will generate 68,191.2 kg CO_2 per year given the fact that the Power Plant will

operate for 8000 hours in one year for 118,700,000.00 kWh of annual electricity production. GHG emission for the operation phase of the Project is calculated as 574.48 g/kWh according to the following calculation:

420 tonnes/hour * 2.05/100 (NCG percentage) * 99/100 (CO_2 percentage) = 8.5239 tonnes CO_2/h

8.5239 tonnes CO_2/h * 1,000,000 g/tonnes * 8,000 hours/year * 1 year/118,700,000 kWh = 574.48 g/kWh

Still the Project Company will be analysing the amount and quality of CO_2 gas release during operation and will decide on a management strategy as to store or dissolve CO_2 in the reinjection water.

7.2.10 Impacts on Landscape

Establishment of the geothermal power plant on the existing landscape will unavoidably change the visual aspects of the landscape. Construction of the administrative building, power station, the wells, steam coming from temporary testing of wells can affect the landscape by changing its character and change visual aesthetics. Temporary drilling rigs will be visible to the nearby settlements and be contrasting in the landscape. The highest structure within the scope of the Project will be the drilling rigs of 45 meter however will be erected for a limited period of time.

Other Project associated structures erected during the operation phase can be designed with low contrast with the existing landscape. It is likely that the Project structures and steam will be visible by the nearby settlements and some of them will be visible from a distance although the effects can be mitigated by appropriate design of structures with the existing landscape.

The landscape around the Project site comprises of agricultural lands at east, west and north and railway and highway on the south. The area has flat topography with no specific visual features except for the Ancient City of Sardis whose boundary is at about 2.5 km distance from the Power Plant Visibility analysis for the landscape impacts on the Ancient City of Sardis was conducted and a visibility map was prepared which is provided below in Figure 7-1. The structural features of the Ancient City are located within a limited area surrounded with orchards at about 4 km from the plant. There are also other structures such as dwellings, orchards and road between the existing and planned Project units (the power plant, wells and aboveground pipelines) and the Ancient City which will decrease the visibility of the units. The distance is also relatively long for creating a major negative landscape impact. .

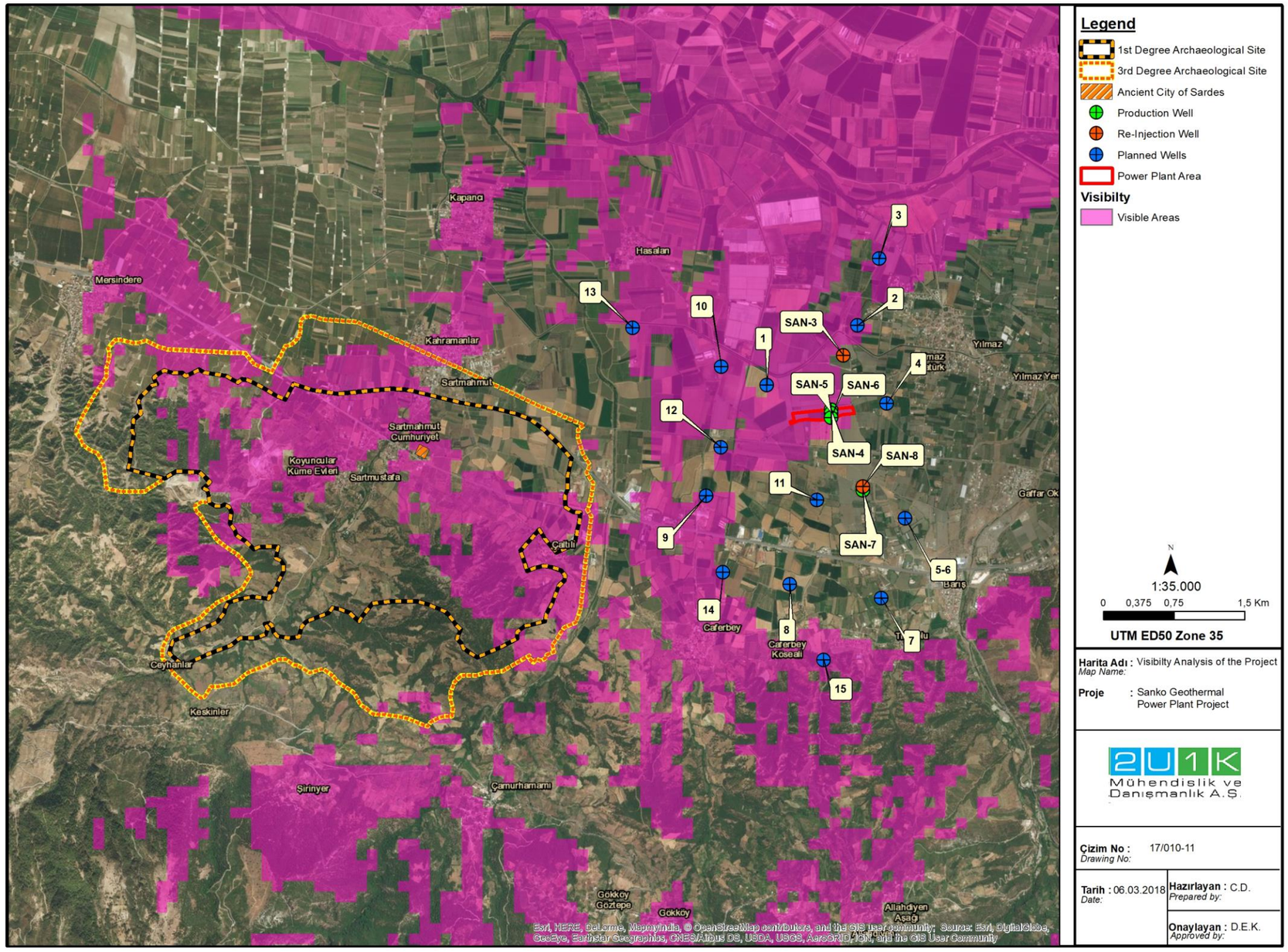

Figure 7-1 Visibility Analysis Map

Table 7-17. Impact on Landscape

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impact on landscape is direct and negative.				
Impact Duration	Temporary	Short Term	**Long Term**	Permanent	
	The impact is long-term throughout construction and operation stage.				
Impact Extent	Project Area	Local	**Regional**	National	
	Impact is local, limited to the nearby settlements				
Impact Magnitude	Negligible	**Low**	Medium	High	
	Impact is low given that the area does not comprise specific visual characteristics for the communities. Ancient City of Sardis is at a distance with low visibility of Project components.				
Likelihood of Impact	Unlikely	**Likely**	Certain		
	The impact is likely.				
Impact Significance	Insignificant	**Minor**	Moderate	Major	
	Significance of impact is minor.				
Reversibility of Receptor	Insignificant	Low	**Medium**	High	
	Reversibility of impact is medium as visual impact will diminish after the Project closure.				
Final Impact Assessment	**Insignificant**	Low	Medium	High/Critical	
	Overall impact is insignificant and does not require additional mitigation measures.				

7.3 Closure Phase Impacts

Operation period of the Project is planned to be 30 years at this stage however the duration can be extended based on maintenance and rehabilitation of the equipment and the system. Therefore closure phase impacts can be altered in the future at the end of the operation phase of the Project. Yet estimated impacts are as follows:

7.3.1 Impacts on Ecology

Impacts on Ecology during closure phase activities would be similar to that would occur during construction, but at a reduced magnitude.

Noise from machineries and demolition can affect animals, disturb them or scare them which could have impact on results from nesting season. Noise generation during closure phase will be temporary and transient in nature and will be controlled through good site working practices, limited working hours and decommissioning will be planned outside breeding season. Therefore noise impact during closure phase of the Project is expected to be insignificant.

Closure activities can temporary cause trapping or accidents for wildlife. Entrance of the animals will be prevented by fences surrounding the Project area. Decommissioning will be planned so it will be continuous and surface finish will not leave hazards of abandoned structures for wildlife. Therefore impact on wildlife during closure phase of the Project is expected to be insignificant.

7.3.2 Water Supply

Impact regarding water supply during closure phase will be similar to construction phase. Water will be used for dust suppression and domestic uses. It is expected that the impact will be insignificant during closure phase.

7.3.3 Wastewater Generation

Wastewater will be generated due to domestic uses of the workers. Domestic wastewater will be collected in septic tanks and discharged by the Municipality. Impact due to wastewater generation during closure phase is expected to be insignificant.

7.3.4 Impacts of Geothermal Fluid

Geothermal fluid will be reinjected to the reservoir during the operation phase of the Project. The wells will be closed after the operation phase is over and there will be no use of geothermal fluid during closure phase.

7.3.5 Impacts of Solid Wastes on Soil and Groundwater

Impacts of solid waste will be similar to the construction phase of the Project. There will be non-hazardous solid waste generation by the workers and also waste oil and drilling mud. The requirements of Regulation on Waste Management, Packaging Waste Control Regulation, Regulation on the Control of End-of-life Tires, Regulation on the Control of Waste Batteries and Accumulators will be complied with during closure phase and the impacts are expected to be low after mitigation measures.

7.3.6 Impacts on Air Quality

Potential impacts on air quality are expected to be similar to the construction phase of the Project however with a smaller extent. There will be limited earth moving activities and less vehicle movement and demolition of Project components will be conducted minimizing the generation of dust. Therefore impact on air quality during closure phase of the Project is expected to be insignificant.

7.3.7 Noise Impact

Noise generation during closure phase will be temporary and transient in nature and will be controlled through good site working practices, limited working hours. Therefore noise impact during closure phase of the Project is expected to be insignificant.

7.4 Impacts of the Energy Transmission Line

The route of the energy transmission line (ETL) will be about 6.5 .km. Most of the area on the route is agricultural land. It is projected that there will be 14 towers through the route, each of which has 4 legs, each one with a base area of 2 m x 2 m and a depth of 3 m.

