REPORT

Bandırma-Bursa-Yenişehir-Osmaneli High Standard Railway Project

Environmental and Social Impact Assessment (ESIA)

Submitted to:

Kalyon İnşaat Sanayi ve Ticaret A.Ş.

Kuzguncuk Paşalimanı Cad. NO:78 Üsküdar/İstanbul

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June, 2021

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Executive Summary

The 201 km long BBYO Project is planned to be realized, starting from Bandırma, passing through Kuşcenneti, Karacabey, Teknosab, Bursa, Gürsu, Yenişehir Airport and Yenişehir stations and connecting to the Ankara-Eskişehir-Istanbul High Speed Train Line in the Osmaneli region. The Project is composed of three sections which are,

- Section 1: Yenişehir-Osmaneli, between 101+700 - 149+670 (47+970 km length)
- Section 2: Bursa-Yenişehir, between 46+000 - 101+700 (55+700 km length)
- Section 3: Bandırma-Bursa, between 0+000 - 97+000 (97+000 km length)

Kalyon İnşaat Sanayi ve Ticaret A.Ş. retained Golder Associates Turkey Ltd. Şti. (“Golder”) to prepare the Environmental and Social Impact Assessment (“ESIA”) for the 201 km length Bandırma-Bursa-Yenişehir-Osmaneli (“BBYO”) High Standard Railway Project (“Project”) in compliance with the national and international requirements.

This ESIA Report has been prepared by Golder for the following objectives:

- Identification and assessment of social and environmental impacts, both adverse and beneficial, in the project’s area of influence;
- Evaluation of the main environmental and social risks and potential impacts of the Project;
- Presentation of Environmental and Social Management Plan (ESMP), Environmental and Social Management System (ESMS), Stakeholder Engagement documentation, and grievance mechanism against the Applicable Standards;
- Description of the management, mitigation, monitoring and compensation measures, including the ESMS, the ESMP, and the thematic action or management plans (e.g. corrective action plan, resettlement action plan);
- Cumulative impact assessment (as required by the Applicable Standards);
- Assessment of associated facilities.
- Main components of the assessment include:
  - The potential environmental and social impacts of the Project throughout the full life cycle;
  - A public consultation to ensure that local communities and other key stakeholders are informed of the Project and have an opportunity to express their opinions concerning the Project;
  - Proposed mitigation activities to minimize adverse environmental and social impacts;
  - The nature and significance of residual impacts (those adverse impacts that occur after mitigation has been applied) and ongoing monitoring and management plans to address them;
  - The nature and significance of cumulative impacts

This ESIA Report aims to assess the environmental and social impacts of all Project sections as a whole. However, it is necessary to note that the construction activities in Section 2 which are not within the scope of Kalyon had been initiated and currently ongoing. The ESIA methodology presented in this study aimed to collect baseline and technical data as much as possible for Section 2 to define the interferences, potential impacts and mitigation measures as a whole in the Project.

Based on the findings of the potential environmental and social impacts and risks of the projects were identified during that phase, the project is categorised as A in accordance with IFC Sustainability Framework.

The potential environmental and social impacts and risks of the projects were identified based on the project screening information and the additional information collected during the inception and ESIA phase. These impacts and risks are:

- Site specific,
- Readily identifiable,
- Can be readily addressed by standard industry practice mitigation measures (as also detailed in the following sections), and
- Largely reversible.

An ESIA evaluates a project's potential environmental and social risks and impacts in its area of influence; examines project alternatives; and includes the process of mitigating and managing adverse environmental and social impacts throughout project implementation.

A specific Stakeholder Engagement Plan is currently under preparation for the Project. The overall objectives of the SEP are:

- Continuously informing the local community about the Project related development activities;
- Ensuring that the local community is informed about the hazards associated with construction, operation activities of the Project and mitigation measures implemented to reduce impacts where possible;
- Minimizing potential disputes between Contractor's and Subcontractors' and the local community;
- Incorporating local knowledge during the entire Project life cycle, by taking into account bottom up information and feedback provided by local communities; and
- Timely and effectively responding to community concerns regarding the issues such as employment of the local workforce reserve in the construction and operation phases, disruption to daily activities, safety issues, disturbances due to noise or dust, and other environmental and social issues.

A Grievance Mechanism (for both internal and external) will be established as part of the SEP for communities and individuals to formally communicate their concerns, complaints and grievances to the company and facilitate resolutions that are mutually acceptable by the parties.

As a key step in the ESIA process; various studies have been conducted to collect information on the existing environmental and social baseline conditions. Apart from the desktop and relevant literature review the following activities were performed (along the entire route) for the collection of information on social and environmental baseline conditions.

- The social baseline of the AoI is collected through community level surveys and household surveys. Qualitative and quantitative methods have been used during the baseline data gathering.
- Air quality measurement activities were conducted at selected points along the Project route near surroundings,
- Ambient noise measurements were conducted at selected points along the Project route near surroundings,
- Surface water quality measurements were conducted at selected points along the Project route,

- Soil quality measurement activities were conducted at selected points along the Project route,
- Site visit was performed for identification of biodiversity baseline,
- Site visit performed for the assessment of the archaeological survey.

Impact Assessment Results

Main features of Current Situation	Potential impacts	Mitigation Measures
Geology and Seismology		
The project area is in 1st degree earthquake zone.	Changes in the local morphology	Compliance of design with the provisions of the "Regulation on the Buildings to be Constructed on Earthquake Zones" (06.03.2007 O.G. No: 26454).
Soils		
Geological and geotechnical investigations were carried out at the Project Area. 10 soil samples were taken from different sampling points along the BBYO route to identify the baseline conditions.	Topsoil and lower soil removal Pollutant emissions to the soil Occupation of land	Removed topsoil will be stored at designated storage areas, to be used for landscaping after the construction. Prevention of leaks and spills. Spill response arrangements.
Hydrogeology and Groundwater Quality		
Groundwater level was measured only in drillings along the Yenişehir-Osmaneli line, and these levels were between 0.5 and 27.50 m BGS.	Hydrogeological change Groundwater pollution	Prevention of leaks and spills.
Hydrology and Surface Water Quality		
Nilüfer Stream and its tributaries, Karaçay and its tributaries (mainly Ulu Creek), which are fed from the sub-basins in the north of the Susurluk basin, are the main surface water resources in the Bandırma-Bursa and Bursa-Yenişehir lines and its immediate surroundings. The Akçasu Stream, which is fed from the sub-basin to the north-west of the Sakarya basin, and then the Göksu Stream are the	Surface water pollution. Sediment pollution.	Engineering and design practices will be in place for the collection and disposal of wastewater from all sources during construction and operation of the project. Appropriate surface drainage will be ensured for the construction and operation phases. Regular maintenance of vehicles and machinery/equipment will be undertaken to ensure that leakages of oil/fuel

Main features of Current Situation	Potential impacts	Mitigation Measures
main surface water resources associated with the Yenişehir-Osmaneli line. These streams are sub-drainage streams of the Sakarya River, which is the most important surface water resource in the basin. There are three natural lakes close to the Project route. These lakes are Kuşgölü, Ulubat Lake and İznir Lake. 27 surface water samples were taken along the BBYO Route to identify the baseline conditions		Temporary waste storage areas will be constructed ensuring potential leakages are prevented.
Air Quality		
PM_{10}, and $PM_{2.5}$ measurement values are in compliance with Project standards.	Calculations on the estimated amount of air emissions during construction indicated no significant contribution to the ambient air quality.	Measures will be in place to minimise the air emissions during construction and operation.
Noise and vibration		
Ambient noise measurement results vary between 44.5 and 52.2 dBA for day and 38.8 and 43.9 dBA for night which are all under both IFC and Turkish Regulation limits. The locations of the vibration sources (i.e, where the blastings will be carried out), the distance of the nearest receptor to the vibration source, and the calculated vibration values on these receptors are presented in Table 138. Since the blasting operations for the railway route for the tunnels are completed for Section 2, vibration is not assessed in the locations where	Potential impacts from noise during the construction phase of the Project are mainly caused by the heavy equipment/machines that will be used in the infrastructure and superstructure construction. During the construction phase, impacts will be mainly associated to the following ***impact factors***: ■ Noise emissions The impact factor is evaluated considering duration, frequency, geographic extent and intensity for construction phase. Residual impact values	A monitoring programme of noise at the baseline locations and receptors exceeding the limit values during construction and the commissioning and operational phase will be in place. The monitoring campaign will be conducted by 48 hours continues measurements at the locations. Vibration impacts for the construction phase of the Project due to the blasting operations are evaluated in the matrix provided in Table 135. As can be seen in the matrix all impact factors considered for vibration originated from construction activities have negligible residual impacts on the Project personnel and nearby communities

Main features of Current Situation	Potential impacts	Mitigation Measures
the blasting operations were completed in Section 2 During the operational phase, not any blasting operations will be carried out, thus not any vibration effects due to the Project activities is expected	for the impact factors are then calculated and classified considering all mitigations as described above and further elucidated in the blasting management plan.	
Traffic		
There are already access roads on the BBYO route. However, some extension works might be performed in case of need. The land traffic in the construction phase will be generated by the machinery, equipment, material and staff to be transported to the Project construction sites.	During construction phase impacts will be mainly associated with the increased road traffic. Railway traffic will increase with the commencement of the Project's operation.	Scheduling of traffic to avoid peak hours on local roads. Adopting traffic control and operations devices and emphasizing safety aspects among project drivers. Regular maintenance of vehicles should be undertaken to ensure that vehicles are safe and emissions and noise are minimized.
Biological Components		
Desktop studies and on-site observations were conducted at 17 terrestrial sampling points and at 11 freshwater sampling points along the BBYO Route. The sampling stations were selected to be representative of the study areas in terms of position, to ensure coverage of the entire local study area, and habitats investigated. The Project is not located within any protected areas. However, a small portion of the footprint, and consequently of the Project LSA, in the western part partially falls within the internationally recognized Manyas Lake (Kuş Lake) Key Biodiversity Area (KBA) and Important Bird Area (IBA), which substantially matches with the Kuş Lake Ramsar Site (Wetlands of International Importance). In addition, the Project LSA minimally overlaps the internationally recognized Kocaçay Delta Key Biodiversity Area (KBA) and Important Bird Area (IBA). Finally, the Marmara Islands KBA and IBA is located at 5 km from the LSA, while the Uluabat Lake KBA, IBA and Ramsar Site, the Armutlu Peninsula KBA and IPA (Important Plant Area), the Ulu (Uludag) Mountain KBA and IPA, and Kocaçay Delta KBA and IPA are located at 20 km from the Project LSA. Based on the findings, 3 flora species, 2 fish species and 1 bird species were identified as potentially triggering critical habitat. 3 flora species *(Aubrieta olympica, Centaurea sakariyaensis, Ornithogalum pascheanum)* 2 fish species (*Barbus niluferensis, Cobitis puncticulata)*		

<table>
<tr><th>Main features of Current Situation</th><th>Potential impacts</th><th>Mitigation Measures</th></tr>
<tr><td colspan="3">1 bird species (Falco cherrug,)

A list of mitigation measures are defined for Project phases within the scope of ESIA including additional field studies to collect data and plan mitigation measures.</td></tr>
<tr><td colspan="3">Social Components</td></tr>
<tr><td>Social studies were carried out in the provinces of Balıkesir, Bursa and Bilecik, and a total of nine districts of these provinces were visited to conduct community level and household surveys.

The expropriation process has not started as of April 2021 between the route between Bandırma and Bursa. According to the information obtained from the project company, a total area of 5,809,967 m^2 is needed in this area for the high-speed train construction. 91% of this area is private lands, 2% pasture lands and 7% forest lands.

Part of the expropriation process of the lands on the Yenişehir-Osmaneli route has been completed, and additional lands are needed for the realization of the project. In this section, a total of 1,716,612 m^2 of land is required for the realization of the project. 57% of these lands are private lands, 7% pasture lands and 36% forest lands.</td><td>The need of workforce that can be considered a positive impact.
Increased traffic and transportation requirements.
Community health and safety concerns in relation to Project construction and operation.
Workers' accommodation camps to be established.</td><td>A continuous stakeholder engagement process and grievance mechanism will be in place
• to exchange information on the project with the local community and other stakeholder and
• to record and respond any complaints and concerns raised by the local community members and other stakeholders
Maximising of local employment and procurement in order to increase the positive socio-economic impact of the project on the local community.

Coordination with the local community for the arrangements of accommodation and establishment of the construction camps.</td></tr>
</table>

Environmental and Social Management System

The Environmental and Social Management System (ESMS) will be implemented (for both construction and operation phases) to ensure that the Project:

- complies with all applicable Turkish legislation as well as relevant IFC guidelines provided in this report;
- implements Good International Industry Practices (GIIP) to minimize potential environmental and social impacts during the construction, operation and decommissioning phases;

- is executed in compliance with the commitments addressed in this report for the minimization of potential environmental and social impacts;
- works in accordance with high standards of safety;
- cares for the protection of own employees and public;
- promotes its policies through training, supervision, regular reviews and consultation;
- generates local socio-economic benefits by using local and regional labour forces;
- engages and communicates with the local community and other stakeholders through a stakeholder engagement programme.

The minimum requirements of an ESMS have been defined and will be established for the project in order to mitigate the risks associated with;

- Environmental aspects
- Labour and occupational health and safety Issues
- Community Health & Safety aspects
- Stakeholder management and social aspects (including grievances)
- Land acquisition and livelihood management
- Waste Management

Study Limitations

This report has been prepared based on the documentation provided to Golder by the Investor. Golder cannot confirm the accuracy of the information provided by third parties during this due diligence process.

IMPORTANT: This section should be read before reliance is placed on any of the opinions, advice, recommendations or conclusions herein set out.

a) The purpose of this report was to undertake ESIA pursuant to the appointment of Golder to act as Consultant.

b) Except for Kalyon İnşaat Sanayi ve Ticaret A.Ş. (“Client”) and Lenders (existing and future), any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third parties. Should additional parties require reliance on this report, written authorization from Golder will be required. Golder disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No duty is undertaken, nor warranty nor representation made to any party in respect of the opinions, advices, recommendations or conclusions herein set out.

c) The report is based on data and information collected up to issue date. It is based solely on a review of information and data obtained by the Investor as described in this report, and discussion with representatives of the Investor, as reported herein.

d) In evaluating the Project, Golder has relied in good faith on information provided by other individuals noted in this report. Golder has assumed that the information provided is factual and accurate. In addition, the findings in this report are based, to a large degree, upon information provided by the Investor. Golder accepts no responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of omissions, misinterpretations or fraudulent acts of persons interviewed or contacted.

e) Golder makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation. These interpretations may change over time, thus the client should review these issues with appropriate legal counsel.

f) In the Conclusions section of this report and in the Executive Summary, Golder has set out its key findings and provided a summary and overview of its advice, opinions, and recommendations. However, other parts of this report will often indicate limitations of the information obtained by Golder and therefore any advice, opinions or recommendations set out in the Conclusions section and in the Executive Summary should not be relied upon until considered in the context of the entire report.

g) This Report is prepared during the Covid-19 pandemic which was declared as a pandemic worldwide and continues to endanger the communities’ health. The field studies within the scope of this ESIA were conducted in line with the Covid-19 restrictions including limited interaction with the local communities.

ACRONYMS AND ABBREVIATIONS

AYGM: Directorate General of Infrastructure Investments (Altyapı Yatırımları Genel Müdürlüğü)

AGI: Flow Monitoring Station

BBYO: Bandırma-Bursa-Yenişehir-Osmaneli

CO: Carbon monoxide

dBA: A-weighted decibels

DSI: State Hydraulic Works

EA: Environmental Assessment

EEA: European Environmental Agency

EHS: Environmental, Health, and Safety

EIA: Environmental Impact Assessment

EPFI: Equator Principles Financial Institutions

EPs: Equator Principles

ESAP: Environmental and Social Action Plan

ESIA: Environmental and Social Impact Assessment

ESMP: Environmental and Social Management Plan

ESMS: Environmental and Social Management System

EU: European Union

GIIP: Good International Industry Practice

Golder: Golder Associates Turkey Ltd. Şti

Ha: Hectare

Hr: Hour

IA: Impact Assessment

IEEP: Institute for European Environmental

IFC: International Finance Corporation

IUCN: International Union for Conservation of Nature

Kalyon: Kalyon İnşaat Sanayi ve Ticaret A.Ş.

Kg: Kilogram

kVA: Kilovolt Ampere

L: Liter

L&FS: Life and Fire Safety

Leq: Equivalent continuous sound level

LV: Low voltage

μg: Microgram

M: Meter

Mg: Milligram

Ml: Millilitre

Mm: Millimetre

MoEU: Ministry of Environment and Urbanization

MoFWA: Ministry of Forestry and Water Affairs

MV: Medium voltage

NGOs: Non-governmental organizations

NO_2: Nitrogen dioxide

NO_x: Nitrogen oxides

O.G.: Official Gazette

OECD: Organization for Economic Co-operation and Development

OHS: Occupational Health and Safety

PDoEU: Provincial Directorate of Environment and Urbanization

PDF: Project Description File

PM: Particulate matter

PM_{10}: Particulate matter with diameter less than or equal to 10 micron

PPE: Personal Protective Equipment

PRs: Performance Requirements

PS: Performance Standard

Project: Bandırma-Bursa-Yenişehir-Osmaneli High Standard Railway Project

QA/QC: Quality Assurance/Quality Control

S: Second

SA: Study Area

SO_2: Sulphur dioxide

SSA: Social Study Area

SI: Social Impact

TCDD: Turkish State Railways (Türkiye Cumhuriyeti Devlet Demiryolları)

ToC: Table of Contents

TOX: Total organic halogens

TPH: Total petroleum hydrocarbons

TÜİK: Türkiye İstatistik Kurumu (Turkish Statistical Institute)

WHO: World Health Organization

WMP: Waste Management Plan

WWF: World Wide Fund for Nature

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1.0 INTRODUCTION

1.1 Background and Objectives

Kalyon İnşaat Sanayi ve Ticaret A.Ş. ("Contractor", "Client", "Kalyon"), retained Golder Associates Turkey Ltd. Şti. ("Golder") to prepare the Environmental and Social Impact Assessment ("ESIA") for the 201 km length Bandırma-Bursa-Yenişehir-Osmaneli ("BBYO") High Standard Railway Project ("Project") in compliance with the national and international requirements.

The 201 km long BBYO Project will start from Bandırma, pass through Kuşcenneti, Karacabey, Teknosab, Bursa, Gürsu, Yenişehir Airport and Yenişehir stations and connect to the Ankara-Eskişehir-Istanbul High Speed Train Line in the Osmaneli region. The Project is composed of three sections which are,

- Section 1: Yenişehir-Osmaneli, between 101+700 - 149+670 (47+970 km length)
- Section 2: Bursa-Yenişehir, between 46+000 - 101+700 (55+700 km length)
- Section 3: Bandırma-Bursa, between 0+000 - 97+000 (97+000 km length)

Project History

The Project was included in the Investment Programme of the government for the first time in 1978, with the initial name Bandırma-Bursa-Osmaneli-Ayazma-İnönü Railway Project. The Project was then subject to different investment programmes until 2021. The Project's tender process during this period is chronologically explained below.

- The first tender for Bursa-Yenişehir section the Project which was the construction of infrastructure works of the alignment was held on 1st of August 2011 and then cancelled before beginning of the construction.
- On 2nd of December 2016 another tender was held for the tunnelling works at the Bursa-Yenişehir section of the Project. Çelikler Taahhüt İnşaat ve Sanayi A.Ş. ("Çelikler") and YSE Yapı Sanayi ve Ticaret A.Ş. Joint Venture was awarded the tender. The construction works are still ongoing and approximately 70% of the works have been completed in Section 2 by Çelikler.
- On 10th of March 2017 a new tender was held for the infrastructure works (except tunnels) at the Bursa-Yenişehir section of the Project. Duygu Mühendislik ("Duygu") which is a subsidiary of Cengiz Construction was awarded the tender. The construction works are still ongoing and approximately 80% of the works have been completed in Section 2 by Duygu.
- On 3rd of April 2018, the infrastructure works, except the works which area under construction, superstructure works and electromechanical works at the Bursa-Osmaneli section of the Project were tendered, and a while later was cancelled before beginning of the construction.
- Finally, on 20th of August 2020 the tender for the turn key, design, build and finance of Bandırma-Bursa-Yenişehir-Osmaneli High Standard Railway Project (except the works under construction by other Contractors explained above) was held and Kalyon İnşaat Sanayi ve Ticaret A.Ş. was awarded the contract on 17th of September 2020. The financing process is currently ongoing. Following the financial close, the construction will commence.

Project Owner

The BBYO Project owner is the Republic of Turkey Ministry of Transport and Infrastructure (MoTI), Directorate General of Infrastructure Investments (AYGM). The Construction Contract was signed between Kalyon and AYGM on 17th of September 2020. After the completion of the construction for BBYO Project, the Project will be commissioned with the transfer of the Project by AYGM to Turkish State Railways (TCDD) including all the structures and other elements included in the Construction Contract.

The investment costs provided by AYGM will be covered by equity and external financing.

Some of the roles and responsibilities of AYGM are as follows:

- To prepare or get prepared and approve the plans and projects of railways, logistic villages, centres or bases, ports, shelters, coastal structures, airports to be built by the state, constructing and / or having the transportation infrastructures built, transferring the completed projects to the relevant institutions.
- To determine the principles by developing Public-Private Partnership (PPP) models in order to ensure the construction and operation of transportation infrastructures, including those completed or ongoing by public institutions and / or organizations, the private sector and / or legal entities, when deemed necessary on a project basis, the private sector, to negotiate with real and legal persons, to determine contributions, to give and receive commitments, to lease, to operate, to receive and give guarantees, to ensure the participation of the private sector and to establish a partnership.

Contractor

Kalyon İnşaat Sanayi ve Ticaret A.Ş. which will be acting as the main Contractor of the BBYO Project, was established in 1974 as part of Kalyon Holding. According to the Construction Contract signed with AYGM on 17th of September 2020, the scope of works to be conducted by Kalyon include the following:

- Establishment of 2 new railway lines on the ~56 km railway route of Bursa-Yenişehir section (Infrastructure works in this section are carried out under another contract by TCDD, Kalyon will do the infrastructure completion[1], superstructure, electrification, signalisation and telecommunication works).
- Construction of 2 new railway lines on the ~50 km railway route of Yenişehir-Osmaneli section,
- Design and construction of 2 new railway lines on the ~95 km railway route of Bandırma-Bursa section,
- If the analysis of the railway route between Bursa-Gemlik and Bursa-Balıkesir is deemed appropriate, making reservations,[2]
- The construction of stations, tunnels and engineering structures in accordance with the Unit Price and Technical Specifications in the annex of the Contract for all these routes, and the production of superstructure, electrification, signalisation and telecommunication, testing and commissioning.

The other two main Contractors of TCDD who had started their construction activities in Bursa-Yenişehir Section (Section 2) before this ESIA Study are Çelikler and Duygu, i.e., the tunnel works were started by Çelikler in 2016 and infrastructure works were started by Duygu in 2017.

Environmental Permitting

Project's status according to Environmental Impact Assessment Regulation:

The Project was initially defined as out of scope of the Turkish Environmental Impact Assessment (EIA) Regulation (Official Gazette No. 26939, 17.7.2008) according to the provisional clause 3 *"(1) Projects that have been included in the investment program before 23/6/1997 and have passed the planning stage as of 5/4/2013 or have been tendered or have started production or operation, and the structures and facilities that are obligatory for their realization, the provisions of this Regulation are not applied, without prejudice to the permissions required in other regulations."*

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[1] Construction of the infrastructure components in Bursa-Yenişehir Section is within the scope of different Contractors (Duygu-Çelikler,

Table 4). In case the infrastructure components' construction is not completed by Duygu-Çelikler due to extended expropriation, Kalyon will be responsible for the completion of incomplete infrastructure works.

[2] The analysis of the railway route between Bursa-Gemlik and Bursa-Balıkesir is currently out of scope of the BBYO Railway Project, therefore not assessed within the scope of this ESIA study.

Following the revision in the EIA Regulation on 03.10.2013 and lately on 25.11.2014, the provisional clause 3 was amended as *"Projects that are documented to start production and/or operation before 7/2/1993, which is the first publication date of the Environmental Impact Assessment Regulation, are out of the scope of Environmental Impact Assessment."*

Following the amendment in the EIA Regulation, the Project had to be evaluated within the scope of the EIA Regulation. The BBYO Project sections are included in the scope of the Annex-II of Environmental Impact Assessment Regulation Item 31-Infrastructure facilities, *"The railway lines that are not included in Annex-I railway lines (i.e., railway lines with the length of 100 km and more) shall prepare a Project Description File (PDF)."*

The Project has secured and comply with the "EIA Not Required Decision" for Section 2 (Bursa-Yenişehir) and Section 1 (Yenişehir-Osmaneli). The EIA Process will be initiated for Section 3 (Bandırma-Bursa) following the finalization of the railway route technical design.

Considering the associated facilities, Kalyon is in the process of obtaining the licenses and initiating the EIA studies and permitting for the quarries and borrow sites, concrete plants, precast plants planned to be constructed and operated within the Project scope (Section 3.3.6).

The Project's environmental permitting information is provided in Table 1 below.

Table 1 Project's EIA Decisions

Project EIA Decisions	Issue Date
"EIA Exemption Decision" from MoEU for the Bandırma-Bursa-Osmaneli-Ayazma-İnönü Railway Project: "The railway project, which was determined to be included in the investment program in the years before 1993, is not subject to the provisions of the EIA Regulation in accordance with the temporary article 3 of the EIA Regulation."	August 3rd, 2009
"EIA Not Required" Decision from MoEU for the "Yenişehir-Osmaneli Section" of the Bandırma-Bursa-Ayazma-Osmaneli High Speed Railway Project.	February 20th, 2013
"EIA Not Required" Decision from MoEU for the "Bursa-Yenişehir Section" of the Bandırma-Bursa-Ayazma-Osmaneli High Speed Railway Project.	June 14th, 2013
"EIA Not Required" Decision from MoEU for the "Yenişehir-Osmaneli Section" of the Yenişehir-Osmaneli and Yenişehir-Bozüyük Railway Project.	April 20th, 2017
Official Letter from the MoEU confirming that "EIA Not Required" Decision is valid for the 20.730 km route change in the design of the "Bursa-Yenişehir Section" of the Yenişehir-Osmaneli and Yenişehir-Bozüyük Railway Project.	November 28th, 2017

The Project's status according to Regulation on Environmental Permits and Licenses:

- During the construction phase of the BBYO Railway Project, the camps site which will be established for more than 1 year and will include a wastewater treatment plant operation will be subject to environment permit in accordance with the Regulation on Environmental Permits and Licenses and necessary discharge permits will be obtained.
- All associated facilities which are planned to be established within the scope of the BBYO Railway Project will be assessed in accordance with the Regulation on Environmental Permits and Licenses and relevant

environment permit will be issued for air emissions, environmental noise, wastewater discharge as required.

- The operation of the BBYO Railway Project is out of scope of the activities and facilities listed in Annex-I and Annex-II of the Regulation on Environmental Permits and Licenses. However, during the operation phase, if the domestic wastewater originating at the stations cannot be connected to the Municipality sewage systems, package wastewater treatment plants will be established for over 84 people. In this case, necessary discharge permits will be obtained.

ESIA Objectives

This ESIA Report has been prepared by Golder for the following objectives:

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  - The nature and significance of residual impacts (those adverse impacts that occur after mitigation has been applied) and ongoing monitoring and management plans to address them;
  - The nature and significance of cumulative impacts

This ESIA Report aims to assess the environmental and social impacts of all Project sections as a whole. However, it is necessary to note that the construction activities in Section 2 which are not within the scope of Kalyon had been initiated and currently ongoing. The ESIA methodology presented in this study aimed to collect baseline and technical data as much as possible for Section 2 to define the interferences, potential impacts and mitigation measures as a whole in the Project.

Kalyon will aim the development of appropriate communication methods in the Project to cooperate and ensure that appropriate impact mitigation measures are implemented at all sections. TCDD will be responsible from the implementation of the mitigation measures by the Contractors (Duygu & Çelikler) in Section 2.

1.2 Project Rationale

In parallel with the gradual liberalization of trade in the world, the increase in competition and the prolongation of transportation distances with the gaining of global and regional organizations have highlighted the element of speed. This situation has increased the importance of delivering raw materials and processed products to buyers at low cost and on time, and widespread the use of combined transportation systems supported by logistics services.

Since rail and sea transportation physical infrastructure is not developed enough in line with the transportation demand in Turkey, this has led to the installation of the road network mainly for freight and passenger transport. This situation has caused the formation of an unbalanced and inefficient transportation system among transport types. In addition to these, traffic safety, especially on highways, has not reached sufficient levels yet.

The solution of these problems will be possible with railway transportation. However, first of all, the railway infrastructure needs to be improved and expanded, and the passenger and logistics services provided on the railway must be improved. It is necessary to expand the existing railway network, especially to include developed industrial cities, to make the necessary connection lines to the industrial zones, to make the lines with low service quality and maintenance and to make them suitable for higher quality service with the establishment of signalisation systems. With the increase in combined transport with road-rail connection and the establishment of logistic villages that will provide them with the necessary infrastructure, the load on the highway can be shifted to the railway.

In order to ensure faster and safer travel between cities, high-speed train projects will need to be implemented on economical lines. Bursa, one of the most developed industrial cities of our country, is located in a region closely related to the above problems and solution proposals. It is one of the leading cities both in terms of population and the added value in Turkey. In a province like Bursa where there are large industrial facilities, most of the raw materials and products are transported by road. Today, Bursa needs a new railway connection with its high load and passenger capacity.

Many goals and targets have been determined for the development of railways in the 2019-2023 Strategic Plan of TCDD. These are:

- To develop and expand the national rail network.
- To ensure that infrastructure operations are maintained in a safe, uninterrupted and comfortable manner.
- To provide safe traffic and station management with effective capacity in the national railway network.
- To ensure the integration of railway infrastructure with other transportation systems.

According to the 11th Development Plan of the Turkish Republic Presidency of Strategy and Budget, in order to create a more balanced distribution and increase passenger comfort, high-speed train railways under construction will be completed. In this context, railway investment and development targets were determined in the period until 2023 (Table 2). In this respect, the target was established as giving priority to the investments in the establishment of signalisation and electrification systems in existing railway lines in order to increase capacity, reduce operating costs, reduce carbon emissions, ensure safe transportation, reduce external dependency by using electrical energy in transportation and save time.

Table 2 Railway Investment and Development Goals (11th Development Plan)

	2018	2023
High Speed Train Line Length (km, cumulative)	1,213	5,595
Rail Passenger Transport Ratio in Total (Terrestrial %)	1.3	3.8
Double-Rail Railway Ratio in the Total Line (%)	12.4	26.3

In this respect, the BBYO Project aims to:

- Increase the ratio of railways in the intercity transportation,
- Develop fast, safe and economical transportation opportunities,
- Increase in integration with other rail system lines.

With the realization of the BBYO Project:

- The ratio of railways in intercity transportation will increase,
- Fast, safe and economical transportation will be provided,
- Rail system network will expand across the country,
- Intercity logistics costs will decrease.
- Employment will be provided both during the construction and operation phases.

1.3 Project Categorisation

The requirements from IFC and EBRD regarding the Environmental and Social Assessment process and outcomes differ depending on the category of the project. Projects are categorized as follows:

Table 3 Project Categorisation

Category	Description of the Project
	IFC and EP4
Category A	Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented
Category B	Projects with potential limited adverse environmental and social risks and/or impacts those are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures.
Category C	Projects with minimal or no adverse environmental and social risks and/or impacts.

Given the potential scale, complexity and type of the environmental and social impacts and risks presented by the Project, the categorisation, associated with the construction and operation of the project is proposed as “A” in reference to Equator Principles 4 and IFC for project categorization.

1.4 Key Steps in the ESIA Process

1.4.1 Screening & Scoping

A group of Golder experts consisting archaeologists, social experts and biodiversity experts conducted site visits along the BBYO route in March 2021. The purpose of the site visit was to identify the key environmental and social issues associated with the Project and requiring detailed evaluation as part of the ESIA process to establish the most appropriate approach to the assessment and the categorisation of the Project.

The site visit was based on the review of the characteristics of the Project and the associated releases to the environment and a walkover survey of the site and of the surrounding area. Major potential environmental and social issues associated with the Project are identified together with the requirement for additional studies on specific issues during that phase.

1.4.2 Baseline Data Collection

Baseline information has been obtained from the Project specific social and environmental baseline studies that have been carried out as part of this ESIA, utilising both desktop and field-based approaches. These studies have been compiled through specifically commissioned surveys, collated from a range of sources including publicly available information and through consultation. Relevant information used to support the assessment process is referenced in the relevant sections.

1.4.3 Stakeholder Engagement

WB and IFC recommend that the project sponsor consults with the relevant stakeholders at least twice:

a) During scoping and before the terms of reference for the ESIA are finalized, and

b) Once a draft ESIA report is prepared. The ESIA report must be made accessible to the public once completed, however it is recommended to consult and inform local stakeholders in earlier phases of the process.

Preliminary engagement activities during the site visit were performed during the ESIA process. Detailed information is provided about the Stakeholder Engagement in Section 5.0 of this report.

1.4.4 Impact Assessment

The general methodology adopted by Golder for Environmental and Social Impact Assessment Studies has been designed to be analytical and transparent and allow a semi-quantitative analysis of the impacts on the various environmental and social components. The methodology is based on the premise that projects can generate both negative and positive impacts with a magnitude that can be evaluated by considering several attributes of the project activities and of the receiving environment.

The methodology is based on three main building blocks and on the identification, description and quantification of the following key elements:

- **Project actions:** activities directly or indirectly related to the project which can interfere with the environment as primary generative elements of environmental or social pressures;
- **Impact factors**: direct or indirect interferences produced by the project actions on the environment, able to influence the state or quality of one or more environmental and social components;
- **Sensitivity of the component**: sum of the conditions which characterize the present quality and/or trends of a specific environmental and social component and/or of its resources;
- **Impacts**: changes undergone by the environmental state or quality because of the effects caused by the impact factors on the environmental or social component;
- **Mitigation measures**: actions adopted to mitigate negative impacts or to improve the effects of positive impacts on the environmental and social component.

The details of the impact assessment methodology are presented in Appendix C.

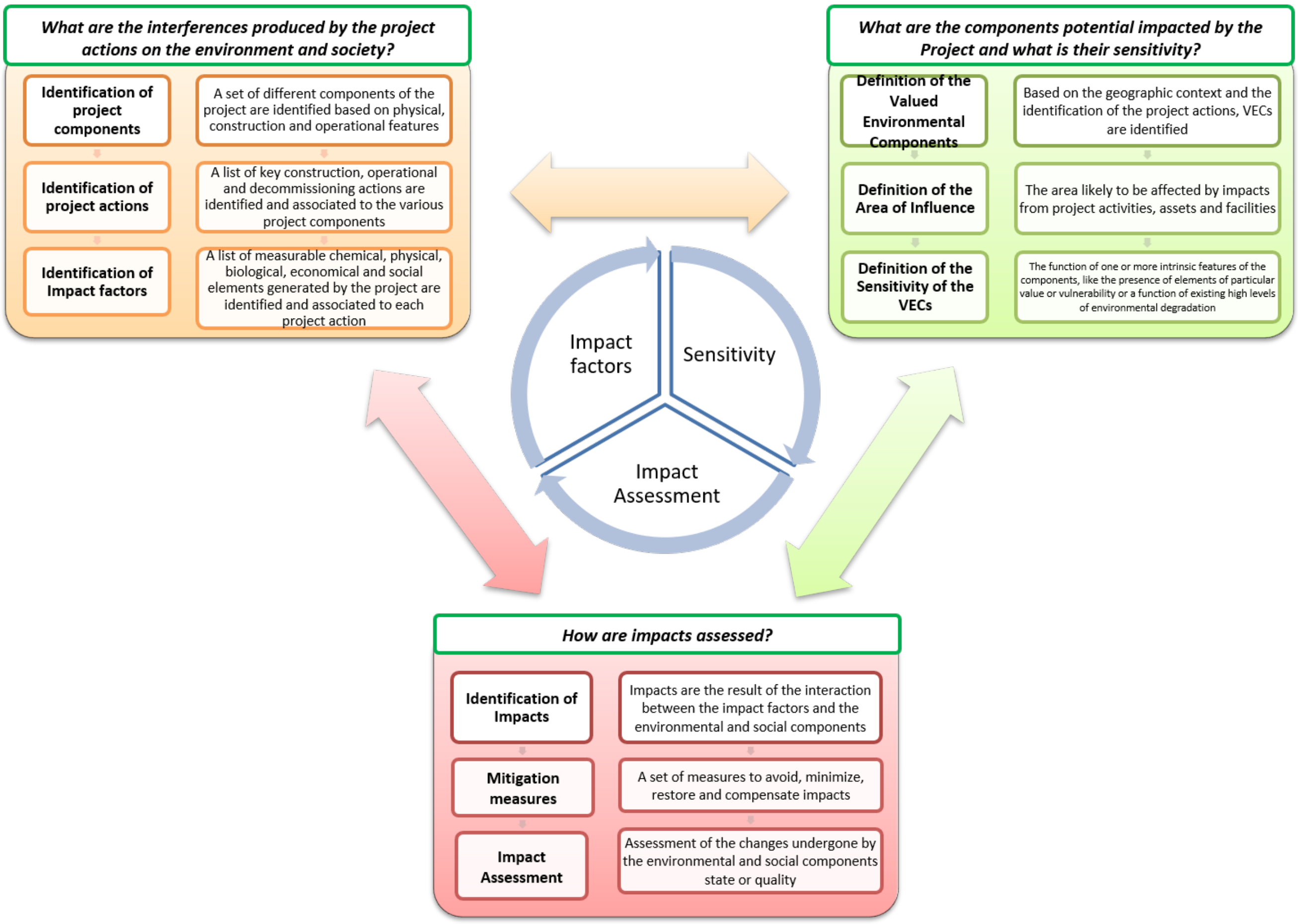


Figure 1 Three building blocks of the ESIA methodology

1.4.5 Physical and Biological Components

The study area and methods for the collection of baseline information on physical and biological components are presented in Sections 7.1 and 7.2. The baseline characteristics were collected through both desktop and field studies. The impact assessments for both components are presented in Sections 8.1 and 8.2.

1.4.6 Social Components

Golder reviewed the social baseline study and social interactions conducted so far between the Contractor and nearby settlements to support the planned social survey for pre-ESIA process. The studies have been focused on assessing the potential presence of any land acquisition and livelihood issues within the Project area.

Additional field studies have been conducted to confirm the presence and impact of the social status of the nearby settlements within the Project area. This baseline studies were performed in order to:

- Understand the characteristics of the social context that may be subject to change, either as a) a result of Project potential direct and indirect impacts or b) that are showing changes and trends that are independent of the Project impacts. This will enable monitoring of the socioeconomic situation in the social context over time, using the present baseline as the pre-Project comparison point.
- Understand what resources are available at the household level in terms of livelihoods strategies and coping/resilience mechanisms through profiling households’ economic, social and cultural activities.
- Identifying particular groups deemed vulnerable in the local context and potentially less able to cope with the changes brought about by the Project, or less able to benefit from its positive effects

Social components include;

- Demographics and socio-politics
- Economy
- Education skills and employment
- Land use, resettlement, land acquisition and livelihoods
- Ecosystem services
- Public Services and Infrastructure
- Community health, safety and security

The fieldwork was carried out by a team of social experts led by Golder Social Expert, between 24 March 2021 and 31 March 2021 for the social baseline and impact assessment studies. Within the scope of the social field study, the neighbourhoods and villages on the project route were visited and a community level survey and household questionnaire were applied.

The demographic information of the neighbourhoods was collected through the community level questionnaire, and through the household questionnaire, both the demographic structure of the households and the Project impacts, including expropriation, were asked to the participants. Social studies were carried out in the provinces of Balıkesir, Bursa and Bilecik which are located on the route, and a total of nine districts of these provinces were visited.

The social components of the Project are presented in Section 7.3 and impact assessment is presented in Section 8.3.

1.4.7 Identification of Mitigation Measures

Mitigation measures were identified through the application of the mitigation hierarchy of avoid, minimize, or, where residual impacts remain, compensate/offset providing the framework for developing a checklist of mitigations measures for risks and adverse environmental and social impacts. This approach implies that priority have been given to preventive actions mainly related to Project design, location and implementation rather than curative interventions that handle adverse outcomes after the emergence of the anticipated problems.

Realistic and affordable (cost-effective) mitigating measures have been proposed to prevent, reduce or minimise the impacts to acceptable levels and address other issues such as the need for e.g. worker health and safety improvements, community engagement, institutional involvement.

Given the fact that changes would be possible in the course of the development of the Project, mitigation measures have been designed to adapt to the changes readily through an adaptive management in which the implementation of mitigation and management measures are responsive to changing conditions and the results of monitoring throughout the Project’s lifecycle. With this flexibility of the proposed mitigation measures sufficiently considered, it would prevent any unnecessary delay due to further assessment.

1.4.8 Uncertainties

This ESIA is prepared based on the Project information provided by the Client (refer to Section 3.0) and the information collected during the site visits. Like most ESIAs, the current ESIA faced a number of challenges in terms of retrieving baseline information, the level of accuracy of predicting impacts, and developing appropriate mitigation. Furthermore, even with a firm Project design and an unchanging environment, predictions are by definition uncertain.

In order to facilitate decision-making, then areas of uncertainty, data gaps and deficiencies, during further stages of Project development have been highlighted within the ESIA report. In order to address the uncertainties, monitoring will be undertaken by the Contractor to understand whether the identified mitigation measures are sufficient or there is a need for any refinements.

1.4.9 Environmental and Social Management System

The general framework for the environmental and social management system to be developed and implemented by the Project through the project lifecycle has been defined in Section 10.0.

1.4.10 Environmental and Social Action Plan

The preliminary Environmental and Social Action Plan (ESAP) will be prepared within the scope of the Project.

1.5 Outline of the ESIA Report

This document is the ESIA Report for the BBYO Railway Project is prepared in compliance with the national and international requirements. This document presents the following sections:

- Introduction (Section 1)
- Regulatory Framework (Section 2)
- Project Description (Section 3)
- Analysis of Alternatives (Section 4)
- Stakeholder Engagement (Section 5)
- Impact Screening and Definition of the Valued Environmental and Social Components (Section 6)
- Environmental and Socio-Economic Baseline (Section 7)
- Impact Assessment (Section 8)
- Cumulative Impact Assessment (Section 9)
- Environmental and Social Management System (Section 10)
- Conclusions (Section 11)
- References (Section 12)
- Appendices (Section 13)

2.0 REGULATORY FRAMEWORK

2.1 Current National Environmental and Social Legislation

The Turkish legal framework for environmental protection was developed in line with national and international initiatives and standards, and some of them have been revised recently to be harmonized with the European Union (EU) Directives in the scope of pre-accession efforts of Turkey to the EU. In the following sections, related institutions, legislation, processes and procedures that are related to the environmental and social aspects of the proposed project are described.

The Ministry of Environment and Urbanization ("MoEU") is the responsible organization for the issuing and implementation of policies and legislation adopted for protection and conservation of the environment and for sustainable development and management of natural resources.

The Ministry of Forestry and Water Affairs ("MoFWA") is the responsible organization for the issuing and implementation of policies and legislation adopted for the protected areas.

The Turkish Environment Law No. 2872, which came into force in 1983, deals with environmental issues on a very broad scope. According to the basic principles that govern the application of the Environment Law, and as stated in the Constitution, citizens as well as the state bear responsibility for the protection of environment. Complementary to the Environment Law and its regulations, other laws also govern the protection and conservation of the environment, the prevention and control of pollution, and the implementation of measures for the prevention of pollution.

The Environment Law of 1983 has a comprehensive structure that has a holistic and integrated vision for the environment. "Polluter pays" and "user pays" principles and carrying capacity concepts form the basis of regulatory tools in the Environmental Law. The Law is supported by numerous Regulations and decrees prepared or updated in the process of alignment with EU legislation, thus contributing significantly in compensating the gaps within the former legislative system of Turkey.

The Ministry of Family, Labour and Social Services ("MoFLSS") is the responsible organization for the issuing and implementation of policies and legislation adopted for the labour and working conditions. The Labour Law No. 4857 regulates the working conditions and work-related rights and obligations of employers and employees working under an employment contract. The Occupational Health and Safety Law No. 6331 of 2012 regulate duties, authority, responsibility, rights and obligations of employers and workers in order to ensure occupational health and safety at workplaces and to improve existing health and safety conditions. There are a series of regulations issued under these two main Labour and OHS Law in Turkey.

The main relevant Turkish legislation applicable to the Project are provided in Appendix A.

2.2 International Requirements

For the preparation of the present document, international conventions and agreements, ESIA International Standards (i.e., Equator Principles, IFC Performance Standards and guidelines, EBRD Performance Requirements) have been analysed and considered together with national standards.

2.2.1 International Conventions and Agreements

Turkey has ratified several international conventions and agreements for environmental protection. The main conventions and agreements relevant to the Project are given in Appendix A.

2.2.2 Current European Union Environmental and Social Legislation

The EU legal instruments, interest approximately 300 directives covering environmental protection, polluting and other activities, production processes, procedures and procedural rights as well as products, and cross-cutting issues (e.g. EIAs, access to information on the environment and combating climate change). Quality and related emissions standards are set for air, waste management, water, nature protection, industrial pollution control, chemicals and genetically modified organisms, noise and nuclear safety and radiation protection. The EIA Directive of 1985 has been amended three times, in 1997, in 2003 and in 2009. The initial Directive of 1985 and its three amendments have been codified by Directive 2011/92/EU of 13 December 2011. Directive 2011/92/EU has been amended in 2014 by Directive 2014/52/EU.

There are a series of social directives covering labour and occupational health and safety and railway specific one (2016/798/EC Railway Safety Directive) which are considered in the BBYO Project as well. The main relevant European Directives applicable to the Project are provided in Appendix A.

2.3 Requirements of International Financial Institutions

2.3.1 Requirements of Equator Principles

The Equator Principles are a set of voluntary environmental and social guidelines that have been adopted by a significant number of financial institutions influential in the project finance market (collectively the Equator Principles Financial Institutions, "EPFI"s). The EPs comprise a set of ten broad principles that are underpinned by the environmental and social policies, standards and guidelines.

Among other contents, the Equator Principles endorse the environmental and social policies and guidelines of the World Bank and the International Finance Corporation. Thus, with the adoption of the Equator Principles, commercial lending institutions are also formally accepting IFC Performance Standards.

The EPFIs emphasize that they will not provide loans to projects where the borrower will not or is unable to comply with the EPFIs social and environmental policies and procedures that implement the Equator Principles.

The EPFIs have ten (10) principles:

- **Principle 1**: Review and Categorization
- **Principle 2**: Environmental and Social Assessment
- **Principle 3**: Applicable Social and Environmental Standards
- **Principle 4**: Environmental and Social Management System and Equator Principles
- **Principle 5**: Stakeholder Engagement
- **Principle 6**: Grievance Mechanism
- **Principle 7**: Independent Review
- **Principle 8**: Covenants
- **Principle 9**: Independent Monitoring and Reporting
- **Principle 10**: Reporting and Transparency

In addition, the Equator Principles endorse the applicable IFC Performance Standards, IFC General EHS Guidelines and IFC Industry Specific EHS Guidelines. The Performance Standards establish the standards that the project is to meet throughout the life of an investment by IFC or other relevant financial institution. General and Industry Specific EHS Guidelines provide implementation guidelines and environmental quality limits that projects should comply with.

2.3.2 World Bank Environmental and Social Standards

The World Bank Environmental and Social Standards set out the requirements for Borrowers relating to the identification and assessment of environmental and social risks and impacts associated with projects supported by the Bank through Investment Project Financing. The application of these standards, by focusing on the identification and management of environmental and social risks, will support Borrowers in their goal to reduce poverty and increase prosperity in a sustainable manner for the benefit of the environment and their citizens. The standards will: (a) support Borrowers in achieving good international practice relating to environmental and social sustainability; (b) assist Borrowers in fulfilling their national and international environmental and social obligations; (c) enhance non-discrimination, transparency, participation, accountability and governance; and (d) enhance the sustainable development outcomes of projects through ongoing stakeholder engagement.