The potential impacts of the ETL during the construction phase are expected to be mainly on land use, air quality, noise, soil and groundwater and occupational health and safety.

The expropriation procedure, which could be required for the lands along the ETL route, will be undertaken by TEİAŞ, however through obtaining of the easement rights, agricultural lands can remain around the ETL components through the operation phase. It is also important to inform the owners of the lands which are close to the route in advance of construction of the electricity transmission line and transmission towers in order to avoid any grievances due to the construction activities.

The emissions during the construction phase will be associated with the dust and exhaust gas resulting from the operation of onsite diesel vehicles, skimming of topsoil layers, and excavation for the electricity transmission towers and transportation of the necessary material and equipment for the construction of the electricity transmission line and transmission towers. The existing access roads will be used if possible and unnecessary traffic will be restricted. Excavated material storage will be minimized and will be covered if

required. The construction impacts will be limited in duration and extent, therefore are expected to be negligible.

Improper use or handling and spills of hazardous materials such as insulating oils, paints or fuel can lead to soil and groundwater contamination. In case of storage of hazardous material at the site, the materials will be kept in leak proof containments on designated areas with impermeable floor, spill kits will be available at the working site. Maintenance of the construction vehicles will not occur at the site. The impacts on soil and groundwater are expected to be negligible.

Noise generation due to the vehicle movement and construction equipment will occur during the construction activities however will be temporary and transient in the environment. Also, the working hours will be limited in order to prevent nuisance. Therefore, the noise impacts are expected to be negligible.

Occupational health and safety hazards during the construction activities are primarily due to the live power lines and working at height. The risk of hazard will be minimized through employment of only trained and certified workers and provision of fall protection systems along with required personal protective equipment (PPE). Furthermore, the local communities should be informed about the high voltage before switching on the transmission line.

During the operation phase, the potential impacts are expected to be mainly due to the electromagnetic field (EMF) and corona effect. Although the site will be visited regularly by TEİAŞ for maintenance, there will be no generation of domestic or hazardous wastes, air emissions or noise. During the operation of the ETL, plants and trees will be cleared to protect the electric wires if necessary.

The ETLs are the source of the high electricity and magnetic fields because of the high voltage and currents. Although there is no proven adverse impact of electromagnetic field on human health, there are still some potential risks depending on the frequency and intensity of the fields. Therefore, some limits were developed for exposure to electrical and magnetic fields. “IFC EHS Guidelines for Electric Power Transmission and Distribution” presents exposure limits for general public exposure to 50/60 Hz electric and magnetic fields published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) which are provided below in Table 7-18.

Table 7-18. ICNIRP Exposure Limits for General Public Exposure to Electric and Magnetic Fields

Frequency	Electric Field (V/m)	Magnetic Field (μT)
50 Hz	5000	100
60 Hz	4150	83

Although there are no limits regarding electrical and magnetic field exposure in national legislation, the Turkish Standards Institute has defined limit values for Exposure of Human to the Electromagnetic Field-Low Frequencies (0 Hz-10 kHz) (given in the standard of TS ENV 5016-1/April 1996 publication and numbered 29020). Accordingly, the public exposure limit to electric field is 10 kV/m and to magnetic field is 6.4 Gauss (=640 μT).

The frequency value for the ETLs operated by alternating current is 50 Hz. According to the study carried out by TEAŞ (former Turkish Electricity Generation and Transmission Incorporation) and TUBİTAK (The Scientific and Technological Research Council of Turkey), the National Metrology Institute in 2001, electric and magnetic fields of some high voltage energy transmission lines were determined. According to this study, electric and magnetic fields of high voltage 154 kV overhead ETLs are in the range of 0.3-1 kV/m and 9-14 mG (= 0.9-1.4 μT), respectively. Since the voltage of the proposed ETL is 154 kV, it can be concluded that electric and magnetic fields of the ETL will be significantly below the limit values presented above.

The effect of the electromagnetic field decreases when the distance increases. Therefore, negative impact of EMF of the ETL is not expected at the residential areas close to the predicted ETL route.

The Regulation on Electric Power Installations (issued in the Official Gazette dated November 30, 2000 and numbered 24246) defines limitations for the distance between energy transmission lines and settlement areas, roads and other structures.

The minimum distance between the ETLs and the settlements considering electric and magnetic field effects and safety issues such as collapse of pylons and lines will be 4 m in accordance with the Regulation on Electric Power Installations. In addition, the width of the ETL corridor (right-of-way) which will be cleared from trees and be expropriated as well will be 50 m.

Also, the minimum vertical and horizontal distances to safety zones are defined by the Regulation on Electric Power Installations. Article 44 of the Regulation states that the horizontal distances given in below must exist between the overhead line conductors and the most projected sections of the buildings, near which they pass, with maximum oscillation.

Table 7-19. Minimum Horizontal Distances of the Overhead Line Conductors to the Structures with Maximum Oscillation

Permitted Highest Continuous Operation Voltage of the Line (kV)	Horizontal Distance (m)
0 – 1 (1 included)	1
1 – 36 (36 included)	2
36 – 72,5 (72.5 included)	3
72,5 – 170 (170 included)	4
170 – 420 (420 included)	5

The regulation also states that that all trees violating conductor stringing and line safety must be trimmed or cut. The minimum horizontal distances of the line conductors to trees in maximum oscillation condition are given in Table 7-20.

Table 7-20. Minimum Horizontal Distances of Overhead Line Conductors to Trees

Permitted highest operational voltage of the line (kV)	Horizontal distance (m)
0 – 1 (1 included)	1
1 – 170 (170 excluded)	2.5
170	3
170 – 420 (420 included)	4.5

The minimum vertical distances of the conductors to the locations and objects over which they pass calculated in accordance with Article 46 of this Regulation with maximum sag are given in Table 7-21.

Table 7-21. Minimum Vertical Distances of Overhead Line Conductors to the Places over which They Pass with Maximum Sag

Locations	Maximum Continuous Operational Voltage of the Line (kV)					
	0-1 (1 included)	1-17.5	36	72.5	170	420
	Minimum Vertical Distances (m)					
Water with no traffic (in accordance with the highest surface of the water)	4.5*	5	5	5	6	8.5
Pastures, fields, grassland etc. suitable for passage of vehicles	5*	6	6	6	7	9.5
Village and city roads suitable for the passage of vehicles	5.5*	7	7	7	8	12

Locations	Maximum Continuous Operational Voltage of the Line (kV)					
	0-1 (1 included)	1-17.5	36	72.5	170	420
	Minimum Vertical Distances (m)					
Intercity highways	7	7	7	7	9	12
Trees	1.5	2.5	2.5	3	3	5
Flat roofs that can be climbed by everybody	2.5	3.5	3.5	4	5	8.7
Sloped roofs that cannot be climbed by everybody	2	3	3	3.5	5	8.7
Electric lines	2	2	2	2	2.5	4.5
Petroleum and natural gas pipelines	9	9	9	9	9	9
Water and canals with traffic (these distances must be measured from the highest point of the vehicles that may pass on the highest surface of the waters)	4.5	4.5	5	5	6	9
Communication lines	1	2.5	2.5	2.5	3.5	4.5
Railways without electricity (measured from the rail)	7	7	7	7	8	10.5
Motorways	14	14	14	14	14	14

(*) The heights shall be decreased by 0.5 m when insulated overhead line cables are used.

High electric fields on the lines with very small radiuses causing ionization of the air around conductor and relative discharge is called corona. Corona occurs on all types of transmission lines, but it becomes more noticeable at higher voltages. It causes electrical losses, a crackling or humming sound, light, ozone production, acid impacts with the moisture, interferences in the radio and TVs.

According to the “IFC EHS Guidelines for Electric Power Transmission and Distribution”, this effect is greater with high voltage power lines of 400-800 kV. Since the proposed ETL will have a voltage of 154 kV, it is anticipated that the corona effect will be limited. Hence, a potential corona effect such as a sound effect, will not be perceived by the communities.

In addition, maintenance of the ETL will be carried out regularly and contamination in the conductors which increases the corona effect, will be cleared periodically.

8. SOCIAL IMPACT ASSESSMENT

Although there have been innovations in national environmental legislation regarding the social aspects within the framework of the European Union adaptation process, the lack of social impact assessment process still continues. Turkish EIA legislation does not cover social environment and only limited its scope to the physical and ecological environment. The social environment topics that are included in national legislation are limited to stakeholder engagement and resettlement processes. Therefore, in order to cover the national gaps, the international financial institutions are taken into a consideration for investment projects to minimize environmental and social risks and take actions in equitable and transparent forms.

This section of the Report assesses the direct and indirect potential socio-economic impacts of the Project. For this section, impacts likely to have the same receptor and similar mitigation measures for both construction and operation phase are presented in the same section.. Major social issues subject to assessment are:

- National Economy
- Land Acquisition
- Local Economy And Livelihood
- Labour Influx
- Transportation and Traffic
- Community Health and Safety
- Occupational Health and Safety
- Cultural Heritage

Both quantitative and qualitative data collection techniques were used during social impact assessment.

8.1 National Economy

Operation Phase

There are powerful connections between energy provision and socioeconomic development. Energy is an important factor of socioeconomic development. Turkey's energy demand has grown rapidly almost every year and it will continue to grow. One of the main consequences of the Project is the provision of energy. This will create beneficial effect on the wider community.

Table 8-1. Impacts on Local Employment

Impact Type	**Positive**	Negative	**Direct**	Indirect	Cumulative
	The impact of energy provision is a positive impact. The Project is expected to address the electricity needs of people nationally.				
Impact Duration	Temporary	Short-Term	**Long Term**	Permanent	
	Operation phase of the project is planned for 30 years.				
Impact Extent	Project Area	Local	Regional	**National**	
	Extent of the impact will be National level. Produced energy will be connected to national grid.				
Impact Magnitude	Negligible	Low	Medium	**High**	
	Impact magnitude is high.				
Likelihood of Impact	Unlikely	Likely	**Certain**		
	Likelihood of occurrence of impact will be certain.				
Impact Significance	Insignificant	Low	**Moderate**	Major	
	Impact will be moderate.				
Final Impact Assessment	Insignificant	Low	Medium	High/Critical	
	The impact of the Energy Provision is a positive impact.				