The ten Environmental and Social Standards establish the standards that the Borrower and the project will meet through the project life cycle, as follows:

- **Environmental and Social Standard 1:** Assessment and Management of Environmental and Social Risks and Impacts;
- **Environmental and Social Standard 2:** Labor and Working Conditions;
- **Environmental and Social Standard 3:** Resource Efficiency and Pollution Prevention and Management;
- **Environmental and Social Standard 4:** Community Health and Safety;
- **Environmental and Social Standard 5:** Land Acquisition, Restrictions on Land Use and Involuntary Resettlement;
- **Environmental and Social Standard 6:** Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- **Environmental and Social Standard 7:** Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities; (not applicable for this Project)
- **Environmental and Social Standard 8:** Cultural Heritage;
- **Environmental and Social Standard 9:** Financial Intermediaries;
- **Environmental and Social Standard 10:** Stakeholder Engagement and Information Disclosure.

2.3.3 IFC Performance Standards and Guidelines

The World Bank - IFC has developed performance standards, policies, general environmental, health and safety guidelines, and industry-specific environmental, health and safety guidelines on social and environmental sustainability, to minimize negative environmental and social impacts of the development projects it supports, and to optimize benefits.

IFC 2012 Performance Standards (IFC 2012 PS) have been considered the main reference as they are the most recent environmental and social standards issued by an International Financial Institution. IFC 2012 PS comprises 8 documents:

- **Performance Standard 1**: Assessment and Management of Environmental and Social Risks and Impacts
- **Performance Standard 2**: Labour and Working Conditions
- **Performance Standard 3**: Resource Efficiency and Pollution Prevention
- **Performance Standard 4**: Community Health, Safety, and Security
- **Performance Standard 5**: Land Acquisition and Involuntary Resettlement
- **Performance Standard 6**: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- **Performance Standard 7**: Indigenous Peoples (not applicable for this Project)
- **Performance Standard 8**: Cultural Heritage

Performance Standard 1 establishes the importance of:

- integrated assessment to identify the environmental and social impacts, risks and opportunities of projects;

- effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and
- the proponent's management of environmental and social performance throughout the life of the project.

Performance Standards 2 through 8 establish objectives and requirements to avoid, minimize, and where residual impacts remain, to compensate/offset for risks and impacts to workers, Affected Communities, and the environment. While all relevant environmental and social risks and potential impacts should be considered as part of the assessment, Performance Standards 2 through 8 describes potential environmental and social risks and impacts that require particular attention.

The key principles stated in the performance standards that are relevant for this methodology can be summarized as follows:

- principles of non-discrimination and equal opportunity;
- principles of non-discrimination apply to migrant workers;
- principles of pollution prevention;
- the principle of "like-for-like or better";
- principle of proportionality and good international practice;
- the holistic and ecosystem approaches;
- the participatory approach (social);
- the management and conservation principle;
- the preventive, precautionary and anticipatory principle.

2.3.3.1 IFC EHS Guidelines

The Environmental, Health and Safety ("EHS") Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice ("GIIP"). The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs.

The General EHS Guidelines are organized as follows:

1. Environmental

1.1 Air Emissions and Ambient Air Quality

1.2 Energy Conservation

1.3 Wastewater and Ambient Water Quality

1.4 Water Conservation

1.5 Hazardous Materials Management

1.6 Waste Management

1.7 Noise

1.8 Contaminated Land

2. Occupational Health and Safety

2.1 General Facility Design and Operation

2.2 Communication and Training

2.3 Physical Hazards

2.4 Chemical Hazards

2.5 Biological Hazards

2.6 Radiological Hazards

2.7 Personal Protective Equipment (PPE)

2.8 Special Hazard Environments

2.9 Monitoring

3. Community Health and Safety

3.1 Water Quality and Availability

3.2 Structural Safety of Project Infrastructure

3.3 Life and Fire Safety (L&FS)

3.4 Traffic Safety

3.5 Transport of Hazardous Materials

3.6 Disease Prevention

3.7 Emergency Preparedness and Response

4. Construction and Decommissioning

4.1 Environment

4.2 Occupational Health & Safety

4.3 Community Health & Safety

2.3.3.2 IFC EHS Guidelines for Railways

The EHS Guidelines are technical reference documents with general and industry specific examples of GIIP. When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. These industry sector EHS guidelines are designed to be used together with the General EHS Guidelines document, which provides guidance to users on common EHS issues potentially applicable to all industry sectors.

The EHS Guidelines for Railways are applicable to activities typically conducted by rail infrastructure operators dedicated to passenger and freight transport. The document is organized into two main areas, namely rail operations, covering construction and maintenance of rail infrastructure as well as operation of rolling stock, such as locomotives and rail cars; and, locomotive maintenance activities, including engine services, and other mechanical repair and maintenance of locomotives and railcars. This document is organized according to the following sections:

Section 1.0 - Industry-Specific Impacts and Management

Section 2.0 - Performance Indicators and Monitoring

Section 3.0 - References

Annex A - General Description of Industry Activities

The Project should also meet International Labour Organization (“ILO”) core labour standards on:

- Forced Labour (C105)
- Child Labour (C182)
- Discrimination (C111)
- Freedom of Association and the Right to Organize (C87)
- Equal Remuneration (C100)
- Minimum Age (C138)

2.4 Requirements of Environmental Limits in Turkish Regulations, European Regulations, IFC Guidelines

A review of applicable IFC guidelines, European Regulations and National legislation for air quality, water quality, soil quality, noise and vibration was performed and is presented in Appendix B.

According to the recommendations of the IFC guidelines, when national regulations differ from levels and measures presented in the international standards, the Project is expected to achieve whichever is more stringent.

3.0 PROJECT DESCRIPTION

3.1 Project Overview

The planned 201 km long "Bandırma-Bursa-Yenişehir-Osmaneli High Standard Railway Line" will start from Bandırma, pass through Kuşcenneti, Karacabey, Teknosab, Bursa, Gürsu, Yenişehir Airport and Yenişehir stations and connect to the Ankara-Eskişehir-Istanbul High Speed Train Line in the Osmaneli region.

The Project is divided into three sections defined as:

- Section 1: Yenişehir-Osmaneli, between 101+700 - 149+670 (47+970 km length)
- Section 2: Bursa-Yenişehir, between 46+000 - 101+700 (55+700 km length)
- Section 3: Bandırma-Bursa, between 0+000 - 97+000 (97+000 km length)

The start and the end KM’s of the BBYO Project sections are presented in Figure 2. The history of the Project dates back to the past, and the KM’s in the Project were made in this way in the official correspondences previously. For this reason, the same numbering methodology is used in the project component descriptions of the BBYO Project in this ESIA Report.

The BBYO Project Sections and Kalyon's scope of work are described in

Table 4.

The construction activities are currently ongoing by the TCDD Contractors Duygu-Çelikler in Section 2. The construction activities in this Section (out of Kalyon's scope) was initiated with the tunnel works by Çelikler in 2016 and planned to be completed by December 2022, so far approximately 70% of the works have been completed by Çelikler.

In Section 2, Duygu started the infrastructure construction activities in 2017 which are planned to be completed by December 2021, reportedly approximately 80% of the works have been completed.

Kalyon will first start the construction activities from Section 1 (Yenişehir-Osmaneli) where design work and EIA processes have been completed. The construction activities will commence in Section 3 following the finalization of the design and permitting studies. Project detailed schedule for Kalyon activities is presented in Table 5.

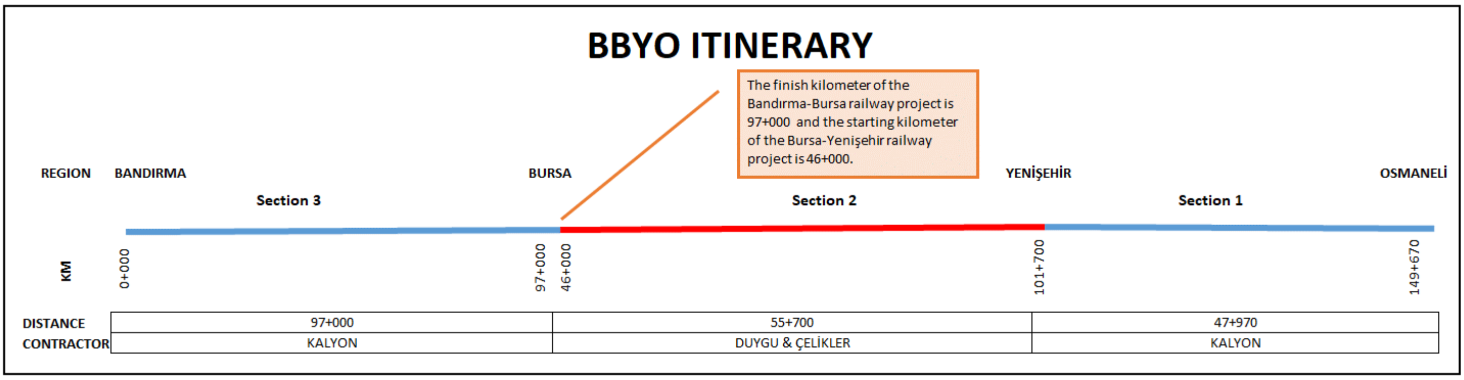


Figure 2 BBYO Itinerary

Table 4 Project Sections and Scope of Work

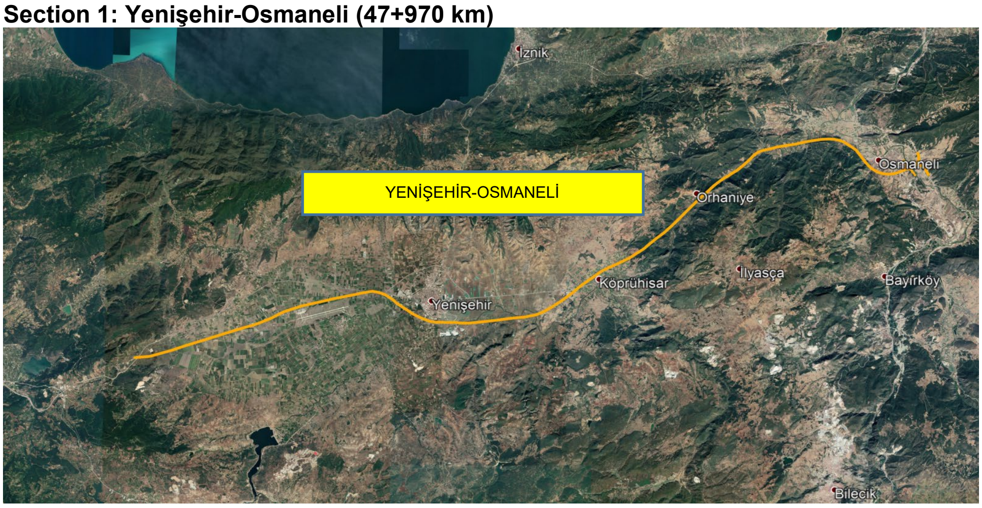
Section	Project Scope of Kalyon	Project Scope of Other Contractors
Section 1: Yenişehir-Osmaneli (47+970 km)  	• Infrastructure and Superstructure constructions • Electrification, signalisation, telecommunication	-
Section 2: Bursa-Yenişehir (55+700 km)  	• Superstructure constructions • Electrification, signalisation, telecommunication	*Duygu Mühendislik:* • Infrastructure constructions *Çelikler Taahhüt İnşaat ve Sanayi A.Ş. and YSE Yapı Sanayi ve Ticaret A.Ş. Joint Venture:* • Tunnel works
Section 3: Bandırma-Bursa (97+000 km)  	• Design • Infrastructure and Superstructure constructions • Electrification, signalisation, telecommunication	-

Table 5 BBYO Project Kalyon's Schedule

Project Activities	2020				2021				2022				2023				2024				2025				2026			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1. Planning Phase																												
1.1. Environmental and Social Database Studies																												
1.2. Official Period of Environmental Impact and Social Assessment (Projected)																												
1.3. Basic Design and Engineering Studies																												
1.4. Detailed Design and Engineering Studies																												
1.5. Mobilization of Camp Areas																												
2. Land Preparation and Construction Phase																												
2.1. Equipment and Material Purchasing and Shipment																												
2.1.1 Section-1 Osmaneli-Yenişehir																												
2.1.2 Section-3 Bursa-Bandırma																												
2.2. Soil Investigation and Soil Improvement Works																												
2.2.1 Section-1 Osmaneli-Yenişehir																												
2.2.2 Section-3 Bursa-Bandırma																												
2.3. Soil and Excavation Works																												
2.3.1 Section-1 Osmaneli-Yenişehir																												
2.3.2 Section-3 Bursa-Bandırma																												
2.4. Engineering Structures																												
2.4.1 Section-1 Osmaneli-Yenişehir																												
2.4.2 Section-3 Bursa-Bandırma																												
2.5. Construction of Tunnels																												
2.5.1 Section-1 Osmaneli-Yenişehir																												
2.5.2 Section-3 Bursa-Bandırma																												
2.6. Railway Superstructure Works																												
2.6.1 Section-1 Osmaneli-Yenişehir																												
2.6.2 Section-3 Bursa-Bandırma																												
2.7. Construction of Station Buildings																												
2.7.1 Section-1 Osmaneli-Yenişehir																												
2.7.2 Section-2 Yenişehir-Bursa																												
2.7.3 Section-3 Bursa-Bandırma																												
2.8. Land Preparation and Construction Phase Environmental Monitoring Activities																												
3. Electromechanical Phase																												
3.1. Tunnel E & M																												
3.1.1 Section-1 Osmaneli-Yenişehir																												
3.1.2 Section-2 Yenişehir-Bursa																												
3.1.3 Section-3 Bursa-Bandırma																												
3.2. Electrification																												
3.2.1 Section-1 Osmaneli-Yenişehir																												
3.2.2 Section-2 Yenişehir-Bursa																												
3.2.3 Section-3 Bursa-Bandırma																												
3.3. Signalization																												
3.3.1 Section-1 Osmaneli-Yenişehir																												
3.3.2 Section-2 Yenişehir-Bursa																												
3.3.3 Section-3 Bursa-Bandırma																												
4. Closure and After																												
4.1. Closure of Dumping and Barrowed Pit Areas																												
4.1.1 Section-1 Osmaneli-Yenişehir																												
4.1.2 Section-3 Bursa-Bandırma																												
4.2. Closure of Quarry Areas																												
4.2.1 Section-1 Osmaneli-Yenişehir																												
4.2.2 Section-3 Bursa-Bandırma																												
4.3. Demobilization of Camp Areas																												
4.3.1 Section-1 Osmaneli-Yenişehir																												
4.3.2 Section-3 Bursa-Bandırma																												

3.2 Project Area

3.2.1 Project Location

The 201 km long BBYO Project will start from Bandırma, pass through Kuşcenneti, Karacabey, Teknosab, Bursa, Gürsu, Yenişehir Airport and Yenişehir stations and connect to the Ankara-Eskişehir-Istanbul High Speed Train Line in the Osmaneli region. The Project railway route will pass through Balıkesir, Bursa and Bilecik Provinces. The location map of the BBYO Project is presented in Figure 3 and the Project layout for three sections are given in Figure 4, Figure 5 and Figure 6.

In the identification of the nearest settlements to the Project, all Project components were considered including the temporary facilities that will be established and operated/used throughout the construction phase of the BBYO Project. It is necessary to note that there are already established temporary facilities within the scope of the construction activities currently ongoing in Section 2.

In the nearest settlements to the Project components and their distances for each section of the BBYO Project are presented in Figure 7, Figure 8 and Figure 9.

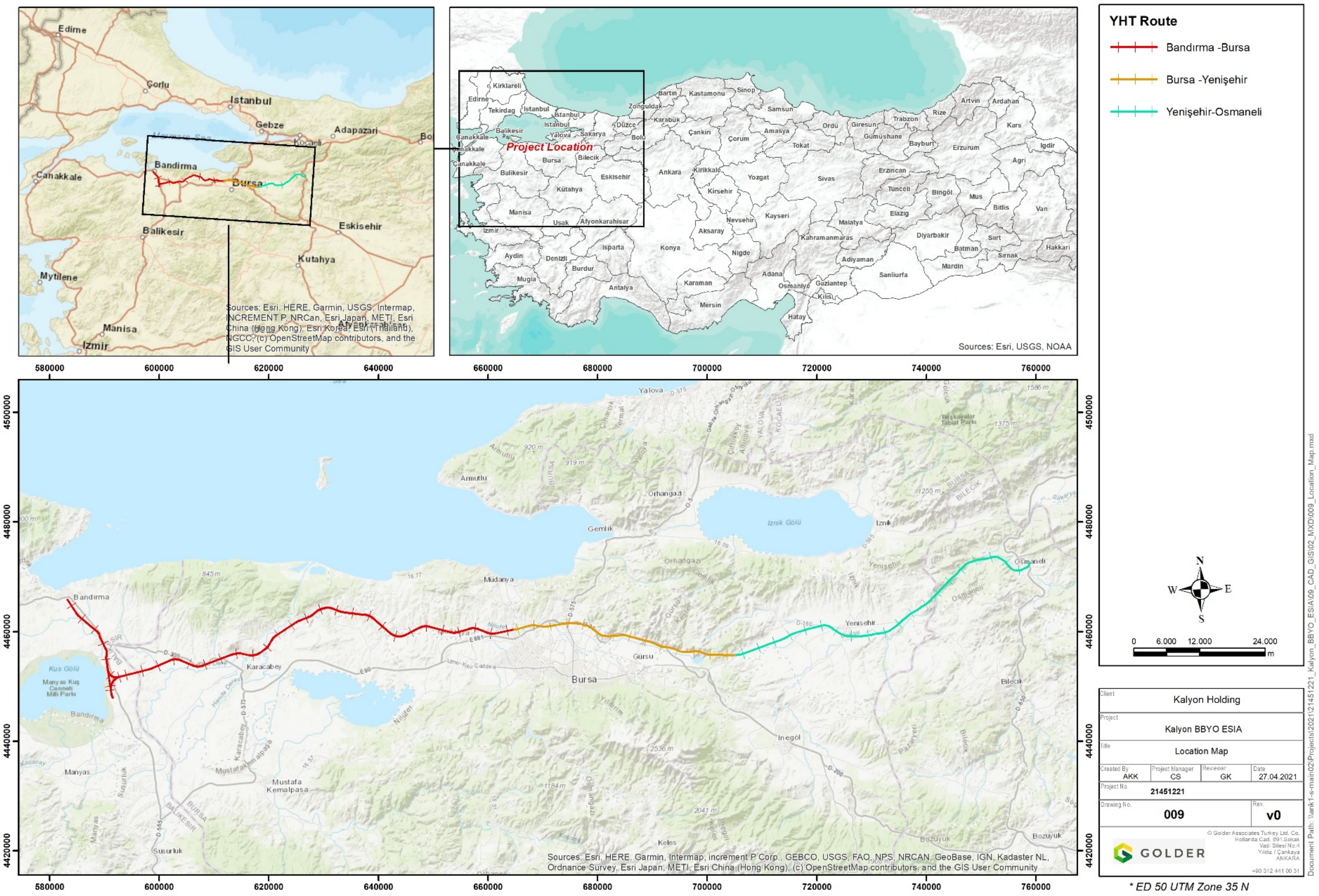


Figure 3 BBYO Project Location Map

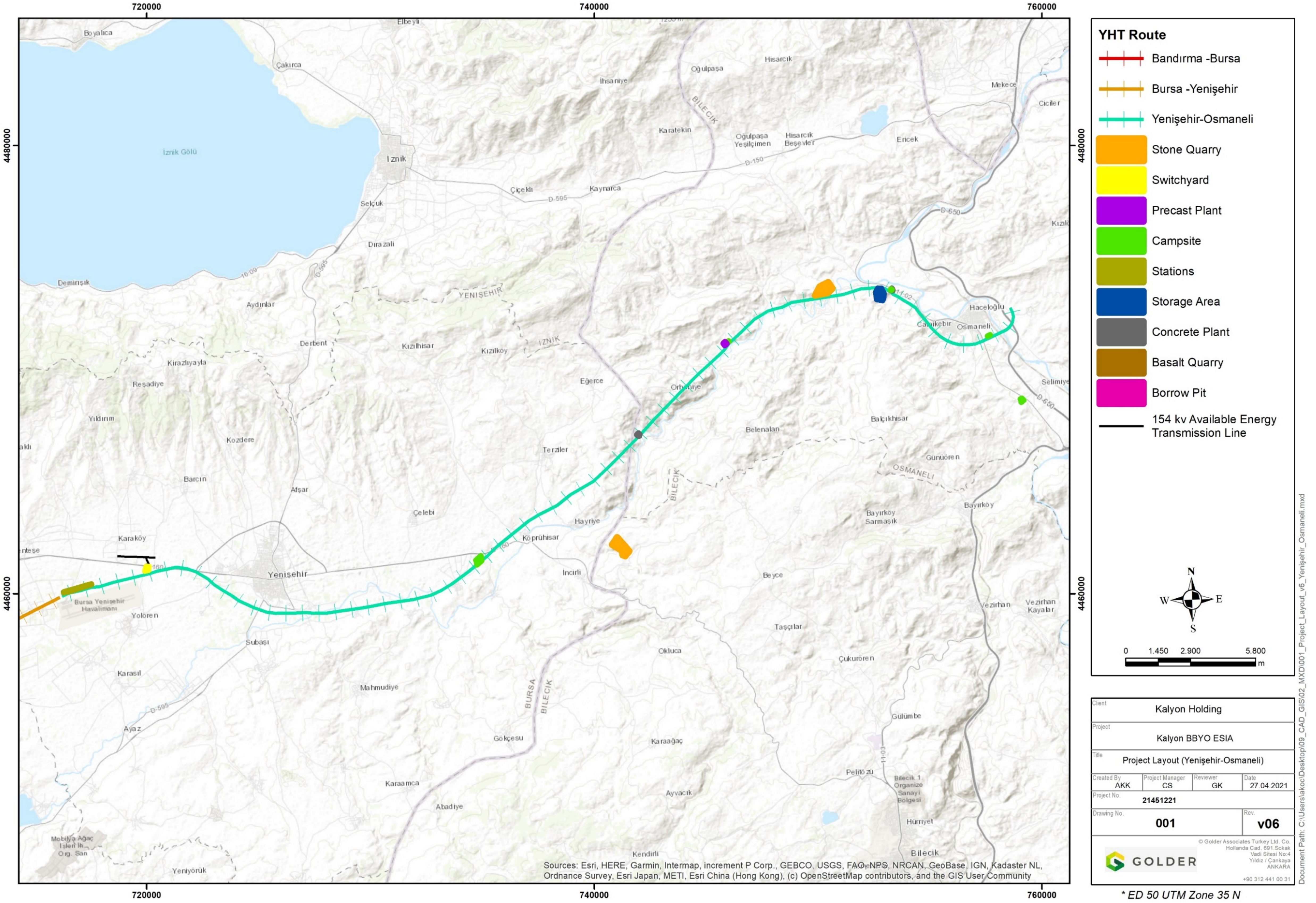


Figure 4 Yenişehir-Osmaneli (Section 1) Layout

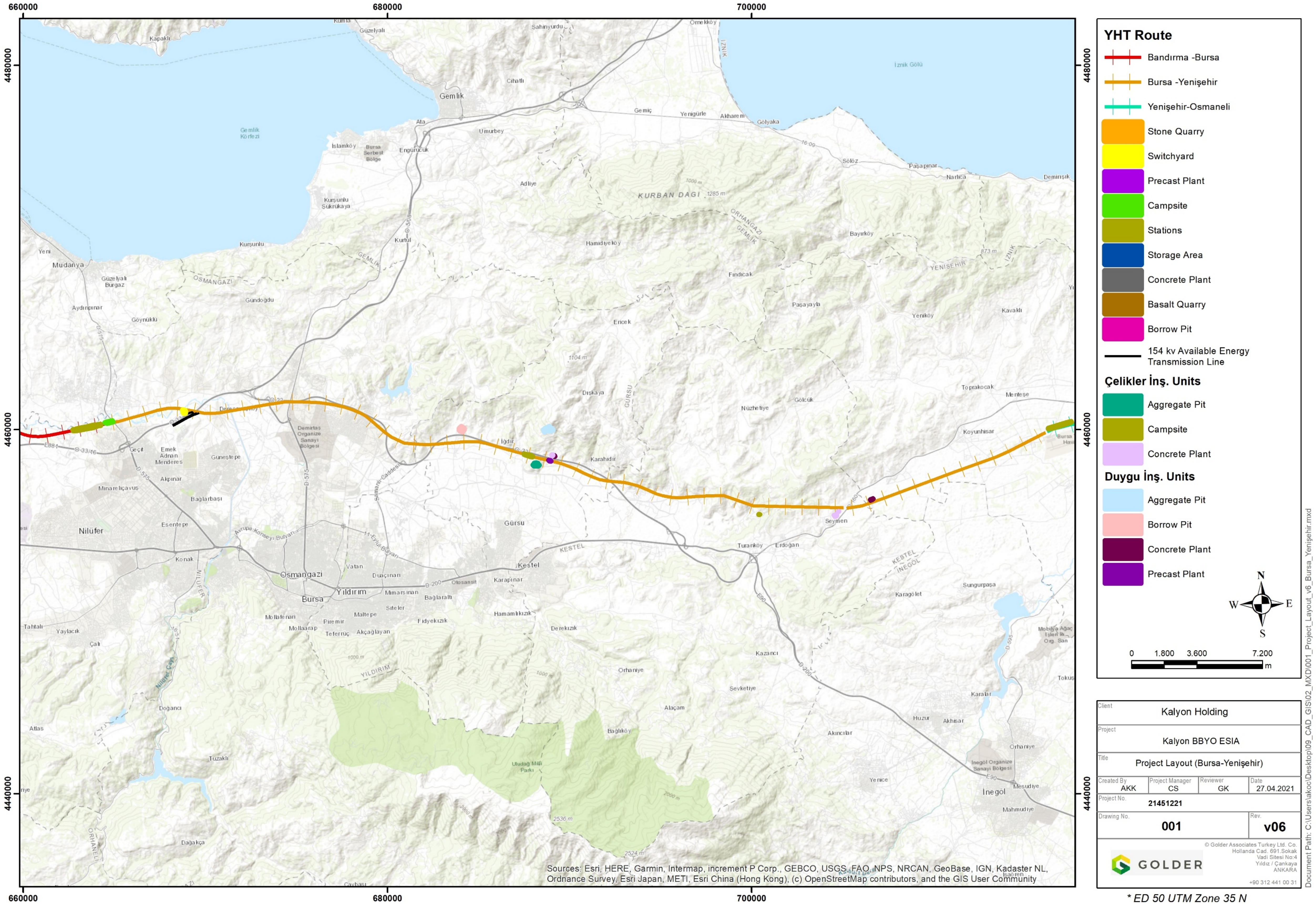


Figure 5 Bursa-Yenişehir (Section 2) Layout

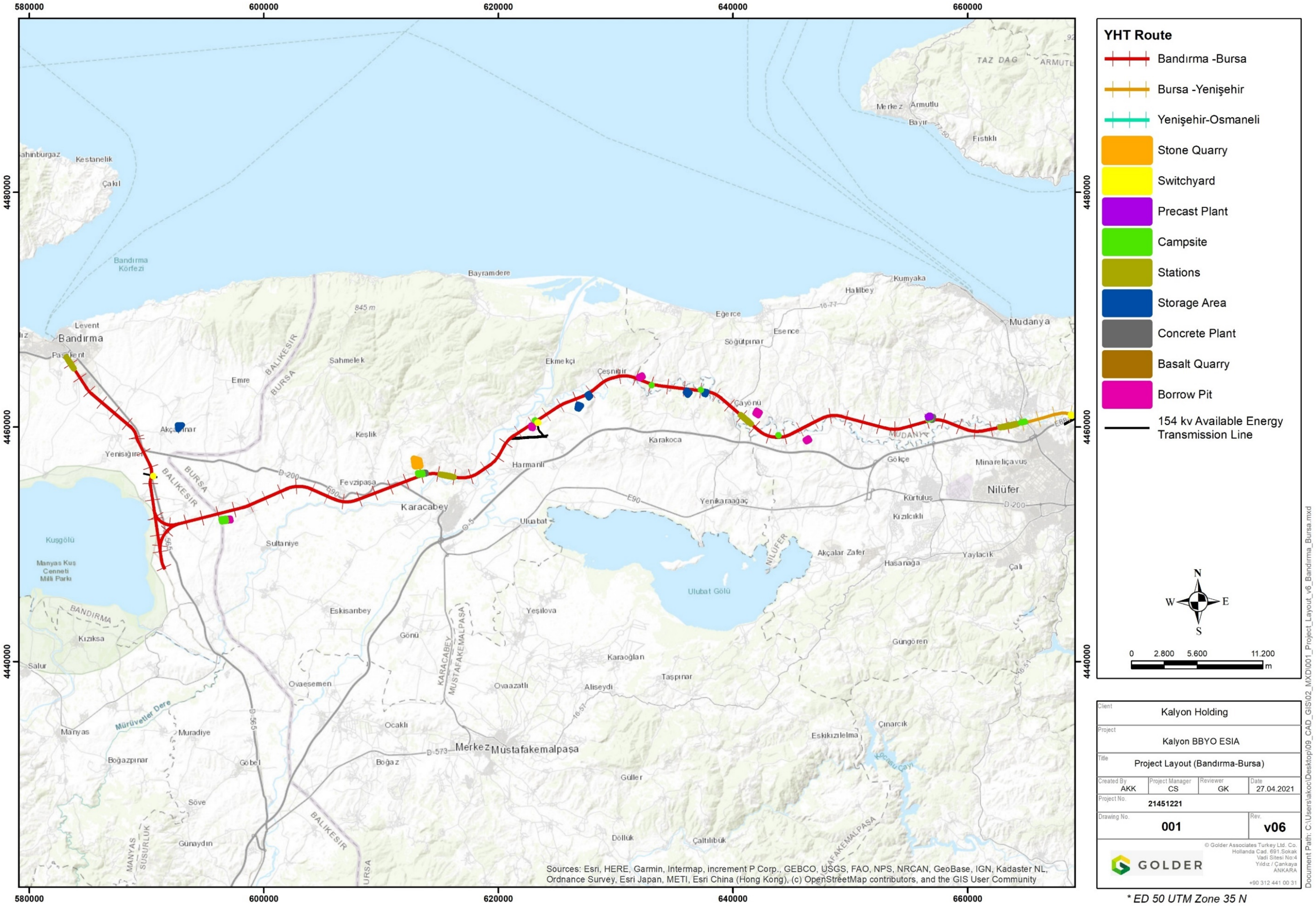
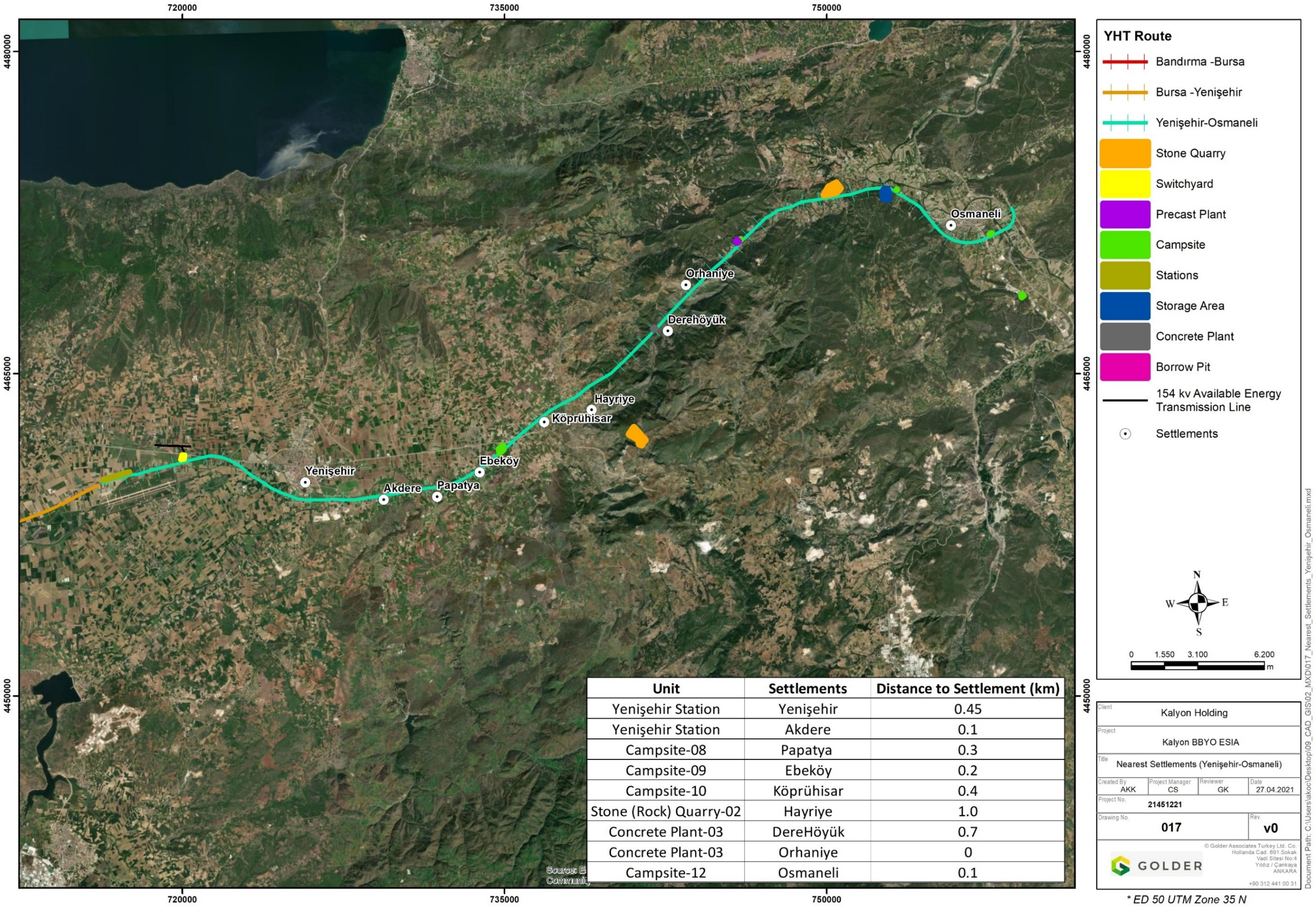
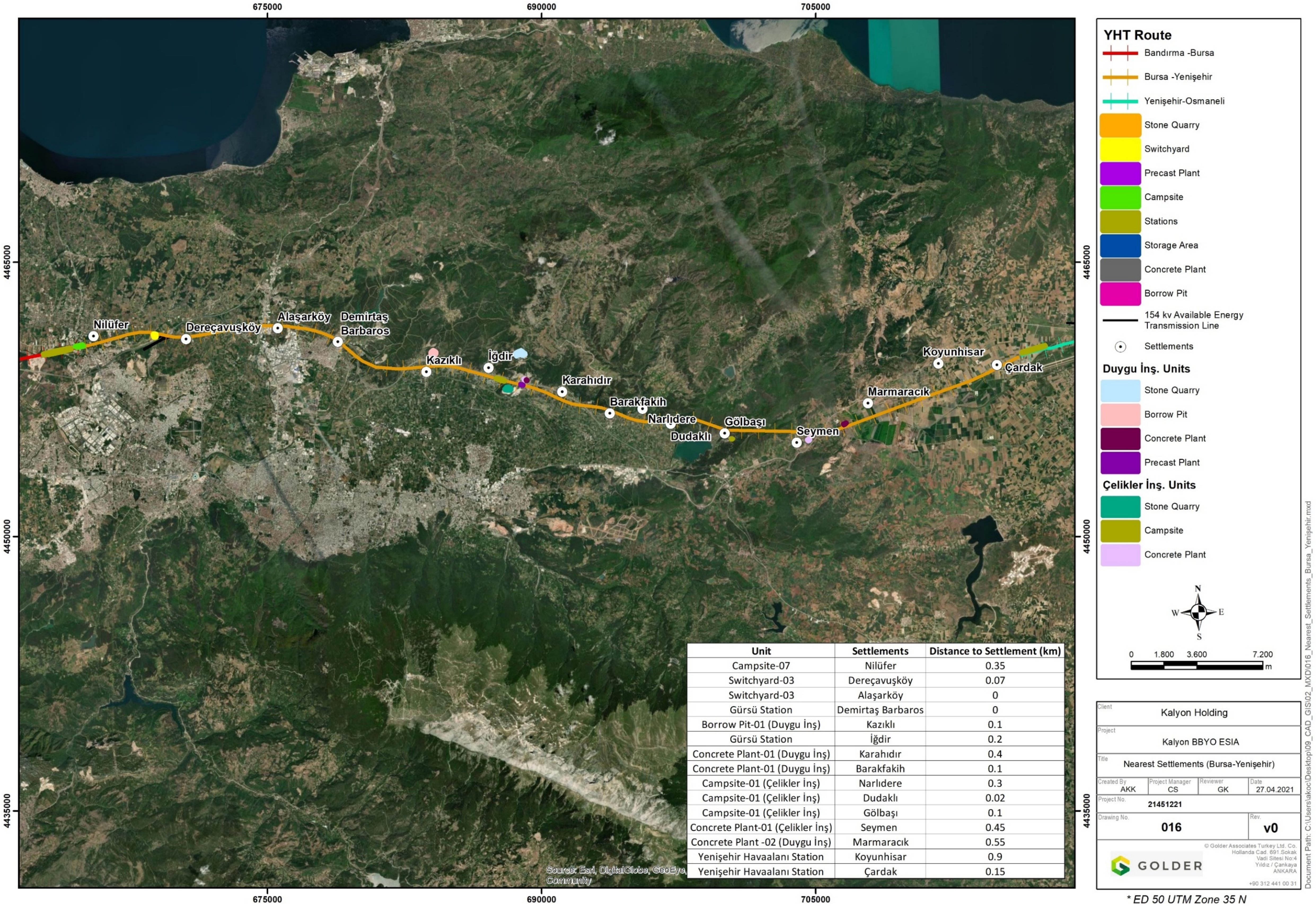


Figure 6 Bandırma-Bursa (Section 3) Layout



Unit	Settlements	Distance to Settlement (km)
Yenişehir Station	Yenişehir	0.45
Yenişehir Station	Akdere	0.1
Campsite-08	Papatya	0.3
Campsite-09	Ebeköy	0.2
Campsite-10	Köprühisar	0.4
Stone (Rock) Quarry-02	Hayriye	1.0
Concrete Plant-03	DereHöyük	0.7
Concrete Plant-03	Orhaniye	0
Campsite-12	Osmaneli	0.1

Figure 7 Yenişehir-Osmaneli (Section 1) Nearest Settlements Map



Unit	Settlements	Distance to Settlement (km)
Campsite-07	Nilüfer	0.35
Switchyard-03	Dereçavuşköy	0.07
Switchyard-03	Alaşarköy	0
Gürsü Station	Demirtaş Barbaros	0
Borrow Pit-01 (Duygu İnş)	Kazıklı	0.1
Gürsü Station	İğdir	0.2
Concrete Plant-01 (Duygu İnş)	Karahıdır	0.4
Concrete Plant-01 (Duygu İnş)	Barakfakih	0.1
Campsite-01 (Çelikler İnş)	Narlıdere	0.3
Campsite-01 (Çelikler İnş)	Dudaklı	0.02
Campsite-01 (Çelikler İnş)	Gölbaşı	0.1
Concrete Plant-01 (Çelikler İnş)	Seymen	0.45
Concrete Plant -02 (Duygu İnş)	Marmaracık	0.55
Yenişehir Havaalanı Station	Koyunhisar	0.9
Yenişehir Havaalanı Station	Çardak	0.15

Figure 8 Bursa-Yenişehir (Section 2) Nearest Settlements Map

Unit	Settlements	Distance to Settlement (km)
Kuşcenneti Station	Bandırma	0.25
Switchyard-01	Kuşcenneti	0.4
Campsite 01/Borrow Pit-01	Danişment	0.6
Campsite-01/Borrow Pit-01	Tophisar	0.1
Campsite-02/Concrete Plant-01	Şahinköy	0.12
Karacabey Station	Taşlık	0.25
Campsite-03	Hayırlar	0.35
Borrow Pit-03	Çamlıca	0.3
Campsite-04	Evciler	0.25
Teknosab Station	Çayönü	0.2
Teknosab Station	Hürriyet	0.45
Campsite-06	Badırga	0.55
Borrow Pit-05	Orhaniye	0.45
Conrete Plant-02, Precast Plant-01 Campsite-14	Balabancık	0.1

* ED 50 UTM Zone 35 N

Figure 9 Bandırma-Bursa (Section 3) Nearest Settlements Map

3.2.2 Land Use

The Project includes approximately 201 km railway and in total 443 Project units including 29 tunnels, 13 escape tunnels, 35 bridges, 15 viaducts, 99 underpasses, 29 overpasses, 6 cut and cover tunnels,217 culverts, and 7 stations.

The existing land use of the Social Are of Influence ("AoI") will be affected by the construction of the Project and its components as well as by the associated facilities. There will be loss of governmental and private land as a result of the Project.

The Project execution will require permanent acquisition of land by using expropriation. The Project is expected to cause economic displacement and physical resettlement, however, at this stage, the magnitude of displacement is not completely known since the land acquisition files have not been prepared for Bandırma-Bursa and Yenişehir-Osmaneli sections.

The expropriation works have been completed on the Bursa-Yenişehir route (Section 2) of the Project, which is currently under construction. 83% of this area is private lands, 17% is forest lands, and 1% is pasture lands.

Part of the expropriation process of the lands on the Yenişehir-Osmaneli route (Section 1) has been completed, and additional lands are needed for the realization of the project. In this section, a total of 1,716,612 m^2 of land is required for the realization of the Project. 57% of these lands are private lands, 7% pasture lands and 36% forest lands.

The expropriation process has not started as of April 2021 between the route between Bandırma and Bursa (Section 3). According to the information obtained from Kalyon, a total area of 5,809,967 m^2 is needed in this section for the high-speed train construction. 91% of this area is private lands, 2% pasture lands and 7% forest lands.

Project land acquisition information is presented in Table 6.

Table 6 General Land Acquisition Information

	Route		Total required land (m^2)	Private parcels (m^2)	Pastura lands (m^2)	Forest land (m^2)	Forest easement right (m^2)	Status of land acquisition
1	**Bandırma**	**Bursa**	5,809,967	5,273,882	100,000	260,000	176,085	Not started
			100%	91%	2%	4%	3%	
2	**Bursa**	**Yenişehir**	3,222,806	2,666,567	20,000	67,000	469,239	Completed
			100%	83%	1%	2%	15%	
3	**Yenişehir**	**Osmaneli**	1,716,612	974,380	125,000	304,000	313,232	Partially completed
			100%	57%	7%	18%	18%	

3.3 Project Components

Technical description of the Project components and the number of engineering structures along the BBYO Railway route are presented in Table 7 and Table 8, respectively. Further information about the technical specification of the project components is provided in the following sections.

Table 7 Project Technical Specification

Parameter	Project Specification
The length of the route	201 km
Operation type	Passenger + Freight
Railway route	Electric double line
Speed	250 km/h
Electrification	25 kV monophase 50 hz
Distance between line axes	4.5 m
Rail Type	UIC 60
Sleeper Type	B70 reinforced sleepers
Sleeper Length	2.6 m
Sleeper spacing	60 cm
Ballast	Graded minimum 30 cm to 60 cm.
Minimum horizontal curve	3500 m
Maximum axle load	25 tons
Maximum vertical grade	%1.6

Table 8 Number of Engineering Structures on the BBYO Railway Sections

Structure	Section 1 Yenişehir-Osmaneli (Kalyon)	Section 2: Bursa-Yenişehir (Duygu-Çelikler)	Section 3: Bandırma-Bursa (Kalyon)	Total
Tunnel	10	11	8	**29**
Escape Tunnel	8	2	3	**13**
Railway Bridge	4	6	25	**35**
Viaduct	3	12	0	**15**
Underpass	37	33	29	**99**
Overpass	6	11	12	**29**
Cut and Cover Tunnel	5	1	0	**6**

Structure	Section 1 Yenişehir-Osmaneli (Kalyon)	Section 2: Bursa-Yenişehir (Duygu-Çelikler)	Section 3: Bandırma-Bursa (Kalyon)	Total
Culvert	71	62	84	**217**
Station[3]	1	2	4	**7**
Total	145	140	165	**443**

3.3.1 Railway Design

The railway line platform will consist of the layers of ballast, sub-ballast and prepared sub-grade (if required) from top to the bottom of the base floor. The body of the railway line platform will be constructed with filling material of different thickness according to the characteristics of the ground, a minimum 40 cm thick sub-grade, minimum 30 cm sub-ballast material and minimum 30 cm ballast material will be laid on the filling material. B 70 type concrete sleepers to be placed on the ballast layer will be formed by mounting UIC-60 type rails with elastic connection material.

The BBYO Railway Route Sections are presented in Appendix D.

3.3.1.1 Sleepers

Railway sleepers which are also known as railroad ties are important railway components which lay at regular intervals perpendicular to the rails to keep the correct space of gauge and transmit the forces acting on the rail to the ballast layer by meeting and spreading on a wider surface.

Within the scope of the Project concrete will be used as the sleeper material which enables less maintenance and longer service life. The material to be used in the production of sleepers will be selected in accordance with TS EN 13230-1 and 2 to ensure that the sleepers are long-lasting. For this reason, materials that are durable, permeable and resistant to abrasion will be selected in the construction of sleepers. For all other materials, TS and TS EN standards will be used primarily, and in cases where TS or TS EN standards are not covered, international standards to be approved by the Control Engineer will be applied.

3.3.1.2 Ballast

Ballast are aggregate stones, gravels, or cinders with 30-60 mm that are placed directly below the sleepers and transmit all the effects transmitted by the sleepers to the platform by spreading them with friction between the grains and forming a track bed to provide stability and proper drainage. The ballast to be used in the Project will consist of broken, natural, artificial or recycled aggregates with the planned thickness of minimum 30 cm.

[3] Kalyon will be responsible from the construction of all stations at each section.

Figure 10 Sample ballast forms

3.3.1.3 Sub-ballast

This is the layer of coarse-grained material that are placed between the ballast and the subgrade to withstand the loads from the ballast and transfer the loads to the subgrade. The sub-ballast in the Project will have sufficient thickness of minimum 30 cm to prevent freezing and thawing. The sub-ballast will enable to transfer most of the water coming from the line to the side trenches therefore will prevent the subfloor become saturated and weaken.

Before sub-ballast production is made in the cut and fill sections, the transitions required for electrification and signalisation will be made with High Density Poly Ethylene (HDPE) pipes 1.50 meters below the top of the rail.

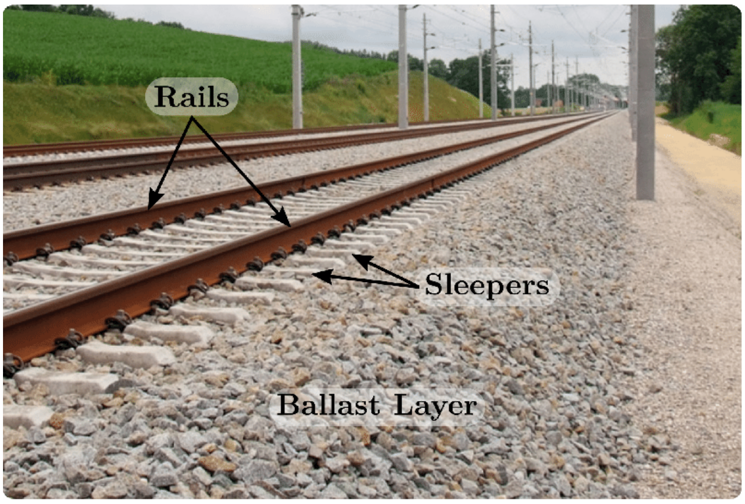


Figure 11 Sample View of the rails, sleepers and ballast[4]

The amount of ballast and sub-ballast material to be applied at the three different sections are as follows:

Table 9 The amount of ballast and sub-ballast materials

Region	Sub-ballast (m³)	Ballast (m³)	Total (m³)
Yenişehir - Osmaneli	144,691	165,391	**310,081**

[4] Numerical analysis of railway ballast behaviour using the Discrete Element Method, Joaquín Irazábal González, Doctoral Thesis, October 4, 2017

Region	Sub-ballast (m³)	Ballast (m³)	Total (m³)
Bursa - Yenişehir	231,330	220,440	**451,770**
Bandırma - Bursa	411,738	412,742	**824,480**
Total	**787,759**	**798,573**	**1,586,331**

3.3.1.4 Sub-grade

The base material to be used in the Project will have the following standards:

- Maximum grain diameter will be ≤10 cm.
- It will have the same slope as the sub-ballast layer to prevent rainwater accumulation on the layer.
- The ratio of fine material (<0.075 mm) will be less than 5%.
- Los Angeles abrasion resistance LA will be <30% (ASTM C 535-89).
- The material will be well graded (uniformity coefficient > 6).
- Chemicals, slag, debris and frozen material will not be used in forming this layer.

3.3.1.5 Rail Type Features

UIC60 rail model which is commonly used rail type in the developed countries will be used within the scope of the Project. The 60E1 (UIC60) rail model is manufactured according to the European standard EN 13674-1 and has a type T section rail with flat bottom rails. The origin of the standard of UIC60 comes from the International Union of Railways with the aim of promoting the global rail traffic, withstand the railway transportation challenges and promote sustainable development.

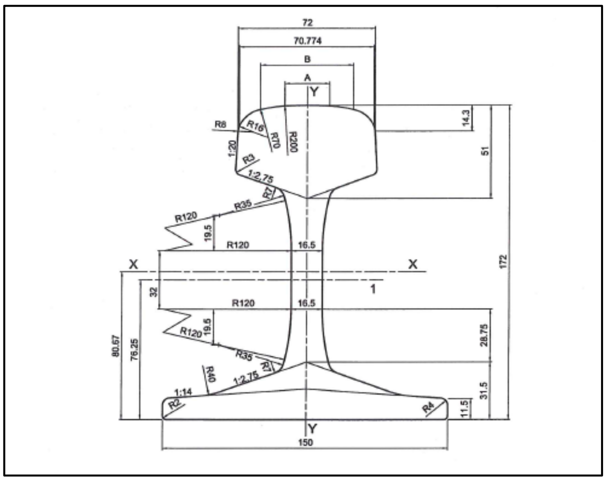


Figure 12 Section view of UIC 60 rail

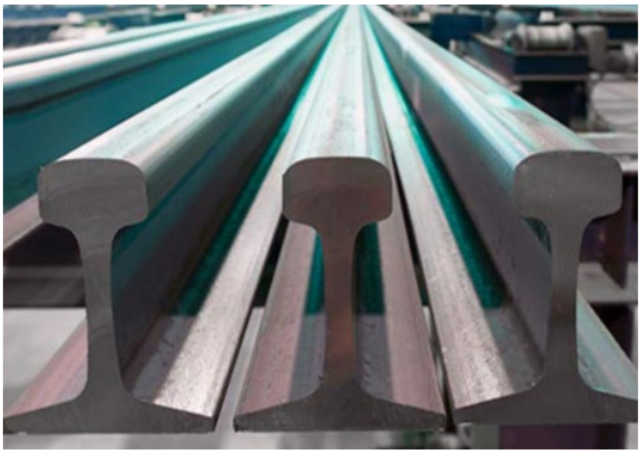


Figure 13 UIC60 rail

3.3.2 Train Capacities

The operation type of the BBYO Project consists both passenger and freight type railway transportation. According to the BBYO High Standard Railway Project Feasibility Report of AYGM, March 2020:

- In freight transportation, taking into account trains with 10 wagons with a capacity of 50 net tons, it has been predicted that a train can carry a total of 500 net tons.
- In the High Standard Railway train sets, the capacity of the passenger train is 332 tons and have the capacity of 411 passenger.

3.3.3 Engineering Structures

The proposed Project will require the construction of the engineering structures which include the tunnels, escape tunnels, railway bridges, viaducts, underpasses, over passes, cut and cover tunnels and culverts. The number of engineering structures may vary during the implementation in line with the institutions' advice. Information about the engineering structures are provided below, please refer to Figure 2 for the numbering methodology used for the start and end KMs of the engineering structures on the BBYO route sections. The nomenclature and naming of all engineering structures is given by the project company that TCDD had the Project done, and they have not been renumbered and renamed to comply with the tender documentation.

3.3.3.1 Tunnels

It is planned to construct 29 tunnels in the BBYO Project. Information about the tunnels are provided in Table 10. The tunnel electromechanical works will consist of emergency routing system, lighting system, linear fire detection and fire extinguishing system.

Table 10 Proposed Tunnels along the BBYO Project

Structure No.	Starting KM	Ending KM	Length (m)	Excavation (m^3)	Portal Excavation (m^3)	Concrete (m^3)
Section 1: Yenişehir-Osmaneli, between 101+700 - 149+670						
T1	124+818	127+945	3,927	540,626	102,818	183,234
T2	128+196	132+141	3,945	543,104	141,835	184,074
T3	133+867	135+108	1,241	170,847	142,143	57,905
T4	135+519	135+639	120	16,520	75,640	5,599
T5	137+548	137+880	332	45,706	90,766	15,491
T6	138+320	138+668	348	47,909	104,090	16,238
T7	141+247	141+722	475	65,393	41,298	22,164
T8	142+963	143+090	127	17,484	105,145	5,926
T9	143+668	143+787	119	16,383	135,748	5,553
T10	144+204	146+956	2,752	378,865	254,376	128,408
Section 2: Bursa-Yenişehir, between 46+000 - 101+700 [5]						
T2	55+177	55+714	536.70			

[5] The information of the structures that will not be built by Kalyon is limited to what is presented in the table.

Structure No.	Starting KM	Ending KM	Length (m)	Excavation (m^3)	Portal Excavation (m^3)	Concrete (m^3)
T3	56+991	58+260	1268.55			
T4	59+155	60+215	1059.70			
T5	61+190	61+420	230.00			
T6	61+910	64+354	2444.20			
T7	70+313	71+099	786.00			
T8	71+545	71+770	225.00			
T9	75+659	76+870	1210.87			
T10	78+635	78+755	120.00			
T11	79+883	82+730	2847.00			
T12	82+850	87+763	4913.24			
Section 3: Bandırma-Bursa, between 0+000 - 97+000						
T1	51+100	51+900	800	110,135	104,400	37,328
T2	52+280	53+580	1300	178,970	170,040	60,658
T3	61+700	63+120	1420	195,490	87,758	66,257
T4	65+040	65+400	360	49,561	83,698	16,798
T5	66+010	66+760	750	103,252	71,499	34,995
T6	67+405	67+995	590	81,225	53,726	27,529
T7	73+850	75+265	1415	194,802	255,014	66,024
T8	93+580	94+470	890	122,525	255,420	41,527

3.3.3.2 *Escape Tunnels*

Escape tunnels are important structures especially for the tunnels longer than 1000 meters to ensure that the passengers can leave the tunnels in case of an emergency event. It is planned to construct 13 escape tunnels within the scope of the BBYO Project. Information about the proposed escape tunnels are provided in Table 11.

Table 11 Proposed Escape Tunnels along the BBYO Project

Structure No.	Starting KM	Ending KM	Length (m)	Excavation (m^3)	Concrete (m^3)
Section 1: Yenişehir-Osmaneli, between 101+700 - 149+670					
Escape T01	125+720		826	31,791	15,571
Escape T02	125+920		1,391	53,518	26,213
Escape T03	126+920		687	26,427	12,944
Escape T04	129+180		571	21,975	10,763

Structure No.	Starting KM	Ending KM	Length (m)	Excavation (m^3)	Concrete (m^3)
Escape T05	130+180		1,113	42,846	20,986
Escape T06	131+200		730	28,094	13,760
Escape T07	145+120		425	16,354	8,010
Escape T08	146+020		408	15,711	7,695
Section 2: Bursa-Yenişehir, between 46+000 - 101+700 [6]					
T12-KT1	83+900		595.05		
T12-KT2	86+690		283.00		
Section 3: Bandırma-Bursa, between 0+000 - 97+000 [7]					
Escape T01	-	-	-	-	-
Escape T02	-	-	-	-	-
Escape T03	-	-	-	-	-

3.3.3.3 Railway Bridges

Along the alignment, bridges will be constructed where the BBYO Projects crosses over large rivers. In total 35 railway bridges are planned to be constructed in the Project and the information about the proposed bridges are provided in Table 12.

Table 12 Proposed Bridges along the BBYO Project

Structure No.	Starting KM	Ending KM	Length (m)	Concrete (m^3)
Section 1: Yenişehir-Osmaneli, between 101+700 - 149+670				
Bridge-1	105+922	105+952	30	1,104
Bridge-2	111+450	111+700	250	9,197
Bridge-3	117+150	117+320	170	6,254
Bridge-4	132+285	132+380	95	3,495
Section 2: Bursa-Yenişehir, between 46+000 - 101+700 [8]				
K1	46+800	46+828	27.70	
K2	47+337	47+396	58.70	
K3	52+313	52+341	27.70	
K4	52+903	52+962	58.70	
K5	53+746	53+774	27.70	
K6	78+160	78+188	27.70	

[6] The information of the structures that will not be built by Kalyon is limited to what is presented in the table.

[7] The escape tunnel Project designs are currently ongoing for Section 3.

[8] The information of the structures that will not be built by Kalyon is limited to what is presented in the table.

Structure No.	Starting KM	Ending KM	Length (m)	Concrete (m^3)
Section 3: Bandırma-Bursa, between 0+000 - 97+000				
K1	8+700	8+775	75	2,759
K2	9+245	9+420	175	6,438
K3	17+160	17+260	100	3,679
K4	24+580	25+830	1250	45,987
DSİ	29+075	29+115	40	1,472
K5	37+260	37+380	120	4,415
K6	38+355	38+435	80	2,943
K7	40+900	41+180	280	10,301
K8	41+400	41+540	140	5,151
K9	43+590	43+720	130	4,783
K10	44+140	44+270	130	4,783
K11	45+830	45+950	120	4,415
K12	57+500	57+590	90	3,311
K13	60+485	60+565	80	2,943
K14	60+775	60+845	70	2,575
K15	63+970	64+380	410	15,084
K16	64+620	64+700	80	2,943
K17	68+040	68+210	170	6,254
K18	69+830	70+100	270	9,933
K19	70+860	70+980	120	4,415
K20	73+440	73+550	110	4,047
K21	76+950	77+070	120	4,415
K22	90+490	90+635	145	5,334
K23	91+130	91+335	205	7,542
K22	1+400	1+500	100	3,679

3.3.3.4 Viaducts

Viaducts will be constructed in the BBYO Project to ensure that the Project will pass at elevated levels through towns and cities. 15 viaducts are proposed in the Project and the information about the viaducts are provided in table below.

Table 13 Proposed Viaducts along the BBYO Project

Structure No.	Starting KM	Ending KM	Length (m)	Concrete (m³)
Section 1: Yenişehir-Osmaneli, between 101+700 - 149+670				
V 1	138+768	139+351	583	27,411
V 2-2A	147+530	148+572	1,042	83,652
V 3-2B	147+530	148+350	820	63,240
Section 2: Bursa-Yenişehir, between 46+000 - 101+700 [9]				
V1	46+040	46+452	412.50	
V2A	50+359	50+905	546.61	
V2B	51+040	51+936	896.39	
V3	55+927	56+581	654.53	
V4	60+327	61+116	789.00	
V5	61+470	61+834	363.50	
V6A	64+679	64+780	101.06	
V6B	64+885	65+451	565.64	
V7A	74+281	74+740	458.95	
V7B	74+880	75+146	265.75	
V8	78+866	79+455	589.00	
V9	79+593	79+832	239.50	
Section 3: Bandırma-Bursa, between 0+000 - 97+000, no viaduct is planned.				

3.3.3.5 Underpasses

Underpasses will be constructed where the proposed railway intersects with the existing roads. 99 underpasses are proposed in the Project and the information about the viaducts are provided in Table 14.

Table 14 Proposed Underpasses along the BBYO Project

Structure No.	Starting KM	Ending KM	Length (m)	Excavation (m³)	Concrete (m³)
Section 1: Yenişehir-Osmaneli, between 101+700 - 149+670					
Underpass 1	102+335	102+345	10	2,500	800
Underpass 2	103+620	103+635	15	2,500	1,000
Underpass 3	104+150	104+160	10	2,500	800
Underpass 4	104+730	104+740	10	2,500	800
Underpass 5	106+575	106+590	15	2,500	800

[9] The information of the structures that will not be built by Kalyon is limited to what is presented in the table.

Structure No.	Starting KM	Ending KM	Length (m)	Excavation (m^3)	Concrete (m^3)
Agricultural pass 1	108+120	108+130	10	2,500	800
Underpass 6	109+013	109+023	10	2,500	800
Underpass 7	109+170	109+200	30	2,500	1,500
Underpass 8	109+415	109+425	10	2,500	800
Underpass 9	110+640	110+650	10	2,500	800
Underpass 10	112+640	112+650	10	2,500	800
Underpass 11	113+753	113+763	10	2,500	800
Underpass 12	114+128	114+138	10	2,500	800
Underpass 13	114+949	114+959	10	2,500	800
Underpass 14	115+574	115+584	10	2,500	800
Underpass 15	116+345	116+355	10	2,500	800
Underpass 16	116+752	116+762	10	2,500	800
Underpass 17	117+643	117+653	10	2,500	800
Underpass 18	120+000	120+020	20	2,500	1,200
Underpass 19	120+725	120+735	10	2,500	800
Agricultural pass 2	121+020	121+030	10	2,500	800
Underpass 20	122+652	122+662	10	2,500	800
Underpass 21	122+888	122+898	10	2,500	800
Agricultural pass 3	123+452	123+462	10	2,500	800
Underpass 22	123+847	123+857	10	2,500	800
Underpass 23	124+177	124+187	10	2,500	800
Agricultural pass 32	132+590	132+600	10	2,500	911
Agricultural pass 33	132+740	132+750	10	2,500	665
Agricultural pass 34	135+415	135+425	10	2,500	633
Agricultural pass 35	136+475	136+485	10	2,500	557
Agricultural pass 36	139+885	139+895	10	2,500	752
Agricultural pass 37	141+765	141+775	10	2,500	796

Structure No.	Starting KM	Ending KM	Length (m)	Excavation (m^3)	Concrete (m^3)
Agricultural pass 38	143+500	143+510	10	2,500	560
Agricultural pass 39	144+120	144+130	10	2,500	896
Underpass 41	148+770	148+780	10	2,500	800
Agricultural pass 42	148+950	148+960	10	2,500	800
Agricultural pass 40	147+480	147+490	10	2,500	638
Section 2: Bursa-Yenişehir, between 46+000 - 101+700 [10]					
AG1	52+865	52+876	11		
AG2	53+025	53+036	11		
AG3	53+540	53+551	11		
AG4	64+500	64+513	13		
AG5	66+360	66+371	11		
AG6	67+220	67+231	11		
AG7	67+800	67+811	11		
AG8	68+858	68+890	32		
AG9	69+720	69+744	24		
AG10	71+880	71+891	11		
AG11	72+375	72+386	11		
AG12	74+180	74+191	11		
AG13	75+470	75+483	13		
AG14	76+950	76+961	11		
AG15	77+610	77+621	11		
AG15	78+040	78+051	11		
AG16	78+230	78+241	11		
AG17	78+440	78+451	11		
AG-1	88+120	88+157	74		
AG-2	89+046	89+058	12		
AG-3 (Agricultural)	90+566	90+577	11		
AG-4	91+190	91+201	11		

[10] The information of the structures that will not be built by Kalyon is limited to what is presented in the table.

Structure No.	Starting KM	Ending KM	Length (m)	Excavation (m^3)	Concrete (m^3)
AG-5 (Agricultural)	91+977	91+988	11		
AG-6	93+157	93+169	12		
AG-7 (Agricultural)	93+944	93+956	12		
AG-8	94+662	94+674	12		
AG-9	95+441	95+453	12		
AG-10	96+206	96+219	13		
AG-11 (Agricultural)	98+914	98+922	8		
AG-12	99+485	99+496	11		
AG-13	100+268	100+310	42		
AG-14	100+295	100+308	13		
AG-15	100+905	100+921	16		
Section 3: Bandırma-Bursa, between 0+000 - 97+000					
AG1	1+947	1+977.24	30.24	2,500	750
AG2	7+340	7+374.83	34.83	2,500	750
AG3	27+455	27+493.29	38.29	2,500	750
AG4	29+923	29+942.36	19.36	2,500	750
AG5	32+723	32+770.08	47.08	2,500	750
AG6	33+955	33+978.72	23.72	2,500	750
AG7	37+092	37+130.35	38.35	2,500	750
AG8	38+708	38+751.53	43.53	2,500	750
AG9	39+006	39+029.72	23.72	2,500	750
AG10	44+062	44+087.38	25.38	2,500	750
AG11	46+660	46+715.25	55.25	2,500	750
AG12	50+027	50+084.16	57.16	2,500	750
AG13	50+920	50+956.77	36.77	2,500	750
AG14	52+120	52+146.32	26.32	2,500	750
AG15	58+978	59+004.68	26.68	2,500	750
AG16	61+032	61+064.72	32.72	2,500	750
AG17	65+700	65+723.72	23.72	2,500	750
AG18	70+647	70+678.27	31.27	2,500	750

Structure No.	Starting KM	Ending KM	Length (m)	Excavation (m^3)	Concrete (m^3)
AG19	76+045	76+068.73	23.73	2,500	750
AG20	78+530	78+553.75	23.75	2,500	750
AG21	80+700	80+736.30	36.30	2,500	750
AG22	81+832	81+885.65	53.65	2,500	750
AG23	83+642	83+673.78	31.78	2,500	750
AG24	83+993	84+016.72	23.72	2,500	750
AG25	85+982	86+012.52	30.52	2,500	750
AG26	87+940	87+963.73	23.73	2,500	750
AG27	89+068	89+091.72	23.72	2,500	750
AG28	91+775	91+797.70	22.70	2,500	750
AG29	95+816	95+947.27	131.27	2,500	750

3.3.3.6 Overpasses

Overpasses will be constructed where the proposed railway intersects with the existing roads. The proposed number of overpasses in the Project are 29 and their alignment are presented in table below.

Table 15 Proposed Overpasses along the BBYO Project

Structure No.	Starting KM	Ending KM	Length (m)	Excavation (m^3)	Concrete (m^3)
Section 1: Yenişehir-Osmaneli, between 101+700 - 149+670					
Overpass 01	118+370	118+410	40	3,000	6,000
Overpass 02	118+740	118+780	40	3,000	6,000
Overpass 03	121+700	121+740	40	3,000	6,300
Overpass 09	133+030	133+054	48		
Overpass 10	135+794	135+830	72		
Overpass 11	142+500	142+524	48		
Section 2: Bursa-Yenişehir, between 46+000 - 101+700 [11]					
UG1	47+845				
UG2	48+600				
UG3	49+630				
UG4	54+400				
UG5	58+330				

[11] The information of the structures that will not be built by Kalyon is limited to what is presented in the table.

Structure No.	Starting KM	Ending KM	Length (m)	Excavation (m^3)	Concrete (m^3)
UG6	58+880				
UG7	66+080				
UG9	71+500				
UG11	73+211				
UG-1	97+326				
UG-2	98+306				
Section 3: Bandırma-Bursa, between 0+000 - 97+000					
UG1	13+911	13+936	25.16		3,800
UG 2	14+609	14+634	25.42		3,800
UG 3	19+190	19+215	25		3,800
UG 4	21+778	21+818	40.34		6,000
UG5	24+165	24+216	51.1		7,600
UG6	30+952	30+972	19.89		3,000
UG7	47+995	48+020	25		3,800
UG8	54+180	54+205	25		3,800
UG9	57+780	57+799	18.5		3,000
UG10	63+194	63+227	33.16		5,000
UG11	75+530	75+555	25		3,800
UG12	79+480	79+499	18.5		3,000

3.3.3.7 Cut and Cover Tunnels

The total number of cut and cover tunnels proposed on the Project route are 6 and their alignment are presented in Table 16.

Table 16 Proposed Cut and Cover Tunnels along the BBYO Project

Structure No.	Starting KM	Ending KM	Length (m)	Excavation (m^3)	Concrete (m^3)
Section 1: Yenişehir-Osmaneli, between 101+700 - 149+670					
Cut and Cover 1	120+125	120+500	375	131,960	
Cut and Cover 2	133+008	133+055	47		2,960
Cut and Cover 3	135+760	135+832	72		4,445
Cut and Cover 4	140+645	141+096	451	111,146	27,791
Cut and Cover 5	142+470	142+520	50	2,235	2,963

Structure No.	Starting KM	Ending KM	Length (m)	Excavation (m³)	Concrete (m³)
Section 2: Bursa-Yenişehir, between 46+000 - 101+700 [12]					
AK1	55+065	55+177	115.98		
Section 3: Bandırma-Bursa, between 0+000 - 97+000, no cut and cover tunnel is planned.					

3.3.3.8 Culverts

At the small waterways crossings, culverts with the sizes ranging from 1.5 m x 1.5 m to 5.0 m x 5.0 m will be built under the railway embankment body. In total 217 culverts are proposed to be constructed in the Project and their alignment are presented in Table 17.

Table 17 Proposed Culverts along the BBYO Project

Structure No.	Starting KM	Length (m)	Size (m)	Excavation (m³)
Section 1: Yenişehir-Osmaneli, between 101+700 - 149+670				
Main body - 1	103+185		5.0x5.0 x 3	
Main body - 2	103+835		2.5x2.5 x 2	
Main body - 3	104+386		2.5x2.5 x 2	
Main body - 4	104+738		2.0x2.0 x 1	
Main body - 5	105+353		2.0x2.0 x 1	
Main body - 6	106+335		2.0x2.0 x 1	
Main body - 7	106+649		2.0x2.0 x 1	
Main body - 8	107+175		2.0x2.0 x 1	
Main body - 9	107+459		2.0x2.0 x 1	
Main body - 10	107+723		2.0x2.0 x 1	
Main body - 11	108+132		3.0x3.0 x 1	
Main body - 12	108+671		2.0x2.0 x 1	
Main body - 13	108+965		2.0x2.0 x 1	
Main body - 14	109+839		2.0x2.0 x 1	
Main body - 15	110+158		2.0x2.0 x 1	
Main body - 16	112+758		2.0x2.0 x 1	
Main body - 17	113+392		2.0x2.0 x 1	
Main body - 18	113+714		2.0x2.0 x 1	
Main body - 19	114+065		2.0x2.0 x 1	
Main body - 20	114+336		2.0x2.0 x 1	

[12] The information of the structures that will not be built by Kalyon is limited to what is presented in the table.

Main body - 21	114+714		2.0x2.0 x 1	
Main body - 22	115+075		2.0x2.0 x 1	
Main body - 23	115+439		3.0x3.0 x 2	
Main body - 24	115+756		2.0x2.0 x 1	
Main body - 25	118+176		2.0x2.0 x 1	
Main body - 26	119+122		2.0x2.0 x 1	
Main body - 27	120+861		2.0x2.0 x 1	
Main body - 28	121+039		3.0x3.0 x 3	
Main body - 29	121+108		2.0x2.0 x 1	
Main body - 30	121+400		2.0x2.0 x 1	
Main body - 31	122+540		2.5x2.5 x 1	
Main body - 32	123+323		4.0x4.0 x 1	
Main body - 33	123+577		2.0x2.0 x 1	
Main body - 34	123+967		2.5x2.5 x 2	
Main body - 35	127+993		2.0x2.0 x 1	
Main body - 36	128+128		2.5x2.5 x 1	
Main body - 37	132+569		2.0x2.0 x 1	
Main body - 38	132+730		2.0x2.0 x 1	
Main body - 39	132+950		2.0x2.0 x 1	
Main body - 40	133+120		2.0x2.0 x 1	
Main body - 41	133+530		3.0x3.0 x 1	
Main body - 42	133+622		2.0x2.0 x 1	
Main body - 43	136+300		3.0x3.0 x 3	
Main body - 44	136+709		2.0x2.0 x 1	
Main body - 45	137+051		2.0x2.0 x 1	
Main body - 46	137+194		2.0x2.0 x 1	
Main body - 47	137+388		2.0x2.0 x 1	
Main body - 48	137+488		2.0x2.0 x 1	
Main body - 49	137+943		2.0x2.0 x 1	
Main body - 50	138+191		2.0x2.0 x 1	
Main body - 51	139+510		2.0x2.0 x 1	
Main body - 52	140+194		2.5x2.5 x 1	
Main body - 53	141+160		2.5x2.5 x 1	

Main body - 54	141+798		3.0x3.0 x 1	
Main body - 55	142+240		2.5x2.5 x 1	
Main body - 56	143+199		2.0x2.0 x 1	
Main body - 57	143+424		2.0x2.0 x 1	
Main body - 58	143+516		2.0x2.0 x 1	
Main body - 59	143+809		2.0x2.0 x 1	
Main body - 60	143+906		2.0x2.0 x 1	
Main body - 61	147+328		2.0x2.0 x 1	
U09 Siding Line - 62	+54		2.0x2.0 x 1	
U09 Siding Line - 63	+136		2.0x2.0 x 1	
U?- Siding Line - 64	+320		2.0x2.0 x 1	
U?- Siding Line - 65	+378		2.5x2.5 x 1	
Y track-1 - 66	148+790		2.5x2.5 x 1	
Y track -1 - 67	149+060		2.0x2.0 x 1	
Y track -1 - 68	149+223		1.5x1.5 x 1	
Y track -1 - 69	149+470		3.0x3.0 x 1	
Y track -1 - 70	149+653		1.5x1.5 x 1	
Y track -2 - 71	148+920		3.0x3.0 x 2	
Section 2: Bursa-Yenişehir, between 46+000 - 101+700 [13]				
M1	48+100			
M2	48+885			
M3	49+330			
M4	49+680			
M5	50+025			
M6	53+880			
M7	56+690			
M8	58+750			
M9	85+530			
M10	66+440			
M11	66+750			
M12	66+910			

[13] The information of the structures that will not be built by Kalyon is limited to what is presented in the table.

M13	67+400			
M14	67+970			
M15	68+300			
M16	68+700			
M17	68+900			
M18	69+800			
M19	71+220			
M20	72+030			
M21	72+220			
M22	72+350			
M23	72+520			
M24	73+400			
M25	75+350			
M26	77+380			
M27	78+530			
M28	82+800			
M29	88+083		3.00x3.00	
M30	88+378		2.50x2.50	
M31	89+998		4.00x4.00	
M32	90+069		2.50x2.50	
M33	90+330		1.50x1.50	
M34	90+389		2.00x2.00	
M35	90+559		2.00x2.00	
M36	90+725		1.50x1.50	
M37	91+000		1.50x1.50	
M38	91+020		2.00x2.00	
M39	91+202		2.00x2.00	
M40	91+420		1.50x1.50	
M41	91+640		1.50x1.50	
M42	91+960		1.50x1.50	
M43	92+260		1.50x1.50	
M44	92+277		3.00x3.00	
M45	92+575		1.50x1.50	

M46	92+825		1.50x1.50	
M47	92+833		2.00x2.00	
M48	93+565		1.50x1.50	
M49	93+584		2x(3.00x3.00)	
M50	93+930		1.50x1.50	
M51	94+318		1.50x1.50	
M52	94+326		2.00x2.00	
M53	95+000		2.00x2.00	
M54	96+100		2.00x2.00	
M55	96+230		2.00x2.00	
M56	97+315		2.50x2.50	
M57	98+000		1.50x1.50	
M58	99+340		2.00x2.00	
M59	99+465		1.50x1.50	
M60	99+474		2.50x2.50	
M61	100+230		1.50x1.50	
M62	100+895		2.00x2.00	
Section 3: Bandırma-Bursa, between 0+000 - 97+000				
M1	1+133	29.21	4.00x3.00	351
M2	2+560	48.23	2.00x2.00	193
M3	3+833	46.61	3.00x3.00	419
M4	4+153	36.83	2.00x2.00	147
M5	4+625	27.76	4.00x4.00	444
M6	5+280	30.45	5.00x5.00	761
M7	7+250	46.35	4.00x4.00	742
M8	7+654	46.29	5.00x4.00	926
M9	8+124	22.37	2.50x2.50	140
M10	9+605	24.49	3.00x2.50	184
M11	12+243	36.08	7.00x5.00	1,263
M12	14+930	32.2	5.00x4.00	644
M13	16+315	77.56	4.00x3.00	931
M14	17+530	77.25	3.00x3.00	695
M15	18+340	74.46	2.00x2.00	298

M16	20+745	16.94	3.00x3.00	152
M17	23+560	19.19	2.00x2.00	77
M18	27+800	49.56	2.00x2.00	198
M19	28+002	49.56	2.00x2.00	198
M20	29+537	17.52	3.00x3.00	158
M21	30+061	22.24	4.00x3.00	267
M22	31+155	38.08	4.00x4.00	609
M23	34+555	43.48	4.00x4.00	696
M24	35+757	18.66	3.00x2.50	140
M25	36+877	59.23	2.00x2.00	237
M26	42+015	23.67	4.00x3.00	284
M27	43+255	33.46	3.00x2.50	251
M28	47+125	22.01	2.00x2.00	88
M29	47+480	19.49	2.00x2.00	78
M30	48+924	72.04	3.00x2.50	540
M31	49+740	27.04	2.00x2.00	108
M32	50+045	69.36	4.00x4.00	1,110
M33	50+780	40.52	2.00x2.00	162
M34	52+055	43.09	5.00x4.00	862
M35	53+995	18.4	2.50x2.00	92
M36	54+790	52.6	2.50x2.00	263
M37	55+210	66.7	2.00x2.00	267
M38	56+350	49.71	2.00x2.00	199
M39	57+005	26.98	2.00x2.00	108
M40	57+190	16.28	2.00x2.00	65
M41	58+560	49.71	2.00x2.00	199
M42	58+930	28.89	2.00x2.00	116
M43	59+320	29.82	2.00x2.00	119
M44	59+552	43.5	2.00x2.00	174
M45	61+535	27.35	2.50x2.50	171
M46	63+356	18.57	2.50x2.00	93
M47	65+790	37.9	2.00x2.00	152
M48	67+055	45.42	2.00x2.00	182

M49	67+345	25.16	2.00x2.00	101
M50	68+770	45.38	2.50x2.50	284
M51	69+137	43.87	2.50x2.00	219
M52	69+690	41.85	2.00x2.00	167
M53	71+950	65.62	4.00x3.00	787
M54	75+638	19.22	2.00x2.00	77
M55	76+312	15.27	2.00x2.00	61
M56	77+495	23.93	2.00x2.00	96
M57	78+340	26.65	2.50x2.50	167
M58	79+405	16.74	2.00x2.00	67
M59	79+930	50.35	2.00x2.00	201
M60	80+170	25.74	2.00x2.00	103
M61	80+765	45.08	2.00x2.00	180
M62	80+950	34.78	4.00x4.00	556
M63	81+910	50.79	2.00x2.00	203
M64	82+230	24.11	2.00x2.00	96
M65	83+120	36.47	2.00x2.00	146
M66	83+950	50.45	4.00x3.00	605
M67	85+250	21.57	2.00x2.00	86
M68	85+940	27.34	2.00x2.00	109
M69	87+130	16.61	3.00x3.00	149
M70	88+400	15.71	2.00x2.00	63
M71	89+752	45.64	2.50x2.00	228
M72	95+015	45.55	2.00x2.00	182
M73	95+530	100.25	2.00x2.00	401
M74	95+935	107.41	2.00x2.00	430
M75	96+175	91.35	2.00x2.00	365
M76	96+552	47.47	2.00x2.00	190
M77	+573	52.9	4.00x3.00	635
M78	1+650	51.39	2.50x3.00	385
M79	2+980	38.57	-	154
M80	4+762	27.41	2.00x2.00	110
M84	+858	69.53	2.00x2.00	278

M83	+898	48.76	2.50x2.50	305
M82	1+690	46.58	2.00x2.00	186
M81	2+490	58.08	5.00x4.00	1,162

3.3.4 Station Buildings

The number of stations planned to be constructed on the BBYO Railway route are 7. Kalyon will be responsible from the construction of all stations along the route including two stations located on Section 2. Information about the stations is provided in Table 18 and locations are shown in Figure 14.

Table 18 Proposed Stations along the BBYO Project

Structure No.	Starting KM	Ending KM	Length (m)	Planned area (m^2)
Section 1: Yenişehir-Osmaneli, between 101+700 - 149+670				
Yenişehir	110+118.67	111+159.19	1,041	104,052
Section 2: Bursa-Yenişehir, between 46+000 - 101+700				
Gürsu	69+820	70+285	465.00	106,679
Yenişehir Airport	99+900.00	101+208.33	1308.00	130,833
Section 3: Bandırma-Bursa, between 0+000 - 97+000				
Kuşcenneti	0+000	1+200	1000	100,000
Karacabey	42+015.00	42+800.00	785	78,500
Teknosab	71+400.00	72+600.00	1200	120,000
Bursa	95+000	96+426	1426	285,150

Figure 14 Location of the Stations along the BBYO Route

3.3.5 Electrification, Signalisation and Telecommunication

Electrification is defined as the energy distribution system that provides energy to the electrically operated vehicles on the railway. The electrification system will consist of the transformer centres, energy transmission lines (catenary), remote control and control centres. Within the scope of the BBYO Project, four 154/25kV 25MVA switchyards will be established and 154kV energy transmission line (ETL) with an approximate length of 3 km long has been planned which will be connected to the existing ETLs. According to the ongoing design criteria, the catenary system will be suitable for the 250 km/h operating speed on the railway and will consist of approximately 5,800 tons of galvanized steel material, 1,478km copper or aluminium conductor and 11,300 cantilevers.

Signalisation is defined as the illuminated system that regulates the traffic in railways. TCDD has both mechanical and electrical signalisation systems where the traffic is controlled via levers and transmission wires on the control desk in the station building and via the control of the movement of the railway vehicle movements from the command centre. The command centre consists of a monitoring panel, dispatcher control console, traingraph, protocol printer, and communication system. The signalisation elements along the railway route include rail circuits, signals, switch equipment, automatic train stop (ATS) equipment and interlocking circuits.

Telecommunication is the communication system used for the transmission of all kinds of information and documents within the TCDD and to ensure traffic safety. TCDD has an in-house telephone exchange system independent of the national telephone system and transmission lines. Control centers have a traffic controller phone which are used only for traffic and transportation-related conversations between traffic controllers and stations, trains and all other railway vehicle officials. Communication of the staff on the railway line is provided with mobile phone, call service phone, radio, etc. and all these conversations are automatically recorded on the tape recorder in the center.

The design documents for the electrification, signalisation and telecommunications is currently ongoing, and more details on the required materials will be defined as part of the detailed design studies.

Kalyon will be responsible from the superstructure electromechanical and signalisation works along the 201 km BBYO route.

3.3.6 Switchyards

Within the scope of the Project 4 switchyards will be constructed in the Project. Connection from switchyards to existing electricity transmission lines (ETL) will be provided, and no new ETL will be established within the scope of the BBYO Project. Four 25 MVA switchyards will be established and 154kV energy transmission line with an approximate length of 3 km long has been planned for the connection from four switchyards to the existing ETLs. The location of the switchyards and the connections to the existing ETL is presented in Figure 16.

Information about the planned switchyards are provided below. Connection permits for the connection from switchyards to existing ETLs will be provided before commissioning.

Table 19 Switchyards Information

No	Province	District	Neighbourhood	Plot No.	Parcel No.	KM	Planned Area (m^2)
Switchyard-01	Bursa	Bandırma	Kuşcenneti	-	-	12+500	10,000
Switchyard -02	Bursa	Karacabey	Hayırlar	0	377	52+000	15,000
Switchyard -03	Bursa	Osmangazi	Ahmetbey	10019	130	50+000	19,000
Switchyard -04	Bursa	Yenişehir	Karaköy	159	1	51+000	27,000

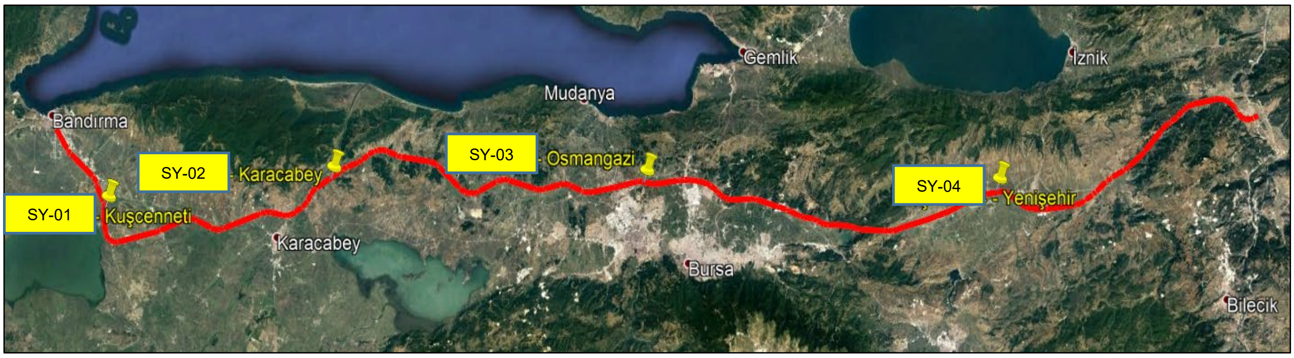


Figure 15 Location of the Switchyards

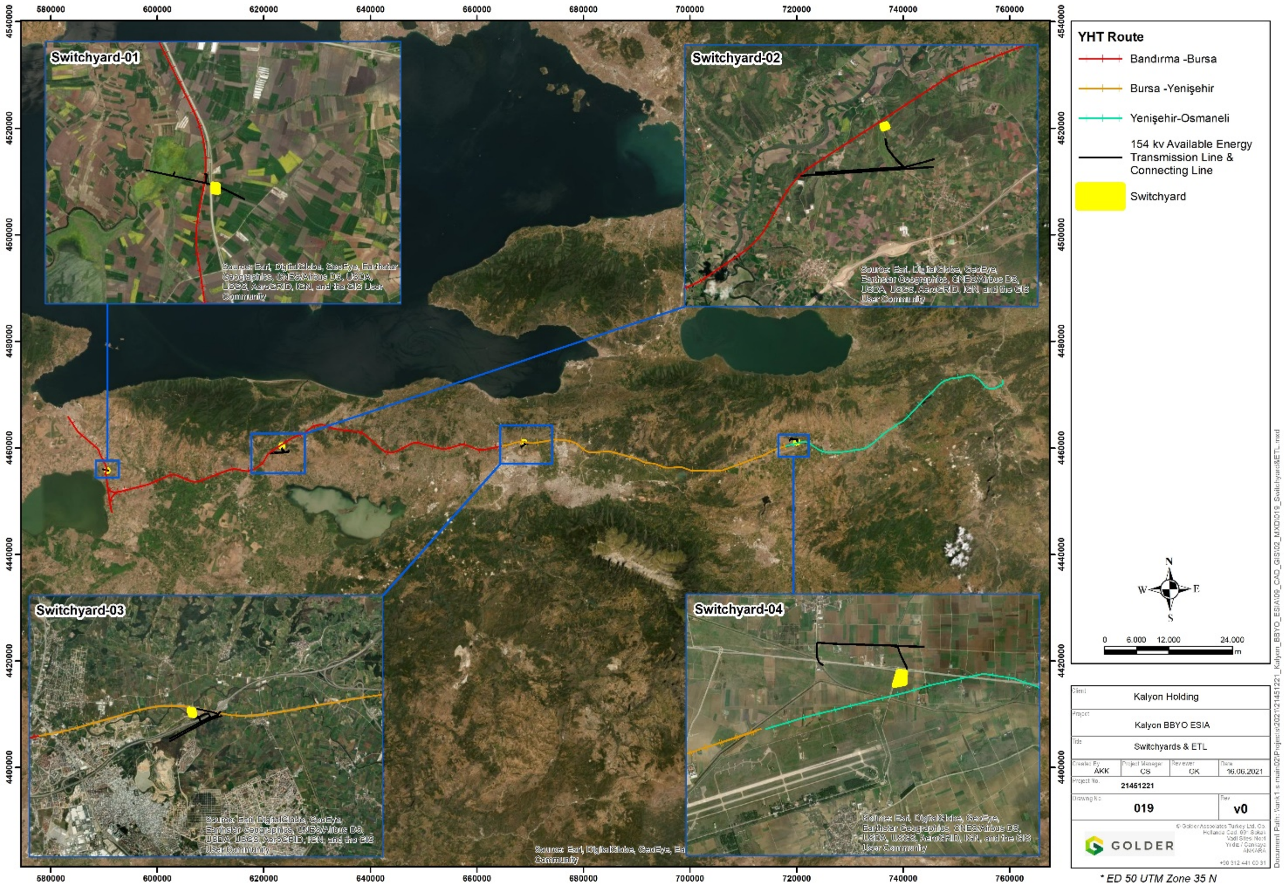


Figure 16 Location of the Switchyards and ETL connections

3.3.7 Associated Facilities

The temporary facilities which are considered as the associated facilities and planned to be constructed and operated by Kalyon and already operated by Duygu-Çelikler in Section 2 are described in below sections.

3.3.7.1 Temporary Facilities (Kalyon)

The number of temporary facilities to be used and/or constructed by Kalyon within the scope of the BBYO Project according to locations are summarized in Table 20. All temporary facilities established by the Contractor within the scope of the Project will be rehabilitated after the construction phase.

Further information about the temporary facilities is presented in the following sections.

Table 20 Number of Temporary Facilities in the BBYO Project

Facility	Bilecik	Bursa	Balıkesir	Total
Borrow Site	-	5	-	5
Basalt Quarry	-	1	-	1
Rock Quarry	2	2	-	4
Store	1	5	-	6
Concrete Plant	2	2	-	4
Precast Plant	1	1	-	2

Facility	Bilecik	Bursa	Balıkesir	Total
Camp Site	5	9	-	14

3.3.7.1.1 Borrow Sites and Quarries

Borrow sites and quarries will be used in order to provide the necessary filling materials along the BBYO route construction. Some of the material borrow site and the quarries will be operated by the Contractor; and some private quarry operations will also be used for the material supply during the construction phase. Obtaining the necessary permits and licenses have been initiated for some of the quarries to be operated by the Contractor, e.g., EIA Application Files have been prepared and submitted for the Necmiköy and Düzmeşe quarries in March 2021 and April 2021, respectively. All necessary permits and the licenses will be obtained before commencing the operation of the borrow sites and the quarries within the scope of the BBYO Project. Open-pit mining will be implemented in the quarries with blasting method.

Information about the material borrow sites and quarries considered to be used for the Project purposes are provided in Table 21. The location of the borrow sites and quarries can be changed during the period of assessing the most feasible and suitable material supply to the Project. All impact assessment control measures presented in the report will apply for any new borrow sites and quarries to be used within the scope of the BBYO Project.

Table 21 Borrow Sites and Quarries Information

Facility	Owner	Province	District	Neighbourhood	Plot No.	Parcel No.	KM	Planned Area (m^2)
Borrow Sites								
Borrow Site-01	Kalyon	Bursa	Karacabey	Danışment	0	1392	23+000	80,000
Borrow Site-02	Kalyon	Bursa	Karacabey	Hayırlar	0	326	52+000	60,000
Borrow Site-03	Kalyon	Bursa	Mudanya	Evciler	142	158	63+000	60,000
Borrow Site-04	Kalyon	Bursa	Mudanya	Yörükyenicesi	183	231	73+000	100,000
Borrow Site-05	Kalyon	Bursa	Nilüfer	Çayli	0	1025	77+000	60,000
Quarries								
Basalt Quarry-01	Kalyon	Bursa	Orhangazi	Yeniköy	-	-	-	250,000
Rock Quarry-01	Kalyon	Bursa	Karacabey	Şahin	856	1	41+000	250,000
Rock Quarry-02	Kalyon	Bilecik	Merkez	Necmiyeköy	0	765	125+000	245,000
Rock Quarry-03	Kalyon	Bilecik	Osmaneli	Düzmeşe	139	43	139+000	240,000
Rock Quarry-04	Private premises	Bursa	Niliüfer	Kayapa	-	-	-	-

Figure 17 Location of the Borrow Sites

Figure 18 Location of the Basalt Quarry

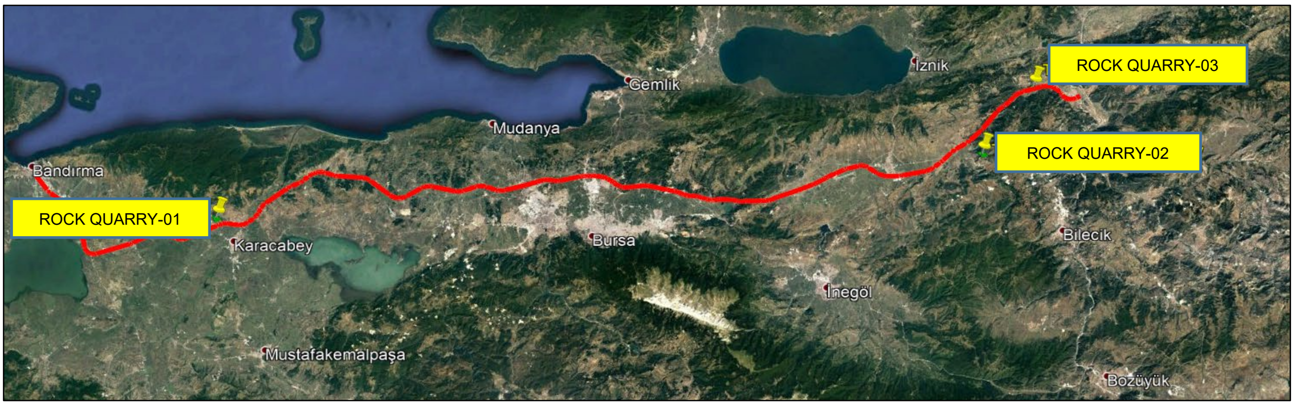


Figure 19 Location of the Rock Quarries

Figure 20 Location of the Private Rock Quarries in Kayapa Region

3.3.7.1.2 Stores

Stores to be constructed within the scope of the Project will be used for the storage of the excess excavated materials which arise from the tunnel and route excavation works and not used as backfilling. In total 6 stores are planned to be constructed on the BBYO route (Table 22).

Table 22 Stores Information

Facility	Owner	Province	District	Neighbourhood	Plot No.	Parcel No.	KM	Planned Area (m^2)
Store-01	Kalyon	Bursa	Bandırma	Akçapınar	104	19	10+000	80,000
Store-02	Kalyon	Bursa	Karacabey	Canbaz	0	2758	56+000	80,000
Store-03	Kalyon	Bursa	Karacabey	Canbaz	0	2759	57+000	50,000
Store-04	Kalyon	Bursa	Mudanya	Muratlı	0	673	66+000	80,000
Store-05	Kalyon	Bursa	Mudanya	Muratlı	0	580	68+000	50,000
Store-06	Kalyon	Bilecik	Osmaneli	Balçıkhisar	107	4	141+000	163,919

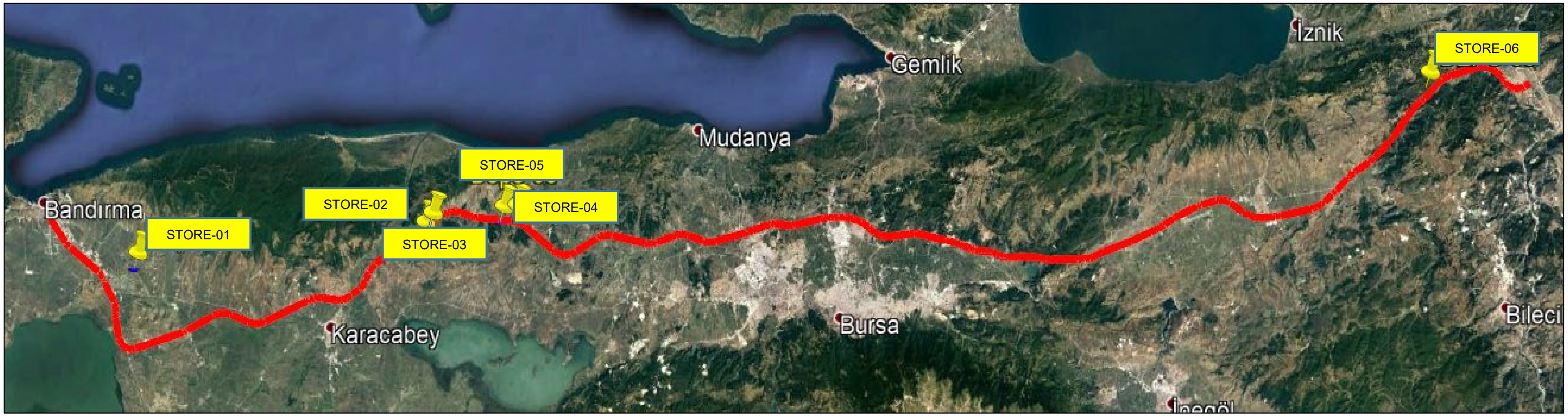


Figure 21 Location of the Stores

3.3.7.1.3 Concrete Plants

It is planned to establish 4 concrete plants within the scope of the BBYO Project to supply concrete needs to the Project during the construction phase. Information about the planned concrete plants is provided in Table 23.