Enhancement Measures

The Project will address the energy needs of Turkey, contribute to national development, and help improve efficiency and quality of infrastructure services.

Residual Impacts

The impact will be positive.

8.2 Land Acquisition

Construction and Operation Phase

The Project is planned to be established on agricultural lands of private owners. Land acquisition for the Project has already been completed by voluntary purchase method. Total area of 84,841.00 m^2 has been acquired for Project activities and payment for the area has been completed. No physical displacement occurred for the Project.

Existing access roads will be used for the Project activities and there will be no additional land acquisition for access roads. In case additional access roads are required in the future, environmental and social impact assessment will be conducted for the proposed route.

The information on purchased lands for the Project provided by the Project Company is provided in Table 8-2 below.

Table 8-2. Land Purchased for the Project Activities

Parcel No.	Size of Land (m^2)	Purchased Land (m^2)	Remaining Land (m^2)	Type of Land	Use of the Land
1182	6.950,00	6.950,00	0	Agricultural Land	Power Plant
1182	6.950,00	6.950,00	0	Agricultural Land	Power Plant
1182	6.950,00	6.950,00	0	Agricultural Land	SAN 4, SAN – 5, SAN-6 wells
1182	27.800,00	27.800,00	0	Agricultural Land	Power Plant
1182	6.950,00	6.950,00	0	Agricultural Land	Power Plant
1181	19.600,00	19.600,00	0	Agricultural Land	For Road and Crane Use
40	81,87	81,87	0	Agricultural Land	SAN-7 and SAN-8 wells
40	81,87	81,87	0	Agricultural Land	SAN-7 and SAN-8 wells
40	81,87	81,87	0	Agricultural Land	SAN-7 and SAN-8 wells
40	163,75	163,75	0	Agricultural Land	SAN-7 and SAN-8 wells
40	163,75	163,75	0	Agricultural Land	SAN-7 and SAN-8 wells
40	163,75	163,75	0	Agricultural Land	SAN-7 and SAN-8 wells
40	54,58	54,58	0	Agricultural Land	SAN-7 and SAN-8 wells
40	54,58	54,58	0	Agricultural Land	SAN-7 and SAN-8 wells
40	27,29	27,29	0	Agricultural Land	SAN-7 and SAN-8 wells
40	27,29	27,29	0	Agricultural Land	SAN-7 and SAN-8 wells
40	122,81	122,81	0	Agricultural Land	SAN-7 and SAN-8 wells
40	40,94	40,94	0	Agricultural Land	SAN-7 and SAN-8 wells
40	491,24	491,24	0	Agricultural Land	SAN-7 and SAN-8 wells
40	491,24	491,24	0	Agricultural Land	SAN-7 and SAN-8 wells
40	42,98	42,98	0	Agricultural Land	SAN-7 and SAN-8 wells
40	42,98	42,98	0	Agricultural Land	SAN-7 and SAN-8 wells
40	42,98	42,98	0	Agricultural Land	SAN-7 and SAN-8 wells
40	42,98	42,98	0	Agricultural Land	SAN-7 and SAN-8 wells
40	42,98	42,98	0	Agricultural Land	SAN-7 and SAN-8 wells
40	184,22	184,22	0	Agricultural Land	SAN-7 and SAN-8 wells
40	184,22	184,22	0	Agricultural Land	SAN-7 and SAN-8 wells
40	184,22	184,22	0	Agricultural Land	SAN-7 and SAN-8 wells
40	184,22	184,22	0	Agricultural Land	SAN-7 and SAN-8 wells
40	767,56	767,56	0	Agricultural Land	SAN-7 and SAN-8 wells

Parcel No.	Size of Land (m^2)	Purchased Land (m^2)	Remaining Land (m^2)	Type of Land	Use of the Land
28	1175,00	1175,00	0	Agricultural Land	SAN-3 well
28	2350,00	2350,00	0	Agricultural Land	SAN-3 well
28	293,75	293,75	0	Agricultural Land	SAN-3 well
28	293,75	293,75	0	Agricultural Land	SAN-3 well
28	293,75	293,75	0	Agricultural Land	SAN-3 well
28	293,75	293,75	0	Agricultural Land	SAN-3 well
Total		**84,841.00 m^2**			

According to the information obtained from the Project Owner, 90% of the purchased land belongs to a total of 5 land owners. The purchased lands were planted with corn except for parcel 40 which was not cultivated. There were no structures on the lands, only a hovel on parcel 1181 which had been used by the land owners during planting activities to rest underneath.

The Project Owner has previous experience on land purchase within the license area. During the earlier stages of Project design, lands in the licence area have been acquired through expropriation by the Project Owner. The lands were not utilized due to insufficient resources and are not utilized for the subject Project of this ESIA. Based on their previous experience, the Project Owner decided to conduct land purchase by voluntary purchase method in order to provide better relationship with the land owners and ease the land purchase process for this 15 MW capacity Project which is subject to potential financing. Prices were negotiated with the land owners and the payments were about twice of the previously determined expropriation prices. In case there was no agreement with the owner for particular lands, alternative parcels were investigated within the license area by the Project Owner and negotiations were pursued with the new land owner.

Land acquisition process for energy transmission lines is governed by TEDAS. Expropriation is on-going for the lands on the route for ETL. Since expropriation process is on-going, Project Company has gone to agreements with the land owners to secure access right to the lands before the completion of the expropriation process. Payments for the easement rights of the lands have been conducted by negotiations with the land owners.

During the one-on-one interviews with the locals who sold their lands to the Project Company, it was stated that expropriation was not preferred for land acquisition since the values might be lower than negotiated prices, therefore they preferred to go on an agreement with the Project Company on land value rather than expropriation. It was observed during the interviews that there was a common concern on loosing profit in a case of expropriation.

Land acquisition process was also discussed during the PPM which was held on 27.09.2016 in Salihli district, Yılmaz neighbourhood in compliance with the Environmental Impact Assessment Regulation. The Project Owner attended the meeting and addressed concerns of the participants. The PPM meeting was announced in the national and local newspapers and was also posted on the billboard of the neighbourhood. Due to the high population of the

neighbourhood level of participation was low. Detailed information on the previous stakeholder engagement activities are provided in SEP document.

Table 8-3. Impacts of Land Acquisition on Local Communities

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Land acquisition is a direct impact and was performed by means of voluntary land purchase.				
Impact Duration	Temporary	Short Term	Long Term	**Permanent**	
	The impact is permanent.				
Impact Extent	**Project Area**	**Local**	Regional	National	
	Impact is local, limited to the Project area.				
Impact Magnitude	Negligible	Low	**Medium**	High	
	Impact is rated medium, as some locals who sold their land either invested in other lands through purchasing or renting as some stated that they did not invest their land acquisition money.				
Likelihood of Impact	Unlikely	Likely	**Certain**		
	The impact is certain as land is acquired for the purpose of the Project.				
Impact Significance	Insignificant	Minor	**Moderate**	Major	
	Significance of impact is moderate.				
Reversibility of Receptor	**Irreversible**	Low	Medium	High	
	Once the land is occupied for the Project, no further agricultural use will be possible.				
Final Impact Assessment	Insignificant	Low	Medium	**High**/Critical	
	Impact is high and necessary mitigation measures should be applied throughout the future Project phases not to trigger economic displacement of the locals.				

Mitigation Measures

- Grievance mechanism will be disclosed to the affected community and will be provided as a means of encouraging affected people to state their grievances about the land acquisition process.
- Project Company will guide the villagers who sold their lands through community engagement (mainly by organization of trainings with the collaboration of NGOs) toward investing in sustainable income sources.
- The Project Company will organize cooperation activities with Project affected local communities. This will include social responsibility projects for the benefit of the affected community.

Residual Impacts

Given that land acquisition for the Project (15 MW capacity) has already been completed on voluntary purchase, providing assistance when needed and establishing good monitoring system will make the land acquisition process more efficient and will eliminate the possible negative outlook for the Project Company.

8.3 Local Economy and Livelihood

8.3.1 Employment

Construction and Operation Phase

The most important contributor of the Project to the local economy is the employment provided in works during construction. Approximately 100 workers will be hired during the construction phase of the Project. On the other hand, it is estimated that a maximum of 27 workers will be required for the operation phases of the Project. The locals will have the priority for the employment opportunities of the construction phase. Opportunities for local people are most likely to be for unskilled staff positions since the information regarding to social baseline, local people do not have professional skills for the construction and operation phases of the Project.

Table 8-4. Impacts on Local Employment

Impact Type	**Positive**	Negative	**Direct**	Indirect	**Cumulative**
	Employment opportunities will create a positive impact directly from the Project. All geothermal projects will contribute to increased local employment and may reverse out-migration in cumulative terms.				
Impact Duration	Temporary	Short-Term	**Long Term**	Permanent	
	Impact is long-term. Higher employment opportunities will be possible during construction, and less during operation stage.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impact will provide benefit particularly to Salihli District.				
Impact Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is positive and medium.				
Likelihood of Impact	Unlikely	Likely	**Certain**		
	Employment opportunities within the region and the associated improvement of the local economy are certain impacts of the Project.				
Impact Significance	Insignificant	Low	**Moderate**	Major	
	Impact will be moderate.				
Final Impact Assessment	Insignificant	Low	Medium	High/Critical	
	The Project will contribute to problems of unemployment as a positive impact.				

The Project Company will be responsible for human resources for the drilling, construction and operation periods. Turkey is currently in the middle of a harmonization process with the European Union and labor laws are being reviewed to ensure alignment. The Project will comply with national labor, social security and occupational health and safety laws as well as the principles and standards of ILO convention. Based on the national principles embodied in the ILO convention, the Project Company will take measures by:

- not employing children under the age of 18,

- eliminating forced labor and ensuring a Human Resources Policy compatible with the European Convention on Human Rights and the Turkish Constitution,
- eliminating discrimination based on language, race, sex, political opinion, philosophical beliefs and religion in the employment relationships,
- ensuring workers' access to the right of collective bargaining (Act of Collective Bargaining Agreement on Trade Unions Act No. 6356 and 4857 Labor Law)
- ensuring access to the Project grievance mechanism that is functional effectively

Labor Law (4857) applies to all establishments and to their employers, employees, employer's representatives and employee representatives, irrespective of the subject matter of their activities. The Project Company is yet to develop a formal grievance procedure for workers although an informal procedure is in place. The Project Company Human Resources Policy will have provisions for age, wages, working hours, disabled employees, non-employee workers (i.e. sub-contractors), health and safety; and workers camps.

Enhancement Measures

- Project Company will ensure that its HR Policy will maintain that all workers will have contracts that clearly state the terms and conditions of their employment and their legal rights.
- The Project Company will have a Human Resources policy which observes wage standards, working hour regulation, freedom of association and staff encouragement. The policy will also eliminate child and forced labor, discrimination on the basis of religion, language, gender or social status, bullying and harassment. This policy will be developed by the Project Company to cover local employment and training of local people.
- Workers will be provided with information including, but not be limited to, entitlement to wages, hours of work, overtime arrangements and overtime compensation, and any benefits (such as leave for illness, maternity / paternity or holiday).
- All workers will be able to join trade unions of their choice and have the right to collective bargaining.
- Contracts will be verbally explained to all workers where this is necessary to ensure that workers understand their rights prior to any employment contract to be signed.
- Wages, benefits and conditions of work offered will be comparable to those offered by equivalent employers in Manisa.
- The Project and all contractors will put in place a formal worker grievance mechanism.

Residual Impacts

Positive impacts will be enhanced with the implementation of the enhancement measures described.

8.3.2 Local Economy

Construction and Operation

The Project will be beneficial for the economic growth in the Region. In addition, the Project may create in-direct employment opportunities during the construction period to provide service for the Project Company. According to Focus Group Discussions, the locals are pleased to provide services and have opportunities to increase their economic income for the Project activities.

Table 8-5. Impacts on Local Economy

Impact Type	**Positive**	Negative	**Direct**	Indirect	**Cumulative**
	The Project will provide benefit to the local business and services, in which will create a positive impact directly from the Project..				
Impact Duration	Temporary	Short-Term	**Long Term**	Permanent	
	Impact is long-term. Higher employment opportunities will be possible during construction, and less during operation stage.				
Impact Extent	Project Area	**Local**	**Regional**	National	
	Impact will provide benefit particularly to Salihli District.				
Impact Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is positive and medium.				
Likelihood of Impact	Unlikely	Likely	**Certain**		
	Economic opportunities within the region and the associated improvement of the local businesses are certain impacts of the Project.				
Impact Significance	Insignificant	Low	**Moderate**	Major	
	Impact will be moderate.				
Final Impact Assessment	Insignificant	Low	**Medium**	High/Critical	
	The Project will contribute to problems of unemployment as a positive impact.				

Mitigation Measures

- The Project will have a Business Ethics Policy/Good Neighbor Policy that commits the Project to 'Buy Local'.

Residual Impacts

- Positive impacts will be enhanced with the implementation of the enhancement measures described.

8.3.3 Labor Influx

Construction Phase

The labour influx impacts may be expected during the construction phase of the Project. However, considering that employees figure for construction phase will be 100 and operation phases will be 27 people, which can be assessed to not account for a considerable population increase.

The participants of the household survey stated that there has currently been no impact of the Project regarding the magnitude of the local population. No population related impacts are anticipated for the future as well.

Local people will be employed to the extent possible. Until now, approximately 25% of the Project workers were employed from Salihli and Alaşehir Districts. Occupation types of these 25% of the local employees are namely as; operation manager, office workers, construction workers, technicians and service workers. In which, it is safe to state that, the Project Company considers all type of education backgrounds of the locals in terms of employment. The nearest settlement to the Project site is Yılmaz, which is anticipated to experience impacts related to the population influx. However, during the community level interviews, there have been no complaints or concerns regarding the influx.

Table 8-6. Impacts on Labour Influx

Impact Type	Positive	Negative	**Direct**	Indirect	Cumulative
	Population influx impact of the Project is expected to occur throughout the construction phase, however, due to low number of construction workers, no significant concern have been stated from the locals.				
Impact Duration	Temporary	**Short Term**	Long Term	Permanent	
	It is evaluated as an impact during the construction period of the Project at the site.				
Impact Extent	**Project Area**	Local	Regional	National	
	Population influx was not a concern of the local resident.				
Impact Magnitude	Negligible	**Low**	Medium	High	
	Impact magnitude is evaluated as low level.				
Likelihood of Impact	**Unlikely**	Likely	Certain		
	Occurrence of the impact is considered unlikely .				
Impact Significance	Insignificant	**Minor**	Moderate	Major	
	Significance of impact is minor.				
Reversibility of Receptor	Insignificant	**Low**	Medium	**High**	
	Local people will be employed for construction phase as to an extent possible. Furthermore, due to low number of Project workers and there is no concern of local community, the reversibility is high.				
Final Impact Assessment	Insignificant	**Low**	Medium	High/Critical	
	The impact is considered as low, with the implementation of below mitigation measures				

Mitigation Measures

- The Project will provide job opportunities for the residents of nearby settlements to the extent possible.
- A code of conduct should be developed and implemented for workers, outlining expected behaviour with respect to their daily interactions with local residents and users of public amenities. This will be part of the labour force management plan to be developed for the Project
- The locals are willing to contribute for the Project activities once they feel their opinions matter and received sufficient information regarding the Project activities and potential impacts.
- The Project Company will establish a grievance mechanism, which will support the information disclosure process.

Residual Impacts

- No residual impacts are anticipated.

8.4 Transportation / Traffic

Construction Phase

Increase in local traffic may be one of the impacts that is expected during the construction phase of the Project.

Transportation impacts were one of the concern topics regarding the Project during the Focus Group Meetings as well as Mukhtar meetings. According to residents of AoI; heavy vehicles are damaging the roads and they fear that heavy vehicles may cause closure of narrow roads. Furthermore, communities had questions regarding the dust from heavy vehicles may cause community health issues and may pose safety issues especially on children.

Table 8-7. Impacts of Project Transportation Activities

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Traffic load caused by heavy vehicles is a direct and negative impact arising from the Projects.				
Impact Duration	Temporary		**Short Term**	Long Term	Permanent
	Since the heavy machineries will be used for the drilling and construction period of the Project, it is going to be a short term impact.				
Impact Extent	Project Area		**Local**	Regional	National
	Impacts related to transportation and traffic load is expected to be local.				
Impact Magnitude	Negligible		Low	**Medium**	High
	Given the public nuisance expressed during surveys, traffic and transportation are assumed to pose a medium level impact.				

Likelihood of Impact	**Unlikely**	Likely	Certain	
	Impacts of transportation operations on community health and safety are unlikely with measures taken.			
Impact Significance	Insignificant	**Minor**	Medium	High
	Level of impact significance is minor.			
Reversibility of Impact	Irreversible	Low	Moderate	**High**
	Health and safety risks associated with traffic loads from heavy vehicles will disappear once the construction stage is over.			
Final Impact Assessment	**Insignificant**	Low	Medium	High/Critical
	Given the high reversibility and measures taken, the impact is considered insignificant.			

Mitigation Measures

- The Project Company will prepare and implement site specific Traffic Management Plan so as to adequately manage traffic in the access roads used by communities. In case of disturbing access roads, the Project Company and its contractors will be responsible to improve the roads back to their original status. Communities will be informed about schedules of transportation and also on safety and security measures to be taken at the level of individuals.
- The Project will implement an awareness raising information disclosure with local stakeholders regarding the risks related to the movement of heavy vehicles and increased traffic in the area. The main focus of this campaign will be during the construction phase and will focus on local residents and children. It will be implemented in coordination with local community groups such as Mukhtars.
- Warning signs will be placed at entrances and exits of site vehicles.
- Establishing rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures (e.g. prohibiting operation of forklifts with forks in down position), and control of traffic patterns or direction.
- Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents.
- Using locally sourced materials, whenever possible, to minimize transport distances. Locating associated facilities such as worker camps close to project sites and arranging worker bus transport to minimizing external traffic.

Residual Impacts

Strict health and safety standards will be implemented including traffic management plan to reduce the road related accidents. With the implementation of above mitigation measures the residual impact of the Project are considered to be low.

8.5 Community Health and Safety

Construction and Operation

Community health and safety issues are associated with pollution factors that may arise from drilling, construction and operation period of the Project. During the focus group discussions, the attendees suggested to conduct brief meeting regarding the possible impacts of the Project that may affect the local community, especially during the construction phase.

These concerns are mainly rooted in speculative information that rotated among locals.

Communities around the Project area may be exposed to physical hazards associated with the Project components such as wells and pipeline. Besides, confined spaces or falling hazards may occur due to unattended infrastructure. Project area is surrounded with fence in order to prevent physical hazards to communities associated with the Project.