Table 23 Concrete Plants Information

Facility	Owner	Province	District	Neighbourhood	Plot No.	Parcel No.	KM	Planned Area (m^2)
Concrete Plant-01	Kalyon	Bursa	Karacabey	Şahin	856	1	41+000	35,000
Concrete Plant -02	Kalyon	Bursa	Mudanya	Dedeköy	0	1136	89+000	60,000
Concrete Plant -03	Kalyon	Bilecik	Osmaneli	Dereyörük	102	1	128+000	9,000
Concrete Plant -04	Kalyon	Bilecik	Osmaneli	Camicedit	827	1	142+000	6,000

Figure 22 Location of the Concrete Plants

3.3.7.1.4 Precast Plants

Two precast factories will be constructed and operated by Kalyon within the scope of the BBYO Project construction phase. Precast Plant-01 is planned to be located in adjacent to the Concrete Plant-02 and Camp Site-14 in Mudanya, Bursa; and Precast Plant-02 is planned to be located near the Camp Site-09 in Osmaneli, Bilecik. Information about the planned precast plants is provided in Table 24.

Table 24 Precast Plant Information

Facility	Owner	Province	District	Neighbourhood	Plot No.	Parcel No.	KM	Planned Area (m^2)
Precast Plant -01	Kalyon	Bursa	Mudanya	Dedeköy	0	1136	89+000	50,000
Precast Plant -02	Kalyon	Bilecik	Osmaneli	Çiftlik	111	130	134+000	15,000

Figure 23 Location of the Precast Plant-01

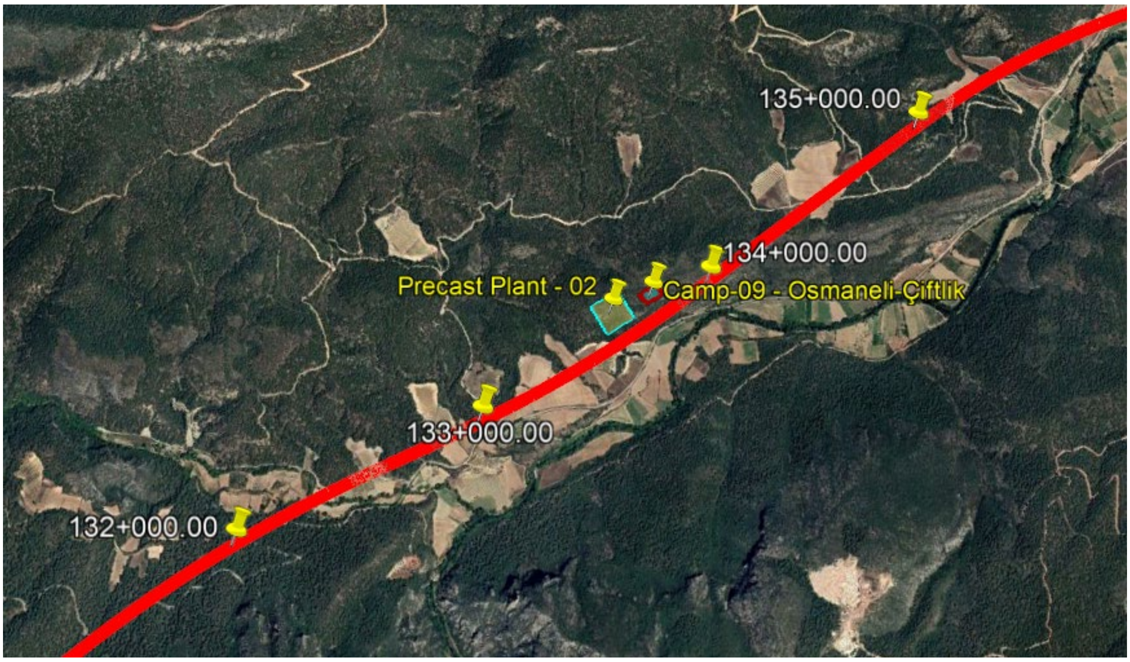


Figure 24 Location of the Precast Plant-02

3.3.7.1.5 Construction Camp Sites

The total number of construction camp sites planned to be established along the BBYO route by Kalyon and subcontractors are 14. Information about all 14 camp sites are presented in Table 25 and locations are shown in Figure 25.

Project specific Camp Site Management Plan will be prepared within the scope of the Project in line with the IFC/EBRD's Guidance Note on Worker's Accommodation, 2009. The management principles to be implemented at the accommodation areas are provided in Section 10.4.2. Kalyon will ensure that subcontractors' construction camp sites are in compliance with the Project standards.

Table 25 Camp Sites Information

Facility	Company	Province	District	Neighbourhood	Plot No.	Parcel No.	KM	Planned Area (m^2)	Number of Employees to stay
Camp-01	Kalyon	Bursa	Karacabey	Danışment	0	791	22+000	100,000	150
Camp -02	Kalyon	Bursa	Karacabey	Şahin	856	1	41+000	75,000	500
Camp -03	Subcontractor	Bursa	Karacabey	Hayırlar	0	326	52+000	3,000	100-150
Camp -04	Subcontractor	Bursa	Mudanya	Evciler	142	181	63+000	3,000	100-150
Camp -05	Subcontractor	Bursa	Karacabey	Muratlı	0	580	67+000	3,000	100-150
Camp -06	Subcontractor	Bursa	Nilüfer	Badırga	0	3521	75+000	3,000	100-150
Camp -14	Kalyon	Bursa	Mudanya	Dedeköy	0	1136	89+000	30,000	300
Camp -07	Kalyon	Bursa	Nilüfer	Ahmet Yesevi	2685	6	97+000	20,000	50-70
Camp -08	Kalyon	Bursa	Yenişehir	Ebeköy	195	1	120+000	50,000	500
Camp -09	Subcontractor	Bilecik	Osmaneli	Çiftlik	111	130	134+000	3,000	100-150
Camp -10	Subcontractor	Bilecik	Osmaneli	Düzmeşe	139	43	139+000	3,000	100-150
Camp -11	Subcontractor	Bilecik	Osmaneli	Balçıkhisar	110	1	142+000	2,000	100-150
Camp -12	Subcontractor	Bilecik	Osmaneli	İnönü	725	117	147+000	2,000	100-150
Camp -13	Kalyon	Bilecik	Osmaneli	Camikebir	649	2	148+000	14,000	150

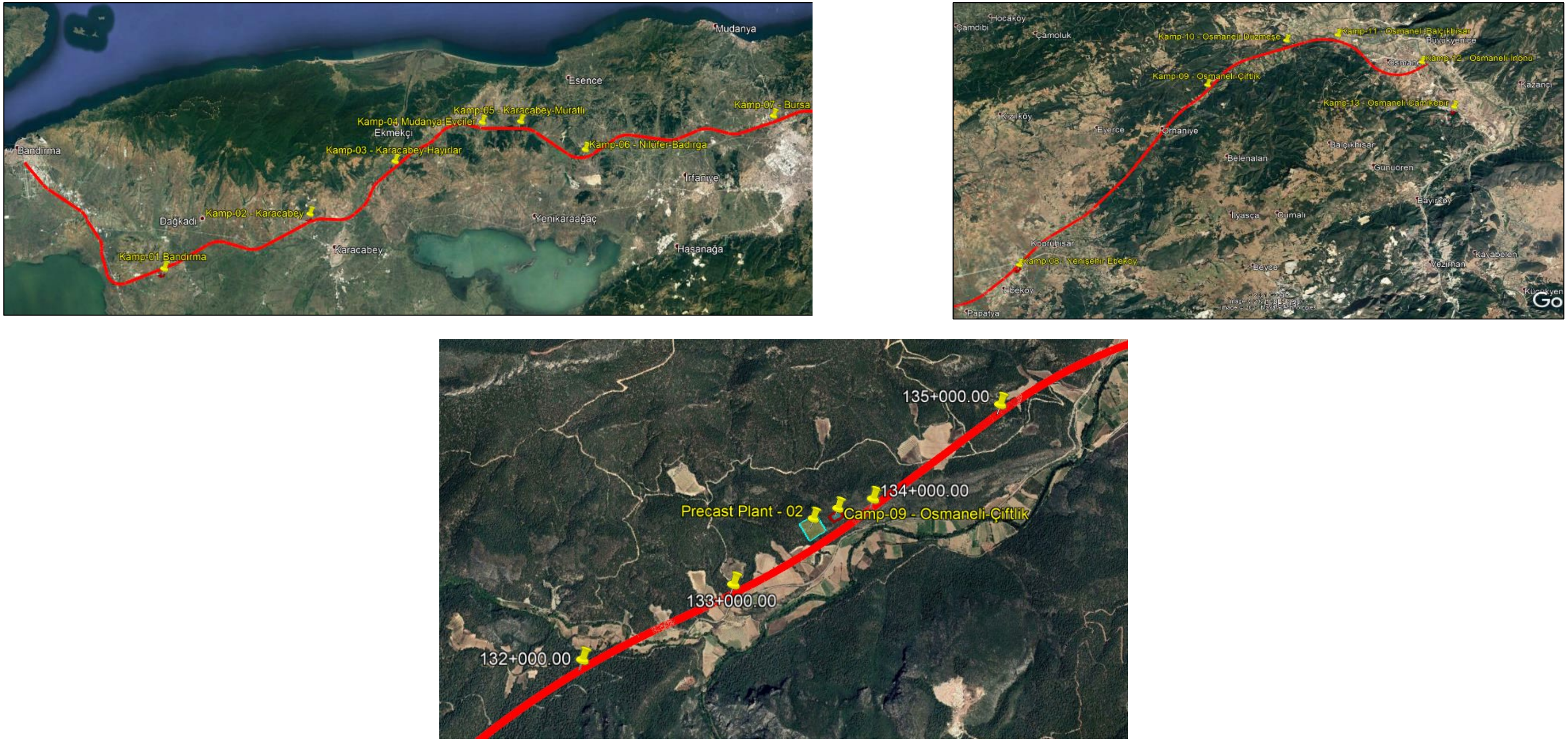


Figure 25 Location of the Camp Sites

3.3.7.2 Temporary Facilities (Duygu & Çelikler)

In Bursa-Yenişehir Section (Section 2) the tunnel works were started by TCDD Contractor Çelikler in 2016 and infrastructure works were started by TCDD Contractor Duygu in 2017. The temporary facilities required to realize the Section 2 works had been constructed and been operating before the Project ESIA studies commenced. Information about the temporary facilities established within the scope of the works conducted by Duygu-Çelikler are given below.

- In total 5 construction camps were established:
  - 130 personnel capacity Çelikler camp site at KM: 72+000,
  - 350 personnel capacity Çelikler tunnel camp site at KM: 87+000,
  - Çelikler Subcontractor Construction Site KM: 83 + 300 South of Axis
  - 120 personnel capacity Duygu camp site at KM: 71+500,
  - 250 personnel capacity Duygu construction camp site KM:71+400,
- Çelikler Concrete Plant at KM:71+400,
- Çelikler Concrete Plant KM: 87 + 300 South of Axis
- Duygu Precast Facility of at KM:71+200,
- Çelikler Aggregate Quarry KM: 70 + 700 South of Axis
- Duygu Aggregate Quarry KM: 70 + 700 North of Axis
- Duygu Borrow Site KM: 66 + 200 in the North of Axis
- Duygu Mobile Concrete Plant KM: 900 + 400 Axis

The location of the existing temporary facilities currently being operated by Duygu and Çelikler are shown in Figure 5.

3.4 Project Phases

3.4.1 Construction Phase

The construction phase of the Project consist of the following:

- Land preparation and construction activities
  - Equipment and material purchasing and shipment
  - Soil investigation and soil improvement works
  - Soil and excavation works
  - Construction of engineering structures
  - Railway superstructure works
  - Construction of station buildings
- Electromechanical works including electrification, signalisation and telecommunication

There are already access roads on the BBYO route. However, some extension works might be performed in case of need.

It is predicted that maximum 4300 people will be employed during the construction phase of the Project by Kalyon.

Kalyon will initiate the construction activities from Section 1 where design work and EIA processes have been completed. The construction activities will commence in Section 3 following the finalization of the design and permitting studies. Project detailed schedule is given in Table 5.

The construction period of the BBYO Railway Project for Section 1 and Section 3 is planned to be 3 years. The construction of the tunnel works and infrastructure works are currently ongoing by the TCDD Contractors Duygu-Çelikler in Section 2. In Section 2, the infrastructure construction activities are planned to be completed by December 2021 and the tunnel works are planned to be completed by December 2022.

The information on machinery and equipment to be used in the construction of the Project Section 1 and 3 are given in below table. It is necessary to note that the list of equipment currently used in Section 2 for the ongoing infrastructure and tunnel works are not included in this table. However, estimated number of equipment used in Section 2 are included in the model studies conducted within the scope of the BBYO ESIA studies.

Table 26 Estimated Number and Type of Equipment to be used in the Construction Phase

Equipment	Section 1: Yenişehir-Osmaneli (47+970 km)	Section 3: Bandırma-Bursa (97+000 km)	Total Quantity
Jumbo-Drill	16	29	45
Robot (spraymec)	18	32	50
Soil improvement group	12	14	26
Excavator	50	60	110
Concrete pump	9	11	20
Mixer	45	55	100
Truck	180	210	390
Grader	6	6	12
Dozer	7	8	15
Loader	20	24	44
Cylinder	14	16	30
Diesel Tanker	7	5	12
Crane	12	14	26
Maintenance Vehicle	7	5	12
Water truck	10	14	24
Manitou	9	12	21

Equipment	Section 1: Yenişehir-Osmaneli (47+970 km)	Section 3: Bandırma-Bursa (97+000 km)	Total Quantity
Other machines	90	120	210
Total	**512**	**635**	**1147**

3.4.2 Commissioning/Operation Phase

After the completion of the construction and electromechanical works at the BBYO Project, the Project will be commissioned with the transfer of the Project by AYGM to TCDD including all the structures and other elements included in the Construction Contract.

During the operation phase, Kalyon will be responsible from the maintenance works on the BBYO Railway route.

The impact assessment of the Project commissioning/operation phase on physical, biological and social components are explained in Section 8.0.

3.4.3 Decommissioning/Closure Phase

There is not an expected lifetime of the BBYO Project and decommissioning is not warranted at an estimated time. In the BBYO High Standard Railway Project Feasibility Report of AYGM (March 2020), a 32-year investment and operation period covering the years 2020-2051 was taken into consideration. Although an exact project life span is not determined for the BBYO Project, minimum of 32 years is projected for the BBYO Project.

The decommissioning phase of the Project may result in the land use triggered by demolition activities. In such a case, a Demolition and Decommissioning Plan shall be prepared to include the management strategies for both environmental and social impacts.

3.5 Wastewater and Waste Management

3.5.1 Water Use and Wastewater

<u>Construction</u>

The water supply for construction activities will be provided with the connection with the water networks of the Balıkesir, Bursa and Bilecik Municipalities and via water tankers outside the boundaries of the municipal adjacent areas. The water sources and the tankers to be used to supply water demand in the Project will comply with the regulatory requirements as per the Regulation Showing the Special Characteristics of Foodstuffs and Articles and Supplies Related to Public Health. In case groundwater will be encountered during the construction, groundwater should be abstracted from the work area; treatment, storage and disposal should be done according to the regulatory requirements after necessary analyses have been performed and relevant permits are obtained.

During the construction phase of the project, maximum 4300 workers will be employed by Kalyon. Assuming that daily water demand per capita is 150 L/day (State Planning Organization, 2007), the maximum daily amount of water to be used will be as follows:

Total number of employees: 4300

Maximum amount of water to be used by employees: 4300 people x 150 L/day/person = 645 m^3/day.

For the dust emission raising from the construction activities, sprinkler (water truck) will be used. 12.5 m^3/day water is estimated to be used for the dust suppression during the construction phase of the Project for one section.

Drinking water needs of personnel will be supplied by water bottles.

Wastewaters will be generated at the construction sites and camps sites due to water consumption of the personnel. No wastewater generation is expected due to water suppression. Domestic wastewaters will be collected in the septic tanks provided that the number of personnel is less than 84 in accordance with the Water Pollution Control Regulation. Wastewaters will be collected in leak-proof quality septic tanks and will be disposed of to the wastewater infrastructure by sewage trucks. Septic tanks will be designed to comply with the requirements of the Regulation on Septic Pit Opening at Locations where Sewer Construction is not Feasible.

At the construction sites where there are more than 84 people, a package treatment plant will be established. Project approval will be obtained by preparing a Wastewater Treatment Plant Project for the treatment facility within the scope of the Wastewater Treatment/Deep Sea Discharge Project Approval circular numbered (2018/14) dated 20.11.2018. In case wastewater treatment plant is established at the construction camp sites, the temporary facility established for more than 1 year will be subject to environment permit in accordance with the Regulation on Environmental Permits and Licenses. Water discharges from the wastewater treatment plants will comply with the national and international domestic wastewater discharge standards which are provided in Appendix B.

<u>Operation</u>

Water demand during the operation phase will be due to the passengers and the railway workers. The railway stations within the scope of the project remains within the residential areas, therefore the city water network will be used at the stations. The water needed in the trains will be supplied from the city network waters supplied to the stations.

During the operation phase it is estimated that maximum 431 people including 20 railway workers and 411 passengers will use one station at a time. There will be 7 stations along the BBYO route.

Total number of people: 431

Maximum amount of water used by people at one station: 431 people x 150 L/day/person = 65 m^3/day

Total amount of water used at 7 stations: 65 m^3/day x 7 = 455 m^3/day

Drinking water needs of personnel and passengers will be supplied by water bottles.

During the operation phase of the project, domestic wastewater will be generated from passengers and the personnel to be employed. The amount of wastewater will vary according to the number of passengers. Considering the maximum number of personnel and passenger exist at one station at a time 65 m^3/day is expected to be generated along the BBYO route during the operation phase. Considering that the amount of water consumption especially for the passengers will be less than 150 L/day/person during the travels, it is presumed that the wastewater amount to be generated will be much less than 455 m^3/day at the stations.

Wastewaters generated at the railway stations will be disposed to the municipality sewage systems. In case there is no sewage system, wastewater treatment plants will be established in line with the regulatory requirements where necessary approval and environment permits will be obtained, and discharge standards will be complied with.

3.5.2 Solid Waste

Domestic Solid Waste

During all phases of the project, domestic solid waste generation is expected from the daily activities of personnel and passengers. During the construction phase, maximum number of employees planned to be employed are 4300 workers. Assuming that average daily domestic solid waste per capita is 1.22 kg/person/day (average of 1.49 kg/person/day for Balıkesir, 1.09 kg/person/day for Bilecik and 1.08 kg/person/day for Bursa)[14], the amount of daily expected solid waste production during construction phase will be as follows:

Total number of people: 4300

Maximum amount of solid waste generation (construction) = 4300 people x 1.22 kg/person/day = 5.2 ton/day

During the operation phase, the amount of domestic solid waste will depend on the number of personnel employed in the Project including the locomotive personnel and station personnel and also the number of passengers. During the operation phase it is estimated that maximum 431 people will use one station at a time. There will be 7 stations along the BBYO route.

Total number of people: 431

Maximum amount of water used by people at one station: 431 people x 1.22 kg/person/day = 526 kg/day

Total amount of water used at 7 stations: 526 kg/day x 7 = 3.7 ton/day

During operation phase, similar waste management principles applied in the construction phase will apply for the Project. During construction phase domestic solid waste from the workers will be collected in closed containers located at various points of the construction site area. These solid wastes will be transported to the solid waste collection system belonging to closest Municipality be at certain intervals and be disposed of. Any recyclable solid waste such as plastics, papers, glass etc. will be collected separately for recycling purposes. Principles set in the Regulation on Waste Management will be followed in the Project. Necessary measures will be in place to comply with the Regulation on Zero Waste and Regulation on Waste Management.

The control measures to be implemented for different type of solid wastes are described below.

Packaging Waste

There would be packaging waste generation from the packaging materials used in the transport of equipment, from the packaging of the materials used and from the personnel in all phases of the project. The packaging wastes, e.g., packing paper, plastic and glass bottles will be collected separately from other wastes without considering material used and the source of the material and should be sent to licensed recycling facilities according to the Regulation on Control of Packaging Waste.

Construction Waste

Recyclable construction wastes such as woods, cement bags, metal scraps are expected to be generated during the construction phase of the project. All recyclable construction wastes will be segregated and collected separately on site and will be disposed by the Municipality or authorized company from municipality.

[14] Turkish Statistical Institute, 2018 Balıkesir, Bilecik & Bursa Municipality Solid Waste Statistics

Excavation Wastes

Excavation soil will be reused on site for the backfilling purposes and excess amounts will be stored in the storage areas to be established along the BBYO Route (Section 3.3.7.1.2). Excavation wastes will be disposed of in accordance with the Regulation on Control of Excavation Soil, Construction and Demolition Wastes.

Hazardous Wastes

The hazardous wastes that are possibly occurred within the scope of the project during construction phase of the project are fluorescent tubes, cartridges, print toners, transformers, paints/varnishes, waste lubricants. These wastes are occurred as a result of machine and equipment usage and hazardous waste produced by domestic usage and other wastes contaminated with these kinds of wastes.

The quantity of the hazardous wastes would be dependent on the activities in the construction sites and it is not possible to give exact information on the amount of the waste at this stage.

According to the provisions in the Regulation on Waste Management, the hazardous wastes would be stored temporarily within the construction site separate from other wastes in a closed environment preventing any chemical reaction. After that, these wastes would be sent via licensed transportation vehicles to hazardous waste disposal companies licensed by the Ministry of Environment and Urbanization.

During the storage of hazardous wastes following provisions will be implemented:

- A record shall be kept on the amount of the waste and packaging and labelling of the waste shall be according to the internationally accepted standards required by the environmentally licensed recycling or disposal facility which will receive the waste.
- The Waste Declaration Form indicated in the Regulation on Waste Management shall be filled and approved every year by the end of March with the previous year’s information using the web-based program prepared by the Ministry of Environment and Urbanization and a copy shall be stored for five years.
- The waste would be temporarily stored in durable, leak-proof, safe containers at international standards placed on a concrete or impermeable area away from the buildings of the construction site, there will be hazardous waste labels on the containers, the quantity and the stored date would be indicated on the container, if the containers are damaged, the waste would be transferred to other containers having the same specifications, containers would always be kept closed, and they would be stored so that the waste does not chemically react. Temporary waste storage permit will be obtained in case of more than 1 tons of hazardous waste storage in a month.
- Hazardous wastes can be stored in the temporary storage area for a maximum of 6 months.
- Regardless of the quantity of hazardous waste temporary storage areas / containers, Dangerous Goods and Hazardous Waste Compulsory Financial Liability Insurance shall be insured in accordance with the provisions of Article 16 of the Regulation on Waste Management.
- All the measures shall be taken for the health and safety of the employees responsible for the collection, transportation and temporary storage of the waste within the facility.
- In order to prevent pollution that happens as a result of accidental spill or by deliberate actions, depending on the type of the waste, location of the incident would be brought to its original condition by latest within a month from the time of the incident. Provincial Directorate shall be informed and a report detailing the

accident date, accident location, type and quantity of the waste, cause of the accident, the waste disposal action and rehabilitation of the accident location shall be submitted to the office of the governor.

Waste Batteries and Accumulators

The maintenance process during the construction and operation phase of the Project can result in generation of waste accumulators and batteries which will be stored in a closed containers with a leak-proof floor according to the Regulation on Control of Waste Batteries and Accumulators. Batteries shall be delivered to the collection points established by Municipalities on the BBYO route or by the companies distributing or selling batteries and waste accumulators shall be delivered to the temporary storage areas established by the companies distributing or selling accumulator products and maintenance companies.

Medical Wastes

Medical waste generation is expected during both the construction and operation phase of the Project due to potential first aid cases. Infirmaries will be established at the construction camp sites. In case of incidents requiring medical treatment, the nearest hospitals will be used (Please see Section 8.3.3.2). In case of any medical waste generated in the Project lifecycle, they will be collected separately in accordance with the Regulation on Control of Medical Wastes. Medical wastes will be collected from site according to the Medical Waste Protocol that will be signed with the Municipality. At a minimum the following control measures will be implemented for the management of medical wastes.

- Medical wastes will be placed inside the red plastic bags which are resistant to tearing, piercing, bursting and carrying; originally from moderate density polyethylene material, with double bottom seam and without pleats, with double ply thickness of 100 microns, with at least 10 kg holding capacity, carrying on both sides the warning symbol of “International Biohazard” and “ATTENTION! MEDICAL WASTE” with at an easily readable size. The bags will be filled at a maximum of ¾ capacity and closed tightly and when necessary double bagging having the same specifications will be made in order to ensure absolute leak-proofing.
- Medical wastes that have cutting and piercing properties will be collected separately from the other waste in a plastic or laminated cardboard having the same specification as piercing, tearing, breaking and bursting resistant, waterproof and leak-proof, could not be opened or tampered with, having the warning symbol of “International Biohazard” and warning of “ATTENTION! CUTTING AND PIERCING MEDICAL WASTE”. These collection containers will be filled at a maximum of ¾, closed tightly and put into red plastic bags.
- The amount of medical waste that are produced under the scope of the project will be recorded regularly according to the Regulation on Control of Medical Waste, sent to the Provincial Directorate of Environment and Urbanization. This information will be kept for at least three years and kept open to examination of the Ministry upon request.

Waste Oils

Waste oil generation can be expected during the maintenance and repair works both at the construction and operation phase. In case of any waste oil production at the work areas, the waste oil shall be collected in a closed temporary waste storage area with leak-proof floor and covered with a shelter. Waste oil types will not be mixed with each other and the collected waste oil will be given to a licensed waste oil recovery company according to the Regulation on Management of Waste Oil. Suitable control measures will be ensured to prevent overflow, spillage, leakage and similar situations at the temporary waste storage areas.

The Waste Declaration Form shall be filled and approved every year by the end of March with the previous year's information using the web-based program prepared by the Ministry of Environment and Urbanization and a copy shall be stored for five years.

Waste Vegetative Oils

The meals of the workers who will accompany at the camp sites will be prepared in the dining halls, which will result in the waste vegetative oil generation. Waste vegetative oil generation is not expected during the operation phase.

The reduction, separation, collection and recovery of waste vegetable oils at the source is essential. Vegetable waste oils will be disposed of by environmentally licensed recycling facilities and vegetable waste oil interim storage facilities in accordance with the provisions of the Regulation on Control of Vegetative Oils

Waste Tires

During lifecycle of the project, the maintenance activities of the vehicles and construction machines would be done in authorized services. If there is a need to change the tires of these vehicles and machines in the construction site area, the end of life tires that come out would be sent to tire distribution companies or to the authorized transporters. All provisions in the Regulation on the Control of End of Life Tires would be respected.

Waste Electrical and Electronic Goods

Any waste electrical and electronic good deriving from the project activities shall be taken to the collection places of the distributors, related municipalities, producers or processing facilities in accordance with the provisions of the Regulation on Control of Waste Electrical and Electronic Goods.

4.0 ANALYSIS OF ALTERNATIVES

4.1 No Project Option

"No project option" implies that Project will not be realized (i.e., the no go alternative), no construction activities will occur and therefore there will be no positive and negative environmental and social risks connected to the Project. Furthermore, no socio-economic benefits would accrue to the nearby communities and the government.

Currently, the rail transportation physical infrastructure is not developed enough in line with the transportation demand in Turkey. In order to ensure faster and safer travel between cities, high-speed train projects will need to be implemented on economical lines. In this respect, 2019-2023 Strategic Plan of TCDD aims to develop and expand the national rail network.

Failure to implement the proposed Project would involve missing the following opportunities:

- Loss opportunity to contribute to the national goal of increasing the ratio of railways in the intercity transportation of TCDD Strategic Plan,
- Loss opportunity to develop fast, safe and economical transportation in Turkey,
- Loss opportunity to increase in integration with other rail system lines,
- Loss of opportunity to create direct employment to workers.

4.2 Technology Selection

In the technology selection of the BBYO Project, the design criteria included electric locomotive engines instead of diesel-powered locomotives. The benefits of the electrified railways can be listed as following[15]:

- Diesel-powered trains transfer about 30-35 percent of the energy generated by combustion to the wheels, whereas about 95 percent of the energy is directly transferred from an overhead powerline to the wheels.
- In terms of cost benefits, electric locomotive engines' cost is about 20 percent less than diesel locomotive engines, similarly maintenance costs are 25-35 percent less than for diesel engines.
- According to many analysts, the diesel fuel prices tend to increase in the long-term.
- Use of electrical locomotives will help to reduce the air pollution including volatile organic compounds, nitrogen oxides, and sulphur oxides compared to diesel locomotives. This advantage of electrical railways become more important especially in the urban areas.
- Selecting cleaner energy sources compared to petroleum-based liquid transportation fuels will help to reduce the greenhouse gas emissions (Please see section 8.7.1 for further assessment on the comparison of the electrical railway and diesel hauled railway on the greenhouse emissions).

Based on the advantages listed above, BBYO Project which will be operated with electrical railway will not only be cost effective in the short- and long-term period, but the environmental impacts will also be minimized compared to a diesel hauled railway.

The Project will be developed in accordance with the agreed design and building criteria specified in the Construction Contract Technical Specifications. The Project description details are provided in Section 3.

4.3 Location Selection

4.3.1 Route Selection

In the BBYO route selection, after the corridor determined by the General Directorate of TCDD was processed on 1 / 25,000 scaled maps (topographical, geological, etc.), alternatives are evaluated with the survey studies carried out. The alternate routes assessment includes but not limited to the following:

- Meeting the project criteria
- Cost
- Roads
- Pipelines
- Irrigation areas and channels
- Energy transmission lines
- Geological structures (landslide, earthquake, etc.)
- Land use and existing settlements which would be impacted by the Project
- Expropriation

[15] https://www.itv.com/news/border/2014-11-28/electrified-trains-what-are-the-benefits

- Facilities along the route which would be impacted by the Project (i.e., proximity to the dams and hydroelectric power plants)
- Proximity to the legally protected areas

The route assessment processes can be summarised as following for the BBYO Project sections:

Section 1 - Yenişehir-Osmaneli (between 101+700 - 149+670)

In the route alternatives assessment of the Yenişehir-Osmaneli section, seven different route alternatives were assessed which are explained below.

Route Alternatives for Section 1 - Yenişehir-Osmaneli:

Route studies were conducted on seven lines including Alternative-1 (Blue), Alternative-2 (Green), Alternative-3 (Orange), Alternative-4 (Brown), Alternative-5 (Red), Alternative-6 (Yellow) and Alternative-7 (Khaki) as shown in Figure 26. Based on the below explained assessments, Alternative-5 (Red) was chosen as the most suitable route for the Yenişehir-Osmaneli section.

All of the route alternatives proceed on the alluvial plains of the Yenişehir plain between ~ KM: 88+000-102+000.

Alternative-1: The Alternative-1 corridor consists of the same corridor as the Alternative-5 corridor, up to the Köprühisar District. After KM 118+000, it leaves the Alternatif-5 route, continues from the north of Köprühisar and enters the tunnel at Dereyörük. In the Alternative-1 corridor the total length of the tunnel at Dereyörük location has been elongated compared to Alternative 5. After exiting from the tunnel in Dereyörük and after crossing the new Göksu Dam with two bridges, Alternative-1 joins with the Alternative 5 route in the Orhaniye District. If the Alternative-1 route is constructed after the new Göksu Dam, the water level will need to be lowered. During this time, the dam will not be able to generate electricity. In Alternative-5, the route is passed without being affected by the dam area at a low cost.

Alternative-2: It follows the same line up to KM 119+000 with the Alternative 5 corridor. After separating from the Alternative-5 route, Alternative-2 route has been designed to continue through the north of Köprühisar and Hayriye Villages and does not enter the new dam area and passes through tunnels on the north of the dam area. At KM 134+000, it joins with the Alternative-5 corridor. In Alternative-2, the tunnel length has increased therefore the cost has increased compared to Alternative-5.

Alternative-3: Alternative-3 Corridor leaves the Alternative-5 corridor at KM 113+500 and continues from the south of the Çelebi location and enters a long tunnel in Terziler locality. According to the landslide maps of the General Directorate of Mineral Research and Exploration (MTA), it was determined that there is an active landslide in the northern part of Terziler locality. In the field investigations, flows were observed in this region and slope debris was detected. For this reason, a long tunnel was passed from the south of Terziler location in a way not to be affected by the landslide area. Since the tunnel length exceeds 5 km in this region, a double tube tunnel project can be applied. Alternative-3 route continues from the south of Eyerce, Çiftlik and Düzmeşe locations and joins with the Alternative-5 line at KM 141+300. Compared to Alternative-5, it was found that alternative-3 is more expensive and passes through a weaker ground.

Alternative-4: After passing the Yenişehir Airport Station, Alternative-4 separates from other alternatives and continues south of the district centre of Yenişehir. It continues by cutting Göksu Stream and drying channels in more than one place. It also affects the agricultural lands in this section. It was found that this alternative is more costly compared to the Alternative-5 route and it was predicted that the groundwater level is high considering the drying channels, Göksu Stream and agricultural lands in that region since it passes through the south of Yenişehir District. It was also seen that Alternative-4 route proceeds from the section where weak ground conditions continue.

Alternative-5: This alternative route does not pass within the impact area of Göksu Dam. A tunnel was passed from the south of Osmaneli district center without damaging the properties. After the tunnel exit, the Sakarya River and Adapazarı-Bilecik road were crossed with a viaduct for the high speed railway connection, and the connection to the existing İstanbul - Ankara High Speed Railway line was provided. In Alternative-5, the total number and length of engineering structures is less than other alternatives.

Alternative-6: At about KM 113+000, Alternative-6 leaves the Alternative-5 corridor and continues from the south of Çelebi village and enters a long tunnel in Terziler locality. In order not to be affected by the landslide zone previously specified for Alternative-3 route, this area has been crossed with a tunnel from the south. Then the line continues with the tunnel over the Orhaniye village and joins with the Alternative-5 route at KM 132+000. In the section where it leaves Alternatif-5, the length of the route was shortened about 300 m, however the tunnel length and cost was increased. Due to the fact that there is a tunnel exceeding 5 km for this route, a double tube tunnel project had to be applied.

Alternative-7: In this alternative, the connection alternative to the İstanbul - Ankara High Speed Railway connection was examined by connection to the existing conventional lines. Alternative-7 route disconnects from the Alternative-5 route at KM 142+000 and connected to the conventional line that goes to Istanbul in the north and Ankara in the south. This alternative resulted in the route length of approximately 6 km, decrease in the Project geometric standards and increase in the cost.

Based on the decision on Alternative-5 route for Yenişehir-Osmaneli Section, official opinions of the relevant institutions have been obtained as part of the EIA Process.

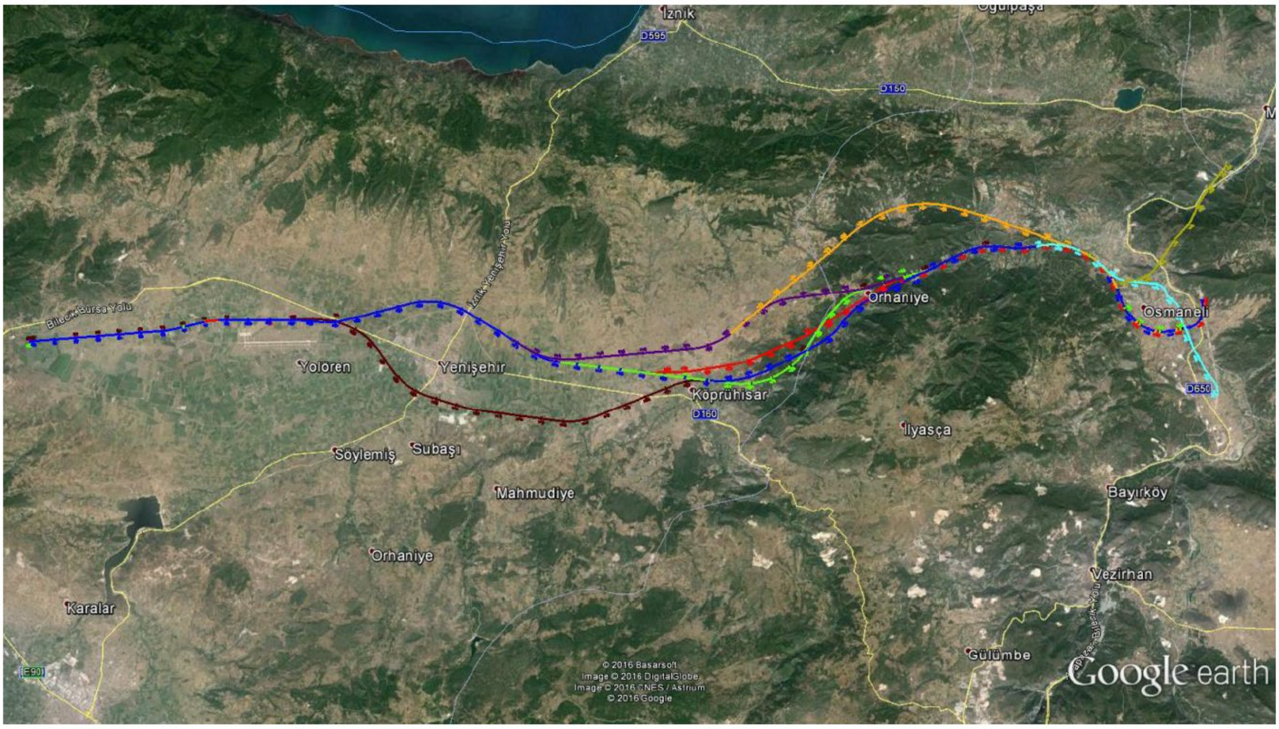


Figure 26 Route Assessment for Yenişehir-Osmaneli Section

Section 2 - Bursa-Yenişehir, (between 46+000 - 101+700)

The infrastructure works in this section are currently carried out under another contract by TCDD. According to the Construction Contract, Kalyon İnşaat Sanayi ve Ticaret A.Ş. is responsible from the superstructure, electrification, signalling and telecommunication works for this section.

In the route alternatives assessment of the Bursa-Yenişehir section, four different route alternatives were reported to be assessed which are explained below. The route selection has been finalized as the black route shown in Figure 27.

Alternative-1: The alternative 1 which is shown in pink colour was assessed to be too long compared to other alternatives and considering the terrain conditions this route would require too many tunnels which is not economical as well. It was also identified that the alternative-1 passes through heavily undisturbed areas, therefore this option was eliminated considering the number of non-feasible disadvantages of the route compared to other alternatives.

Alternative-2&3: The Alternative 2 and 3 are shown in yellow and green colours, respectively. Compared to the other route alternatives, it was assessed that the amount of settlements and agricultural land directly affected by the project is increasing a lot in these alternative 2 and 3. Both alternatives were concluded to create an obstacle on the health growth of the city. Alternative 2 is also reported to have potential impacts on the lakes passing through. Therefore, considering these of non-feasible disadvantages Alternative 2 and 3 were eliminated.

Alternative-4: Alternative-4 route shown in black colour which is the selected and currently under construction was assessed considering the type of the lands passing through and it was noticed that the directly affected settlements and agricultural lands are minimum compared to other three alternatives. Since the route is passing through the slope of the mountain it does not hinder the healthy growth of the city.

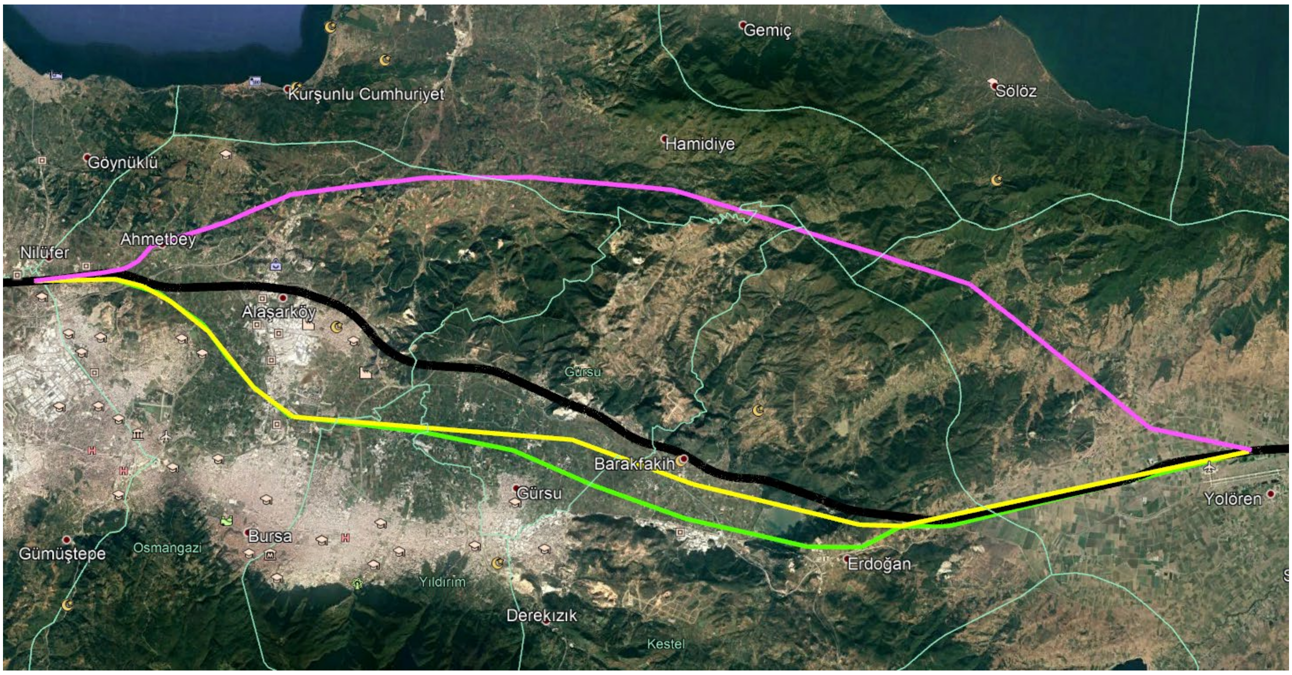


Figure 27 Route Assessment for Bursa-Yenişehir Section

Section 3 - Bandırma-Bursa, (between 0+000 - 97+000)

The detail route design of section 3 has not been finalized yet. Environmental and Social components are taken into consideration while determining the most appropriate route. Whilst the route selection studies are currently undertaken, especially the cultural heritage component is considered within the scope of ESIA studies considering the primary goal of the Project is to prevent any adverse effect on the archaeological and cultural heritage assets. The possible route changes on the alignment where the route had overlapped with archaeological findings were expeditiously re-considered by the Project Engineering Department. Accordingly, some route changes were realized (please see Section 8.3.6 and Table 184).

The design of Section 3 is also aimed to minimize physical displacement, reduce land acquisition where possible and applicable. The project alignment mainly follows the existing railway which is and advantage of where residential development and private land ownership is lower.

4.3.2 Location of the Temporary Facilities

Specialised materials will be required for the construction of the BBYO Project including all Project components such as main track, engineering structures, stations, etc. In this respect, suitable gravel and fill materials shall be selected to meet the Project technical criteria.

For the selection of the location of the temporary facilities presented in Section 3.3.7, the following aspects were prioritized:

- Borrow sites and quarries that will provide the suitable type of materials meeting the Project criteria.
- Minimum distance of the temporary facilities to the BBYO route

Try to avoid natural habitats whilst positioning the temporary facilities. Utilization of the existing modified habitat for placement of temporary facilities was prioritized as much as possible as part of the ESIA study. In this respect, the location and number of the planned storage sites was revised from 6 to 5 and the locations were moved in order to avoid the use of natural habitat in the remaining locations. The previous locations and the modifications applied for the storage areas considering the impacts on the natural habitats area summarised in table below.

Table 27 Associated Facilities Location Assessment on the BBYO Route

Sites Type	Sites Name	Natural/ Modified Habitat	Habitat Type	EUNIS	Confirmed/ Cancelled/ Moved	New Site Name	Natural/ Modified	New Habitat type	New EUNIS	Area, ha
Storage Area	Bandırma Doğruca 114-89	Natural	Grassland	E2.1 - Permanent mesotrophic pastures and aftermath-grazed meadows	Cancelled	-	-	-	-	-
Storage Area	Karacabey Arız 0-191	Natural	Grassland	E2.1 - Permanent mesotrophic pastures and aftermath-grazed meadows	Moved	Depo-Karacabey Canbaz 0 - 2759	Modified	Artificial forestry plantations	G3.F - Highly artificial coniferous plantations	5.01
Storage Area	Nilüfer Çayli 0-1324	Modified	Artificial forestry plantations	G1.C - Highly artificial broadleaved deciduous forestry plantations	Moved	Depo - Karacabey Muratlı 0-580	Natural	Grassland	E1.C - Dry Mediterranean lands with unpalatable non-vernal herbaceous vegetation	5.02

Sites Type	Sites Name	Natural/ Modified Habitat	Habitat Type	EUNIS	Confirmed/ Cancelled/ Moved	New Site Name	Natural/ Modified	New Habitat type	New EUNIS	Area, ha
Storage Area	Nilüfer Badirga 0-3511	Natural	Forest	G1.7 - Thermophilous deciduous woodland	Moved	Adsız Çokgen	Modified	Artificial forestry plantations	G3.F - Highly artificial coniferous plantations	8.02
Storage Area	Bandırma Kuşcenneti 0-355	Natural	Grassland	E2.1 - Permanent mesotrophic pastures and aftermath-grazed meadows	Moved	Depo - Bandırma Akçapınar 104-19	Natural	Forest	G1.7 - Thermophilous deciduous woodland	8.02
Storage Area	Karacabey Canbaz 0-2758	Modified	Artificial forestry plantations	G3.F - Highly artificial coniferous plantations	Moved	Depo Karacabey Canbaz 0-2758	Modified	Artificial forestry plantations	G3.F - Highly artificial coniferous plantations	8.02

The construction activities in Section 2 were started by Çelikler ve Duygu in 2016 and 2017, respectively and the temporary facilities in Section 2 were established within the scope of these works. No location alternative assessment could be conducted for the temporary facilities for Section 2 as part of this ESIA.

5.0 STAKEHOLDER ENGAGEMENT

5.1 Stakeholder Engagement Plan

Stakeholders are identified as any person, group, or organisation with a vested interest in the outcome of the Project. For this Stakeholder Engagement Plan (SEP), a stakeholder is defined as a key stakeholder when having a significant influence on the project or may be impacted (either positive or negative) by the Project. Stakeholder groups identified for the Project are;

- National Governmental Organizations,
- Local Governmental Organizations,
- Public Economic Enterprises
- Non-governmental organizations,
- Mukhtars, local communities and local residents,
- Vulnerable groups,
- Local businesses,
- Universities,
- Local media,
- Lenders of the Project, and
- Direct and indirect Project workers.

A specific SEP is currently being prepared for the Project. The overall objectives of the SEP are:

- Continuously informing the local community about the Project related development activities,

- Ensuring that the local community is informed about the hazards associated with construction, operation activities of the Project and mitigation measures implemented to reduce impacts where possible,
- Minimizing potential disputes between Contractor's and Subcontractors' and the local community,
- Incorporating local knowledge during the entire Project life cycle, by taking into account bottom up information and feedback provided by local communities; and
- Timely and effectively responding to community concerns regarding the issues such as employment of the local workforce reserve in the construction and operation phases, disruption to daily activities, safety issues, disturbances due to noise or dust, and other environmental and social issues.

A Grievance Mechanism will be set up as part of the SEP for communities and individuals to formally communicate their concerns, complaints and grievances to the company and facilitate resolutions that are mutually acceptable by the parties.

5.2 Stakeholder Management Activities Realised

5.2.1 Engagement for National Environmental Impact Assessment

The Project's Yenişehir-Osmaneli Section and Yenişehir-Osmaneli Section have secured the EIA Not Required decision, therefore no consultation activities were carried out. The EIA process of the Bandırma-Bursa section is not yet initiated, and no consultation activities were conducted in this section as well.

5.2.2 Engagement for ESIA

A fieldwork was carried out between 24th of March 2021 and 31st of March 2021 for social baseline and impact assessment studies. Within the scope of the social field study, the neighbourhoods and villages on the project route were visited and a community level survey and household questionnaire were applied.

The demographic information of the neighbourhoods was collected through the community level questionnaire, and through the household questionnaire, both the demographic structure of the households and the Project impacts, including expropriation, were asked to the participants. Social studies were carried out in the provinces of Bilecik, Bursa and Balıkesir, which are located on the route, and a total of nine districts of these provinces were visited. The survey numbers of the conducted study and the villages and neighbourhoods visited within the scope of the project are presented in the table below.

Table 28 Social Survey Information

Province	District	Village Neighbourhood	Number of the surveyed households
Bursa	Yenişehir	Akdere	1
Bursa	Yenişehir	Köprühisar	3
Bursa	Yenişehir	Çardak	4
Bursa	Yenişehir	Ebeköy	3
Bursa	Yenişehir	Papatya	3
Bursa	Yenişehir	Karacaali	1
Bursa	Gürsu	Karahıdır	8
Bursa	Yenişehir	Kazıklı	4
Bursa	Yenişehir	İğdir	5

Province	District	Village Neighbourhood	Number of the surveyed households
Bursa	Yenişehir	Seymen	3
Bursa	Karacabey	Akçakoyun	7
Bursa	Karacabey	Hayırlar	1
Bursa	Karacabey	Taşlık	6
Bursa	Karacabey	Fevzipaşa	1
Bursa	Karacabey	Karasu	1
Bursa	Karacabey	Çekrice	1
Bursa	Karacabey	Çeşnigir	3
Bursa	Karacabey	Çamlık	1
Bursa	Karacabey	Şahinköy	3
Bursa	Karacabey	Danişment	2
Bursa	Karacabey	Muratlı	2
Bursa	Karacabey	Çamlıca	1
Bursa	Karacabey	Hürriyet	2
Bursa	Karacabey	Harmanlı	1
Bursa	Mudanya	Balabancık	3
Bursa	Mudanya	Dedeköy	8
Bursa	Mudanya	Hasköy	1
Bursa	Nilüfer	Yolçatı	2
Bursa	Nilüfer	Doğanköy	1
Bursa	Nilüfer	Balat	1
Bursa	Nilüfer	Badırga	3
Bursa	Kestel	Gölbaşı	2
Bursa	Kestel	Barakfakih	4
Bursa	Kestel	Narlıdere	5
Bursa	Kestel	Dudaklı	2
Bursa	Osmangazi	Barbaros	5
Bursa	Osmangazi	Çağlıyan	6
Bursa	Osmangazi	Alaşar	2
Bursa	Osmangazi	Dereçavuş	11
Bursa	Osmangazi	İsmetiye	2
Bursa	Osmangazi	Geçit	4
Bursa	Osmangazi	Aksungur	1
Bilecik	Osmaneli	Dereyörük	1

Province	District	Village Neighbourhood	Number of the surveyed households
Balıkesir	Bandırma	Akçapınar	1
Balıkesir	Bandırma	Doğruca	1
Balıkesir	Bandırma	Kuşcenneti	2
Balıkesir	Bandırma	Ömerli	1
Balıkesir	Bandırma	Kirazlu	1
TOTAL			137

The expropriation procedures have been completed in the area where Duygu and Çelikler (Bursa-Yenişehir Section) continue the construction activities. In the interviews held in this area, some participants highlighted the social issues regarding the construction process, including blasting, dust, inadequate waste management, and insufficient expropriation values. Although Kalyon is not responsible from the ongoing construction activities in Section 2, Kalyon is committed to continuous communication via appropriate communication methods to ensure that suitable and sufficient environmental and social mitigation measures are implemented in Section 2 which are currently led by TCDD.

During interviews, in areas where expropriation procedures and construction have not started, there are concerns about the division of agricultural lands, impacts on irrigation resources, access to pasture areas, access to agricultural lands. Further information about the social components of the Project are presented in Section 7.3 and impact assessment is presented in Section 8.3.

6.0 IMPACT SCREENING AND DEFINING OF THE VALUED ENVIRONMENTAL AND SOCIAL COMPONENTS

6.1 Identification of Area of Influence

The Area of Influence ("AoI") of the Project is the area in which a direct or indirect impact on the biological, physical and social components might occur.

According to IFC's PS1, the project area of influence encompasses, as appropriate:

- The area likely to be affected by: (i) the project 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 (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.
- Cumulative impacts 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.

A Study Area ("SA") is defined for each environmental and social component.

With reference to the physical components, SA is expected to encompass the area affected by all potential environmental impacts (e.g., noise, terrestrial flora and fauna and air quality impacts), and it is consistent with the methodologies adopted by other studies of similar projects.

With reference to the Social components a Social Study Area is identified based on socio-economic and administrative considerations and includes the provinces of Balıkesir, Bursa and Bilecik and the relevant district where the BBYO Route passes.

The BBYO Project AoI is presented in **Figure *28***.

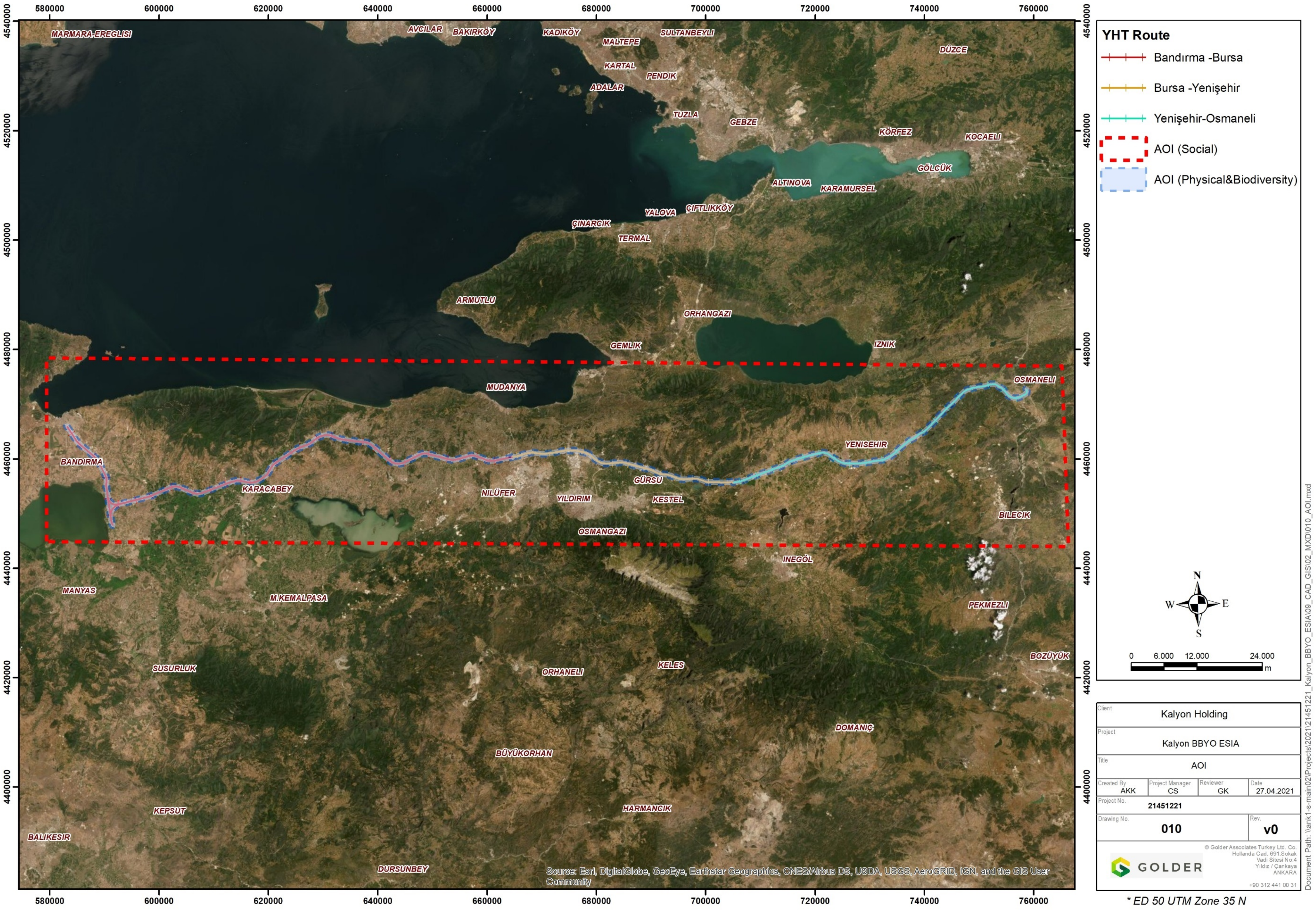


Figure 28 BBYO Project Area of Influence

6.2 Identification of the Project Actions

Activities or project actions that could potentially contribute to environmental or social changes during the construction, operational and decommissioning phases have been identified from the project description and from the documents provided by the Contractor. Project actions which can interfere significantly with the environment are listed below for each phase.

Construction phase

- Surface levelling and grading
- Temporary stockpiling of material
- Operation of temporary facilities during the construction
- Transportation of construction materials
- Assembling the railway track
- Disposal of waste deriving from construction
- Increase of water needs and wastewater generation

Operation phase

- Operation of the railway and stations
- Disposal of waste deriving from operation
- Disposal of domestic wastewater

Decommissioning/Closure phase (Not foreseen)

- Disassembling
- Disposal of waste deriving from disassembling
- Transport of dismantled material
- Land reclamation and restoration

6.3 Identification of the Components

After the identification of the Project actions, in order to identify the components potentially impacted by the project actions, matrixes have been created to link environmental, biological and social components to Project actions.

Table 29:Matrix for Physical Components

Project Phases	Actions	Geology and Geomorphology	Air quality	Noise and vibration	Hydrogeology and groundwater quality	Soil and subsoil	Hydrology and surface water quality	Traffic and infrastructures
Construction phase	Surface levelling and grading	√	√	√		√		√
	Temporary stockpiling of material	√				√		
	Operation of temporary facilities during the construction	√	√	√	√	√	√	√
	Transport of construction material	√	√	√		√		√
	Assembling the railway track		√	√		√		√
	Disposal of waste deriving from construction		√	√	√			√
	Increase of water needs and wastewater generation				√		√	√
Operation phase	Operation of the railway and stations		√	√		√		√
	Disposal of waste deriving from operation		√	√	√			√
	Disposal of domestic wastewater			√				√
Decommissioning/ Closure phase	Disassembling			√				√
	Disposal of waste deriving from disassembling			√				√
	Transport of dismantled material		√	√				√
	Land reclamation and restoration							

Table 30 Matrix for Biological Components

Project Phases	Actions	Terrestrial Flora	Terrestrial Fauna	Terrestrial habitats	Protected Areas and internationally recognized areas
Construction phase	Surface levelling and grading	√	√	√	√
	Temporary stockpiling of material	√	√	√	√
	Operation of temporary facilities during the construction	√	√	√	√
	Transport of construction material	√	√	√	√
	Assembling the railway track	√	√	√	√
	Disposal of waste deriving from construction	√	√	√	√
	Increase of water needs and wastewater generation	√	√	√	√
Operation phase	Operation of the railway and stations	√	√	√	√
	Disposal of waste deriving from operation	√	√	√	√
	Disposal of domestic wastewater	√	√	√	√
Decommissioning/ Closure phase	Disassembling	√	√	√	√
	Disposal of waste deriving from disassembling	√	√	√	√
	Transport of dismantled material	√	√	√	√
	Land reclamation and restoration	√	√	√	√

Table 31 Matrix for Social Components

Project Phases	Actions	Demographic profile and land use, Employment and socio-economic conditions, Social capital	Health issues and facilities, Education issues and facilities	Cultural Heritage
Construction phase	Surface levelling and grading		√	√
	Temporary stockpiling of material		√	
	Operation of temporary facilities during the construction	√	√	
	Transport of construction material	√	√	
	Assembling the railway track	√	√	
	Disposal of waste deriving from construction		√	
	Increase of water needs and wastewater generation	√	√	
Operation phase	Operation of the railway and stations	√	√	
	Disposal of waste deriving from operation	√	√	
	Disposal of domestic wastewater	√	√	
Decommissioning/ Closure phase	Disassembling	√	√	
	Disposal of waste deriving from disassembling		√	
	Transport of dismantled material	√	√	
	Land reclamation and restoration	√	√	

6.4 Identification of the Impact Factors

Based on the components and Project actions previously listed, the preliminary main impact factors which are direct or indirect interferences produced by the project actions on the environment, able to influence the state or quality of one or more environmental and social components can be listed as following:

- Emission of dust
- Emission of noise
- Pollutant emissions to the soil
- Hydrogeological change

- Hydrological change
- Discharge of wastewater
- Changes of morphology
- Introduction of buildings / infrastructures
- Increase of vehicular and railway traffic
- Vegetation and topsoil removal
- Changes in local hydrology and water quality
- Introduction and spreading of alien species
- Population changes
- Employment opportunities
- Demand for goods and services
- Economic contribution during the operation
- Physical displacement
- Loss of agricultural land
- Access to ecosystem services
- Temporary loss of livelihoods

In order to show the correlation among the project actions, the impact factors for different phases and the single components potentially impacted, the correlation matrices have been created and presented in below.

The correlation between impact factors and the components are given in below table.

Table 32 Matrix for Physical Components and Impact Factors

Impact factor / Component	Emission of dust	Emission of noise and vibration	Pollutant emissions to the soil	Hydrogeological change	Hydrological change	Discharge of wastewater	Changes of morphology	Introduction of buildings / infrastructures	Increase of traffic	Topsoil and lower soil removal
Geology and Geomorphology							√			
Air quality	√									
Noise and vibration		√								
Hydrogeology and groundwater quality				√		√				
Soil and subsoil			√							√

Hydrology and surface water quality					√	√				
Traffic and infrastructures									√	

Table 33 Matrix for Biological Components and Impact Factors

Impact factor / Component	Vegetation and topsoil removal	Changes in local hydrology and water quality	Increase in vehicular traffic	Emission of noise and vibration	Introduction and spreading of alien species
Biological components	√	√	√	√	√

Table 34 Matrix for Social Components and Impact Factors

Impact factor / Component	Population changes	Employment opportunities	Demand for goods and services	Economic contribution during the operation	Increased Traffic	Physical displacement	Loss of agricultural land	Access to ecosystem services	Temporary loss of livelihoods
Social components	√	√	√	√	√	√	√	√	√

7.0 ENVIRONMENTAL AND SOCIAL BASELINE

As a first step of the overall impact analysis methodology a definition of the current state or quality of the different environmental and social components potentially impacted based on the results of the baseline studies is required.

According to IFC guidelines, baseline studies should identify any relevant condition associated with existing project that could be impacted by the project to be financed and could lead to cumulative impacts. Baseline studies of biodiversity resources provide a reference point against which any future changes associated with a project can be assessed and offer information for subsequent monitoring of biodiversity performance.

The baseline data were collected through literature survey and desktop studies and supported by data collection at site. The literature sources that are referred but not limited to;

- Turkish Statistical Institute

- Ministry of Environment and Urbanization database
- Related Municipalities
- National and international published resources

Additional site data collection is performed for physical, biological and social components. The methodology of the baseline data collection and the analysis of baseline data for each component are explained in sections below.

7.1 Physical Components

7.1.1 Study Area

The study area of physical components is presented in Section 6.1.

7.1.2 Sensitivity Assessment

Each environmental and social component in the area of influence of the project has a different sensitivity to the impact factors generated by the project or can pose a different level of risk to the project. The sensitivity of an environmental component is typically evaluated on the basis of the presence/absence of some features which define both the current degree of the environmental quality and the susceptibility to environmental changes of the component.

Based on the information collected with the methodology described in each physical component section, the sensitivity of the component was determined according to the using component specific-metrics during the baseline and can assume values between 1 and 5 (i.e., Low, Medium-low, Medium, Medium-high and Very high).

7.1.3 Geology and Geomorphology

7.1.3.1 Regional Geology

In the project area, there are Pre-permian regional metamorphic rocks, Paleozoic (Permian), Mesozoic (Jurassic, Cretaceous), Cenozoic (Paleocene, Eocene, Neogene, Quaternary) aged sedimentary rocks, magmatic rocks younger than Eocene, and pyrometamorphic rocks and cataclastic metamorphic rocks formed in relation to the faults.

The borders of the formations and members, their thickness and the symbols from the rock stratigraphic units are displayed in the generalized stratigraphic section.

Paleozoic

In the investigation area, the Pre-Permian regional metamorphic rocks which make the oldest basement, being in low pressure type green schist facies, are formed by Dereköy Metamorphites and İznik Marble.

Dereköy Metamorphites (Pzd)

They are in graded contact and conformaible with the iznik Marble. Dereköy Metamorphites are found unconformable with the overlapping sandstones of Sarmaşık formation (Lower-Upper Permian).

The classification and nomenclature of the metamorphic rocks are made according to A. MIYASHIRO (1973). Rock groups have been subdivided to subclasses according to textural specifications. Within the metamorphic rock groups of the Dereköy Metamorphites, three members are also identified according to the law of stratigraphical no-menclature. The occasional repetition of these rock groups together with the members constitute Dereköy Metamorphites. These groups are identified as the following;

I. ***PELITIC METAMORPHIC ROCKS (METAPELITES)***

Pelitic Metamroiphic rocks contain abun-dant AL2O3 and K2O. The shistosity is signi-ficant when there is abundant mica and fine minerals. The increase in the pressure and temperature effect the new mineral reactions. The most abundant minerals are muscovite and chlorite. As it is in metapelites, they are together with quartz.

II. ***METAMORPHIC ROCKS DERIVED FROM CALCEROUS SEDIMENTS – Marble***

The metamorphic rocks derived from calcerous sediments are seen in the form of marble. If the $CaCO_3$, percentage is high in the limestone which is the original rock, then pure marble is formed. If it contains SiO_2, clayey materials and rock fragments, then micaceous marble is formed, and thus, it ma-kes the schistosity more significant.

III. ***BASIC METAMORPHIC ROCKS (METABASITES)***

The term "metabasites" is offered by HACKMAN (1907) and is applied by MIYAS-HIRO (1973). These metabasites which are rich with MgO, FeO, CaO and Al2O3, contain minerals as epidotes, chlorites and actinolites, muscovites and biotites. These characte-rize the green schist facies having low temperature.

There are formations of mineral assemblages as muscovite-chlorite in the slatephylites and schist of metapelites; epidote-chlorite, muscovite in the slate-phylite, phylite and schists of the metabasites; epidote-chlo-rite-actinolite and epidote-calcite-actinolite in the schists of metabasites; and epidote-chlo-rite-calcite in some of the marbles, all belonging to Dereköy Metamorphites. According to the above mentioned mineral assemblages, it is understood that the Dereköy Metamorphites are formed in the low pressure type green schist facies.

In the orogenic belts, the sedimentary deposits together with the basaltic volcanites in between them have gone through metaorphism. Because of this reason, it is under possibility to observe the same mineral assemblages in the metasedimentites and the metabasites recrystallized under the same temperature and pressure.

İznik Marble (Pzi)

This Formation graded contact and conformable with the Dereköy metamorphites. The Dereköy Metamorphi-tes lying bleow are overlapped by the Lower- Upper Permian aged Sarmaşık formation and are unconformable with them.

Permian

Sarmaşık Formation (Ps)

This formation is formed by grey, yellow-grey sandstones which cover the metamorphic rock particles and the Sarısu limestone member which is found within these sandstones in the shape of wedge, lense and beds. In the sandstones, there are lithologies such as feldispathic quartz arenite, feldispathic (quartz) arenite, feldis-pathic quartz wacke, feldispathic (quartz) wacke, wacke pebbled feldispathic quartz arenite, metaquartzite pebbled feldispathic quartz arenite, carbonate cemented quartz arenite; in the limestone beds and tenses which are situated in the sandstones and in the limestones which belong to Sarısu limes-tone member, there are crystallized micrite, crystallized biomicrite, crystallized fossiliferous micrite, algal biomicrudite, algalbiomicrite. The age of this formation is Lower- Upper Permian which is determined according to carbonate sandstones situated in the upperlayers and Fusulinidae and Algae which are discriminated in the Sarısu limestone member and the limestone layers of the formation.

Yeni Şeferiye Limestone (Py)

The Limestone lies as graded contact and conformable with the sandstones of Sarmaşık Formation. It is formed by grey-black and grey colored sandy and silty limestone at the lower part and rather grey and white colored homogenous limestone at the upper la-yers. In these li-mestones, there are lithology types such as crystallized fossiliferous micrite, crystallized biomicrite, fossiliferous sparite, crystallized algal biomicrite, sparite, sandy biomicrospar-rudite, silty biomicros- parrudite, silty biomicrudite, biosparite, ibios- parrudite, intrabiosparite, fossiliferous spari-te, biomicrite, biomicrudite. It contains a lot of Fusulinidae and Algae and the age is Upper Permian due to these factors.

MESOZİC

Jurassic

Yardankaya Limestone (Jy)

This unit has angular unconfor-mity on the Upper Permian aged Yenişerefiye limestone and consists of white, cream-white limestone, The typical location is at Yardankaya. This location is used in the formation nomenclature.

Cretaceous

Karadin Formation (Kk)

This formation, ge-nerally being angular unconformable on Dereköy metamorphites and so-metimes on sandstones of Sarmaşık formation, consists of grey, yellow grey, white grey, pink white, grey, dark green grey, olive, red, dark red conglo-merate, pebbly sandstone, sandstone, siltsto-ne, clayey siltstone, claystone, shale, marn, radiolarite, radiolarian marn, radiolarian li-mestone, clayey limestone and limestone alternation and Upper Jurassic-Lower Creta-ceous, Middle -Upper Jurassic aged Limestone blocks existing in the form of olistolite. The formation, according to the lithologies and the fossils it covers, is formed in an alternating shallow and deep water.

Nushetiye Formation (Kn)

Nushetiye formation has vertical and lateral graded contact and conformity with the Karadin Formation lying be-low. The boundary is sometimes unclear and over it, there is the Lower-Middle Paleocene aged Yağhane Limestone which has graded contact and conformity. Nushetiye formation is formed by green grey, red grey, blue grey and grey colored sandstone (lithic arenite, quartz arenite) and claystone interbedded thick conglomemte level at the bottom sandstone interbedded shale and claystone alternation, clayey limestone, marl, mudstone, conglomerate, sandstone and carbonate sandstone alternation, sandstone calcerous sands-tone and limestone interbedded calcerous sandstone with orbitoides and Siderolites on the upper level. There are three limestone members which was identified with in the Nushetiye Formation seperately.

Senozoic

Paleocene

Yağhane Limestone (Tya)

It is typically observed in the Yağhane Dere and lies on the NW edge of Derbent Village. It is conformable and lies with graded contact on the Nushetiye formation aged Upper Cretaceous. Ay-doğdu formation lies un-conformable over it. Yağhane limestone is white grey and grey colored, uniform in texture, has mono-tonous sequence and is formed by lithologies as Algal biosparrudite, corall Ibiosparrudite, Algal biomicrudite, corall biomicrudite, silty biosparrudite, sandy coral biomicrudite, silty Algal biosparrudite and silty corall biosparru-dite.

Aydoğdu Formation (Ta)

Aydoğdu formation which has angular unconformity on Yağhane limestone, covers Orbitoides sp. and sandstone particles with Orbitoides and Globotruncana aged Upper Cretaceous and Yağhane limestone pebbles which are fossiliferous and aged Lower - Upper Paleocene. This formation is overlied as unconformable by the Neogene aged Yenişehir formation. The sequence which is yellow grey, grey white, pink orange, red, sometimes grey green colored, is formed by alternations of sandstone, calcerous sandstone, clayey bio-micrite, polymictic conglomemte, silty clayey biomicrite, quartz arenite, siltstone, claystone and partially crystallized biomiclite.

Eocene

Derbent Formation (Td)

The outcrops of this unit are situated in the villages of Hocaköy and çam-dibi, Derbent and Beypınar villages and in the areas surrounding these localities. Derbent formation has angular unconformity on Nushetiye formation and Yağhane Limestone. And it is overlapped by the Yenişehir formation which is unconformable with it. The Derbent formation is cut by Pyroxene andesite. The formation is composed by the alternation of yellow grey, dark yellow, yellow white colored sandstone, clay-stone, siltstone and shale. There are volcanic tuffs which rarely contain quartz and generally contain alkali feldspars, plagioclase minerals and sometimes vol-canic rock particles are asitic and with glassy ground mass, found locally and rarely in between the layers of this formation. Within this formation, richly fossilife-rous Beypınar silty limestone and Hırsızkaya limestone members at the bottom, and Saracık sandstone member at the top are distinguished.

Neogene

Miocene

Yenişehir Formation (Ty)

This formation has an-gular unconformity with the Cretaceous, Paleocene, Eocene aged deposits and Middle, Up-per Eocene aged volcanites and has graded contact and conformity with the Çamlik Limestone lying over it. Yenişehir formation is formed by medium, medium-thick bedded, roughly bedded, unbedded, cross bedded, red violet and sometimes yellow white colored blocked conglomerate, blocked sandstone, polygenic conglomerate, gravel, sandstone, mudstone, marl, detritic limestone alternations. The formation is formed generally in the shallow parts of fresh lake water. The presence of cross bedding with blocks carried by streams and flows shows that these are the channel filling of the marginal facies.

Çamlık Formation (Tf)

Çamllk limestone is observed typically in Çamllk Tepe, 9 km East of Yenişehir district and is generally white and sometimes yellow-white in color. Çamlık limestone which has graded con-tact and conformity on Yenişehir formation, is formed by alternation of detritic limestone and White, yellow white, porous micrite, clayey micrite, and sandy mictite.

Quaternary

Quaternary is identified by İznik Formation, travertine, alluvium, terrace and slope waste (Holocene) .

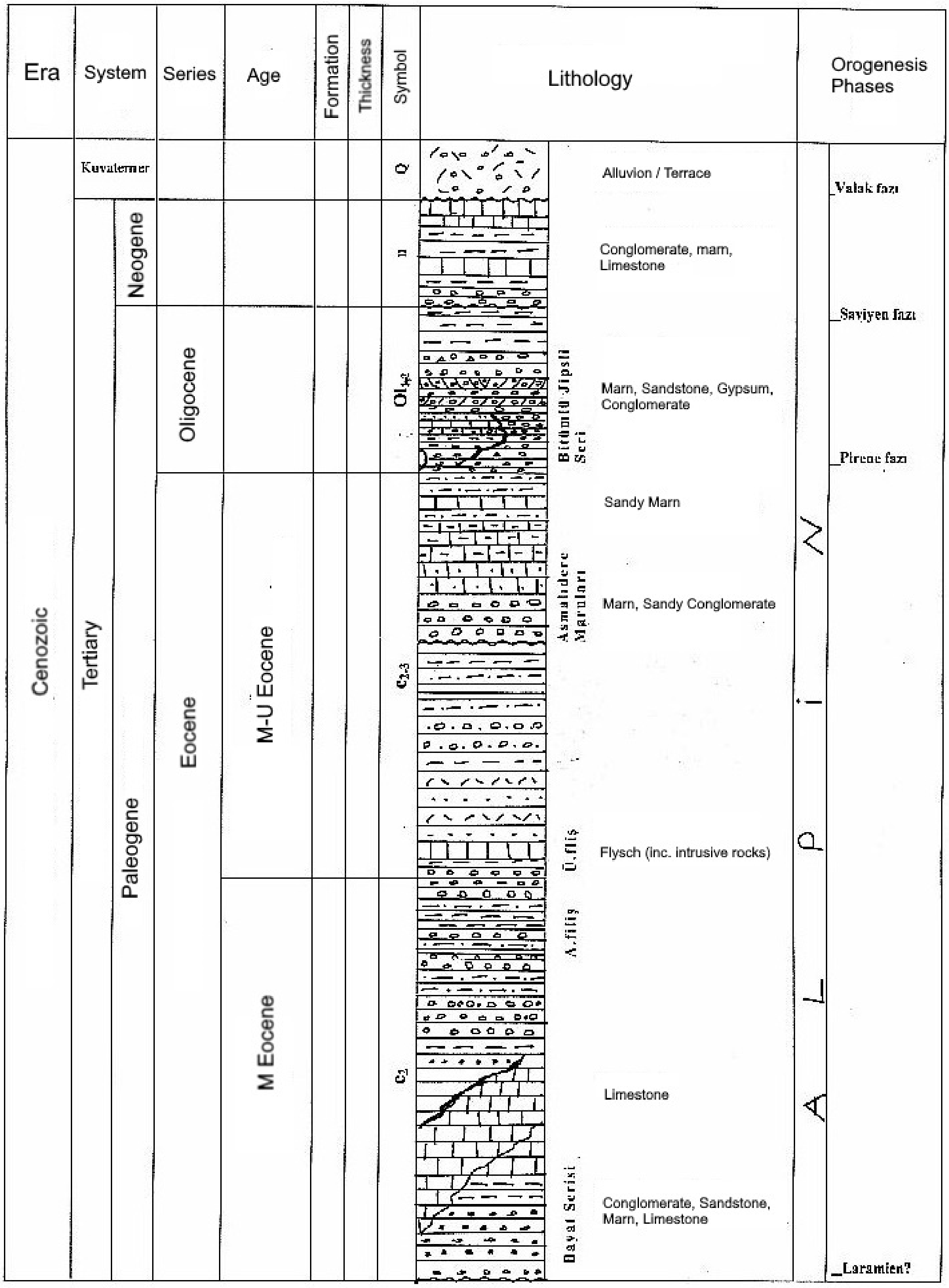
Pleistocene

İznik Formation (Qi)

This formation is represented by beddings which have dipping towards the lake and is located in the South and Southeast of the İznik Lake on the margin of the İznik Lake. Iznik formation is transgressive overlying the pyroxene andesite. Over this formation, there is alluvium having angular unconformity. The unit, which is formed by lithologies as conglomerate, pebbly sandstone, and sandstone, formed in a shallow lake bigger than İznik Lake.

7.1.3.2 Baseline

In the project area, several orogenic movements had been effective. These orogenic movements which formed the folds, faults, landslides, joints and foliations can be analysed under three sections; Pre-Hercynian Movements, Hercynian Movements, Alpine Movements. The project area, which had been effected by various orogenesis had the role of the faults on the present morphology. These are vertical slip; dip slip (normal, reverse) and strike slip faults. Some of them continue for long distances. The most important ones are generally in the E-W direction, the ones in N-S direction are of secondary importance.


Era
System
Series
Age
Formation
Thickness
Symbol
Lithology
Orogenesis Phases
Cenozoic
Kuvaterner
Tertiary
Neogene
Paleogene
Oligocene
Eocene
M-U Eocene
M Eocene
Q
n
Alluvion / Terrace
Conglomerate, marn, Limestone
Marn, Sandstone, Gypsum, Conglomerate
Sandy Marn
Marn, Sandy Conglomerate
Flysch (inc. intrusive rocks)
Limestone
Conglomerate, Sandstone, Marn, Limestone
Bitümlü Jipsli Seri
Asmalıdere Marnları
Ü.filiş
A.filiş
Dayal Serisi
ALPIN
Valak fazı
Saviyen fazı
Pirene fazı
Laramien?

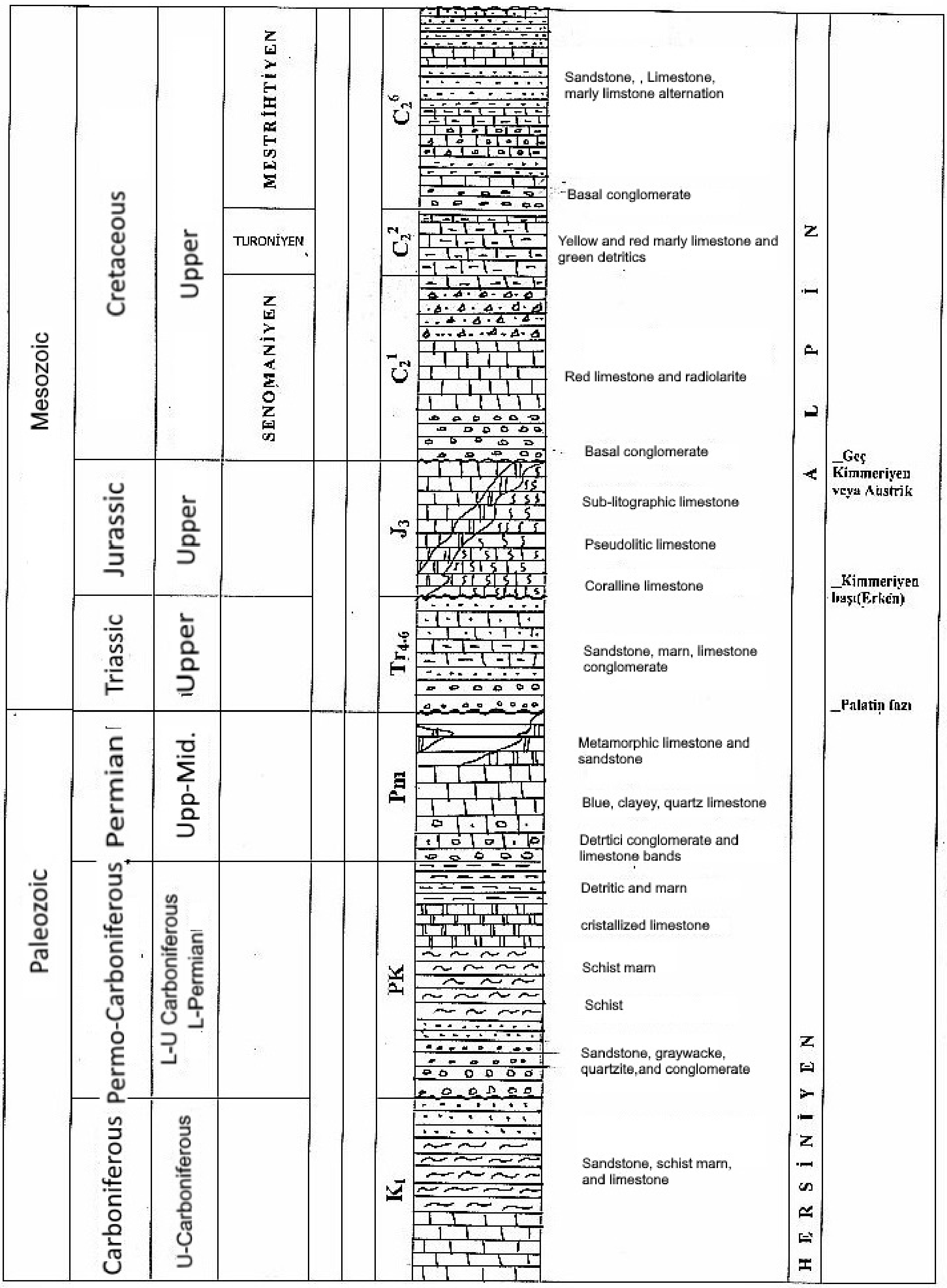


Figure 29 Regional Stratigraphy of the Project Line

7.1.4 Seismology

7.1.4.1 Regional Seismology

The structural geology details related to Project Area derived from Geological and Geotechnical Report is presented in Section 7.1.3

The first Earthquake Zoning Map of Turkey was prepared by the Ministry of Public Works and Settlement considering the latest knowledge, approved by the Government of Turkey and published in 1996. This Map was revised in 2018 and the latest Turkey Earthquake Hazard Map is prepared by Disaster & Emergency Management Authority, Presidential of Earthquake Department and published in the 30364 numbered official gazette on March 8th, 2018.

In the new map, unlike the previous map, the maximum ground acceleration values are shown instead of earthquake zones and the concept of “earthquake zone” is eliminated. “Turkey Building Earthquake Regulation (Official Gazette Date: 18.03.2018 Number: 30364)" refers to this map for the calculation of acceleration values that will affect the construction. The project area is in 1st degree earthquake zone.

The earthquake hazard map of the region near the Project Line according to the Map of Turkey Earthquake Hazard Map is given in the **Figure *30***.

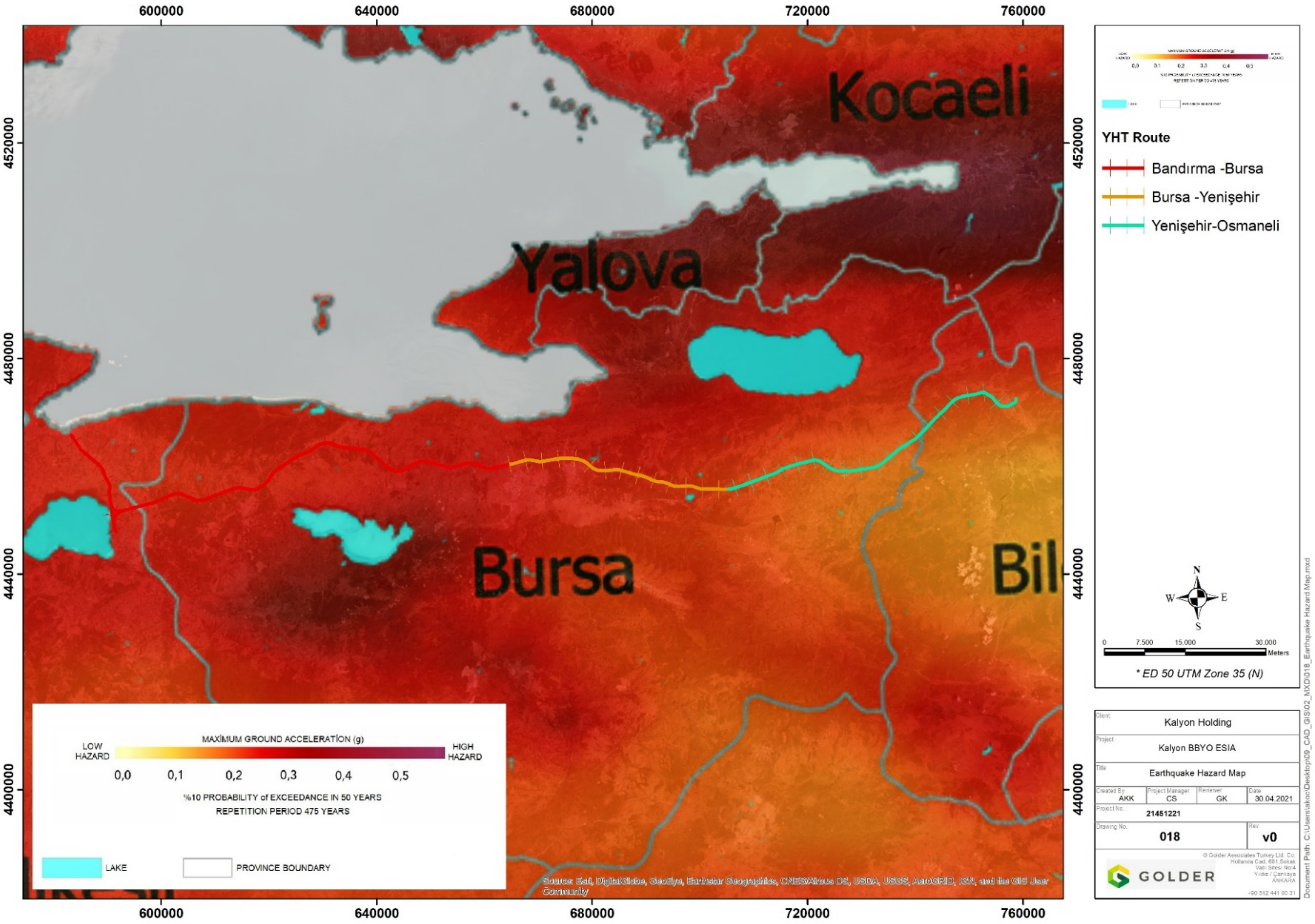


Figure 30 Turkey Earthquake Hazard Map

7.1.5 Hydrology and Surface Water Quality

The regional hydrology and surface water quality assessments with regards to the Project route are discussed below.

7.1.5.1 Regional Hydrology and Surface Water Quality

As mentioned in the previous sections, the Project consists of 3 main lines: Bandırma-Bursa, Bursa-Yenişehir, and Yenişehir-Osmaneli. While Bandırma-Bursa and Bursa-Yenişehir lines are located within Susurluk basin, Yenişehir-Osmaneli line remains within Sakarya basin.

7.1.5.1.1 Surface Water Resources

Streams and Rivers

Nilüfer Stream and its tributaries, Karaçay and its tributaries (mainly Ulu Creek), which are fed from the sub-basins in the north of the Susurluk basin, are the main surface water resources in the Bandırma-Bursa and Bursa-Yenişehir lines and its immediate surroundings. The Akçasu Stream, which is fed from the sub-basin to the north-west of the Sakarya basin, and then the Göksu Stream are the main surface water resources associated with the Yenişehir-Osmaneli line. These streams are sub-drainage streams of the Sakarya River, which is the most important surface water resource in the basin.

A map showing the major streams and rivers crossing the Project route, including the major basins with their sub-basin boundaries, is presented in Figure 31.

Dams, Ponds, and Lakes

There are three natural lakes close to the Project route. These lakes are Kuşgölü, Ulubat Lake and İznir Lake. Iznik Lake, which has the largest surface area of these three lakes, is located in the Marmara basin, while Ulubat and Kuşgölü are located in the Susurluk Basin. Ulubat Lake and Kuşgölü are located close to the Bandırma-Bursa line due to their location. Ulubat Lake is located upstream of the line, while Kuşgölü draws attention due to its closest location to the railway line and due to its location being downstream of the line.

There are many large and small dams and ponds close to the project route. Some of these dams and ponds are active and some are at the planning stage.

It can be said that the closest dam to the Project route is Gölbaşı Dam and the closest pond to the Project route is Yolçatı Pond.

The map showing the dams, ponds, and lakes located in the vicinity of the Project route is presented in Figure 32.

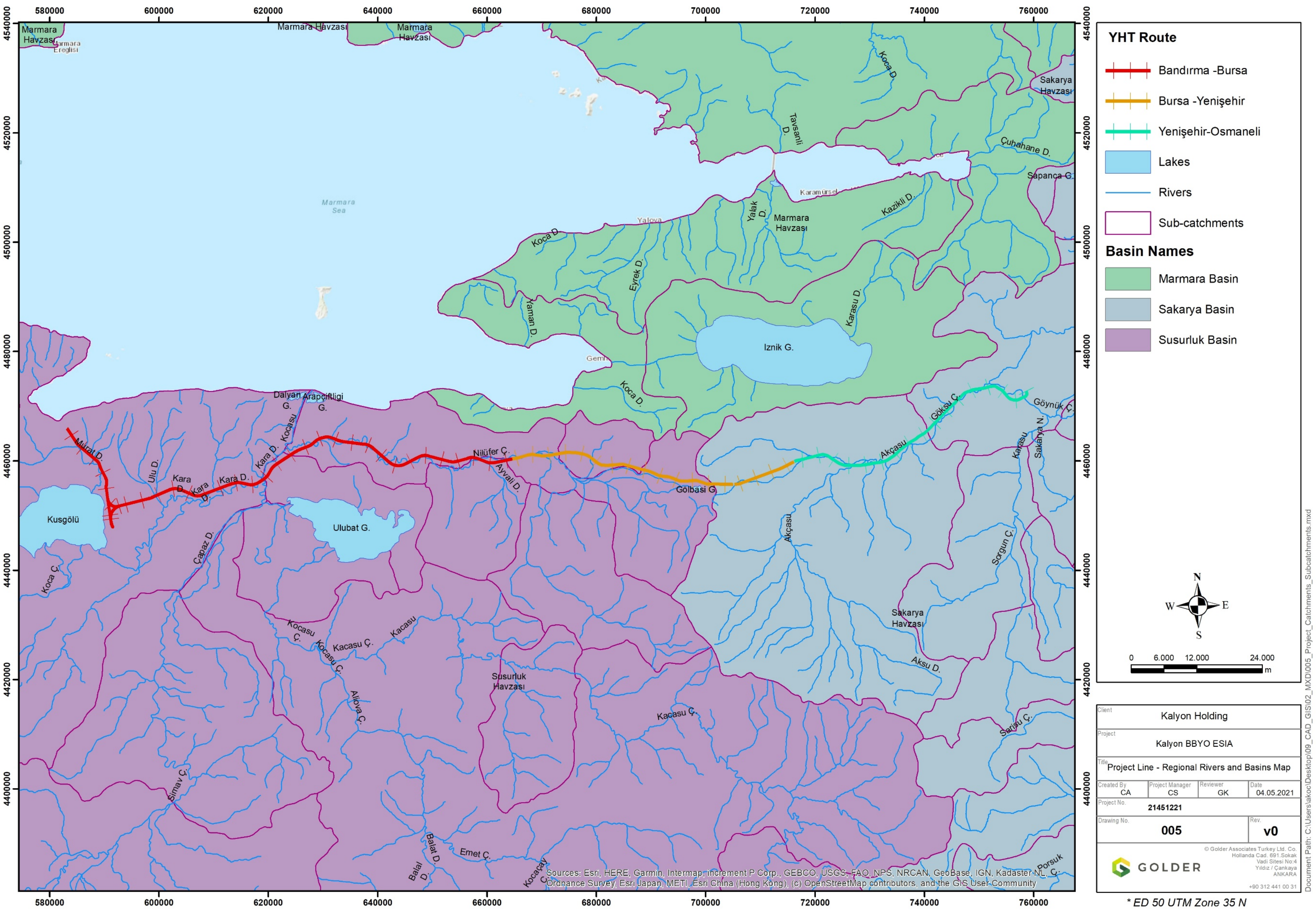


Figure 31 Project Line Regional Rivers and Basins Map

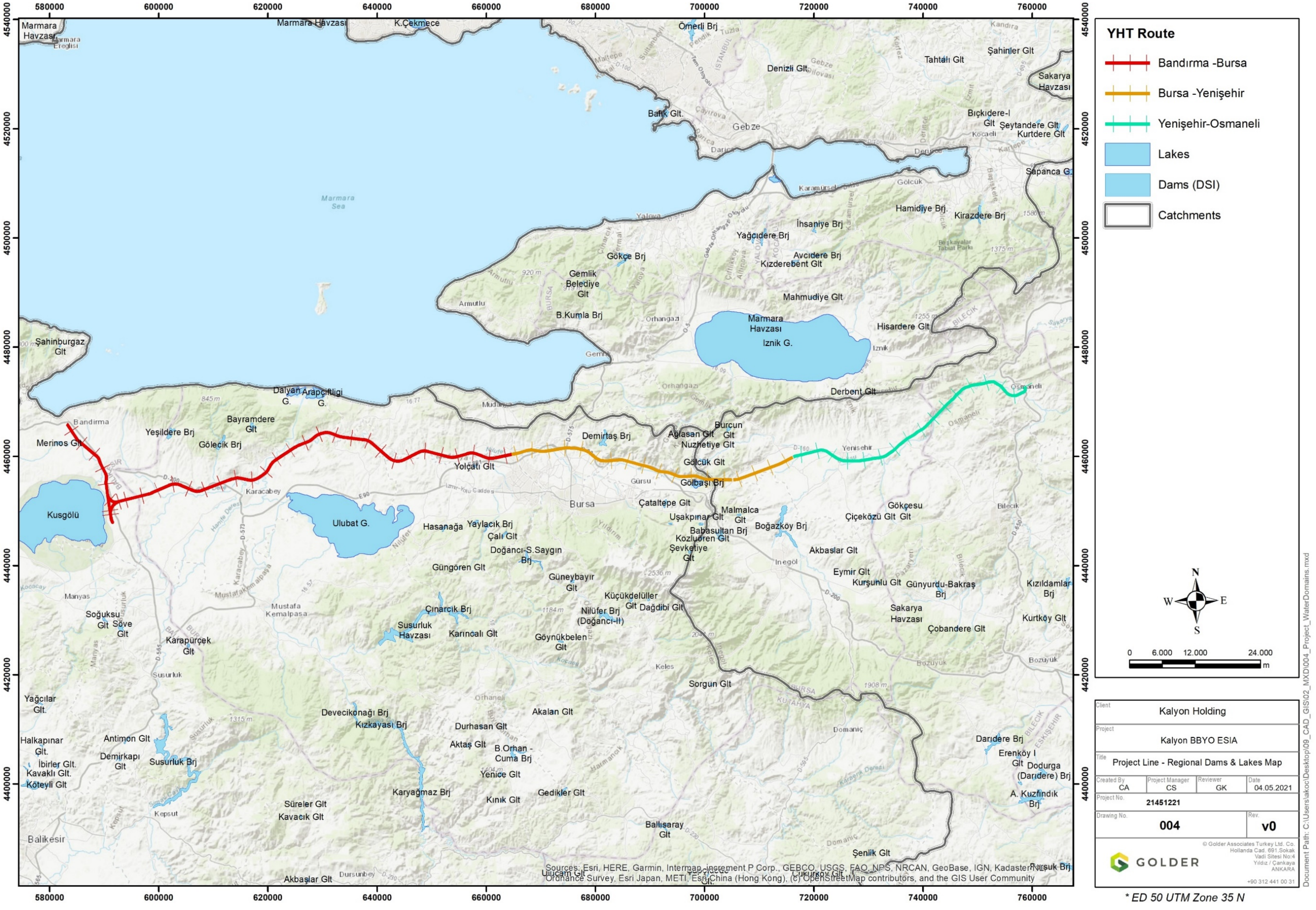


Figure 32 Project Line Regional Dams and Lakes Map

Within the scope of the project, characteristic studies of the sub-catchments where the railway line passes, and flood risk assessment studies of these sub-catchments have been completed.