Table 8-8. Impacts on Community Health and Safety

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Increase of, dust emissions and noise due to Project activities are a direct and negative impact arising from the Project. Based on misinformation, local people have concerns over investment projects, especially for the construction phase.				
Impact Duration	Temporary		**Short Term**	Long Term	Permanent
	Since most of dust and noise emissions will occur during construction period of the Project, it is going to be a short term impact.				
Impact Extent	Project Area		**Local**	Regional	National
	Impacts related to transportation and traffic load is expected to be local.				
Impact Magnitude	Negligible		Low	**Medium**	High
	Given the public nuisance expressed during surveys, traffic and transportation are assumed to pose a medium level impact.				
Likelihood of Impact	Unlikely		**Likely**		Certain
	Impacts on community health and safety are likely to occur if no mitigation measure is taken.				
Impact Significance	Insignificant		Minor	**Medium**	High
	Level of impact significance is medium.				
Reversibility of Impact	Irreversible		Low	Moderate	**High**
	Community Health and safety risks are mainly associated with construction phase and expected to disappear once the construction stage is over.				
Final Impact Assessment	Insignificant		**Low**	Medium	High/Critical
	Given the high reversibility and measures taken, the impact is considered low.				

Mitigation Measures

- The Project area and wells are surrounded by security fence in order to prevent unauthorized entrance. Health protection strip has also been established for the Project which is 15 m. Warning signs will be in place around the Project area, the wells and pipeline in order to inform the locals for Project site associated risks.
- Emergency Response Plan prepared for the Project will be improved in order to cover a contingency plan for hydrogen sulphide release events.
- The Project will operate on a closed system and the Project Company will take measures for lowering emissions that cause nuisance. Inclusion of buffer strips or other methods of physical separation around project sites to protect the public from major hazards associated with hazardous materials incidents or process failure, as well as nuisance issues related to noise, odors, or other emissions.
- Training and licensing industrial vehicle operators in the safe operation of specialized vehicles such as forklifts, including safe loading/unloading, load limits.
- The Project Company will monitor emissions and noise and take immediate measures where necessary. However, the locals are currently misinformed and misguided by means of unproven and non-scientific information. A well-structured stakeholder engagement will minimize public concerns by clearly explaining the project operations, mitigation measures and possible residual impacts. It is recommended that the stakeholder engagement process can be backed up with engagement with universities to undertake research studies and monitor interactions between geothermal drilling and agricultural efficiency. A Stakeholder Engagement Plan is prepared by 2U1K.
- The Project Company will perform effective public consultation and stakeholder engagement in order to provide correct and unbiased information on possible environmental and health impacts of the Project as well as the mitigation measures that will be taken.

Residual Impacts

With the mitigation measures mentioned under respective environmental impact assessment sections, the impacts will be minimized to limits set by regulations.

8.6 Occupational Health and Safety

Construction and Operation Phase

Construction and operation phases of the Project can pose accident risks for the workers. Specific health and safety issues in geothermal power projects include the potential for exposure to geothermal gases, confined spaces, heat and noise.

Occupational exposure to geothermal gases, mainly hydrogen sulfide gas, may occur during non-routine release of geothermal fluids (for example, pipeline failures) and maintenance work in confined spaces such as pipelines, turbines, and condensers. The significance of the hydrogen sulfide hazard may vary depending on the location and geological formation particular to the facility.

Noise is mainly related to well drilling, steam flashing and venting. Other sources include equipment related to pumping facilities, turbines, and temporary pipe flushing activities. Noise abatement technology includes the use of rock mufflers, sound insulation, and barriers during drilling, in addition to silencers on equipment in the steam processing facility.

Through a comprehensive OHS Management System risk of accidents will be minimized for the Project activities. A set of procedures and an OHS management plan will be established for the Project in order to assure occupational health and safety requirements of national and international standards.

An OHS Manager has been appointed by the General Manager of Geothermal Investments for the Project in order to provide the effective implementation of the OHS Plan. The organization chart established for the Project is presented below in **Hata! Başvuru kaynağı bulunamadı.**.

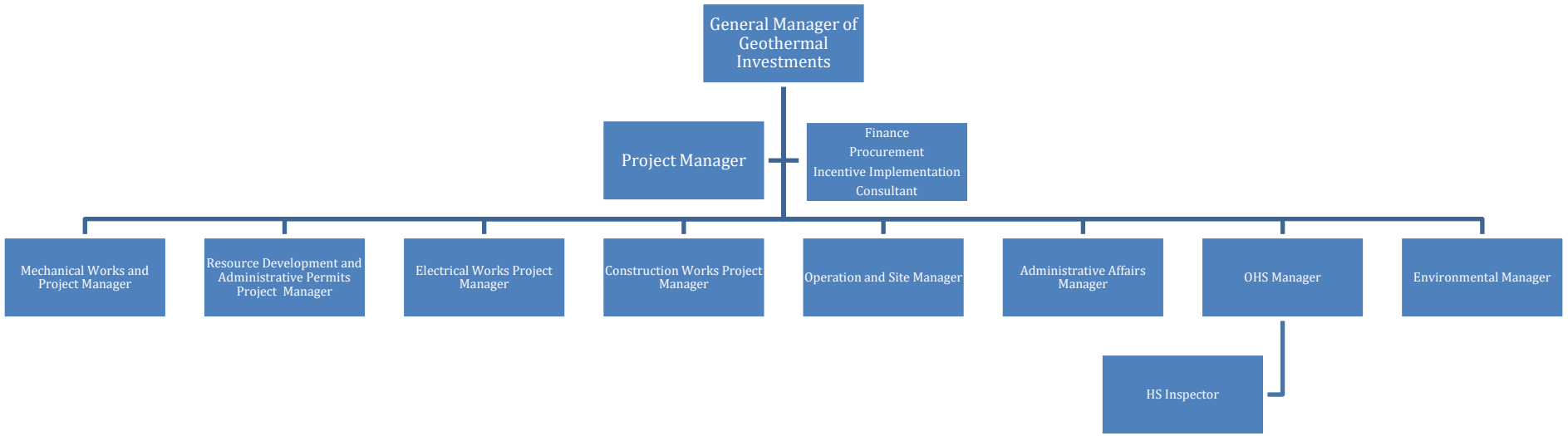

Figure 8-1 Organization Chart

The potential impacts of the Project on Occupational Health and Safety is provided below in Table 8-9.

Table 8-9. Impacts on Occupational Health and Safety

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	OHS risks are direct and negative.				
Impact Duration	Temporary	Short Term	**Long Term**		Permanent
	Impacts related with OHS issues may occur during the construction and operation phase				
Impact Extent	**Project Area**	Local	Regional	National	
	Risks are expected to be local as limited with the Project employees				
Impact Magnitude	Negligible	Low	Medium	**High**	
	OHS impacts in terms of magnitude can be considered as high.				
Likelihood of Impact	Unlikely	**Likely**		Certain	
	Risks are likely in case of not implementing appropriate OHS management system throughout the Project phases.				
Impact Significance	Insignificant	Minor	Medium	**High**	
	OHS risks may cause high significance.				
Reversibility of Impact	Irreversible	**Low**	Moderate	High	
	Reversibility of OHS related incidents may be resulted as low.				
Final Impact Assessment	Insignificant	Low	Medium	**High**/Critical	
	Occupational health and safety impacts can be high.				

Mitigation Measures

- Workers will be provided with contracts which clearly state the terms and conditions of their employment and their legal rights. The Project Company will ensure the workers are aware of the OHS risks of the Project activities and the mitigations to be taken through OHS trainings.
- The Project Company will take reasonable precautions in order to prevent occupational accidents, injuries and diseases on site, including measures to reduce and prevent the risk of exposure to harmful levels of ambient factors and chemicals, as well as the risk of injury or disease that may arise from the use of equipment and machinery.
- There will be H_2S detectors on each well head in order to monitor the hazardous levels of hydrogen sulphide, The Emergency Response Plan will include contingency plan for hydrogen sulphide release events, establishing facility emergency response teams, providing adequate ventilation of occupied buildings to avoid accumulation of hydrogen sulfide gas, development and implementation of a confined space entry program, and providing workers with a fact sheet about the chemical composition of

liquid and gaseous phases with an explanation of potential implications for human health and safety.

- The Project Company will require all employees and contractors to adhere to local and international health and safety legislation and guidelines. This will include the use of suitable personal protective equipment (PPE), hearing protection, and implementation of and adherence to a management system for activities associated with health and safety risks. These would include such aspects of construction such as working at heights and working in confined spaces.
- In order to mitigate occupational exposure to heat occurring during construction activities as well as operation and maintenance, the Project Company will ensure that time required for work in elevated temperature environments is reduced, drinking water is accessible; surfaces where workers come in close contact with hot equipment are shielded.
- The Emergency Response Plan has been developed by the Project Company which includes response measures for the situations of accidents, sabotages, fire and electricity shocks, commutable diseases, hydrogen sulfide releases, well blowouts, earthquake, floods, storms and chemical spills.

Residual Impacts

The overall residual impact on occupational health and safety of the labour force will be low to medium when an OHS management system is fully in place and measures are taken.

8.7 Cultural Heritage

Site preparation works can disturb archaeological remains or sites of cultural value. Noise from testing of wells and from the operation of the power plant and odor may have nuisance for the people visiting the sites. Closest archaeological site to the Project area is the Ancient City of Sardis which was classified as 1st and 3rd Degree Archaeological Site according to the Ministry of Culture and Tourism, İzmir 2nd Regional Committee of Protection of Cultural Heritage. The site is also defined as 1st and 3rd Degree Archaeological Site according to United Nations Educational, Scientific and Cultural Organization (UNESCO). According to the official letter of Ministry of Culture and Tourism, İzmir 2nd Regional Committee of Protection of Cultural Heritage no 08.12.2016-7394 no physical or construction activity can be conducted without the Committee consent.

Although the license area no.143 for the Project intersects the archaeological site as seen in Figure 8-2 below, the Ancient City of Sardis is at about a distance of 4 km to the Power Plant and the wells while the distance to the boundaries of the site is about 2.5 km from Project units. Therefore the area is not expected to be affected due to Project activities. The impact assessment of the Project on the landscape is provided in Section 7.2.10.