The Yenişehir-Osmaneli Railway engineering structures were calculated by synthetic methods, taking into account the observed flows and the project precipitation area.

For the aim of calculation of flood flow with observed flows; It was studied with Point Flood Frequency Analysis (NTFA) and Regional Flood Frequency Analysis (BTFA) method. For this purpose, all open and closed State Hydraulic Works/General Directorate of Electrical Power Resources (DSI/EIE) flow monitoring stations (AGIs) in the 12th Sakarya Basin – Göksu Stream and its tributaries were examined. For the aim of flood calculations with synthetic methods were made with Rational, DSI Synthetic Method, Non-Superposed Mockus Method and Snyder Method, considering the project precipitation area sizes.

The methods with the observed flows (Point and Regional Flood Frequency Analysis) and synthetic methods (DSI-Synthetic Method, Snyder Method, Superpositionless Mockus Method) and flood recurrence values calculated using the Rational Method are given and compared in Appendix J.

These calculations were then used in the construction designs of the project facilities and structures and the designs were made to manage the maximum flow capacity against the flood risk.

The scope of the Project includes the construction of culverts and bridges. At this stage, it has become necessary to take the opinion of DSI for hydraulic and hydrological calculations, and it has been determined that calculations should be made with the methods adopted by DSI, especially for basins larger than 1 km^2, and it should be ensured that the structure dimensions are sufficient.

When the sections within the scope of the project are classified according to the catchment area;

- 32 basins with an area larger than 1km^2,
- 62 basins with an area of less than 1km^2.

7.1.5.1.2 Surface Water Quality Standards

The quality of the surface water is determined by considering whether the measured values of the specified parameters exceed the surface water quality standards. The quality of the surface water is determined according to the following regulations and directives:

- “Surface Water Quality Regulation” (YSKY) issued by the Ministry of Forestry and Water Affairs, which was published in the Official Gazette no. 29327 dated 15.04.2015.
- “Irrigation Water Standards” of the US Salinity Laboratory.

Surface Water Quality Regulation (YSKY)

According to YSKY Article-1 (Amended: RG-15/04/2015-29327), purpose of the regulation is to determine the biological, chemical, physicochemical and hydro-morphological qualities of surface water bodies and coastal - transitional waters; to provide classification thereof; to monitor the water quality and quantity thereof; to identify potential uses for such waters; to protect such waters; and to determine the measures to be adopted in order to achieve good water status. In this context, the water bodies are classified according to the criteria presented in Annex-5, Table-2 of the revised regulation. (Amended: RG-10/08/2016-29797).

The parameters and the limit values are presented in Table 35.

Water Quality Classes: The intended use for the waters according to quality classes:

Class I: High quality water (Very Good);

- High potential drinking water supply,
- Suitable for recreational purposes (including body contact, such as swimming),
- Suitable for trout farming, and
- Suitable for animal breeding and farming needs,

Class II: Slightly polluted water (Good);

- Potential drinking water supply,
- Suitable for recreational purposes,
- Suitable for fish farming other than trout,
- Irrigation water, provided that the water quality parameters comply with the criteria set forth in the legislation in force.

Class III: Polluted water (Medium);

- Can be used as water and industrial water for production of aquaculture products after subjected to suitable treatment, excluding facilities that require qualified water, such as food and textiles.

Class IV: Highly polluted water (Poor);

- Waters that present lower quality than Class III parameters, and can be upgraded to upper water quality classifications only after treatment.

Table 35: Quality Criteria for the Surface Water Sources according to YSKY Annex-5 Table-2 in terms of General Chemical and Physicochemical Parameter Classes

PARAMETERS	Unit	Water Quality Classes			
		I (very good)	II (good)	III (medium)	IV (poor)
pH	-	6.0-9.0	6.0-9.0	6.0-9.0	<6.0 or >9.0
Color	(m^{-1})	RES 436 nm: ≤ 1.5	RES 436 nm: 3.0	RES 436 nm: 4.3	RES 436 nm: > 4.
		RES 525 nm: ≤ 1.2	RES 525 nm: 2.4	RES 525 nm: 3.7	RES 525 nm: > 3.
		RES 620 nm: ≤ 0.8	RES 620 nm: 1.7	RES 620 nm: 2.5	RES 620 nm: > 2.
Conductivity	µS/cm	< 400	1000	3000	> 3000
Oil and Grease	mg/l	< 0.2	0.3	0.5	> 0.5
Dissolved Oxygen*	mg/l	> 8	6	3	< 3
Chemical Oxygen Demand (COD)	mg/l	< 25	50	70	> 70
Biochemical Oxygen Demand (BOD)	mg/l	< 4	8	20	> 20
Ammonium as N (NH_4^+-N)	mg/l	< 0.2	1	2	> 2
Nitrate as N (NO_3^--N)	mg/l	< 3	10	20	> 20
Total Kjeldahl as N**	mg/l	< 0.5	1.5	5	> 5
Total Nitrogen as N (mg N/L)	mg/l	<3.5	11.5	25	>25
Orthophosphate Phosphorus (mg o-PO_4-P/L)	mg/l	< 0.05	0.16	0.65	> 0.65
Total Phosphorus (P)	mg/l	< 0.08	0.2	0.8	>0.8
Fluoride (F-)	µg/l	≤ 1000	1500	2000	> 2000
Manganese (Mn)	µg/l	≤ 100	500	3000	> 3000
Selenium (Se)	µg/l	≤ 10	15	20	> 20
Sulphide	µg/l	≤ 2	5	10	>10

7.1.5.2 Baseline

A total of twenty-eight (28) locations were aimed to be sampled in the scope of baseline water quality assessments. One of these locations were observed as dry and samples were taken from twenty-seven (27) of these locations during the field studies, and such samples were submitted to ALS Prague Laboratories (ALS), which is accredited for international standards. One (1) duplicate sample set was collected and submitted to ALS under different name, in order to determine the precision of the laboratory in the aim of QA/QC of the sampling activities.

The sampling locations are given in Table 36 and presented in **Figure *33***.

The sampling results were assessed in terms of quality classification according to the YSKY. The results are presented in Table 37.

Most of the locations were classified as Class-IV or Class-III according to the YSKY classifications. There is only one location classified as Class-II while there is not any location classified as Class-I.

Locations on Murat Creek have poor water quality (Class-IV) due to their high oil and grease concentrations and additional total phosphorus concentration in SW-01.

Locations on Kara Creek have medium to poor water quality due to their commonly high total kjeldahl nitrogen, total phosphorus, and orthophosphate phosphorus concentrations and additional exceeding concentration in individual locations.

Based on the results obtained from the locations on Nilüfer stream, it is noticable that Nilüfer Stream is highly polluted in terms of oil and grease, dissolved oxygen, chemical oxygen demand, biochemical oxygen demand, ammonium, total kjeldahl nitrogen, total nitrogen, orthophosphate phosphorus and total phosphorus. Therefore, most of the locations on Nilüfer Stream are classified as Class-IV.

Upstream of Göksu (Akçasu Stream) and Göksu Stream have Class-IV and Class-III locations. Among the locations on this stream, SW-22 is classified as Class-IV in terms of high color classification, high oil-grease, chemical oxygen demand, ammonium, total kjeldahl nitrogen, and total phosphorus. Similarly, high oil-grease concentrations were observed at SW-24 and SW-25 locations on the same stream.

The locations on the Sakarya river have medium water quality in terms of high concentrations in conductivity, oil-grease, orthophosphate phosphorus, and total phosphorus, and they were classified as Class-III.

Table 36 Surface Water Sampling Locations

Location ID	Easting (m)*	Northing (m)*	Surface Water Body
SW-01	586076	4461199	Murat Creek
SW-02	589563	4455603	Murat Creek
SW-03	602524	4453285	Kara Creek
SW-04	619491	4458349	Kara Creek
SW-05	623092	4461865	Kara Creek
SW-06	624006	4461871	Nilüfer Stream
SW-07	627739	4463234	Nilüfer Stream
SW-08	634630	4463307	Nilüfer Stream
SW-09	638125	4463351	Nilüfer Stream
SW-10	640602	4460814	Nilüfer Stream (Subdrain)
SW-11	645439	4459898	Nilüfer Stream
SW-12	648678	4460771	Nilüfer Stream
SW-13	651971	4460028	Nilüfer Stream (Subdrain)
SW-14	655028	4459866	Nilüfer Stream (Subdrain)
SW-15	658382	4460123	Nilüfer Stream
SW-16	661885	4460107	Nilüfer Stream
SW-17	668926	4460933	Nilüfer Stream
SW-18	672184	4461310	Nilüfer Stream
SW-19	679122	4460332	Nilüfer Stream (Subdrain)
SW-20	686777	4458203	Nilüfer Stream
SW-21	695305	4456145	Nilüfer Stream
SW-22	705838	4456157	Akçasu Stream (Subdrain)
SW-23	730219	4460409	Akçasu Stream
SW-24	738673	4463027	Akçasu Stream
SW-25	742103	4466961	Göksu Stream
SW-26	751673	4473982	Göksu Stream
SW-27	752050	4473959	Sakarya River
SW-28	759943	4470369	Sakarya River

Notes:
* Coordinate System: ED-50 UTM Zone 35(N)

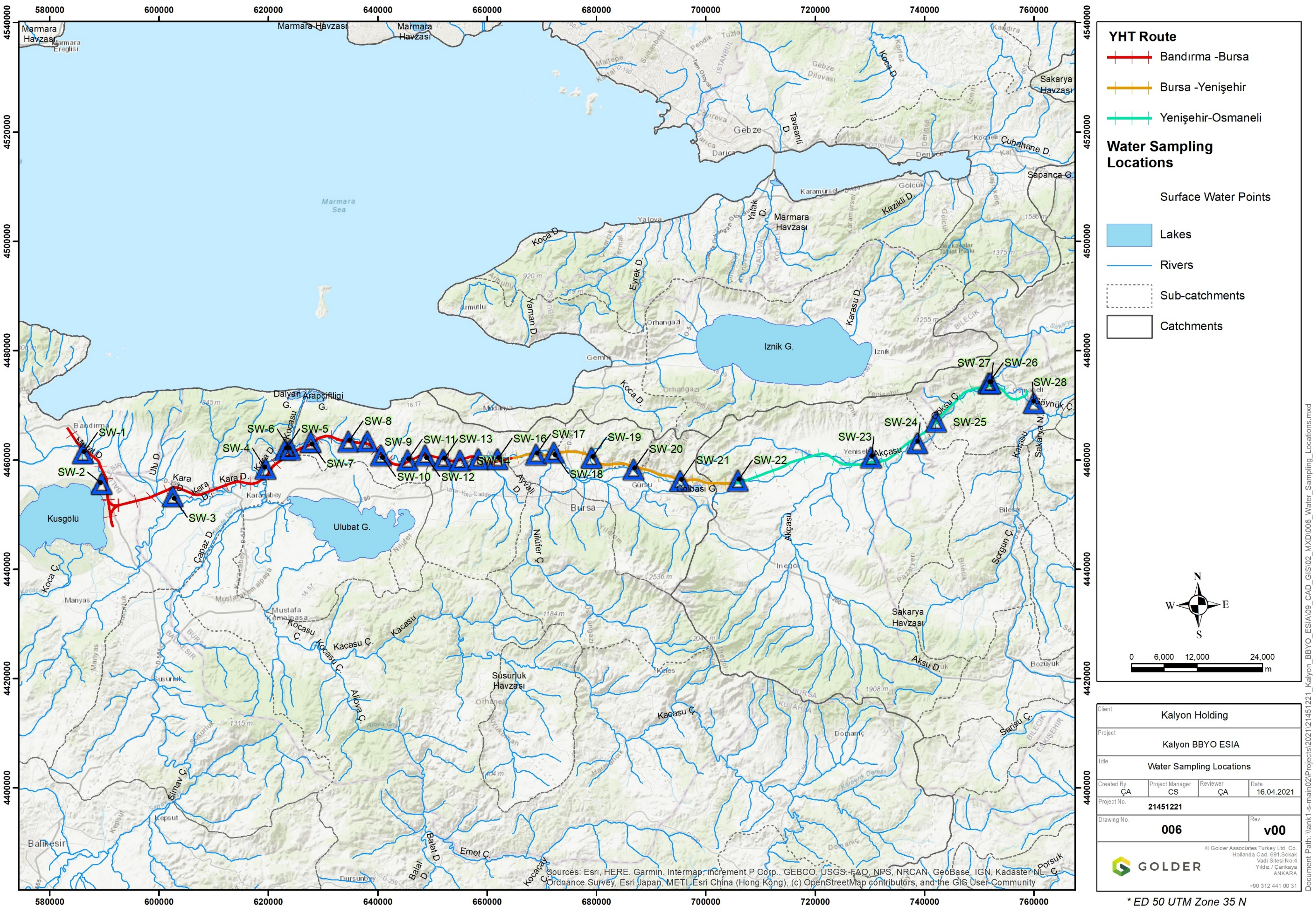


Figure 33 Water Sampling Locations along the BBYO Route

Table 37 Surface Water Quality Classification Assessment according to YSKY Annex-5 Table-2 in terms of General Chemical and Physicochemical Parameters Classes

PARAMETERS	Unit	Water Quality Classes				SW-01	SW-02	SW-03	SW-04	SW-05	SW-06	SW-07	SW-08	SW-09	SW-10	SW-11	SW-12	SW-13
		I (very good)	II (good)	III (medium)	IV (poor)	Mar 2021												
Color	(m^{-1})	RES 436 nm: ≤ 1.5	RES 436 nm: 3.0	RES 436 nm: 4.3	RES 436 nm: ≥ 4.3	1.7	1.8	2.5	1.9	2.4	1.2	0.9	1.1	0.9	0.7	0.8	2.2	1.9
		RES 525 nm: ≤ 1.2	RES 525 nm: 2.4	RES 525 nm: 3.7	RES 525 nm: ≥ 3.7	0.7	0.8	1.1	0.9	1.3	0.7	0.4	0.6	0.5	0.3	0.5	1.2	0.8
		RES 620 nm: ≤ 0.8	RES 620 nm: 1.7	RES 620 nm: 2.5	RES 620 nm: ≥ 2.5	0.4	0.4	0.6	0.5	0.9	0.4	0.3	0.4	0.3	0.1	0.3	0.7	0.4
pH	-	6.0-9.0	6.0-9.0	6.0-9.0	<6.0 or >9.0	7.71	7.67	7.62	7.66	7.69	7.50	7.13	7.31	7.29	7.49	7.18	7.19	8.22
Conductivity	µS/cm	< 400	1000	3000	> 3000	866	936	547	443	445	1070	1020	927	882	918	1060	941	436
Oil and Grease	mg/l	< 0.2	0.3	0.5	> 0.5	0.606	0.644	0.294	0.369	0.490	4.15	7.17	2.66	0.574	1.54	8.33	14.90	0.24
Dissolved Oxygen*	mg/l	> 8	6	3	< 3	6.7	5.3	4.8	7.3	6.2	3	2.3	3.7	6.4	0.9	1.1	1.4	11.02
Chemical Oxygen Demand (COD)	mg/l	< 25	50	70	> 70	36.1	29.5	35.3	21.3	26.4	202	136	120	109	134	123	1950	20.5
Biochemical Oxygen Demand (BOD)	mg/l	< 4	8	20	> 20	3.2	3.2	2.3	3.0	1.8	47.9	41.1	16.6	23.8	33.8	37.6	22.3	1.6
Ammonia as N (NH_4^+-N)	mg/l	< 0.2	1	2	> 2	0.402	1.20	1.77	0.161	0.080	8.81	8.38	5.91	5.22	4.10	7.45	7.010	<0.040
Nitrate as N (NO_3^--N)	mg/l	< 3	10	20	> 20	5.82	3.49	4.07	2.69	2.84	<0.060	0.064	1.11	1.40	1.24	<0.060	<0.060	1.24
Total Kjeldahl as N	mg/l	< 0.5	1.5	5	> 5	2.59	4.68	5.52	2.15	2.09	18.3	15.8	11.2	9.20	9.02	13.0	15.1	1.11
Total Nitrogen as N (mg N/L)	mg/l	< 3.5	11.5	25	>25	8.7	8.4	9.8	4.9	5.0	18.3	15.9	12.4	10.6	10.3	13.0	15.1	2.4
Orthophosphate Phosphorus (mg o-PO_4-P/L)	mg/l	< 0.05	0.16	0.65	> 0.65	0.362	0.495	0.622	0.511	0.474	0.835	1.25	0.960	1.03	1.26	1.36	0.611	0.044
Total Phosphorus (P)	mg/l	< 0.08	0.2	0.8	> 0.8	0.827	0.693	0.908	0.704	0.709	1.52	2.20	1.77	1.84	2.85	1.85	1.31	0.175
Fluoride (F^-)	µg/l	≤ 1000	1500	2000	> 2000	399.0	384.0	202.0	<200	<200	211.0	223.0	260.0	284.0	280.0	232.0	<200	<200
Manganese (Mn)	µg/l	≤ 100	500	3000	> 3000	134	50.7	127.0	228.0	232.0	460	601	377	496	729	557	366	232
Selenium (Se)	µg/l	≤ 10	15	20	> 20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Sulphide (S^{2-})	µg/l	≤ 2	5	10	> 10	<50**	<50**	<50**	<50**	<50**	<50**	<50**	<50**	<50**	<50**	<50**	<50**	<50**
Water Quality Classes						IV	IV	IV	III	III	IV	IV	IV	IV	IV	IV	IV	II

PARAMETERS	SW-15	SW-16	SW-17	SW-18	SW-19	SW-20	SW-21	SW-22	SW-23	SW-24	SW-25	SW-26	SW-27	SW-28
	Mar 2021													
Color (RES 436 nm)	2.4	2.4	2.8	2.2	1.7	1.6	1.4	5.1	1.9	1.7	0.9	0.8	0.7	0.6
Color (RES 525 nm)	1.5	1.5	1.9	1.5	0.7	0.7	0.7	2.4	1	1.1	0.5	0.4	0.4	0.2
Color (RES 620 nm)	1.0	1.0	1.4	0.9	0.3	0.4	0.5	1.3	0.6	0.8	0.3	0.2	0.2	0.1
pH	7.82	7.85	7.62	7.68	7.97	7.94	8.28	7.72	7.81	8.04	8.14	8.16	8.19	8.28
Conductivity	804	880	861	945	510	262	377	573	525	608	551	539	1180	1080
Oil and Grease	13.00	11.20	8.71	5.22	0.23	0.22	0.28	3.86	0.47	0.888	0.502	0.422	0.350	0.35
Dissolved Oxygen*	3.1	3.9	6.2	6.1	9.1	11.1	11.1	9.6	10.07	10.9	11.32	10.2	8.1	7.8
Chemical Oxygen Demand (COD)	44.8	99.8	137	90.4	22.8	33.2	10.4	113	9.4	17.0	11.8	12.9	15.7	12.8
Biochemical Oxygen Demand (BOD)	10.8	21.4	5.5	13	1.7	2.9	1.1	19.9	1.4	2.7	2.8	2.2	3.6	1.2
Ammonia as N (NH_4^+-N)	4.730	5.750	3.380	4.880	0.405	<0.040	<0.040	2.290	0.678	0.673	0.374	0.221	0.507	<0.05
Nitrate as N (NO_3^--N)	0.565	<0.060	1.12	1.06	1.6	0.267	0.702	1.79	1.26	1.79	1.66	1.67	2.40	1.98
Total Kjeldahl as N	11.2	12.5	9.98	8.12	1.42	1.32	0.99	9.48	2.92	0.60	0.61	0.51	0.52	<0.5
Total Nitrogen as N (mg N/L)	11.9	12.5	11.2	9.3	3.1	1.6	1.7	11.5	4.3	2.5	2.4	2.3	3.0	2.1
Orthophosphate Phosphorus (mg o-PO_4-P/L)	0.191	0.459	0.272	2.03	0.338	0.085	0.188	0.686	0.094	0.197	0.113	0.102	0.442	0.396
Total Phosphorus (P)	1.30	1.46	1.18	5.47	0.408	0.591	0.131	1.37	0.177	0.271	0.161	0.204	0.444	0.372
Fluoride (F^-)	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	352.0	396.0
Manganese (Mn)	478	282	113	403	96.2	170	321	426	96.5	159	96.2	99.8	77.2	67.6
Selenium (Se)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<10	<10
Sulphide (S^{2-})	<50**	<50**	<50**	<50**	<50**	<50**	<50**	<50**	<50**	<50**	<50**	<50**	<50**	<50**
Water Quality Classes	IV	IV	IV	IV	III	III	III	IV	III	IV	IV	III	III	III

*Field parameter is used.
** Parameter is not included in classification due to its high limit of reporting value.

7.1.6 Hydrogeology and Groundwater Quality

The regional hydrology and surface water quality assessments with regards to the Project route are discussed below.

7.1.6.1 Regional Hydrogeology and Groundwater Quality

The parts of the railway along the project line are generally settled on quaternary alluvial layers. The aquifer properties vary in direct proportion to the content of sandstone, conglomerate and clay stone, in proportion to the porosity and permeability coefficients.

A map showing the regional hydrogeological formations and related aquifer types is presented in Figure 34.

7.1.6.2 Baseline

Groundwater level measurements obtained from the drilling works planned along the project line are given in Table 38.

Groundwater level was measured only in drillings along the Yenişehir-Osmaneli line, and these levels were between 0.5 and 27.50 m BGS. In addition, artesian conditions have been observed in a borehole and the possible effects and measures to be taken are specified in the relevant parts of the report.

Construction of a groundwater well and groundwater abstraction for the Project might be needed in the Project. In case of encountering groundwater in tunnel excavations planned, dewatering shall be implemented. Therefore, a Dewatering Plan will be prepared for the Project and groundwater samples will be taken from suitable wells around the tunnels to be dewatered, and the study on regional groundwater quality will be completed before the construction phase.

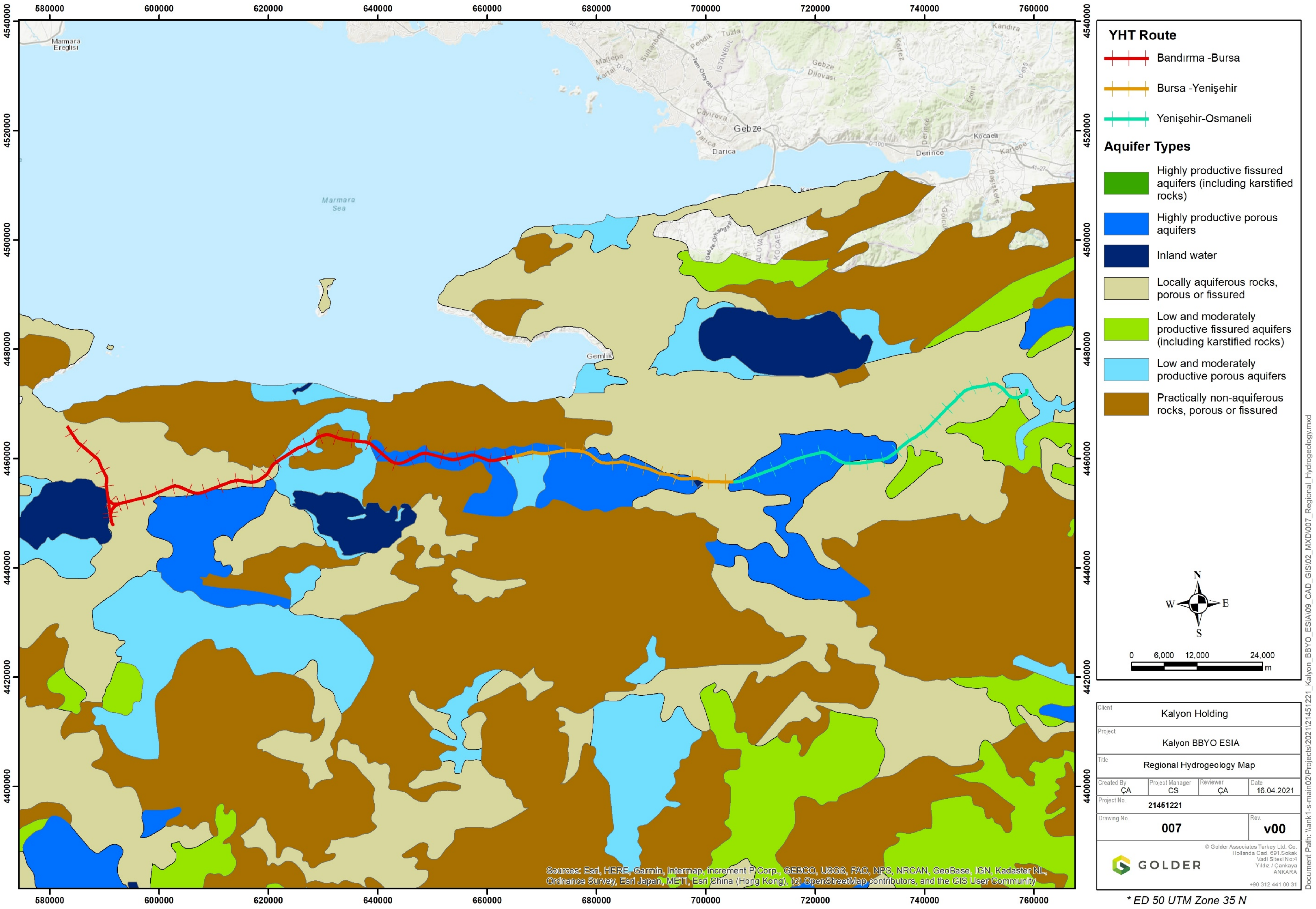


Figure 34: Regional Hydrogeology Map (Source: IHME1500 - International Hydrogeological Map of Europe 1:1,500,000, BGR - https://bgr.bund.de)

Table 38 Ground Water Level Measurement Locations

Borehole ID	Easting (m)*	Northing (m)*	Description	Groundwater Level Measurement (m bgs)
BYO-003	758479	4472845	Fill	8.00 m
BYO-005	758652	4472608	Subway-41	17.00 m
BYO-034	757239	4471289	T-10 Tunnel	4.00 m
BYO-035	756616	4471387	T-10 Tunnel	17.33 m
BYO-044	754646	4472444	Agricultural AG-38	15.00 m
BYO-048	753711	4473308	Fill	14.00 m
BYO-049	753300	4473503	T-07 Tunnel	0.50 m
BYO-054	751455	4473555	Agricultural AG-36	11.00 m
BYO-055	750934	4473439	Viaduct-01	Artesian
BYO-056	750902	4473432	Viaduct-01	2.60 m
BYO-057	750869	4473424	Viaduct-01	2.80 m
BYO-058	750806	4473410	Viaduct-01	3.00 m
BYO-059	750744	4473395	Viaduct-01	2.80 m
BYO-061	750615	4473367	Viaduct-01	3.20 m
BYO-062	750553	4473352	Viaduct-01	3.60 m
BYO-063	750488	4473339	Viaduct-01	3.60 m
BYO-076	748136	4472782	Subway-35	5.00 m
BYO-091	745215	4470645	Passage Cut	27.50 m
BYO-094	744879	4470347	Bridge	4.00 m
BYO-096	744800	4470292	Bridge	4.00 m
BYO-116	738405	4464150	Subway-23	7.00 m
BYO-117	738117	4463984	Subway-22	5.50 m
BYO-118	737771	4463804	Agricultural AG-3	7.50 m
BYO-119	737266	4463505	Subway-21	9.50 m
BYO-120	737077	4463438	Subway-20	8.00 m
BYO-121	736265	4462912	Pedestrian Bridge-3	15.00 m
BYO-122	735738	4462475	Agricultural AG-2	6.50 m
BYO-123	735514	4462292	Subway-19	9.00 m
BYO-124	735532	4462266	Subway-19	9.50 m
BYO-125	735313	4462059	Cut-Cover-1	17.00 m
BYO-126	735201	4462030	Cut-Cover-1	15.50 m
BYO-128	734803	4461560	Passage Cut	10.50 m
BYO-129	734043	4460954	Pedestrian Bridge-2	1.50 m
BYO-130	733727	4460729	Pedestrian Bridge-1	3.00 m
BYO-131	733153	4460320	Subway-17	6.50 m
BYO-132	732867	4460139	Bridge-3	9.20 m
BYO-133	732822	4460112	Bridge-3	4.50 m
BYO-134	732760	4460074	Bridge-3	2.00 m
BYO-136	732397	4459864	Subway-16	5.70 m
BYO-137	732350	4459880	Subway-16	5.00 m
BYO-138	731993	4459715	Subway-15	4.37 m
BYO-139	731651	4459641	Line	4.40 m
BYO-140	731224	4459589	Subway-14	5.00 m
BYO-144	729817	4459375	Subway-12	3.00 m
BYO-145	729798	4459344	Subway-12	5.00 m
BYO-146	729430	4459289	Subway-11	5.00 m
BYO-149	727777	4459056	Line	9.00 m
BYO-150	727397	4459010	Bridge-2	6.50 m
BYO-151	727343	4459006	Bridge-2	6.70 m
BYO-152	727285	4459005	Bridge-2	7.00 m
BYO-153	727227	4459002	Bridge-2	7.50 m
BYO-154	727150	4459004	Bridge-2	8.00 m
BYO-155	726593	4459010	Yenişehir Stt.	5.00 m
BYO-156	726344	4458970	Subway-9	5.20 m
BYO-157	726343	4459042	Subway-9	5.10 m
BYO-158	726133	4459023	Yenişehir Stt.	5.00 m
BYO-159	725833	4459017	Yenişehir Stt.	5.30 m
BYO-160	725637	4459016	Yenişehir Stt.	4.80 m
BYO-161	725133	4459027	Subway-8	5.20 m
BYO-162	725112	4459055	Subway-8	5.10 m
BYO-163	724914	4459083	Subway-7	4.70 m
BYO-172	720416	4461085	Subway-3	5.00 m
BYO-173	720405	4461053	Subway-3	5.20 m
BYO-174	719898	4460948	Subway-2	5.50 m
BYO-175	719893	4460985	Subway-2	5.40 m
BYO-176	719495	4460888	Culvert	5.00 m
BYO-177	718641	4460729	Subway-1	5.80 m
BYO-178	718628	4460693	Subway-1	6.00 m
BYO-179	718107	4460586	Line	5.30 m

7.1.7 Soil and Subsoil

7.1.7.1 Regional Soil and Subsoil Characteristics

Information regarding soil pedology and land use has been collected through desktop studies. Three major soil groups were identified in the Project Area. The most common soil groups in the project area are as follows.

- Alluvial Soil
- Brown Forest Soil
- Non-calcareous Brown Forest Soil

Soil classes are classified according to the suitability of soil for cultivation. Soil classes used by the Ministry of Agriculture and Rural Affairs are shown in Table below. This project is large scale railway project and spread over a wide area. Therefore, all soil classes were identified on the Project footprint.

Table 39 Soil Classes Definition

Class	Suitability for Cultivation	Cultivation Limiting factors
I	Suitable for many crop types.	No limitations.
II	Suitable for long term cultivation of various crops.	It requires measures against soil and water loss.
III	Suitable for cultivation of certain types of crops for which special protection measures are provided.	It is open to erosion and requires artificial drainage for cultivation.
IV	Suitable for some crops. It requires special care when used for agricultural purposes.	There are limitations in terms of depth of soil, stone content, humidity and slope.
V	Plain or slight slope, stony or lush soil. It is not suitable for ploughing or cultivation. It is grassland or forest area .	It has a weak drainage and a structure that is not suitable for ploughing.
VI	Not suitable for ploughing or cultivation. It is generally used as grazing area or forest area.	There are limitations in terms of slope and shallow soil.
VII	Not economically feasible for agriculture but it is suitable for some grazing or forestation.	There are limitations in terms of shallow soil, stone content, slope and erosion.
VIII	Not suitable for flora habitats. It may be used for recreational purposes or can be designated as protection area for wild-life.	Poor soil content.

7.1.7.2 Baseline

The “Soil Pollution Control and Sites Polluted by Point Source Contamination Regulation” was published on June 8. 2010 (Official Gazette: 27605) and was fully implemented on June 8. 2015. In accordance with the new regulation, it is obligatory to prevent pollution, stop pollution release in the polluted areas and determine the extent of pollution.

The soil concentrations measured for the purposes of this study were compared to the generic limit values mentioned in the Annex I of the Regulation.

Annex I of the updated regulation contains different generic limit values dependent on the exposure routes (pathways):

- Generic Limit Value-1: Soil ingestion and absorption through skin contact,
- Generic Limit Value-2: Inhalation of volatile matter in external environment,
- Generic Limit Value-3: Inhalation of fugitive dust in the external environment, and
- Generic Limit Value-4: Transport of pollutants into groundwater and drinking of groundwater (Safety Factor (SF) = 1 or 10).

The Generic Limit Value-1 and Generic Limit Value-3 are used for the surface/shallow soil samples and Generic Limit Value-2 and Generic Limit Value-4 are used for sub-soil samples.

Soil samples collected during field exploration were analyzed for the parameters listed below:

Parameters defined in the Regulation:

- Total Petroleum Hydrocarbons (TPH);
- Benzene, Toluene, benzene, toluene, ethylbenzene and xylenes (BTEX);
- Volatile Organic Compounds;

Table 40 Analytical Parameters

Activity Code	Activity Detail	Regulatory Required Parameters
4910	Intercity passenger transportation by railway	TPH, BTEX, TVOC

Samples were sent to the internationally accredited laboratory ALS Global (Based in Czech Republic, Europe). The parameters presented in above Table were analysed in soil samples as required by the ‘’Soil Pollution Control and Sites Polluted by Point Source Contamination Regulation’’.

Soil sampling locations are shown in **Figure *35*** and the measurement results of the chemical parameters are presented in following tables.

The soil results showed that there is no hydrocarbon contamination for soil around the sampling locations and it can be showed that there was no leachability of any hydrocarbon concentrations into the sub-soil. Also, no historical soil contamination investigation was available on the BBYO route. During construction and operational activities, in case contamination is suspected, a sample can be collected for laboratory analysis. If contamination is put in evidence through laboratory analyses, care must be taken during handling and disposal of the detected contaminated soil, in accordance with the Health & Safety and Environmental regulations. The detailed information of the impact assessment for soil is presented in “Impact Assessment Section 8.1.5 Soil and Subsoil”.

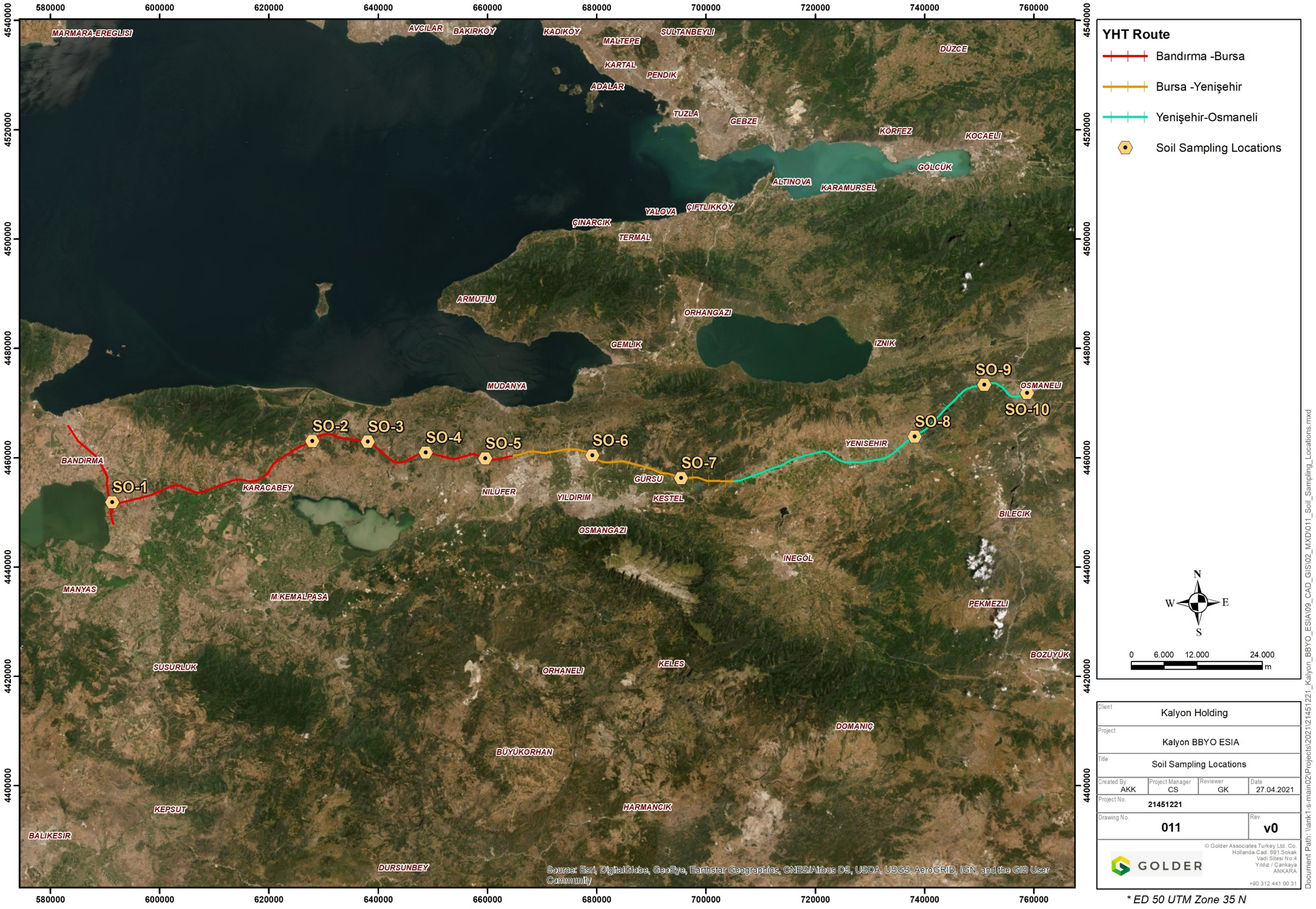


Figure 35 Soil Sampling Locations along the BBYO Route

Table 41 TPH Analytical Results

Turkish Generic Contaminant Limiting Values		Total Petroleum Hydrocarbons (TPH)					
		C5 - C8	C8 - C16	C16 - C35	C5 - C9	C9 - C16	C16 - C35
		Aliphatic Fraction	Aliphatic Fraction	Aliphatic Fraction	Aromatic Fraction	Aromatic Fraction	Aromatic Fraction
Soil ingestion and absorption through skin contact		4693	7821	156429	15643	1564	23446
Inhalation of fugitive dust in the external environment		-	-	-	-	-	-
LOR		3.0	17	30	4.0	16	30
Sample ID	Sampling Depth (m)	mg/kg (dry soil)	mg/kg (dry soil)	mg/kg (dry soil)	mg/kg (dry soil)	mg/kg (dry soil)	mg/kg (dry soil)
SO-01	0-0.3	<3.0	<17	<30	<4.0	<16	<30
SO-02	0-0.3	<3.0	<17	<30	<4.0	<16	<30
SO-03	0-0.3	<3.0	<17	<30	<4.0	<16	<30
SO-04	0-0.3	<3.0	<17	<30	<4.0	<16	<30
SO-05	0-0.3	<3.0	<17	<30	<4.0	<16	<30
SO-06	0-0.3	<3.0	<17	<30	<4.0	<16	<30
SO-07	0-0.3	<3.0	<17	<30	<4.0	<16	<30
SO-08	0-0.3	<3.0	<17	<30	<4.0	<16	<30
SO-09	0-0.3	<3.0	<17	<30	<4.0	<16	<30
SO-10	0-0.3	<3.0	<17	<30	**5,20**	<16	<30

Table 42 BTEX Analytical Results

Turkish Generic Contaminant Limiting Values		BTEX				
		Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene
Soil ingestion and absorption through skin contact		12	6257	7821	156429	156429
Inhalation of fugitive dust in the external environment		-	-	-	-	-
LOR		0.010	0.030	0.020	0.020	0.010
Sample ID	Sampling Depth (m)	mg/kg (dry soil)	mg/kg (dry soil)	mg/kg (dry soil)	mg/kg (dry soil)	mg/kg (dry soil)
SO-01	0-0.3	<0.010	<0.030	<0.020	<0.020	<0.010
SO-02	0-0.3	<0.010	<0.030	<0.020	<0.020	<0.010
SO-03	0-0.3	<0.010	<0.030	<0.020	<0.020	<0.010
SO-04	0-0.3	<0.010	<0.030	<0.020	<0.020	<0.010
SO-05	0-0.3	<0.010	<0.030	<0.020	<0.020	<0.010
SO-06	0-0.3	<0.010	<0.030	<0.020	<0.020	<0.010
SO-07	0-0.3	<0.010	<0.030	<0.020	**0,024**	<0.010
SO-08	0-0.3	<0.010	<0.030	<0.020	<0.020	<0.010
SO-09	0-0.3	<0.010	<0.030	<0.020	<0.020	<0.010
SO-10	0-0.3	<0.010	<0.030	<0.020	<0.020	<0.010

Table 43 VOC Analytical Results

Turkish Generic Contaminant Limiting Values	Soil ingestion and absorption through skin contact	Inhalation of fugitive dust in the external environment	LOR	Sample ID									
				SO-01	SO-02	SO-03	SO-04	SO-05	SO-06	SO-07	SO-08	SO-09	SO-10
			mg/kg (Dry Soil)	Sample Depth (m)									
				0-0.3									
1.1.1-Trichloroethane	156429	-	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
1.1.2.2-Tetrachloroethane	3	-	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1.1.2-Trichloroethane	11	-	0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
1.1-Dichloroethane	15643	-	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
1.1-Dichloroethene	-	-	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
1.2.3-Trichlorobenzene	-	-	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1.2.4-Trichlorobenzene	-	-	0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
1.3.5-Trichlorobenzene	-		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1.2-Dichlorobenzene	7039	-	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1.2-Dichloroethane	7	-	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1.2-Dichloropropane	18	-	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
1.3-Dichlorobenzene	-	-	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1.4-Dichlorobenzene	118	-	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Bromodichloromethane	10	-	0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Bromoform	61	-	0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Chlorobenzene	-	-	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Chloroform	-	-	0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
cis-1.2-Dichloroethene	782	-	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Dibromochloromethane	-	-	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Dichloromethane	85	-	0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80
Tetrachloroethene	1	-	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Tetrachloromethane	-	-	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
trans-1.2-Dichloroethene	1564	-	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Trichloroethene	2	-	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Vinyl chloride	0,4	-	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Styrene	15643	-	0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Methyl tert-Butyl Ether (MTBE)	355	-	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
tert-Butyl alcohol (TBA)	-	-	0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80

7.1.8 Air Quality

7.1.8.1 Baseline

During the construction phase of the Project, dust emissions will be generated due to the cut excavation / backfilling activities on the railway route, excavation activities to be carried out for the engineering structures, and the production activities in the material sites to be operated in order to supply the filling and concrete aggregate material required in the Project. In addition, exhaust emissions from the vehicles in the construction phase will create air emissions.

This section of the ESIA Report represents the baseline conditions for air quality in the Area of Influence (AoI). In order to determine the background concentrations in the AoI, air quality measurement studies (for PM_{10}, $PM_{2.5}$, NO_2, SO_2 and settled dust) were conducted at pre-determined locations along the planned railway (Bandırma-Bursa-Yenişehir-Osmaneli). Details related to these measurements are given below section.

7.1.8.1.1 Baseline Air Quality Measurement Studies

In order to assess the air quality baseline conditions of the AoI, 16 representative noise measurement locations (mostly the closest sensitive receptor to the planned railway) have been determined. In 13-14 March of 2021, daily PM_{10} and $PM_{2.5}$ measurements were conducted in these locations in line with TS EN 12341 standard. Measurement results compared with both Turkish, European and IFC standards and details related to measurement locations are given in Table 45. The locations of measurement points are shown in Figure 37. Also, the signed Air Quality Measurement Report for PM_{10} and $PM_{2.5}$ prepared by BATI Laboratuvarı Çevre Ölçüm Hizmetleri Bilişim Müh. Müş. San. ve Tic. LTD. ŞTİ. is presented in Appendix E.

It can be seen from Table 45 that all the baseline measurement results (PM_{10} and $PM_{2.5}$) are under both Turkish and IFC limits.

Also, additional SO_2, NO_2 and settled dust measurements have been carried out for the same sampling locations. However, the laboratory measurement report is still in preparation.

Table 44: Air Quality Measurement Results (PM_{10} and $PM_{2.5}$)

Measurement Point	Measurement Location						Measurement Results	
	Coordinates (X-Y) (UTM 50)	Corresponding Railway km	Province	District	Village / Neighbourhood	Distance to Railway Section (m)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
A1	583224 – 4466167	000+000	Balıkesir	Bandırma	Bandırma	225	24.3	12.3
A2	598596 – 4453056	024+500	Bursa	Karacabey	Tophisar	180	22.5	10.8
A3	612529 – 4455582	039+450	Bursa	Karacabey	Şahinköy	55	23.2	11.1
A4	630011 – 4464394	060+000	Bursa	Niüfer	Çamlıca	150	21.8	9.2
A5	647567 – 4460767	079+360	Bursa	Niüfer	Hançerli - Çaylı	35	20.3	8.5
A6	666881 – 4461009	048+420	Bursa	Nilüfer	Nilüfer	100	21.2	9.6
A7	686097 – 4458956	068+400	Bursa	Gürsu	İğdir	70	28.7	15.2
A8	705497 – 4455907	088+350	Bursa	Kestel	Seymen	140	26.8	13.7
A9	736598 – 4462772	121+850	Bursa	Yenişehir	Köprühisar	75	19.2	8.8
A10	757102 – 4471190	146+500	Bilecik	Osmaneli	Osmaneli	15	18.8	7.9
A11	729380 – 4459261	113+700	Bursa	Yenişehir	Akdere	60	23.0	11.8
A12	725131 – 4459366	109+400	Bursa	Yenişehir	Yenişehir	110	20.4	9.7
A13	715006 – 4459210	098+350	Bursa	Yenişehir	Çardak	75	19.6	8.5
A14	678601 – 4460755	060+380	Bursa	Osmangazi	Demirtaş Barbaros	80	22.5	10.9
A15	590203 – 4454203	014+400	Balıkesir	Bandırma	Kuçcenneti	245	20.8	9.2
A16	617147 – 4455753	044+150	Bursa	Karacabey	Taşlık	95	19.9	8.8
Turkish Air Quality Standards[1]							**50**	**-**
IFC Air Quality Standards[2]							**50**	**25**
European Directives Air Quality Standards[3]							**50**	**25**

[1] Regulation on Control of Industrial Air Pollution (Dated 03.07.2009 and Numbered 27277) and Regulation on Assessment and Management of Air Quality (Dated 06.06.2008 and Numbered 26898)
[2] IFC General Environmental, Health, and Safety (EHS) Guidelines (WHO stands for World Health Organization) (Dated 30 April 2007)
[3] Directive 2008/50/EC, 21 May 2008, ambient air quality and cleaner air

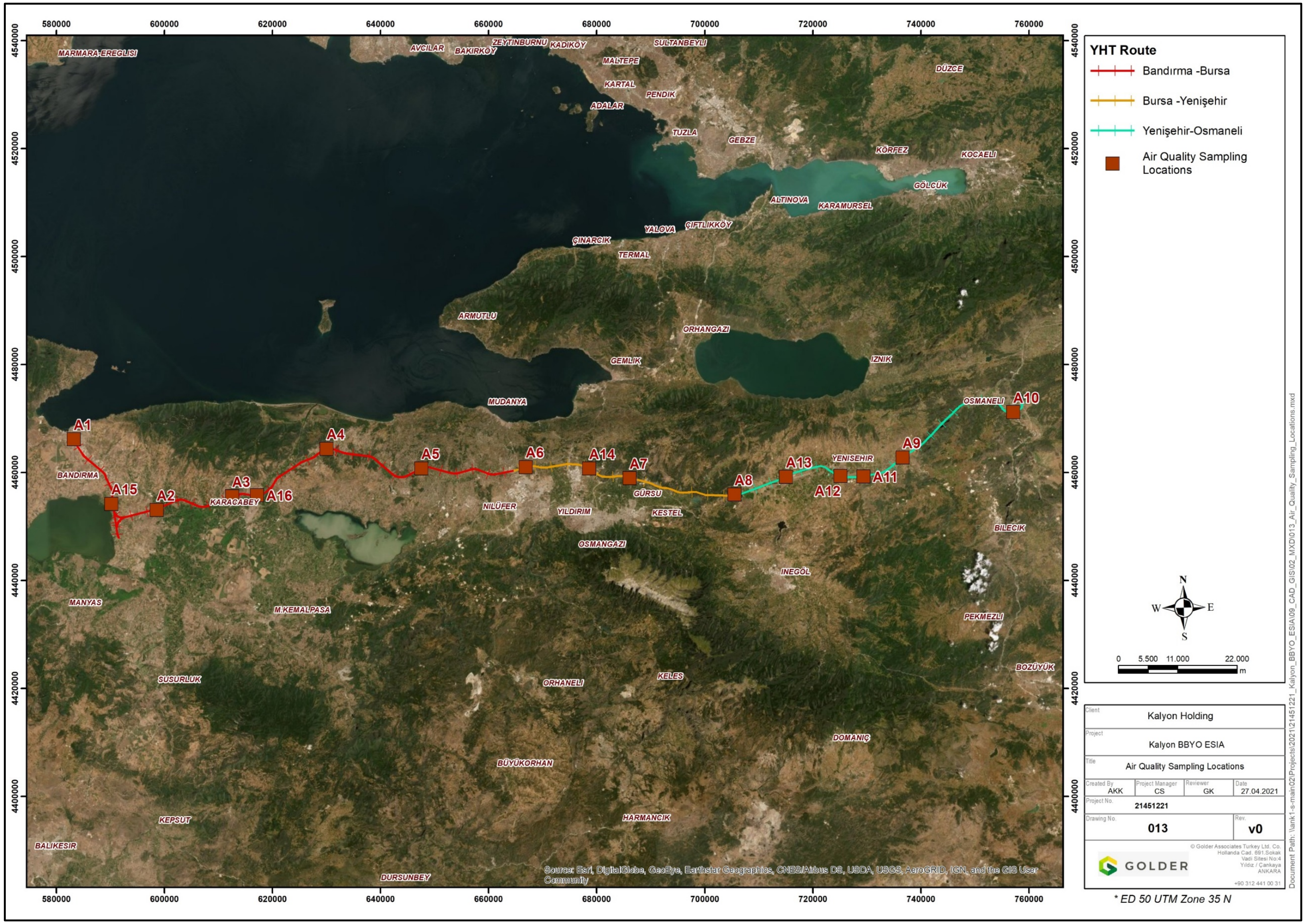


Figure 36: Air Quality Measurement Locations

7.1.9 Noise

7.1.9.1 Baseline

This section of the ESIA Report represents the baseline conditions for noise in the Area of Influence (AoI). In order to determine the baseline noise levels in the AoI, environmental noise measurement studies were conducted at pre-determined locations along the planned railway (Bandırma-Bursa-Yenişehir-Osmaneli).

In order to assess noise baseline conditions of the AoI, 16 representative noise measurement locations (mostly the closest sensitive receptor to the planned railway) have been determined. Between 13-15 March of 2021, ambient noise has been measured for 2 days in these locations in line with ISO 1996-2: 2017 standard. Measurement results compared with both IFC and Turkish Regulatory noise standards and details related to measurement locations are given in Table 45. The locations of measurement points are shown in Figure 37. Also, the signed Noise Measurement Report prepared by BATI Laboratuvarı Çevre Ölçüm Hizmetleri Bilişim Müh. Müş. San. ve Tic. LTD. ŞTİ. is presented in Appendix E.

It can be seen from Table 45 that the noise measurement results vary between 44.5 and 52.2 dBA for day and 38.8 and 43.9 dBA for night which are all under both IFC and Turkish Regulation limits.

Table 45 Noise Measurement Results

Measurement Point	Measurement Location						Measurement Day	Measurement Results (dBA)				
								IFC[2]		Turkish[4]		
	Coordinates (X-Y) (UTM 50)	Corresponding Railway km	Province	District	Village / Neighbourhood	Distance to Railway Section (m)		Day (07:00 to 22:00)	Night (22:00 to 07:00)	Day (07:00 to 19:00)	Evening (19:00 to 23:00)	Night (23:00 to 07:00)
N1	583224 – 4466167	000+000	Balıkesir	Bandırma	Bandırma	225	Day 1	50.3	42.7	51.3	45.1	42.9
							Day 2	50.7	42.6	51.7	45.3	42.8
N2	598596 – 4453056	024+500	Bursa	Karacabey	Tophisar	180	Day 1	47.0	39.6	47.9	42.2	39.7
							Day 2	47.0	39.1	48.1	41.4	39.2
N3	612529 – 4455582	039+450	Bursa	Karacabey	Şahinköy	55	Day 1	48.1	40.0	48.9	43.3	40.2
							Day 2	47.6	40.0	48.5	42.6	40.2
N4	630011 – 4464394	060+000	Bursa	Niüfer	Çamlıca	150	Day 1	49.4	41.7	50.4	44.3	41.8
							Day 2	49.0	41.5	49.9	43.9	41.7
N5	647567 – 4460767	079+360	Bursa	Niüfer	Hançerli - Çaylı	35	Day 1	48.9	41.3	49.8	43.8	41.5
							Day 2	49.3	40.8	50.3	44.0	40.8
N6	666881 – 4461009	048+420	Bursa	Nilüfer	Nilüfer	100	Day 1	50.9	42.3	51.9	45.4	42.4
							Day 2	50.4	42.7	51.4	45.2	42.8
N7	686097 – 4458956	068+400	Bursa	Gürsu	İğdir	70	Day 1	52.1	41.8	53.2	46.5	41.6
							Day 2	51.7	41.6	52.7	46.4	41.5
N8	705497 – 4455907	088+350	Bursa	Kestel	Seymen	140	Day 1	51.9	43.5	53.0	46.3	43.7
							Day 2	51.4	43.6	52.4	46.1	43.8
N9	736598 – 4462772	121+850	Bursa	Yenişehir	Köprühisar	75	Day 1	44.9	39.3	45.4	42.2	39.3
							Day 2	45.3	39.2	45.8	42.2	39.1
N10	757102 – 4471190	146+500	Bilecik	Osmaneli	Osmaneli	15	Day 1	44.5	39.1	44.9	41.8	39.0
							Day 2	44.7	38.8	45.1	42.0	38.6
N11	729380 – 4459261	113+700	Bursa	Yenişehir	Akdere	60	Day 1	50.3	42.2	51.3	44.8	42.3
							Day 2	49.3	41.8	50.2	44.2	42.0
N12	725131 – 4459366	109+400	Bursa	Yenişehir	Yenişehir	110	Day 1	49.3	40.9	50.3	44.0	41.1
							Day 2	48.4	40.9	49.3	43.4	41.1
N13	715006 – 4459210	098+350	Bursa	Yenişehir	Çardak	75	Day 1	47.8	40.4	48.8	42.9	40.5
							Day 2	47.0	39.8	47.9	42.1	40.0
N14	678601 – 4460755	060+380	Bursa	Osmangazi	Demirtaş Barbaros	80	Day 1	51.8	43.9	52.7	46.4	44.1
							Day 2	52.2	43.8	53.2	46.6	44.0

Measurement Point	Measurement Location						Measurement Day	Measurement Results (dBA)				
								IFC[2]		Turkish[4]		
	Coordinates (X-Y) (UTM 50)	Corresponding Railway km	Province	District	Village / Neighbourhood	Distance to Railway Section (m)		Day (07:00 to 22:00)	Night (22:00 to 07:00)	Day (07:00 to 19:00)	Evening (19:00 to 23:00)	Night (23:00 to 07:00)
N15	590203 – 4454203	014+400	Balıkesir	Bandırma	Kuçcenneti	245	Day 1	50.5	40.5	51.6	45.1	40.3
							Day 2	50.1	40.4	51.1	44.9	40.2
N16	617147 – 4455753	044+150	Bursa	Karacabey	Taşlık	95	Day 1	45.8	40.2	46.2	43.0	40.1
							Day 2	45.9	39.9	46.4	43.2	39.8
IFC Noise Standards[1,2]	Industrial; commercial areas							**70.0**	**70.0**	-	-	-
	Residential; institutional; educational areas							**55.0**	**45.0**	-	-	-
Turkish Noise Standards[3,4]	Sensitive areas with Schools, libraries and conference rooms, hospitals and health centres							-	-	**60.0**	**55.0**	**50.0**
	Industrial areas							-	-	**70.0**	**65.0**	**60.0**
	Locations with commercial areas and sensitive areas (dominated by residential areas)							-	-	**65.0**	**60.0**	**55.0**
	Locations with commercial areas and sensitive areas (dominated by commercial areas)							-	-	**68.0**	**63.0**	**58.0**
	Construction sites							-	-	**70.0**	-	-

Notes:
1 IFC Environmental, Health, and Safety (EHS) Guidelines General EHS Guidelines: Environmental - Noise Management;
2 IFC Guidelines provide noise standards for two-time intervals in 24 hours: day (07:00 to 22:00), and night (22:00 to 07:00).
3 Regulation on Assessment and Management of Environmental Noise;
4 Regulation on Assessment and Management of Environmental Noise provides noise standards for three-time intervals in 24 hours: day (07:00 to 19:00), evening and (19:00 to 23:00) and night (23:00 to 07:00);

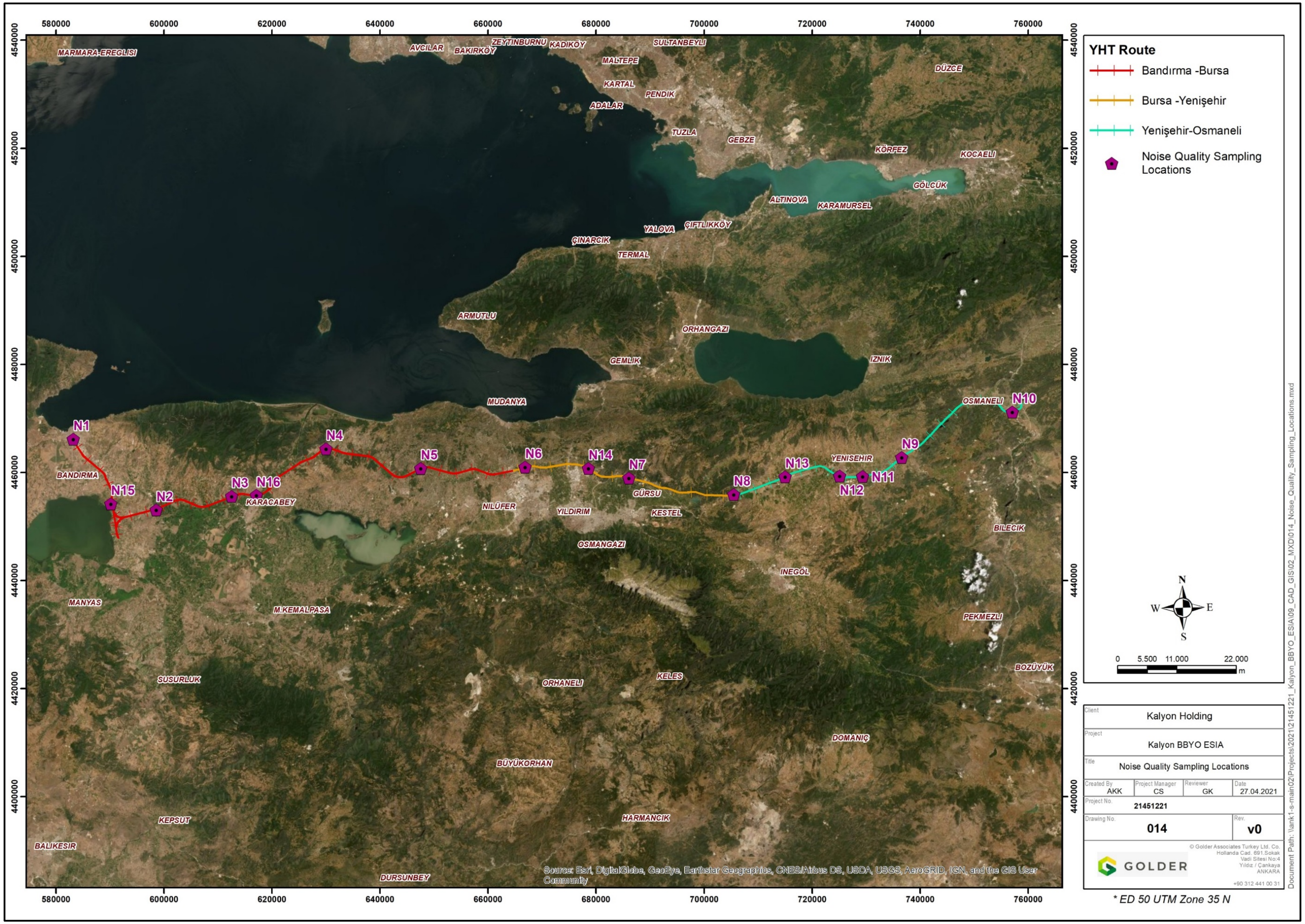


Figure 37: Noise Measurement Locations

7.1.10 Traffic and Infrastructure

The main roads of the General Directorate of Highways will be used during the construction phase of the Project.

Existing roads along the BBYO Project route consisting Balıkesir, Bursa and Bilecik Provinces located in the 14th Region of the General Directorate of Highways are shown in Figure 38.

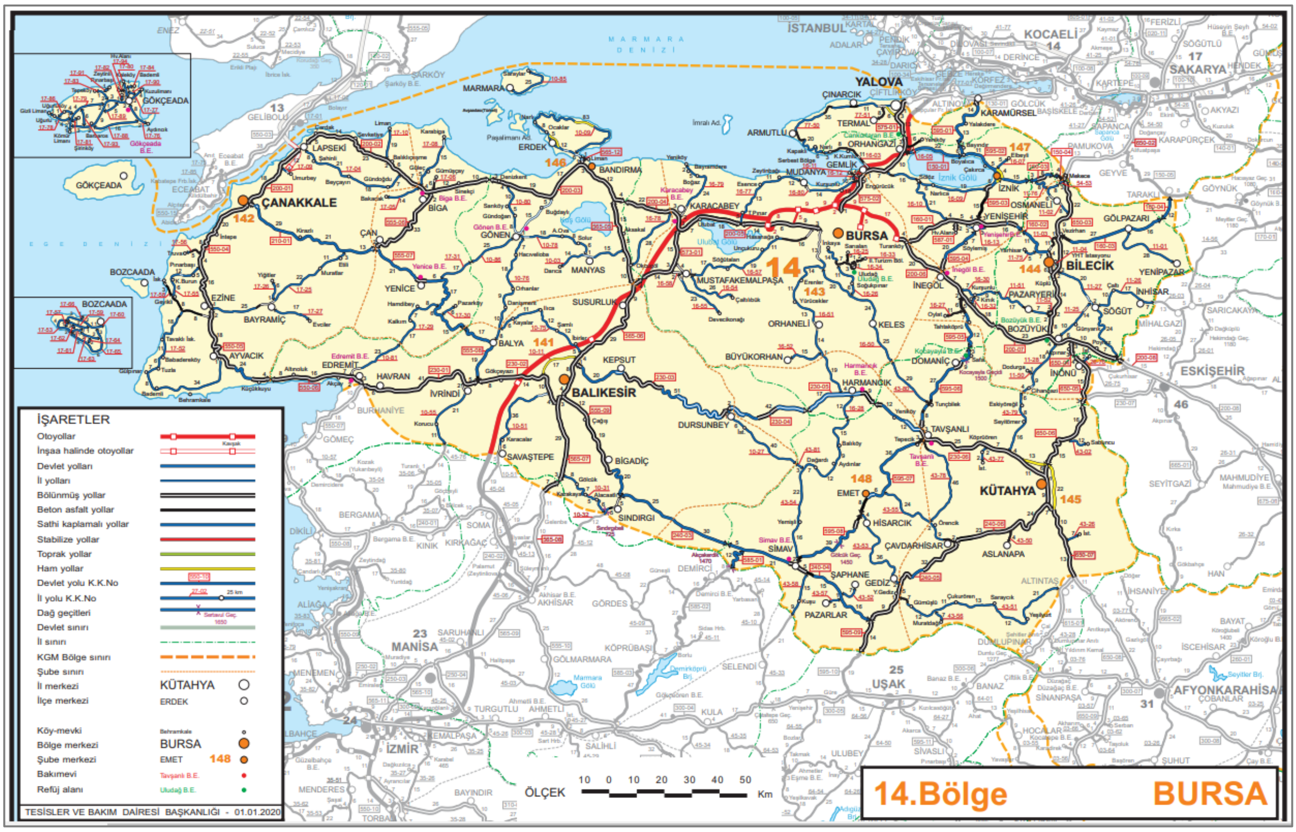


Figure 38 Existing Roads on the 14th Region of the General Directorate of Highways[16]

The traffic volume map indicating the total number of vehicle/day along the BBYO route is presented in Figure 39.

[16] General Directorate of Highways, 2019 Provinces Road and Transportation Information

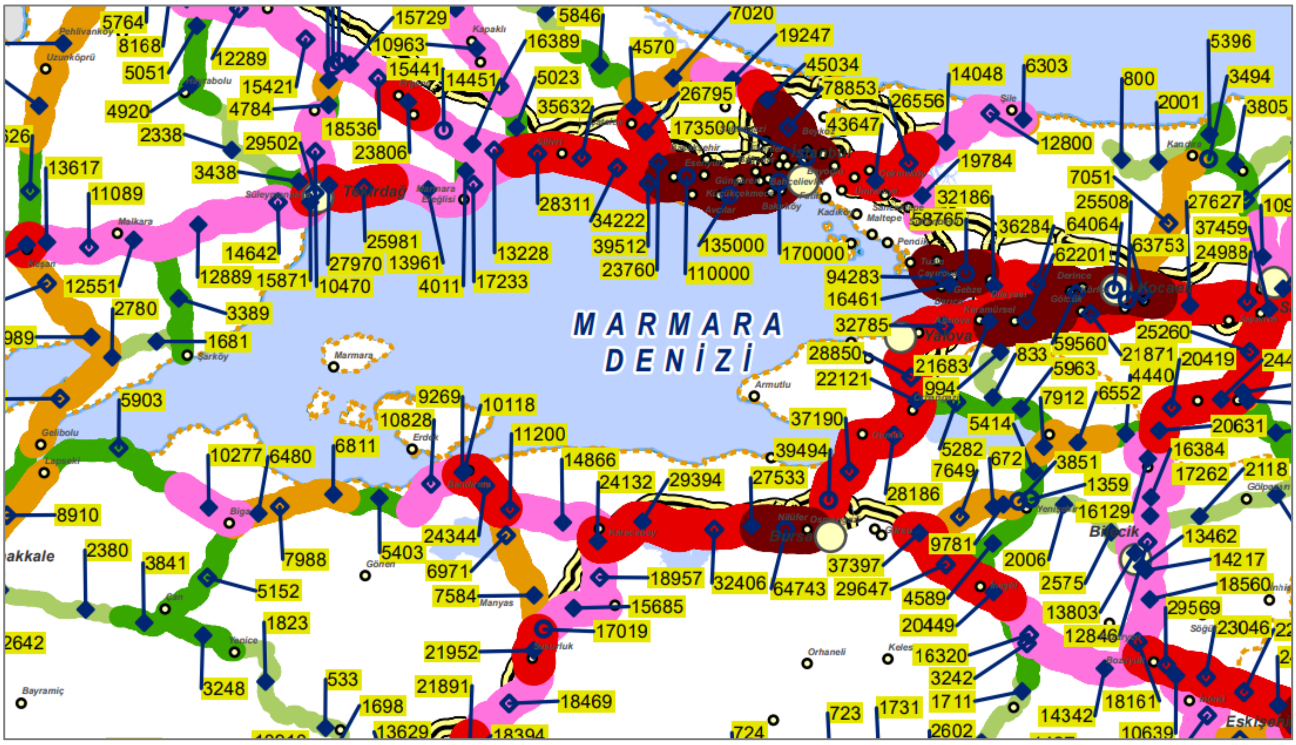


Figure 39 Traffic Volume Map[17]

There are already access roads on the BBYO route. However, some extension works might be performed in case of need. During the construction phase of the Project, permanent service roads will be opened along the 201 km BBYO route on both sides of the route. Additionally about 110 km of permanent service road is planned as the tunnel access roads.

In order to provide access to the associated facilities to be established within the scope of the BBYO Project, around 22 km total service road is planned for the access to quarries by using the existing village and forest roads. Planned service road for the Project sections are given in figures below.

[17] General Directorate of Highways, 2020 Traffic Volume Map

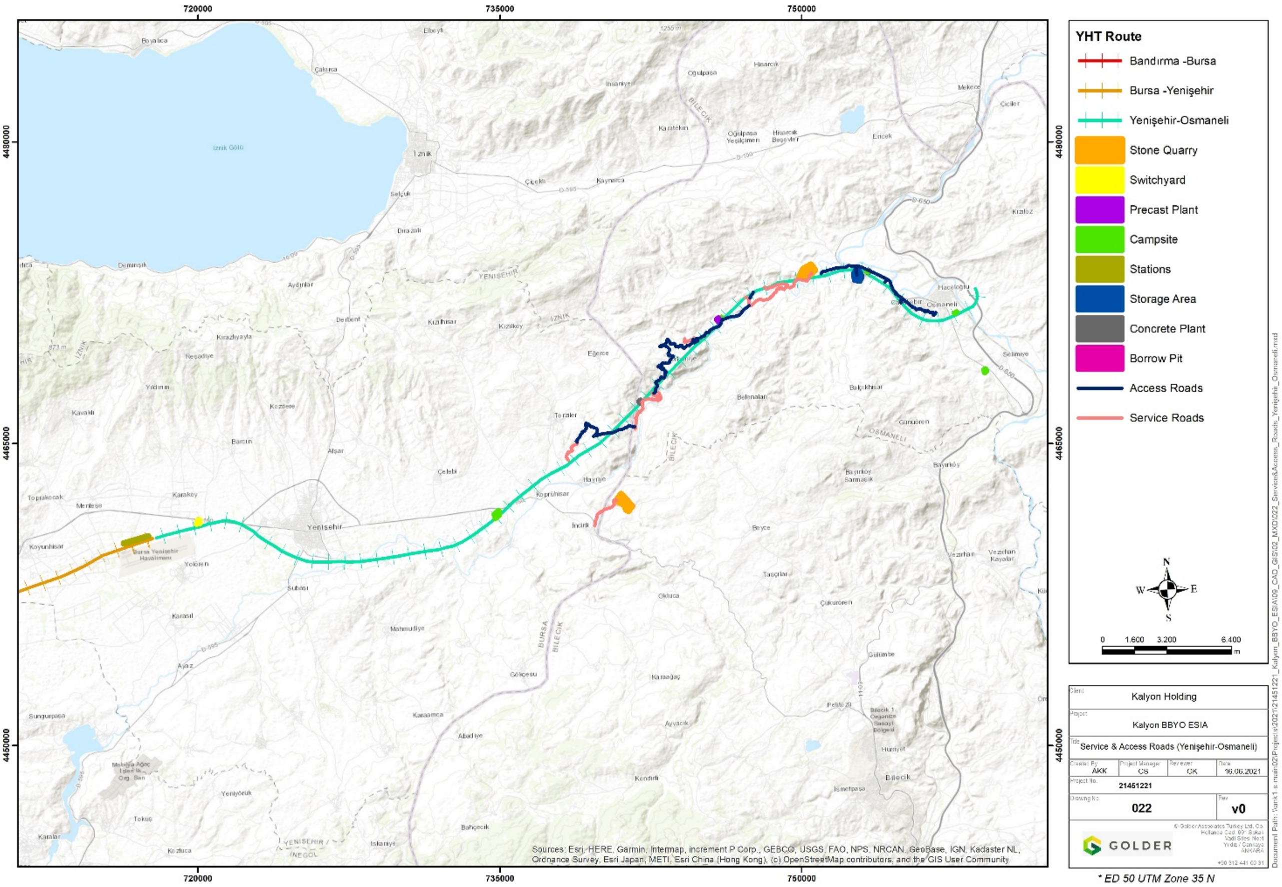


Figure 40 Service Access Roads Yenişehir-Osmaneli

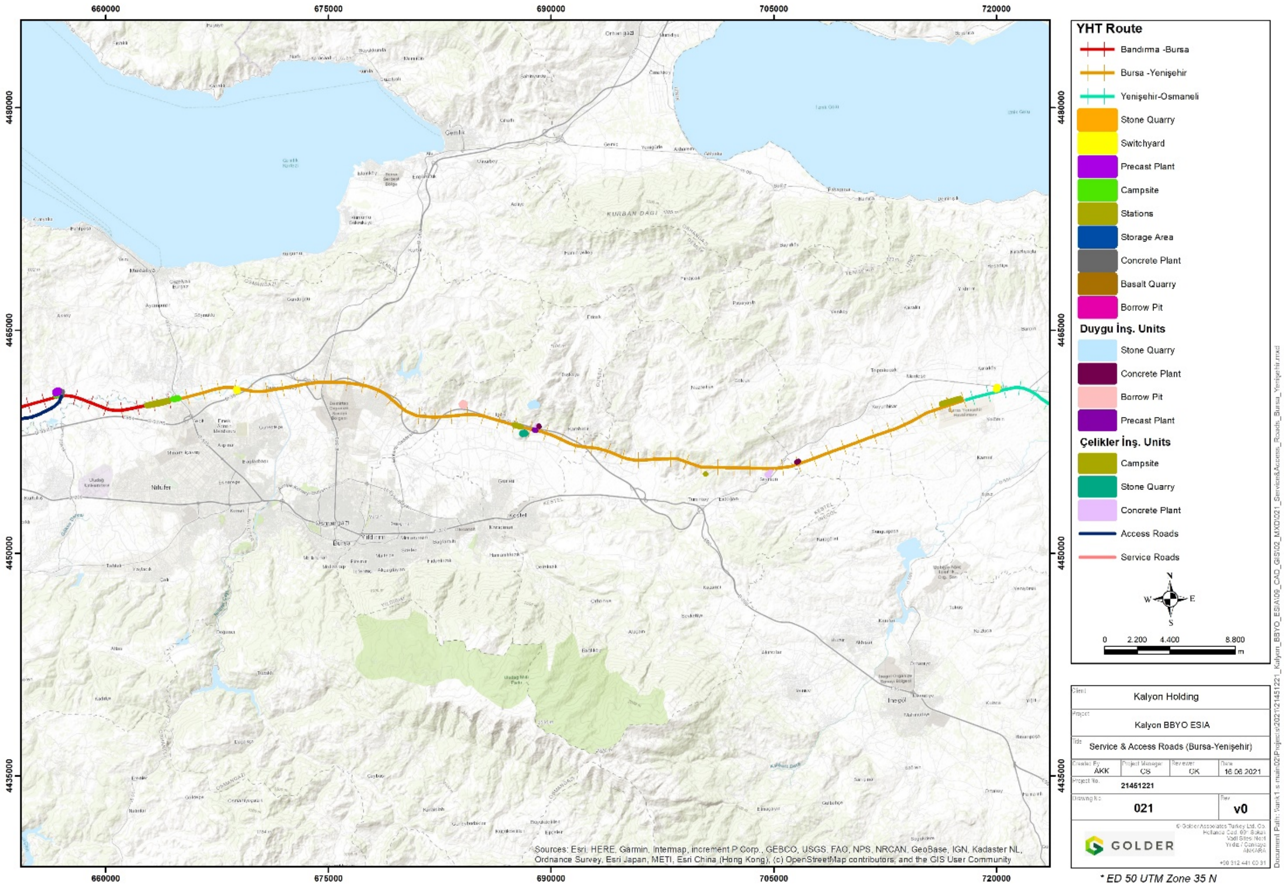


Figure 41 Service Access Roads Bursa-Yenişehir

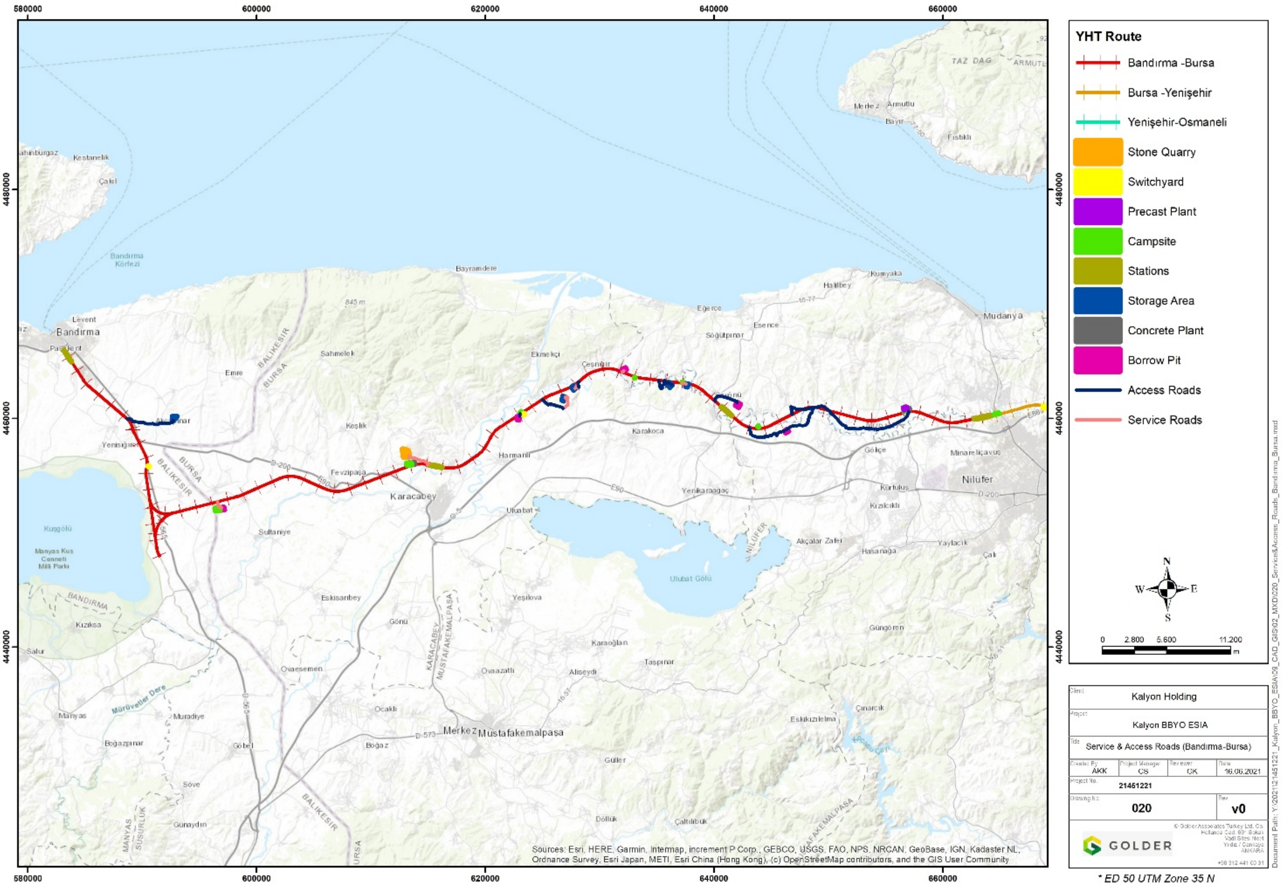


Figure 42 Service Access Roads Bandırma-Bursa

The land traffic in the construction phase will be generated by the machinery, equipment, material and staff to be transported to the Project construction sites. During the construction phase an increase especially of trucks is expected.

7.2 Biological Components

7.2.1 Study areas

7.2.1.1 Regional Study Area (RSA)

The biodiversity Regional Study Area (RSA) is an area containing a geographically distinct assemblage of species, natural communities, and environmental conditions. The RSA is defined in order to assess, based on literature review, the species and habitats potentially occurring within and in the vicinity of the Project.

The Project RSA corresponds to the “Anatolian Conifer and Deciduous Mixed Forests” (PA1202) and “Euxine-Colchic Broadleaf Forests” (PA0422) ecoregions (Olson, 2001[18]), which are part of the broader biome category “Temperate Broadleaf and Mixed Forests” (Figure 43).

Additionally, the LSA fells between the Susurluk (Simav) River basin and the Sakarya River basin, which are part of the “423 - Thrace” and “430 - Northern Anatolia” freshwater ecoregions respectively (Figure 43). They are influenced by continental and Mediterranean climatic conditions and are characterized by a dense hydrographic network of large and minor rivers that follow tortuous courses to the sea.

[18] Olson, D. M., Dinerstein, E., Wikramanayake, E. D., Burgess, N. D., Powell, G. V. N., Underwood, E. C., D'Amico, J. A., Itoua, I., Strand, H. E., Morrison, J. C., Loucks, C. J., Allnutt, T. F., Ricketts, T. H., Kura, Y., Lamoreux, J. F., Wettengel, W. W., Hedao, P., Kassem, K. R. 2001. Terrestrial ecoregions of the world: a new map of life on Earth. Bioscience 51(11):933-938.

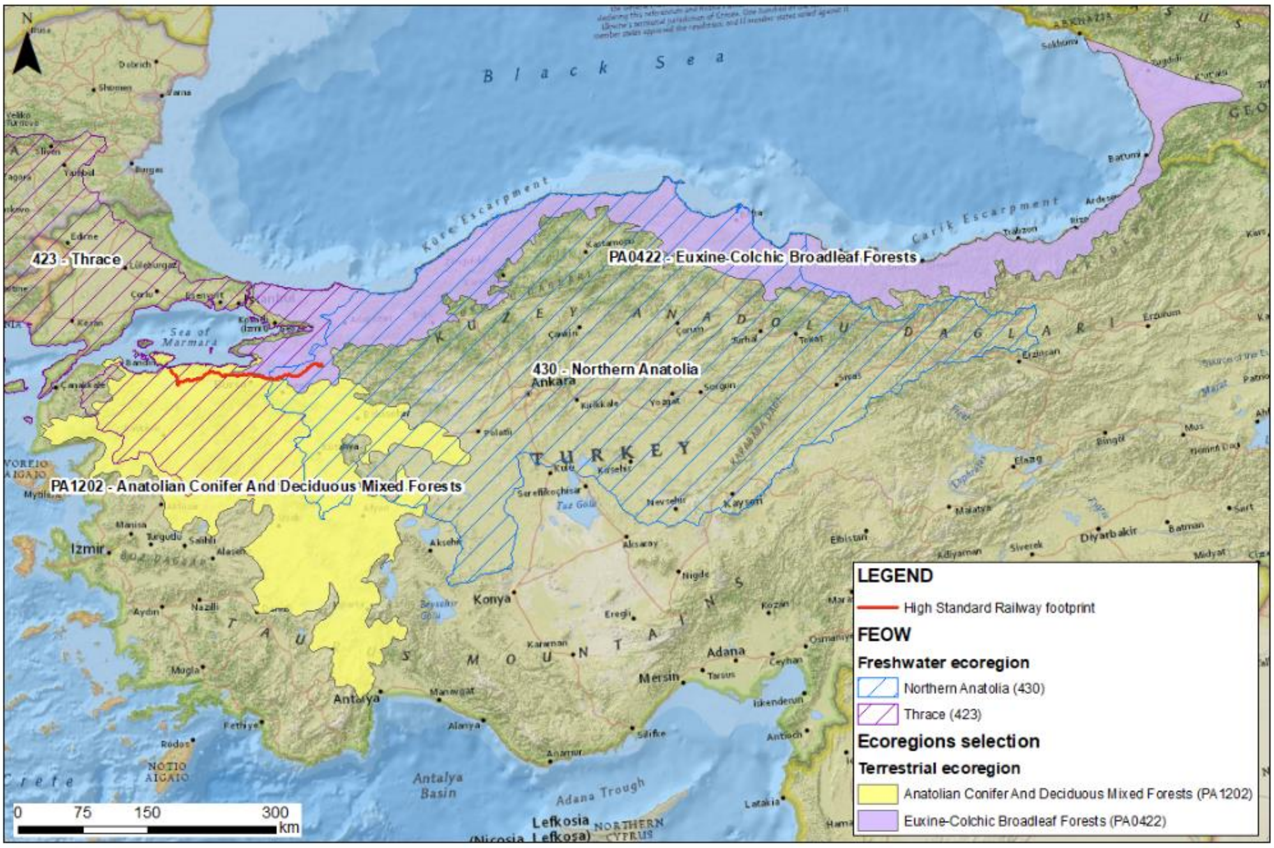


Figure 43 RSA of the High Standard Railway Project

7.2.1.2 Local Study Area (LSA)

The Project LSA extends for about 250 km between the Provinces of Balikesir, Bursa, and Bilecik at elevations between 0 m and about 540 m.

A biodiversity Local Study Area (LSA) was identified for the Project to include all the project components, associated and temporary facilities (camp areas, storage areas, borrow pits, quarries, switchyard, concrete plants, precast plants), as well as the expected Area of Influence of the Project.

The LSA is part of the wider RSA and, since there are no clear physical boundaries, it was designed as a 500 m buffer around the High Standard Railway and around the associated facilities. These buffers are considered as the limits beyond which no detectable effects on biodiversity are expected. The Local Study Area also include an appropriate ecological unit to support the design of a Biodiversity Management Plan.

The LSA was designed as shown in figure below.

Figure 44 Layout and LSA of the High Standard Railway Project

7.2.2 Methodology

7.2.2.1 Desktop analysis

Before site visit, literature review and desktop activities were conducted in order to collect data to:

- define a list of flora and fauna species potentially present within the LSA; information on the species taxonomy, national and global protection and conservation status were also added;
- define and map Natural and Modified Habitats present within LSA according to EUNIS classification;
- identify protected and internationally recognized areas of biodiversity importance present within 20 km from the LSA;
- assess the presence of potential Critical Habitats (CH) within the LSA.

Literature review

The literature review focused on the RSA area in order to document available information on local and global distribution, conservation status, ecological niche, phenology, life cycle etc. of species and ecological features of conservation concern. Scientific literature and “grey” literature were considered in order to give an overview of the biodiversity sensitive elements potentially present in the area.

The literature review included the following:

- The Global Ecoregions: http://www.worldwildlife.org/biomes
- Freshwater ecoregions of the world (FEOW): https://www.feow.org/
- Copernicus Local Land Monitoring Services - Corine Land Cover (CLC): https://land.copernicus.eu/pan-european/corine-land-cover/clc2018?tab=download
- Key Biodiversity Areas: http://www.keybiodiversityareas.org/home

- World Database on Protected Areas (WDPA): https://www.protectedplanet.net/en
- Wetlands of International Importance: https://www.ramsar.org/
- European Environmental Agency (EEA), 2021. European Nature Information System (EUNIS)
- The IUCN Red List of Threatened Species - Version 2021-1: https://www.iucnredlist.org
- Bird Life International: https://www.birdlife.org/.
- Doğa dernegi: https://www.dogadernegi.org/
- Bizim Bitkiler: www.bizimbitkiler.org.tr/
- The plant list database: www.theplantlist.org
- Turkish Plants Data Service (TÜBİVES): http://www.tubives.com/
- Fishbase: https://www.fishbase.in/search.php

7.2.2.2 Field studies

Habitat and flora field work was conducted through a two-day field study within the LSA by Prof. Dr. Aydın Akbulut (Hacettepe University) and Prof. Dr. Hayri Duman (Gazi University). It was carried out on April 6th – 7th, 2021 with the aim of evaluating the baseline conditions of the biological components within the LSA. In particular field studies were conducted in order to:

- identify the presence of threatened (CR, EN and VU according to the IUCN Red List) and endemic flora species;
- verify the EUNIS habitats, with particular regards for the natural habitats;
- identify the conservation status and potential existing threats to the habitats present.

On-site observations were conducted at 17 terrestrial sampling points and at 11 freshwater sampling points. The sampling stations were selected to be representative of the study areas in terms of position, to ensure coverage of the entire local study area, and habitats investigated.

The field campaign were oriented to identify EUNIS habitat present in the LSA at the highest level possible and the main threat/disturbance present (e.g. grazing, soil erosion, dust deposition) and the disturbance level.

Information and coordinates (WGS84 UTM Zone 35N) of the selected sampling stations are reported in Table 46 and shown in Figure 45. Field forms are available in Appendix F for both terrestrial and freshwater habitats.

Detailed photographic documentation of the landscape, vegetation, habitat characteristics and main disturbances were collected at each sampling point.

Table 46 Information and coordinates (decimal degree) of terrestrial and freshwater sampling stations

Sampling station	Terrestrial /Freshwater	X coordinate	Y coordinate
T01	Terrestrial	28.09112	40.28393
T02	Terrestrial	28.13909	40.21200
T03	Terrestrial	28.32885	40.25365
T04	Terrestrial	28.33593	40.24551

Sampling station	Terrestrial /Freshwater	X coordinate	Y coordinate
T05	Terrestrial	28.44489	40.28012
T06	Terrestrial	28.49201	40.29478
T07	Terrestrial	28.55469	40.31679
T08	Terrestrial	28.61882	40.30366
T09	Terrestrial	28.72038	40.26604
T10	Terrestrial	28.84561	40.28093
T11	Terrestrial	29.12067	40.26476
T12	Terrestrial	29.27302	40.23967
T13	Terrestrial	29.35437	40.22701
T14	Terrestrial	29.58707	40.26984
T15	Terrestrial	29.75784	40.26762
T16	Terrestrial	29.83607	40.27283
T17	Terrestrial	29.94740	40.37360
F01	Freshwater	28.04849	40.27279
F02	Freshwater	28.34619	40.24405
F03	Freshwater	28.39623	40.24788
F04	Freshwater	28.44881	40.28312
F05	Freshwater	28.62298	40.30442
F06	Freshwater	28.65838	40.28224
F07	Freshwater	28.97834	40.28155
F08	Freshwater	29.02465	40.28302
F09	Freshwater	29.58269	40.26797
F10	Freshwater	29.85016	40.31866
F11	Freshwater	29.94905	40.37156

Figure 45 Sampling stations' location

7.2.2.3 Habitat mapping

EUNIS habitat were identified and mapped in the entire local study area (LSA) at a fine scale (1:10.000) according to EUNIS classification based on satellite image and literature information, including a Corine Land Cover.

The procedure used for the habitat mapping was as follows:

1) A general land cover map was created using the Corine Land Cover 2018 v.2020_20u1 available on the Copernicus website.
2) The CORINE Land Cover classes were converted into EUNIS Habitat using the highest possible definition level (level 3 at least) by analysing appropriate satellite imagery and taking into consideration available previous studies performed in the area.
3) EUNIS habitat types were then categorized into modified or natural habitats according to PS6 (IFC, 2019).

The results of fauna and flora species surveys were also used to validate the mapping.

7.2.2.4 Identification of Critical Habitat

A first screening based on available information was conducted in order to identified the potential presence of Critical Habitats (CHs) within the LSA according to IFC Performance Standard 6 (PS6).

According to IFC PS6, the definition of Critical Habitat is triggered by the criteria reported below.

i) **Habitats of significant importance to endangered or critically endangered species**

The presence of species having Endangered (EN) or Critically Endangered (CR) conservation status according to global IUCN criteria was considered. In the absence of a Global IUCN assessment (e.g. Not Evaluated NE, or Data Deficient DD) local assessments were considered (e.g. The Red Book of Vascular

Flora of the Republic of Kosovo). In addition, fauna and flora species of community interest identified under the EU Habitats Directive (Annex IV) or under Annex I of the Birds Directive were also included.

In order to assess the importance of the LSA for these species, the following thresholds were applied (Guidance Note 6, GN72, IFC 2019):

a) areas that support globally important concentrations of an IUCN Red-listed EN or CR species (> 0.5% of the global population AND >5 reproductive units of a CR or EN species);

b) areas that support globally important concentrations of an IUCN Red-listed VU species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in GN70(a).

c) as appropriate, areas containing nationally/regionally-important concentrations of an IUCN Red-listed EN or CR species."

ii) Habitats of significant importance to endemic or geographically restricted species

The presence of endemic or restricted range species (EOO less than 50,000 km^2) was considered.

In order to assess the importance of the LSA for these species, the following threshold was applied (Guidance Note 6, GN75, IFC 2019):

a) areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a species.

iii) Habitats supporting globally significant migratory or congregatory species

The presence of Key Biodiversity Areas and Important Bird Areas identified for congregatory species and of Wetlands of International Importance designated under criteria 5 or 6 of the Ramsar Convention was considered. In addition, the presence of migratory and congregatory species were also considered.

In order to assess the importance of the LSA for these species, the following thresholds were applied (Guidance Note 6, GN78, IFC 2019):

a) areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle.

b) areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.

iv) **Highly threatened or unique ecosystems**

Ecosystems that are at risk of significantly decreasing in area or quality, have a small spatial extent, and/or contain concentrations of biome-restricted species were considered for this criterion. This included EUNIS habitats considered Endangered (EN) or Critically endangered (CR) according the "European Red List of Habitats".

In order to assess the importance of the LSA for these habitats, the following thresholds were applied (Guidance Note 6, GN80, IFC 2019):

a) areas representing ≥5% of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN.

b) Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning.

v) Areas associated with key evolutionary processes

The presence of areas with landscape features that might be associated with evolutionary processes or populations of species that are especially distinct and may be of special conservation concern given their distinct evolutionary history was considered.

7.2.3 Sensitivity Assessment

Based on the information collected with the methodology described above, the sensitivity of the component will be determined according to the following definitions. A biological component, as general approach, has:

- **high sensitivity** when it has an attribute with a high quality and rarity on an international, regional or national scale with little or no potential for substitution;
- **medium sensitivity** when it has an attribute with a high quality and rarity on a local scale with little or no potential for local substitution, or with a medium quality or rarity on a regional or national scale with limited potential for substitution;
- **low sensitivity** when it has an attribute with a medium quality and rarity on a local scale with limited potential for substitution, or an attribute of low quality and rarity on a regional or national scale;
- **negligible sensitivity** when it has an attribute of low quality and rarity on a local scale with potential for substitution locally.

7.2.4 General Features

The Project LSA is situated within the "Anatolian Conifer and Deciduous Mixed Forests" (PA1202) and the "Euxine-Colchic Broadleaf Forests" (PA0422) **terrestrial ecoregions** (Olson, 2001[19]), which are part of the broader biome category "Temperate Broadleaf and Mixed Forests" (Figure 43). The LSA altitudinal range is comprised between 0 m and 540 m.

The **Anatolian Conifer and Deciduous Mixed Forests ecoregion** is mountainous and forms a transitional zone among Mediterranean, Euro-Siberian and Irano-Turanian vegetation types. Dominant vegetation includes pure pine forests and mixed pine and oak woodlands and shrublands. The northern part of the ecoregion, wherethe project is located is influenced by the Marmara Sea and hosts many Euro-Siberian elements and has a diverse flora.

The **Euxine-Colchic Broadleaf Forests ecoregion**, extending along the southern Black Sea coast from Turkey's Istiranca Mountains in the west to the Abkhazia region of Georgia in the east. The eastern, or Colchic, portion of this region, where the Project is located, is highly humid (annual precipitation average: 1,500-2,500) and broadleaf deciduous forests constitute the main vegetation type with is the evergreen but mesomorphic broadleaf understory. This area is also an important transit and refueling area for large migratory populations of waterbirds, passerines and raptors. This migratory pathway is known as the 'East Black Sea Migration Route'

The LSA also fells between the Susurluk (Simav) River basin and the Sakarya River basin, which are part of the "423 - Thrace" and "430 - Northern Anatolia" **freshwater ecoregions** respectively. They are characterized by a dense hydrographic network of large and minor rivers that follow tortuous courses to seas, and are influenced by continental and Mediterranean climatic conditions.

The **Thrace freshwater ecoregion** spans the junction of Europe and Asia in northwestern Anatolian Turkey, European Turkey, and eastern Greece. In Anatolian Turkey the main rivers include the Simav (or Kokacay)

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[19] Olson, D. M., Dinerstein, E., Wikramanayake, E. D., Burgess, N. D., Powell, G. V. N., Underwood, E. C., D'Amico, J. A., Itoua, I., Strand, H. E., Morrison, J. C., Loucks, C. J., Allnutt, T. F., Ricketts, T. H., Kura, Y., Lamoreux, J. F., Wettengel, W. W., Hedao, P., Kassem, K. R. 2001. Terrestrial ecoregions of the world: a new map of life on Earth. Bioscience 51(11):933-938.

River basin along with lakes Kus, Uluabat, Iznik and Sapanca, which drainages flow into Black seas and the Sea of Marmara. The major habitat type present are temperate coastal rivers, characterized by mixed forest with irrigated and dry farming and tree crops. Additionally, this basin has an extensive marine coastline, therefore the lower reaches of rivers, and some lakes, have a fauna derived from the sea. Several marine origin families migrate into fresh water and use the basin waters of the Thrace ecoregion for reproduction and for feeding.

To the east of Thrace ecoregion is located the **Northern Anatolia freshwater ecoregion**. This ecoregion comprises the drainages of north-central and western Anatolian Turkey, from the Sakarya basin in the west to the Kizil and Kelkit basins in the east. The Sakarya river is the longest in Turkey, extending 800 km from its source to its mouth.