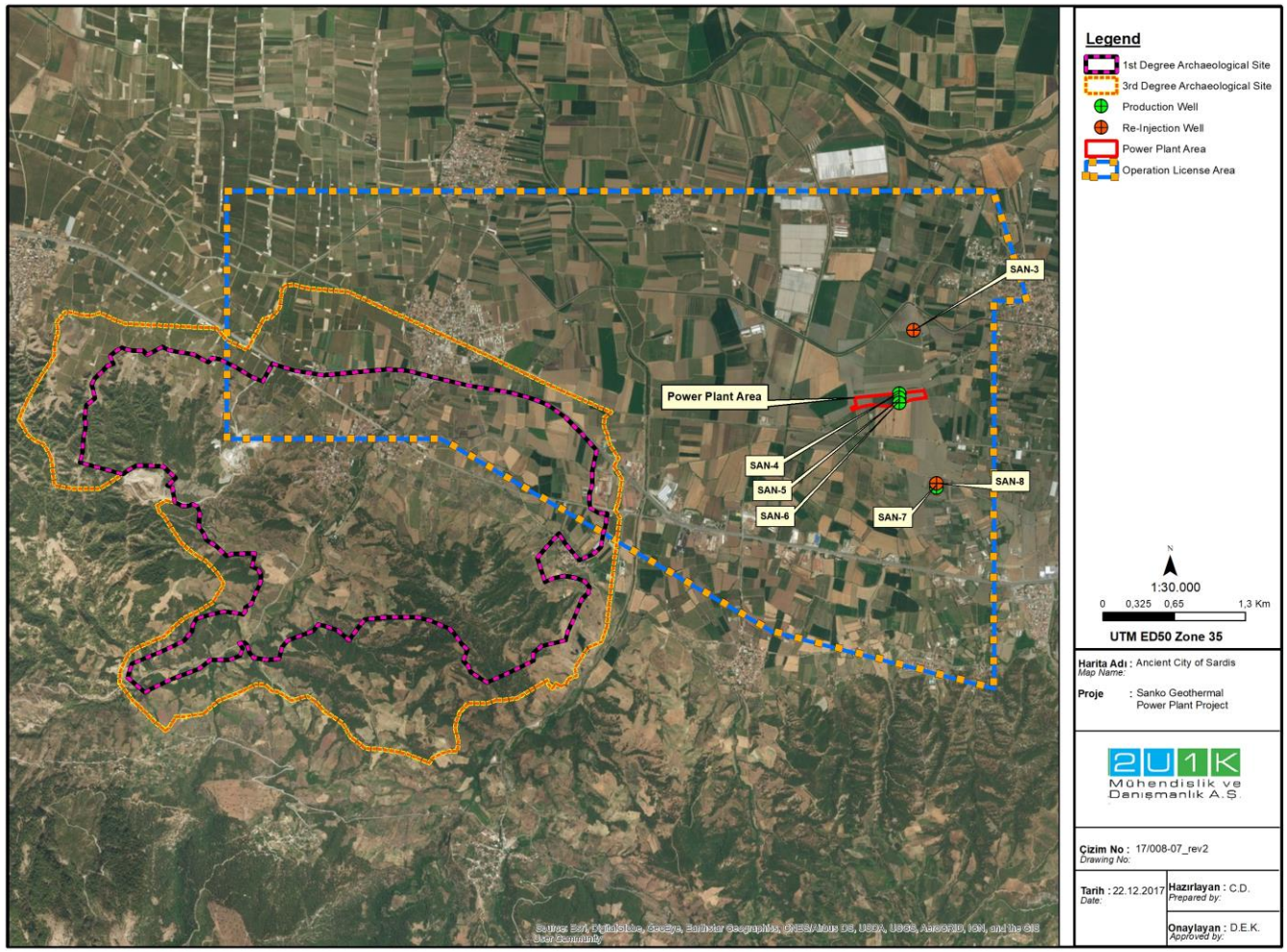

Figure 8-2 Project License Area and the Ancient City of Sardis

Moreover official opinion was obtained from İzmir Cultural Assets Regional Committee on the Project area during the national EIA process for the power plant and the well locations for which the coordinates are provided below in Table 8-10.

Table 8-10 Coordinates of Wells

Well no	Type of Use	Coordinates (WGS84)
SAN-3	Reinjection	38.497200°:28.091983°
SAN-8	Reinjection	38.484597°:28.094202°
SAN-4	Production	38.491547°:28.090448°
SAN-5	Production	38.491638°:28.090444°
SAN-6	Production	38.491455°:28.090445°
SAN-7	Production	38.484507°:28.094177°

According to the official letter there are no registered archaeological or protected sites or cultural heritage assets according to the requirements of Law on “Conservation of Cultural and Natural Assets” (Law No. 2863, amended with the Law No. 5226) within the Project area. However in case any cultural assets are encountered during any Project activity, the work will be stopped and local Department of Culture and Tourism will be informed.

The Project comprises of 2 reinjection wells and 4 production wells for which the locations are provided above in Figure 8-2, however in case of establishment of additional wells for future purposes, a Cultural Heritage Management Plan has been developed for the Project (Annex-3).

Table 8-11. Impacts on Cultural Heritage

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	The chance of finding cultural heritage within the borders of Project activities will be direct and negative impact.				
Impact Duration	Temporary	**Short Term**	Long Term	Permanent	
	The impact is short-term.				
Impact Extent	**Project Area**	Local	Regional	National	
	The impact is limited to the Project Site.				
Impact Magnitude	Negligible	**Low**	Medium	High	
	The magnitude of the impact is low.				
Likelihood of Impact	**Unlikely**	Likely	Certain		
	Archaeological findings are unlikely to be found within the site borders.				
Impact Significance	**Insignificant**	Minor	Moderate	Major	
	Impact is insignificant as there are no archaeological findings.				
Reversibility of Receptor	**High**	Medium	Low	Irreversible	
	In the case of finding archaeological features, findings will be protected and necessary steps will be applied according to national and international regulations and standards.				
Final Impact Assessment	**Insignificant**	Low	Medium	High/Critical	
	Overall impact is insignificant.				

Mitigation Measures

Regarding that the operation licence area of the Project includes a part of the Ancient City of Sardis, a Cultural Heritage Management Plan is prepared for the Project and will be implemented. In the scope of the Project a Chance Find Procedure is prepared, and it will be implemented during the construction phase of the Project to protect the historical and cultural assets.

Residual Impacts

No residual impacts expected as the Project will comply with the prepared Cultural Heritage Management Plan and Chance Find Procedure throughout its lifespan.

8.8 Closure Phase Impacts

Potential social impacts from closure activities are generally similar to those during the construction phase. Following decommissioning, the site would be restored to approximate its original condition or to some standard that results in stable social and environmental conditions.

Impacts would be similar to those addressed for the construction above; however, many of these impacts would be reduced by implementing already established good practices.

8.8.1 Economy and Employment

Closure of the Project will result in retrenchment of Project workers of the operation phase over a number of years, which may lead to an increase in unemployment at the local level. The Project will implement the Retrenchment Procedure in line with IFC PS2. Impacts related to Project closure will be assessed in detail during the operation phase, 5 years before the Project closure.

On the other hand, the creation of temporary employment opportunities for locals during decommissioning activities may arise as well as local businesses may benefit by providing necessary materials during the closure phase.

8.8.2 Land Use

Land use impacts resulting from drilling and construction could be largely reversed by closure activities, depending on the further purpose selected for the Project Site. Impacts related to land use and further decision on the post-Project use of the site will be assessed in detail during the operation phase, in advance of closure phase.

8.8.3 Visual and Landscape

At the closure phase, the removal of Project components will be planned so that no signs will be left of the abandoned power plant where possible. The Project area will be restored to its natural and pre-Project state as much as possible.

8.8.4 Community Health and Safety

Potential community health and safety impacts during closure are expected to be similar to those during the exploration/ drilling and construction phases of the Project. These impacts may be caused due to earthmoving, use of large equipment, dismantling of industrial components, and transportation of overweight and oversized materials. These activities will prevent direct negative impact to the local community if same mitigation measures (See Section 8.5) will be applied as the construction phase of the Project. Besides the wells will be closed and sealed with cement in order to prevent generation of confined space or falling hazard. The area will be surrounded with fence

Given the high reversibility and measures taken, the closure impact is considered insignificant.

8.8.5 Occupational Health and Safety

Site decommissioning will involve closure and removal of facilities and wells, including linear infrastructures and finally vegetation restoration and landscaping. These activities may not

cause direct negative impact to the Project workers if same mitigation measures (See Section 8.6) will be applied as the construction phase of the Project. Given the high reversibility and measures taken, the closure impact is considered insignificant.

8.8.6 Cultural Heritage

Impacts related to closure will be assessed in detail throughout the Project phases, in advance of closure. It is expected that no impacts on physical cultural heritage will occur at Project Closure. Therefore, the closure impact is considered as insignificant.

9. CUMULATIVE IMPACTS

There are no planned or operating geothermal power plants close to the Project area. Closest geothermal power plants are located at Alaşehir District of Manisa.

Given that the Project is at construction stage, nuisance of dust and noise are associated with the drilling and construction activities and transportation activities. Such nuisance is considered as low and temporary, limited to the construction period. Hence dust and noise impacts are not considered to pose a cumulative impact along with other project in the district.

Odor caused by hydrogen sulphide from geothermal fluid can be considered to pose a cumulative impact during the operation stage. Continuous monitoring of hydrogen sulphide levels and grievance from communities will be crucial for determining requirements for extended odor control. Technical measures to abate hydrogen sulphide can be designated once the power plant is operational, given that the sulphide content of geothermal fluid is not known. Still, the closed circuit make-up of the Project will accomplish significant abatement of hydrogen sulfide emissions and related odor.

One of the drivers for the Project is clean electricity generation without depleting the resource and minimizing emissions of greenhouse gases (GHGs) associated with combustion of fossil fuels. Yet, the Project will lead to releases of greenhouse gases, mainly CO_2. During construction, CO_2 will be released from combustion sources such as the diesel generators and the construction plant engines. During tests, but mostly during operation, CO_2 and methane CH_4 will be released as non-condensable gases. The impacts of emissions of greenhouse gases are global, hence cumulative. By nature of these emissions, the specific impacts of any single project cannot be easily assigned.

The licence area of the Project comprises of 21 wells with geothermal potential. The construction impact of the additional wells will be similar to the subject Project. Operation at the additional wells will increase CO_2 release however as mentioned in the previous sections Project Company will be analysing the amount and quality of CO_2 gas release during operation and will decide on a management strategy as to store or dissolve CO_2 in the reinjection water.

Regarding the H_2S emissions which may have effect on locals, the Project Company will continue monitoring H_2S levels. Land take will be an issue regarding the change on agricultural land use characteristics permanently. Primary approach of the Project Company will be to negotiate and reach to an agreed price with the land owners in order to avoid involuntary resettlement through expropriation.

Although the geothermal capacity is predicted as 31,500 MW by the Ministry of Energy and Natural Resources cumulative impacts of geothermal power plants have not been explicitly determined on the reservoir of the region yet. An extensive study lead by the Association of

Geothermal Energy Power Plant Investors has been on-going with the collaboration of stakeholders including Project owners and operators, local authorities and other industry developments in the region.

10. INSTITUTIONAL ARRANGEMENTS

The Project will comply with both Turkish legislation and IFC/WB Performance Standards requirements through its lifespan. An Environmental and Social Mitigation and Monitoring Plan (ESMMP) is established for the Project in order to determine the implementation program of mitigation measures and actions associated with the potential environmental and social impacts of the Project.

The ESMP sets out the environmental and social impacts of the Project and associated measures to avoid, or where avoidance is not possible, mitigate the adverse on environment and communities.

SANKO has the capability in order to implement mitigation measures and monitoring activities effectively and will establish an organizational structure for the implementation of the ESMMP. SANKO will appoint personnel for the implementation of ESMMP activities throughout the Project life.

Contractors and subcontractors will also be employed by the Project Company during construction phase of the Project. Project Company will assure that the contractors are aware of the requirements of the ESMMP and will meet the requirements of the ESMMP. An effective contractors' management will be achieved by;

- Assessment of environmental and social risks associated with contractors;
- Inclusion of PS and ESMMP requirements in tender documents;
- Selection of contractors with knowledge and skills to perform in accordance with PSs and ESMMP requirements;
- Monitoring of contractors for the compliance with ESMMP requirements;

An Environmental Manager has been assigned for both the construction and operation phases of the Project. The organization chart of the Project is presented in Figure 8-1. The Project Company will ensure the implementation of the ESMMP requirements through continuous supervision of the Environmental Manager including the sub-contractor activities if any. The Environmental Manager and the OHS Manager are responsible for the development of the management plans to provide compliance with the ESIA and the ESMMP requirements and monitor their implementation. The management plans will be issued after the review and approval of Project Manager and General Manager of Geothermal Investments. The key responsibilities for the implementation and supervision for the implementation of the ESMMP are given below in Table 10-1:

Table 10-1. Roles and Responsibilities

Role	Responsibility
General Manager of Geothermal Investments	• Provide leadership and direction to achieve Environmental /OHS and Social goals, targets and objectives. • Responsible for the implementation of approval process
Project Manager	• Provide authority and resources for effective implementation of Project policies and Environmental and Social Management System, • Responsible for the implementation of the requirements regarding Project Environmental / OHS and Social Management System • Responsible for the implementation of review process
Environmental Manager	• Act as management representative on Environmental and Social issues and report to the Project Manager, • Prepare, implement, and monitor the Project Environmental and Social Management Plans, • Follow the Project related national and international legislation, • Assure and monitor the implementation of ESMMP requirements, analyse the E&S performances and report to the Project Manager, • Investigate the causes of the environmental and social incidents,
OHS Manager	• Act as management representative on OHS issues and report to the Project Manager, • Prepare, implement, and monitor the Project OHS Management Plans, • Follow the the Project related national and international legislation, • Assure and monitor the implementation of ESMMP requirements, analyse the OHS performances and report to the Project Manager, • Investigate the causes of the OHS incidents,

Company management plans have been prepared and provided as annex to the ESIA report. The Management Plans will be revised to be specific to the Project along with the implementation of the ESIA requirements. The list of the management plans are as follows:

- Construction Emergency Response Plan
- Operation Emergency Response Plan
- Occupational Health and Safety Plan
- Traffic Management Plan
- Waste Management Plan
- Effluent Management Plan
- Hazardous Chemical Management Plan

The Project Company will also assign an External Environmental Consultantto monitor the performance of the implementation of the ESMMP during the Project. The Consultant will report the monitoring results and proposed mitigation measures for the findings periodically.

The roles and responsibilities for the implementation and monitoring of ESMMP during construction and operation phases of the Project are summarized below in Table 10-1.

Table 10-1 Roles and Responsibilities

Activity	Responsible Party	Monitoring Period	Monitoring
Implementation of ESMMP	Environmental Manager of the Project Company/Contractor	Periodically	Analysis/Measurement Reports, Grievance Records, Internal Audit Records
Performance Monitoring of ESMMP	External Company	Annual	Monitoring Report

11. E&S Mitigation and Monitoring Plan

11.1 Construction Stage

E&S Issues	Potential Impacts and Risks	Mitigation Measures	Monitoring Indicators and Frequency	Responsible Entity	Legal Framework
Geothermal fluid	Groundwater contamination	Geothermal fluid will be reinjected back to the system into reinjection wells Geothermal fluid collection ponds covered with impermeable layer will be established for emergency situations.	Visual inspection to ensure the effectiveness of the mitigation measures Groundwater quality monitoring at downstream of geothermal fluid storage ponds will be conducted quarterly (Quarterly)	Project Company and Contractors	Water Pollution Control Regulation Regulation on Monitoring of Surface water and Groundwater Regulation on Monitoring of Groundwater Against Pollution and Deterioration
Chemicals from drilling	Groundwater contamination	Appropriate well casing will be provided (closed casings during drilling and concrete cover around casings)	Visual inspection to ensure the effectiveness of the mitigation measures Groundwater quality monitoring at downstream of reinjection wells will be conducted quarterly (Quarterly)	Project Company and Contractors	Water Pollution Control Regulation Regulation on Monitoring of Surface water and Groundwater Regulation on Monitoring of Groundwater Against Pollution and Deterioration
Drilling mud	Soil and groundwater contamination	Drilling mud will be collected in mud ponds provided with impermeable layer. The mud will be analyzed and disposed according to the analysis	Visual inspection to ensure the effectiveness of the mitigation measures Analysis report of drilling mud	Project Company and Contractors	Water Pollution Control Regulation Circular on the Disposal of Drilling Mud and Wastes

		results.			Generated from the Physical Treatment of Chromium Minery, Waste Management Regulation Regulation on Monitoring of Surface water and Groundwater Regulation on Monitoring of Groundwater Against Pollution and Deterioration Regulation on Landfill of Wastes
H_2S emissions	Temporary odor due to H_2S release from test waters	Use of gas separators	Air quality measurements for monitoring of H_2S concentrations at sensitive receptors. (Quarterly)	Project Company and Contractors	Industrial Air Pollution Control Regulation
Wastewater management	Soil and groundwater contamination	Wastewater generated by the workers will be collected in leak proof septic tank and will be disposed by Salihli Municipality regularly.	Wastewater disposal records	Project Company and Contractors	Waste Management Regulation Regulation on the Construction of Septic Tanks at Places Where Sewer Construction is Not Possible
Solid waste management	Soil and groundwater contamination	Improper dumping of solid waste to the environment which can cause soil and groundwater contamination will be prevented. Wastes will be collected and stored separately according to their types. Domestic solid waste will be collected in leak proof garbage	Visual inspection to ensure the effectiveness of the mitigation measures Waste disposal records	Project Company and Contractors	Waste Management Regulation

		containers. Waste will be collected and disposed by Salihli Municipality. Vegetative top soil stripped during site preparation will be stored separately to be used for landscaping purposes Excavated soil will be stored and re-used for backfilling during construction activities. Waste Management Plan will be implemented for the collection, storage and disposal of wastes			
Handling of hazardous material	Soil and groundwater contamination	Hazardous material will be stored in leak proof containers on impermeable ground. Spill kits will be available at the site for immediate response. MSDS for chemicals will be available for the workers. Hazardous Chemicals Management Plan will be developed and implemented.	Visual inspection to ensure the effectiveness of the mitigation measures Soil quality analysis for heavy metal and hydrocarbons if any contamination risk is observed	Project Company and Contractors	Regulation on Soil Pollution Control and Point Source Polluted Areas
Groundwater use	Sustainability of shallow aquifers	-	Automated monitoring system will be established at two locations to monitor temperature and EC in groundwater. (continuously) Water level measurements (Monthly)	Project Company and Contractors	Water Pollution Control Regulation, Regulation on Monitoring of Surface water and Groundwater Regulation on Monitoring of Groundwater Against Pollution and Deterioration
Impact on flora	Loss of vegetation and	Topsoil will be stripped and stored	Visual inspections to ensure the	Project Company and	Waste Management

and fauna	top soil	in designated storage areas for further site restoration works. Storage areas will be prevented from the accumulation of storm water, provided with drainage. Weed growth in stockpiles of topsoil will be prevented and the stockpiles will be seeded if required. Existing access roads will be used for Project purposes and off-road driving will be prohibited. Project activities will be limited in the construction area and construction sites will be surrounded with fences to prevent wild animals intrusion to the site. Hunting or collection of animals will be strictly prohibited within the Project area. Awareness among all construction workers will be provided during the lifetime of the Project for especially the fauna species with limited mobility. If these species, are observed, they will be translocated to undisturbed but similar areas.	effectiveness of the mitigation measures (Daily)	Contractors	Regulation Water Pollution Control Regulation,, IFC PS6
OHS	Poisoning from H_2S and odour nuisance. Workers health and safety risks during the construction works	An OHS Management Plan will be developed and implemented for the Project. All workers will be provided with OHS training prior to start working Workers will be provided with appropriate PPE. H2S detectors will be placed at well heads to monitor H_2S levels Emergency Response Plan will be	Visual inspections to ensure the effectiveness of the mitigation measures (Daily)	Project Company and Contractors	Law on Occupational Health and Safety

		improved including evacuation procedure regarding H_2S release			
Community HS	Nuisance from noise and dust, H_2S exposure	Maintenance of construction equipment will be conducted regularly, exhaust mufflers will be applied to the equipment in order to minimize noise emissions and also speed limits will be implemented for the vehicles. Construction works will not be performed at nighttime. Construction site and wells will be surrounded by fences. Warning signs will be in place around the Project area, the wells and pipeline in order to inform the locals for Project site associated risks. H_2S levels will be monitored through H_2S detectors at well heads. Community will be informed immediately in case of high levels. An emergency preparedness and response plan to be enacted in the event of abnormal operation. Information boards about public safety hazards and emergency contact information will be available in the Project site.	Environmental noise measurement at sensitive receptors. (Upon grievance)	Project Company and Contractors	Regulation on Assessment and Management of Environmental Noise Industrial Air Pollution Control Regulation IFC PS4
Land use	Loss of agricultural land	In case of land take negotiations with the land owners and mutual agreement on price will be primary approach of the Project Company. In case of a Resettlement Action Plan/Abbreviated Resettlement Action Plan (RAP/ARAP) for land	Meeting records with stakeholders Grievance records	Project Company and Contractors	Expropriation Law, IFC PS5

		acquisition will be prepared and implemented. Stakeholder Engagement Plan will be updated.			
Labor Influx	Impact on local infrastructure and social conflicts	Priority to local employment will be given to the extend possible. Awareness of workers on expected behavior on their relations with the locals through a developed Code of Conduct	Grievance Records Stakeholder Engagement Activities	Project Company and Contractors	IFC PS2, PS4
Transportation / Traffic	Risks to locals and especially to children Damaging Roads	Site specific traffic management will be developed and implemented. If damage on the roads occurs due to Project activities, required maintenance and repair will be performed. Local communities will be informed on the traffic schedule. Warning and safety signs will be in place on the access roads and exit and entrance of the construction site.	Visual inspections to ensure the effectiveness of the mitigation measures Grievance Mechanism	Project Company and Contractors	IFC PS1, PS4
Cultural Heritage	Possible damage to Ancient City of Sardis Possible archaeological finds	Construction works will be monitored for archaeological remains. Work will cease in case any archaeological remains are met. Cultural Heritage Management Plan will be implemented for Project activities. Chance Find Procedure will be in place for Project acitvities.	Reporting by archaeologists (Upon any chance finds)	Project Company	Law on Preservation of Cultural and Natural Assets
Employment	Positive impact on local employment	-	Number of local workers employed	Project Company	-

Local economy	Positive impact on local economy	-	Records of local material and service providers Records of local procurement	Project Company	-

11.2 Operation Stage

E&S Issues	Potential Impacts and Risks	Mitigation Measures	Monitoring Indicators and Frequency	Responsible Entity	Legal Framework
Geothermal fluid	Groundwater contamination	Geothermal fluid will be reinjected back to the system into reinjection wells Geothermal fluid collection ponds covered with impermeable layer will be established for emergency situations.	Visual inspection to ensure the effectiveness of the mitigation measures Groundwater quality monitoring at downstream of geothermal fluid storage ponds will be conducted quarterly (Quarterly)	Project Company	Water Pollution Control Regulation Regulation on Monitoring of Surface water and Groundwater Regulation on Monitoring of Groundwater Against Pollution and Deterioration
Chemicals from drilling	Groundwater contamination	Appropriate well casing will be provided (closed casings during drilling and concrete cover around casings)	Visual inspection to ensure the effectiveness of the mitigation measures Groundwater quality monitoring at downstream of reinjection wells will be conducted quarterly (Quarterly)	Project Company	Water Pollution Control Regulation Regulation on Monitoring of Surface water and Groundwater Regulation on Monitoring of Groundwater Against Pollution and Deterioration
Drilling mud	Soil and groundwater contamination	Drilling mud will be collected in mud ponds provided with impermeable layer. The mud will be analyzed and disposed according to the analysis results.	Visual inspection to ensure the effectiveness of the mitigation measures Analysis report of drilling mud	Project Company	Water Pollution Control Regulation Circular on the Disposal of Drilling Mud and Wastes Generated from the Physical Treatment of Chromium Minery, Waste Management Regulation

E&S Issues	Potential Impacts and Risks	Mitigation Measures	Monitoring Indicators and Frequency	Responsible Entity	Legal Framework
					Regulation on Monitoring of Surface water and Groundwater Regulation on Monitoring of Groundwater Against Pollution and Deterioration Regulation on Landfill of Wastes
H_2S emissions	Temporary odor due to H_2S release from test waters	Use of gas separators	Air quality measurements for monitoring of H_2S concentrations at sensitive receptors. (Quarterly)	Project Company	Industrial Air Pollution Control Regulation
Wastewater management	Soil and groundwater contamination	Wastewater generated by the workers will be collected in leak proof septic tank and will be disposed by Salihli Municipality regularly.	Wastewater disposal records	Project Company	Waste Management Regulation Regulation on the Construction of Septic Tanks at Places Where Sewer Construction is Not Possible
Solid waste management	Soil and groundwater contamination	Improper dumping of solid waste to the environment which can cause soil and groundwater contamination will be prevented. Wastes will be collected and stored separately according to their types. Domestic solid waste will be collected in leak proof garbage containers. Waste will be collected and disposed by Salihli Municipality. Vegetative top soil stripped during	Visual inspection to ensure the effectiveness of the mitigation measures Waste disposal records	Project Company	Waste Management Regulation

E&S Issues	Potential Impacts and Risks	Mitigation Measures	Monitoring Indicators and Frequency	Responsible Entity	Legal Framework
		site preparation will be stored separately to be used for landscaping purposes Excavated soil will be stored and re-used for backfilling during construction activities. Waste Management Plan will be implemented for the collection, storage and disposal of wastes			
Handling of hazardous material	Soil and groundwater contamination	Hazardous material will be stored in leak proof containers on impermeable ground. Spill kits will be available at the site for immediate response. MSDS for chemicals will be available for the workers. Hazardous Chemicals Management Plan will be developed and implemented.	Visual inspection to ensure the effectiveness of the mitigation measures Soil quality analysis for heavy metal and hydrocarbons if any contamination risk is observed	Project Company	Regulation on Soil Pollution Control and Point Source Polluted Areas
Groundwater use	Sustainability of shallow aquifers	-	Automated monitoring system will be established at two locations to monitor temperature and EC in groundwater. (continuously) Water level measurements (Monthly)	Project Company	Water Pollution Control Regulation, Regulation on Monitoring of Surface water and Groundwater Regulation on Monitoring of Groundwater Against Pollution and Deterioration
OHS	Poisoning from H_2S and odour nuisance. Workers health and safety risks during the	H_2S detectors will be placed at well heads OHS Management Plan will be	Visual inspection to ensure the effectiveness of the mitigation measures	Project Company	Law on Occupational Health and Safety

E&S Issues	Potential Impacts and Risks	Mitigation Measures	Monitoring Indicators and Frequency	Responsible Entity	Legal Framework
	construction works	developed and implemented Emergency Response Plan will be improved including evacuation procedure regarding H_2S release Appropriate PPEs will be provided for workers Appropriate Training will be provided for the workers	(Daily)		
Community HS	Nuisance from noise and dust, H_2S exposure Accident risk at the project site	Maintenance of construction equipment will be conducted regularly, exhaust mufflers will be applied to the equipment in order to minimize noise emissions and also speed limits will be implemented for the vehicles. Construction works will not be performed at nighttime. Construction site and wells will be surrounded by fences in order to prevent unauthorized entrance. Warning signs will be in place around the Project area, the wells and pipeline in order to inform the locals for Project site associated risks. H_2S levels will be monitored through H_2S detectors at well heads. Community will be informed immediately in case of high levels. An emergency preparedness and response plan to be enacted in the event of abnormal operation. Information boards about public safety hazards and emergency	Continuous monitoring of Odor from H_2S. Noise measurements before start of the operation and upon complaint. Environmental noise measurement at sensitive receptors. (Upon grievance)	Project Company	Regulation on Assessment and Management of Environmental Noise Industrial Air Pollution Control Regulation IFC PS4

E&S Issues	Potential Impacts and Risks	Mitigation Measures	Monitoring Indicators and Frequency	Responsible Entity	Legal Framework
		contact information will be available in the Project site.			
CO_2 emissions	Gas release from steam separation	-	Biannual assessment	Project Company	-
Land use	Loss of agricultural land	In case of land take negotiations with the land owners and mutual agreement on price will be primary approach of the Project Company. In case expropriation occurs for the Project, a Resettlement Action Plan/Abbreviated Resettlement Action Plan (RAP/ARAP) for land acquisition will be prepared and implemented. Stakeholder Engagement Plan will be updated.	Meeting records with stakeholders Grievance records	Project Company	Expropriation Law, IFC PS5
Labor Influx	Impact on local infrastructure and social conflicts	Priority to local employment will be given to the extent possible. Awareness of workers on expected behavior on their relations with the locals through a developed Code of Conduct	Grievance Records Stakeholder Engagement Activities	Project Company	IFC PS2, PS4
National economy	Positive impact on national economy	-	Annual energy production	Project Company	-
Employment	Positive impact on local employment	-	Number of local workers employed	Project Company	-
Local economy	Positive impact on local economy	-	Records of local material and service providers Records of local procurement	Project Company	-

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