7.2.5 Protected and Internationally Recognized Areas

The Project is not located within any protected areas. However, a small portion of the footprint, and consequently of the Project LSA, in the western part partially falls within the internationally recognized **Manyas Lake (Kuş Lake) Key Biodiversity Area (KBA) and Important Bird Area (IBA)**, which substantially matches with the **Kuş Lake Ramsar Site** (Wetlands of International Importance) (Figure 47).

In addition, the Project LSA minimally overlaps the internationally recognized **Kocaçay Delta Key Biodiversity Area (KBA) and Important Bird Area (IBA)** (Figure 48).

Finally, the Marmara Islands KBA and IBA is located at 5 km from the LSA, while the Uluabat Lake KBA, IBA and Ramsar Site, the Armutlu Peninsula KBA and IPA (Important Plant Area), the Ulu (Uludag) Mountain KBA and IPA, and Kocaçay Delta KBA and IPA are located at 20 km from the Project LSA.

These areas are represented in **Figure 46** and are described below.

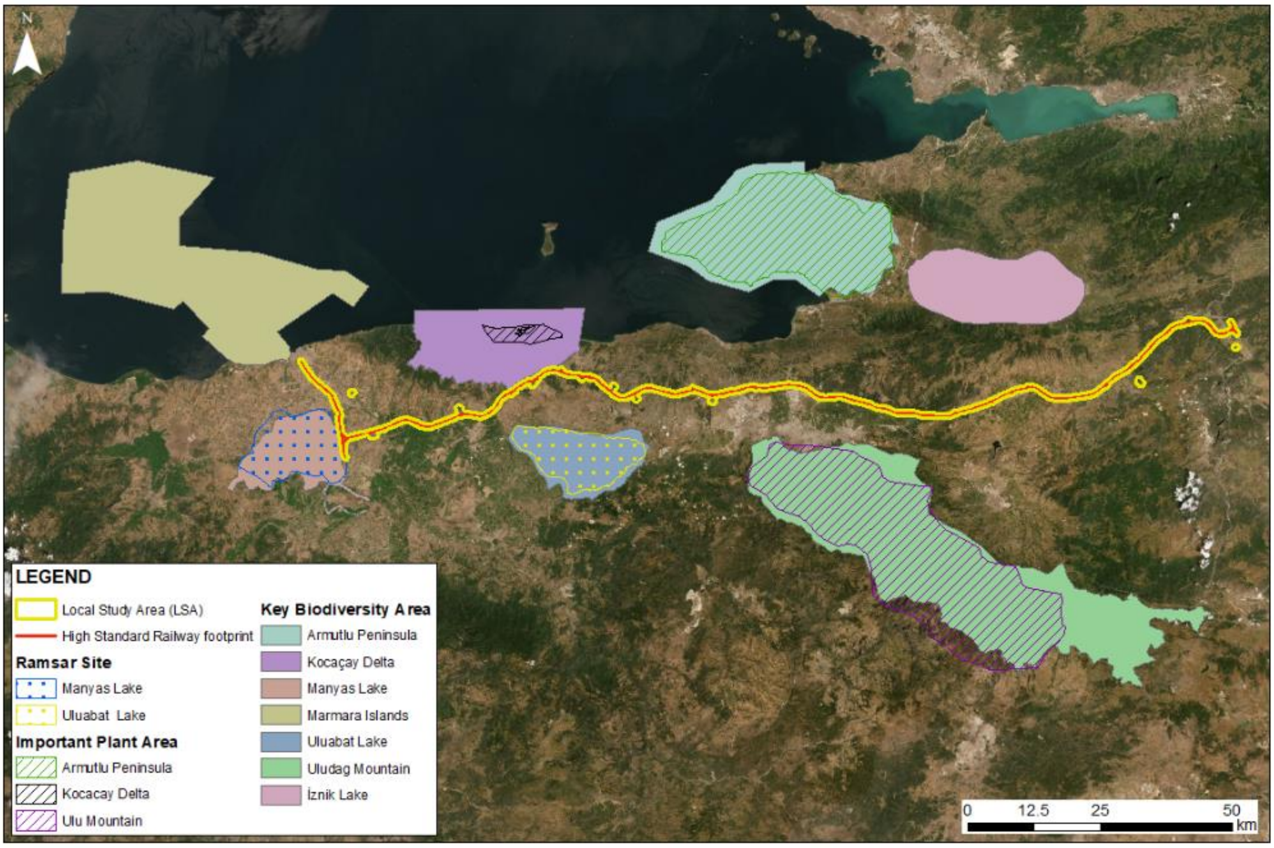


Figure 46: Map of protected and internationally recognized areas

Manyas Lake (Kuş Lake) KBA and IBA, Kuş Lake Ramsar Site

This KBA and IBA (code MAR013), which substantially matches with the homonym Ramsar Site (20,400 ha), is located within the districts of Bandırma, Gönen, and Manyas (Balikesir province), extending from 15 m to 60 m a.s.l. with a total area of about 21,821 ha.

Manyas Lake is considered an important bird sanctuary, as result 64 ha of land on the north-eastern edge of the lake has been protected as Kucenneti (meaning Bird Paradise in Turkish) National Park since 1959. In 1977, the entire lake was declared as Permanent Wildlife Reserve, under the protection of the Cultural and Natural Assets Law, while in 1994 the eastern part of the lake was listed in the Ramsar Convention extending to the whole lake in 1998, which substantially matches with the KBA and IBA.

The lake is one of the most important and famous wetlands of the West Anatolia Region and it consists of a turbid shallow eutrophic freshwater lake (average depth 3 m) fed by groundwater and streams, subject to seasonal fluctuations in level, such as Kocaçay and Sigirci Creeks; small deltas have formed where the latter enter the lake, comprising extensive marshes and tree-lined riverbanks.

Shores of the lake, particularly areas which emerge after withdrawal of water during the summer season, have a rich plant cover and narrow belts of reed Phragmites fringe much of the lake. As a result of the investigations carried out in the area, 118 plant species having speed, were determined. The dominating tree species is *Salix alba*, while hundreds of phanerogamous plants are found in the adjacent marshy meadows: *Potentilla reptans, Polygonum patalum, Ranunculus sanicufolius, Tamarix sp., Lythrum salicria, Athaea officinalis, Nymphaea alba, Roripa sp., Oenonte sp., Solanum dulcamara, Mentha aquatica, Veronica angalloides, Cirsium arvensa, Juncus sp., Iris pseudocorus, Cyperus longus, Typha sp., Phragmites sp., Carex sp.*. Grazing of cattle and sheep is common along these shores.

Manyas Lake, also called the Bird Lake, hosts 266 bird species in the area where in 3000-4000 pairs of birds breeds regularly. The lake, in fact, with its favourable mild climate conditions and the rich plant community is located on a migratory waterbird route, supporting possible shelter and providing important feeding grounds for birds in all seasons. The site holds significant breeding populations of various species of waterbirds, several of which are threatened, and is important for wintering, migrating, and roosting birds. The lake is an important breeding habitat for the threatened *Pelecanus crispus* and *Phalacrocorax pygmeus*. *Egretta garzetta*, *Nycticorax nycticorax*, *Sterna hirundo*, *Vanellus spinosus, Ardeola ralloides*, *Ardea cinerea*, *Plegadis falcinellus*, and *Platalea leucorodia*.

Manyas Lake habitats are suitable for feeding, sheltering and breeding, as the lake is rich in flora and fauna biodiversity, such as insects, worms, frogs, fish and other foods which are necessary for feeding the birds. The lake supports 23 fish such as *Cyprinus carpio*, *Silurus glanis*, *Esox lucius*, *Leuciscus cephalus*, which are all caught for food. Additionally, the inland water fish *Cobitis puncticulata*, endangered on a global scale, lives only in this area in the world.

The KBA is triggered by the presence of 29 species, of which 2 fish species, 1 amphibian species, 1 reptile species, 1 mammal species, and 24 bird species (Table 47). Six species are classified as threatened species, while only the fish species of *Cobitis puncticulata* is considered as endemic.

Moreover, the IBA criteria are triggered by the presence of 8 bird species, of which 3 species are classified as threatened (Endangered - EN, Near threatened - NT) according to the IUCN Red List (BirdLife International 2020). These species are listed in Table 48.

The main threats impacting this area are the agricultural, industrial and domestic pollution. Sığırcı Creek, which joins Lake Manyas from the north and passes through Bird Paradise, carries the discharges of industrial establishments within the borders of Bandırma Municipality directly to the lake. In addition, the sewerage of residential areas is also thrown into the lake and the fertilizers used in agricultural areas are carried to the lake by precipitation water of other agricultural pesticides. Due to over-fishing, disease, pollution and possibly the effects of the changing water regime, fish catches have declined drastically.

Additionally, artificially high water-levels have resulted in the loss of feeding marshes; nesting trees in the National Park have also begun to die as a result of prolonged inundation.

Therefore, within the scope of Manyas Lake Management Plans, zones with different protection status have been determined (**Figure 47**):

- Absolute Protection zones;
- Wetland zones;
- Buffer zones.

The LSA intersects exclusively with the buffer zone but not with the wetland or the absolute protection zone.

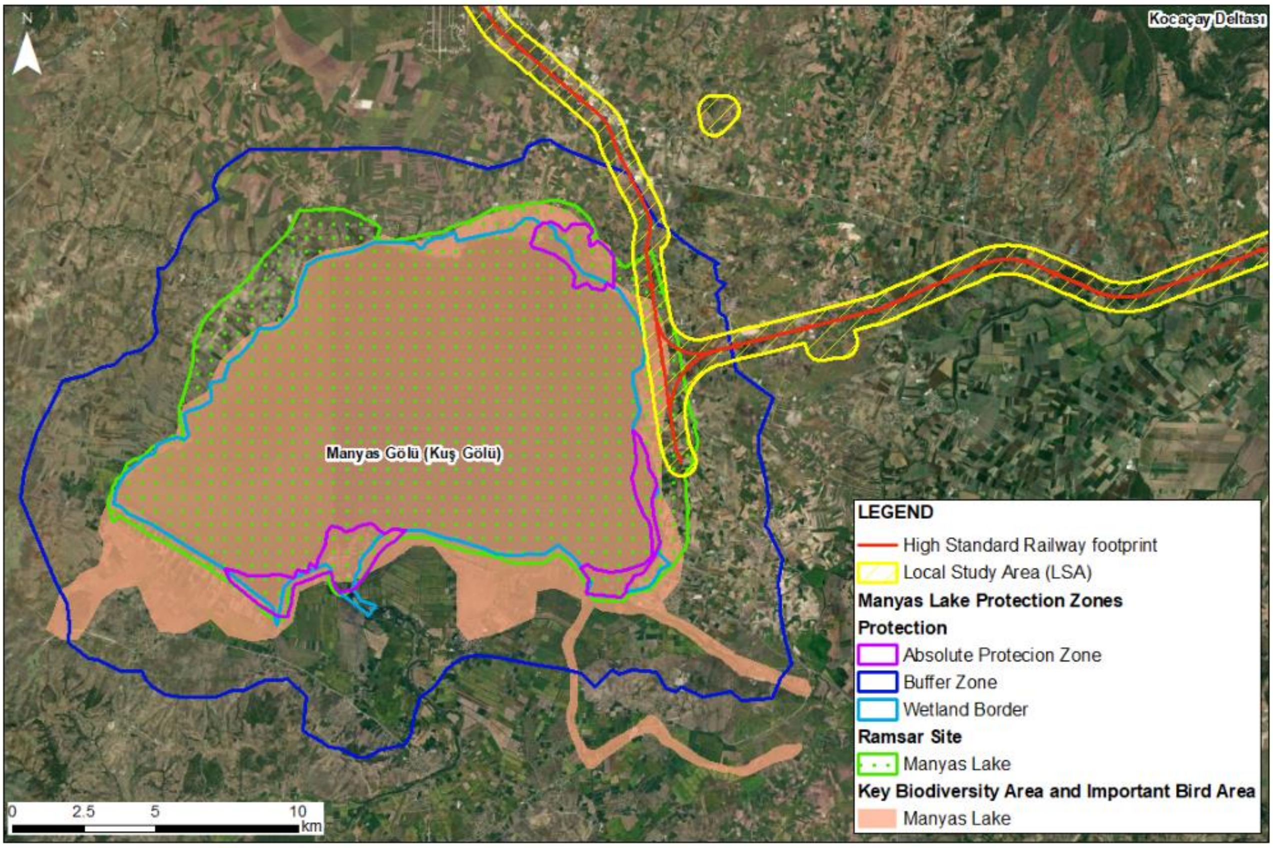


Figure 47: Manyas Lake Protection Zones, Manyas Lake KBA and IBA, and Kuş Lake Ramsar Site in relation to the footprint and LSA Project

Table 47 Flora and fauna species triggering the Manyas Lake (Kuş Lake) KBA

Taxon	Scientific Name	IUCN Red List	Endemism / Restricted Range	KBA criteria
Fish	*Cobitis puncticulata*	EN	Endemic	A1, A2, C1
	Rhodeus (sericeus) amarus	LC	-	C1
Amphibian	*Triturus karelinii*	LC	-	C1

Taxon	Scientific Name	IUCN Red List	Endemism / Restricted Range	KBA criteria
Reptile	*Emys orbicularis*	NT	-	C1
Bird	*Acrocephalus melanopogon*	LC	-	C1
	Ardea purpurea	LC	-	C1
	Ardeola ralloides	LC	-	C1
	Aythya nyroca	NT	-	B1, C1
	Botaurus stellaris	LC	-	C1
	Burhinus oedicnemus	LC	-	B1, C1
	Casmerodius albus	LC	-	C1
	Ciconia ciconia	LC	-	C1
	Circus aeruginosus	LC	-	C1
	Cygnus columbianus	LC	-	B1, B3, C1, C3
	Egretta garzetta	LC	-	B3, C1, C3
	Himantopus himantopus	LC	-	C1
	Ixobrychus minutus	LC	-	C1
	Melanocorypha calandra	LC	-	C1
	Microcarbo pygmaeus	LC	-	C1
	Microcarbo pygmaeus	LC	-	C1
	Nycticorax nycticorax	LC	-	B3, C1, C3
	Oxyura leucocephala	EN	-	A1, B1, C1
	Pelecanus crispus	NT	-	A1, A3, B3, C1, C3
	Pelecanus crispus	NT	-	A1, B3, C1, C3
	Pelecanus onocrotalus	LC	-	A1, B3, C1, C3
	Phalacrocorax aristotelis desmarestii	LC	-	C1
	Platalea leucorodia	LC	-	B3, C1, C3
	Plegadis falcinellus	LC	-	C1
	Sterna hirundo	LC	-	C1

Taxon	Scientific Name	IUCN Red List	Endemism / Restricted Range	KBA criteria
	Vanellus spinosus	LC	-	B1, C1
Mammal	*Lutra lutra*	NT	-	C1

Table 48 Bird species triggering IBA criteria

Species	IUCN Red List	Status	Population estimate	IBA Criteria
Ardeola ralloides	LC	Breeding	100 breeding pairs	B2
Microcarbo pygmaeus	LC	Breeding	150 breeding pairs	A1, B1i, B3
Microcarbo pygmaeus	LC	Winter	58-315 individuals	A1
Nycticorax nycticorax	LC	Breeding	1,500 breeding pairs	A4i, B1i, B2
Oxyura leucocephala	EN	Winter	20-34 individuals	A1
Pelecanus crispus	NT	Breeding	35-40 breeding pairs	A1, A4i, B1i, B2
Pelecanus crispus	NT	Winter	52-117 individuals	A1, A4i, B1i
Pelecanus onocrotalus	LC	Passage	1,500-5,000 individuals	A4i, B1i
Phalacrocorax carbo	LC	Breeding	2,650-3,000 breeding pairs	A4i, B1i
Platalea leucorodia	LC	Breeding	200 breeding pairs	A4i, B1i, B2

Kocaçay Delta Key Biodiversity Area (KBA) and Important Bird Area (IBA)

This KBA and IBA (code MAR016) is located on the southern shore of the Sea of Marmara within the districts of Mudanya, and Karacabey (Bursa province), extending from 0 m to 110 m a.s.l. with a total area of about 38,462 ha.

This KBA is of great importance in terms of natural life, as it contains several ecosystems, ranging from coastal lakes, dune environment with salt plants, lagoons, marshes, alluvional and wet forest, deciduous forests on the hills south of the delta.

The western half of the delta comprises two lagoons, reeds area typically of P*hragmites*, extensive *Fraxinus*, *Alnus* and *Salix* alluvial forest, and a wide dune strip; the eastern half is more open with one large lagoon, arable land, orchards, dunes, reedbeds and *Salicornia*- and *Tamarix*-covered mudflats.

The KBA is one of the most important resting and feeding areas for many predators and waterfowl during their breeding, migration and wintering periods, hosting several species such as *Aquila pomarina*, *Aythya nyroca*, *Burchinus oedicnemus*, *Charadrius alexandrinus, Chlidonias hybrida*, *Glareola pratincole*, *Haliaeetus albicilla* (that does not meet IBA criteria, even if it is one of the few confirmed Turkish sites), *Phalacrocorax pygmeus*, *Platalea leucorodia*, *Plegadis falcinellus*, *Sterna albifrons*, *Sterna hirundo*, *Sterna nilotica*.

The delta also has important habitats for the amphibian *Triturus karelinii* and for the inland fish *Rhodeus sericeus amarus*.

The KBA is triggered by the presence of 36 species, of which 1 fish species, 1 amphibian species, 1 mammal species, and 33 bird species (Table 49); only 2 species are classified as threatened species.

Moreover, the IBA criteria are triggered by the presence of 8 bird species, of which only *Aythya nyroca* is classified as threatened (Near threatened - NT) according to the IUCN Red List (BirdLife International 2020). These species are listed in Table 50.

The main threats impacting this area are mostly the urban and industrial pollution, human intrusions and disturbances due to tourism and recreation. One of the biggest problems in the area is that Nilüfer Stream, which brings Bursa's wastewater, reaches Kocaçay Delta and increases the pollution load of the delta.

The effects of on the delta's ecology are unknown: flooded forests and wetlands are usually used as pastures, while forests and other natural habitats are cleared for arable land and *Populus* plantations; sand extraction is performed to fulfil the demand for sand especially in the spring season, affecting the reproductive success of the birds. Agriculture is carried out in the region between the lakes and the hills.

Kocaçay Delta KBA and IBA intersection with the Project LSA is minimal and it occurres on the outskist of the KBA and IBA (Figure 48).

Table 49 Fauna species triggering the Kocaçay Delta KBA

Taxon	Scientific Name	IUCN Status	Endemism / Restricted Range	KBA criteria
Fish	*Rhodeus (sericeus) amarus*	LC	-	C1
Amphibian	*Triturus karelinii*	LC	-	C1
Bird	*Alcedo atthis*	LC	-	C1
	Aquila pornarira	LC	-	C1
	Ardea purpurea	LC	-	C1
	Ardeola ralloides	LC	-	C1
	Aythya nyroca	NT	-	B1, C1
	Botaurus stellaris	LC	-	C1
	Burhinus oedicnemus	LC	-	C1
	Calandrella brachydactyla	LC	-	C1
	Caprimulgus europaeus	LC	-	C1
	Charadrius alexandrinus	LC	-	C1
	Chilodonias hybrida	LC	-	C1
	Ciconia nigra	LC	-	C1
	Circus aeruginosus	LC	-	C1

Taxon	Scientific Name	IUCN Status	Endemism / Restricted Range	KBA criteria
	Dendrocopos leucotos	LC	-	C1
	Dendrocopos medius	LC	-	C1
	Dendrocopos syriacus	LC	-	C1
	Egretta garzetta	LC	-	C1
	Fulica atra	LC	-	B2, C3
	Glareola pratincola	LC	-	C1
	Haliaeetus albicilla	LC	-	C1
	Himantopus himantopus	LC	-	C1
	Hippolais olivetorum	LC	-	C1
	Ixobrychus minutus	LC	-	C1
	Lanius collurio	LC	-	C1
	Lanius minor	LC	-	C1
	Melanocorypha calandra	LC	-	C1
	Microcarbo pygmaeus	LC	-	C1
	Nycticorax nycticora	LC	-	C1
	Platalea leucorodia	LC	-	C1
	Plegadis falcinellus	LC	-	C1
	Sterna albifrons	LC	-	C1
	Sterna hirundo	LC	-	C1
	Sterna nilotica	LC	-	B1, C1
Mammal	*Lutra lutra*	NT	-	C1

Table 50 Bird species triggering IBA criteria

Species	IUCN Red List	Status	Population estimate	IBA Criteria
Aythya nyroca	NT	Breeding	70 breeding pairs	A1, B2
Charadrius alexandrinus	LC	Breeding	70-90 breeding pairs	B2

Species	IUCN Red List	Status	Population estimate	IBA Criteria
Ciconia nigra	LC	Breeding	10 breeding pairs	B2
Fulica atra	LC	Winter	42,610 individuals	A4i, B1i
Glareola pratincola	LC	Breeding	80 breeding pairs	B1i, B2
Microcarbo pygmaeus	LC	Passage	63-150 individuals	A1
Pelecanus onocrotalus	LC	Passage	800 individuals	A4i, B1i
A4iii Species group - waterbirds	n/a	Winter	27,986-46,291 individuals	A4iii

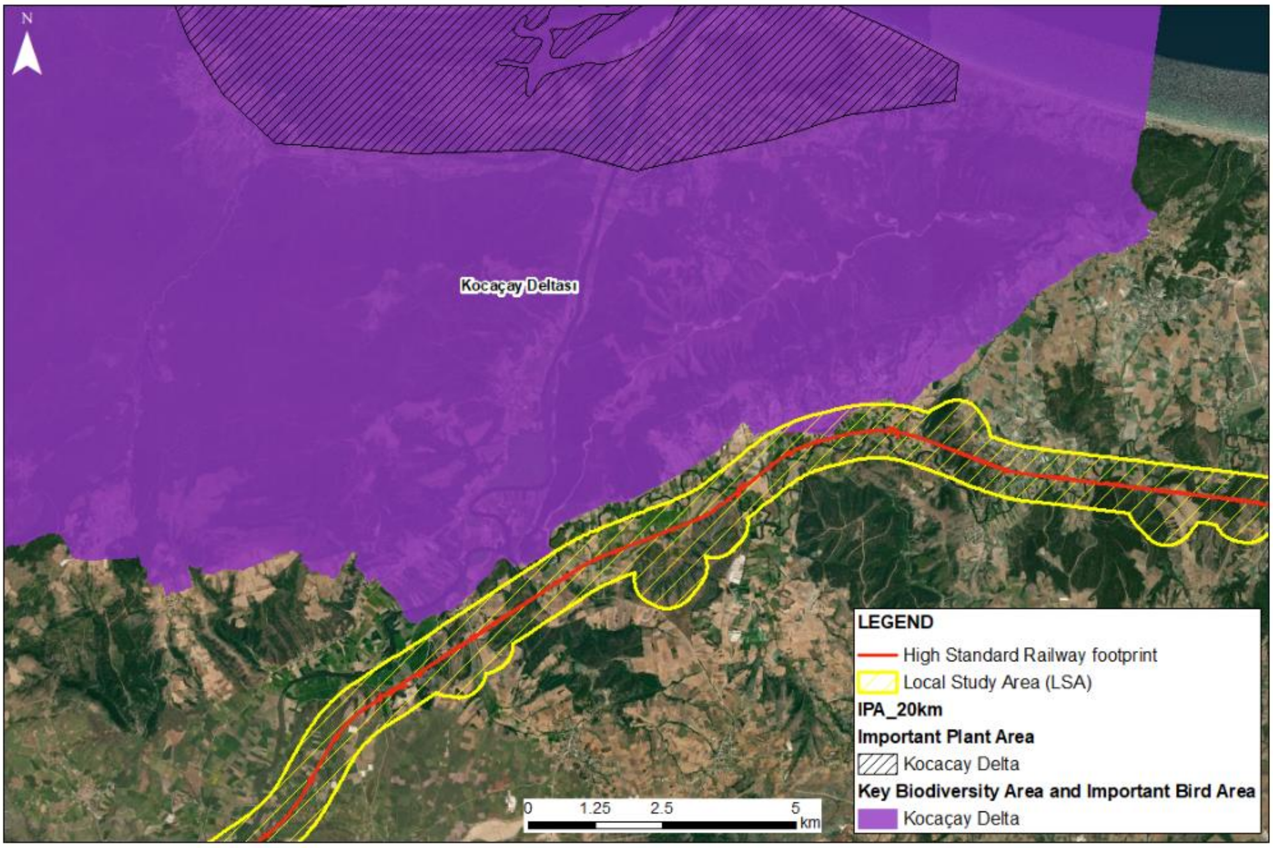


Figure 48: Kocaçay Delta KBA and IBA in relation to the footprint and LSA Project

7.2.6 Natural and Modified Habitat

The presence of natural and modified habitats was identified in the LSA according to the EUNIS habitat classification (level 3) based on literature review and field work conducted by Prof. Dr. Aydın Akbulut and Prof. Dr. Hayri Duman on April 6th – 7th 2020,

Natural habitats occupy 22% of the LSA, and are dominated by lowland to montane coniferous woodland (G3.7; 8% of the LSA), mixed Mediterranean coniferous and deciduous woodland (G4.B; 3% of the LSA), grazed mesotrophic pastures (E2.1; 3% of the LSA) and mixed sclerophyllous evergreen and deciduous shrub thickets (F5.3; 3% of the LSA), followed by thermophilous deciduous woodland (G1.7; 2% of the total LSA), maquis vegetation (F5.2; 1% of the total LSA) and coniferous woodland dominated by *Cupressaceae* or *Taxaceae* (G3.9; 1% of the total LSA). Eight more habitats were identified with a percentage of less than 1% of the Project area.

The 78% of the LSA is covered by modified habitats, mainly represented by agricultural fields, such as intensive mixed cultivation of market gardens and horticulture (I1.2; 38% of the LSA), inundated or inundatable croplands (I1.4; 13% of the LSA), and intensive unmixed crops (I1.1; 7% of the LSA). The 5% of the total LSA is then occupied by orchards (G1.D), followed by rural industrial and commercial sites (J2.3; 4% of the LSA), artificial coniferous plantations (G3.F; 3% of the LSA) and other artificial surfaces (J4.2 - road networks: 2% of the LSA; J1.2 - Residential buildings of villages and urban peripheries: 1% of the LSA; J3 -Extractive industrial sites: 1% of the LSA). All other modified habitats are present with a percentage of less than 1% of the total LSA.

The habitats distribution map of the LSA according to EUNIS habitat classification system is showed in the figures below. The extension in hectares and the cover percentage of each EUNIS habitat are reported in Table 51. Natural habitats are described below.

Table 51 EUNIS habitat types present in the LSA

EUNIS habitat types		TOTAL LSA	
		ha	%
Natural Habitats			
C1.2	Permanent mesotrophic lakes, ponds and pools	2.85	<0.1
C1.6	Temporary lakes, ponds and pools	8.05	<0.1
C2.2	Permanent non-tidal, fast, turbulent watercourses	3.32	<0.1
C2.3	Permanent non-tidal, smooth-flowing watercourses	144.05	1
C2.5	Temporary running waters	4.66	<0.1
E1.C	Dry mediterranean lands with unpalatable non-vernal herbaceous vegetation	51.77	<1
E2.1	Permanent mesotrophic pastures and aftermath-grazed meadows	749.13	3
F5.2	Maquis	315.15	1
F5.3	Pseudomaquis	571.82	3
G1.1	Riparian and gallery woodland, with dominant alder, birch, poplar or willow	80.46	<1
G1.7	Thermophilous deciduous woodland	390.44	2
G3.7	Lowland to montane mediterranean pine woodland (excluding black pine [Pinus nigra])	1,714.58	8
G3.9	Coniferous woodland dominated by [Cupressaceae] or [Taxaceae]	206.62	1
G4.B	Mixed mediterranean pine - thermophilous oak woodland	770.05	3
H3.2	Basic and ultra-basic inland cliffs	22.68	<1
Natural habitats sub-total		***5,036.62***	***22***

EUNIS habitat types		TOTAL LSA	
		ha	%
Modified habitats			
E5.1	Anthropogenic herb stands	1.01	<0.01
G1.C	Highly artificial broadleaved deciduous forestry plantations	187.58	<1
G1.D	Fruit and nut tree orchards	1,060.76	5
G2.4	Olive - carob woodland	12.73	<0.1
G3.F	Highly artificial coniferous plantations	626.58	3
I1.1	Intensive unmixed crops	1,659.57	7
I1.2	Mixed crops of market gardens and horticulture	8,675.70	38
I1.3	Arable land with unmixed crops grown by low-intensity agricultural methods	91.82	<1
I1.4	Inundated or inundatable croplands, including rice fields	3,003.66	13
J1.1	Residential buildings of city and town centres	159.01	<1
J1.2	Residential buildings of villages and urban peripheries	334.35	1
J2.3	Rural industrial and commercial sites still in active use	846.87	4
J3	Extractive industrial sites	257.87	1
J4.2	Road networks	410.48	2
J4.3	Rail networks	31.96	<1
J4.4	Airport runways and aprons	166.53	<1
J5.4	Highly artificial non-saline running waters	22.97	<1
Modified habitats sub-total		***17,549.44***	***78***
Total (ha)		***22,585.06***	***100***

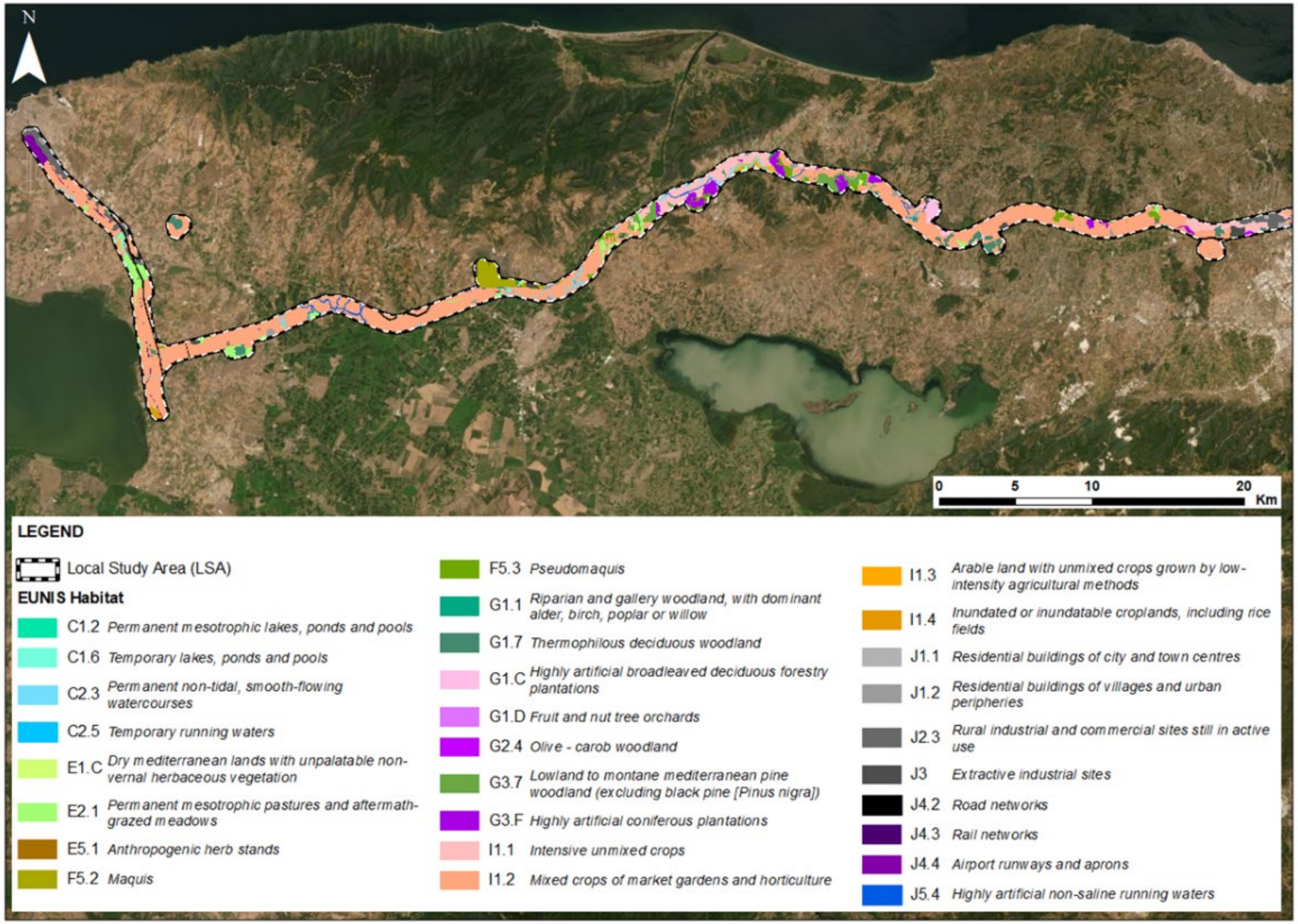


Figure 49: EUNIS habitat map of the Bandırma-Bursa line

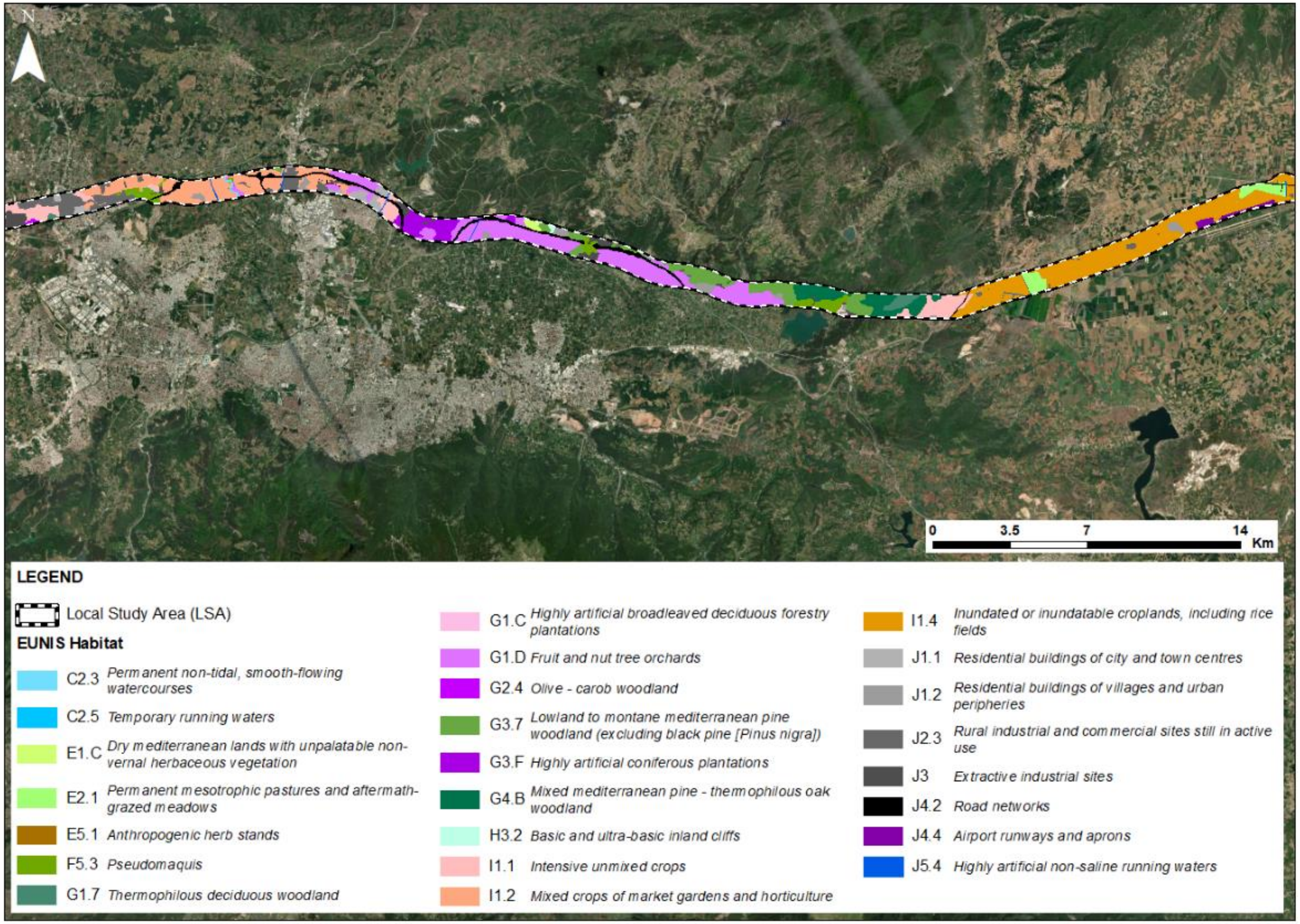


Figure 50: EUNIS habitat map of the Bursa-Yenişehir line

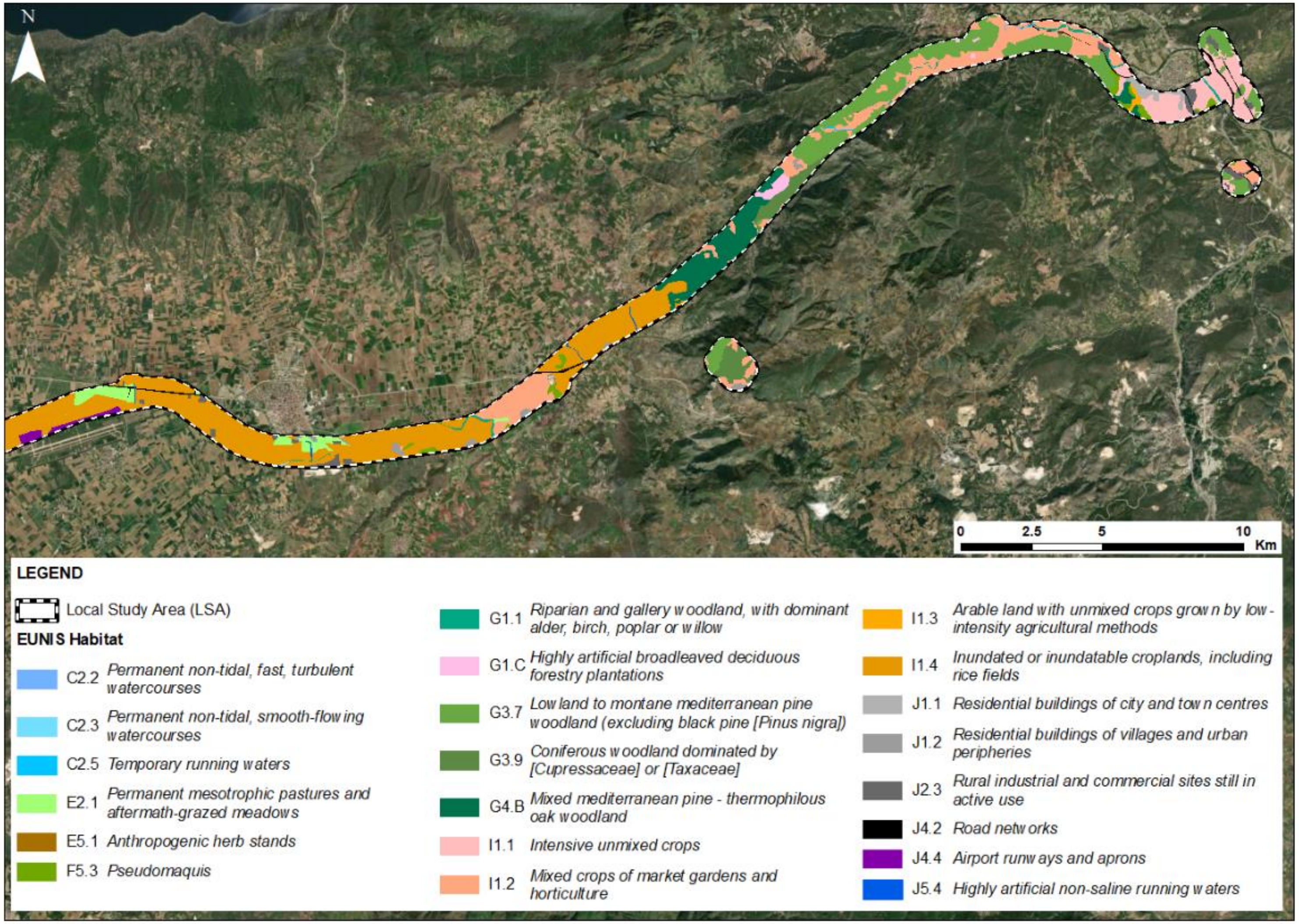


Figure 51: EUNIS habitat map of the Yenişehir-Osmaneli line

7.2.6.1 Freshwater habitats

C1.2 - Permanent mesotrophic lakes, ponds and pools

This habitat is represented by a little portion of the Manyas lake in the western part of the LSA. Its waters are fairly rich in nutrients (nitrogen and phosphorus) and dissolved bases (pH often 6-7). Manyas Lake ecosystem is suitable for feeding, sheltering and breeding, as it is rich in flora and fauna biodiversity. The characteristic communities along the shores consists of reeds (*Phragmites* sp.), cattail (*Typha* sp.), rushes (*Juncus* sp.), and sedges (*Carex* sp.).

C1.6 - Temporary lakes, ponds and pools

Temporary freshwater ponds, as parts of a temporary running waters that become periodically dry, are located near the concrete plant and the camp area of Karacabey-Şahin between km 40+000.00 and 41+000.00, in proximity of the Karacabey city.

C2.2 - Permanent non-tidal, fast, turbulent watercourses

The Sakarya permanent river is characterized by fast-flowing turbulent waters in the eastern part of the LSA, as was observed at sampling stations F10 and F11 (**Figure 52**). The river bed is typically composed of rocks, stones or gravel with only occasional sandy and silty patches, while the characteristic communities of this habitat consists of pelagic and benthic fauna and microscopic algae.

Figure 52: Sakarya permanent river with fast-turbulent waters identified in the LSA at sampling points F10

Figure 53: Permanent non-turbolent stream identified in the LSA at sampling point F02

C2.3 - Permanent non-tidal, smooth-flowing watercourses

Permanent water courses with non-turbulent water are located at mid and low-altitude along the entire LSA and cross the footprint several times (**Figure 53**). They consists of slow-flowing rivers, streams, brooks, rivulets and rills, whose bed is typically composed of sand or mud, and colonized by communities of pelagic and benthic fauna and microscopic algae.

C2.5 - Temporary running waters

Watercourses that cease to flow for part of the year, leaving a dry bed or pools and allowing the growth of vegetation communities usually composed by *Paspalo-Agrostidion*, *Parvopotamion* or *Sparganio-Glycerion fluitantis*, are located along the entire LSA and cross the footprint several times.

Figure 54: temporary stream identified in the LSA at sampling point F06

7.2.6.2 Grasslands habitat

E1.C - Dry mediterranean lands with unpalatable non-vernal herbaceous vegetation

Within the LSA dry lands dominated by grass or herb with low productivity were identified between Karacabey and Cayönü, particularly in sampling points T05 and T08 (Figure 55). They are characterized by a shrub cover less than 10%, probably resulting from over-grazing of the garrigues. This habitat has a large component of non-vernal unpalatable plants, including geophytes (*Asphodelus*, *Urginea*), and thistles (*Carthamus*, *Carlina*, *Centaurea*, *Onopordum*).

The regional endemic *Ornithogalum pascheanum* flora species was observed within this habitat, at sampling point T08.

E2.1 - Permanent mesotrophic pastures and aftermath-grazed meadows

Along the entire LSA, and in particular in the western part of it, lowland and montane mesotrophic and eutrophic pastures and hay meadows were identified (Figure 56). This habitat type is regularly grazed, and on well-drained soils with various herbs species such as *Lolium perenne*, *Cynosurus cristatus*, *Poa* spp., *Festuca* spp., *Trifolium repens*, *Leontodon autumnalis*, *Bellis perennis*, *Ranunculus spp.*, *Cardamine pratensis*, *Deschampsia cespitosa*;

Figure 55 dry lands identified in the LSA at sampling point T08

Figure 56 mesic grassand identified in the LSA at sampling point T14

7.2.6.3 Shrubland habitat

F5.2 - Maquis

Maquis vegetation was identified at sampling points T03 and T04, in correspondence of the borrow pit, the concrete plant and the camp area of Karacabey-Şahin, in proximity of the Karacabey city (Figure 57). This habitat is characterized by evergreen sclerophyllous or lauriphyllous shrub vegetation, with a more or less closed canopy structure, and with few annuals, some geophytes and often scattered trees, some of which may be in shrub form. Unlike arborescent matorral, maquis is typically dominated by species that do not have the potential to grow into tall trees.

F5.3 - Pseudomaquis

Along the LSA was also identified the pseudomaquis habitat (Figure 58), characterized by mixed sclerophyllous evergreen and deciduous shrub thickets, typical of the periphery of the range of Mediterranean sclerophyllous scrublands.

They include, in particular, shrub formations intermediate between Mediterranean maquis and Southeastern sub-Mediterranean deciduous thickets, resulting from the degradation of thermophilous deciduous woodland G1.7, with a mixture of evergreen and deciduous bushes including *Quercus sp.* and *Carpinus sp.*.

The regional endemic *Ornithogalum pascheanum* flora species was observed within this habitat, at sampling point T08.

Figure 57: maquis vegetation identified in the LSA at sampling point T03

Figure 58: pseudomaquis vegetation identified in the LSA at sampling point T06

7.2.6.4 Woodland and forest habitat

G1.1 - Riparian and gallery woodland, with dominant alder, birch, poplar or willow

Riparian woodlands were identified along the temporary and permanent watercourses within the entire LSA. This habitat is typically characterized by one or few dominant species, such as *Alnus*, *Betula*, *Populus* or *Salix* sp..

G1.7 - Thermophilous deciduous woodland

These deciduous forests are typically of Mediterranean climate regions and of western Eurasian steppe zones. They were identified along the entire LSA (Figure 59), excepting the extremely eastern part of it. The characteristic species of this habitat are dominated by deciduous or semideciduous thermophilous *Quercus* species or by other southern trees such as *Carpinus orientalis*, *Castanea sativa* or *Ostrya carpinifolia*. Additionally, thermophilous deciduous trees may, under local microclimatic or edaphic conditions, replace the evergreen oak forests.

The regional endemic *Ornithogalum pascheanum* flora species was observed within this habitat, at sampling point T09.

Figure 59 Decidous woodland (G1.7) identified in the LSA at sampling point T02

G3.7 - Lowland to montane mediterranean pine woodland (excluding black pine [Pinus nigra])

This Mediterranean and thermo-Atlantic habitat, characterized by thermophilous pine forests, was identified along the LSA, between the Karacabey and Osmaneli towns.

G3.9 - Coniferous woodland dominated by [Cupressaceae] or [Taxaceae]

This coniferous habitat is dominated by coniferous trees, mainly evergreen, such as *Cupressaceae*, *Taxus sp. or Juniperus* spp.. In the LSA it was identified in the extremely eastern part within mountains and hills, as evidenced by the sampling station T16 (Figure 61).

The regional endemic *Aubrieta olympica* and the local endemic and restricted range *Centaurea sakariyaensis* flora species were observed within this habitat.

Figure 60 pine woodland (G3.7) identified in the LSA at sampling point T13

Figure 61 coniferous woodland (G3.9) identified in the LSA at sampling point T16

G4.B - Mixed mediterranean pine - thermophilous oak woodland

Mixed forests were identified in the eastern part of the LSA. This woodland habitat is characterized by mixed broad-leaved deciduous and coniferous trees, where neither coniferous, nor broadleaved species account for more than 75% of the crown cover. In the LSA this habitat is located among deciduous forests (G1.7) and coniferous woodland (G3.7 and G3.9).

7.2.6.5 Inland unvegetated or sparsely vegetated habitats

H3.2- Basic and ultra-basic inland cliffs

Inland dry calcareous cliffs were identified within the LSA almost exclusively at sampling station T16 (Figure 62), in the vicinity of the *Cupressaceae* or *Taxaceae* coniferous woodland (G3.9). Specific plant associations colonize these cliffs and rock pavements, which are sparsely vegetated with bryophytes or lichens association.

The regional endemic *Aubrieta olympica* and the local endemic and restricted range *Centaurea sakariyaensis* flora species were observed within this habitat.

Figure 62 Sparsely vegeted cliff identified in the LSA at sampling point T16

7.2.7 Flora species

Based on literature review and field work conducted by Prof. Dr. Aydın Akbulut on April 6th – 7th 2020, 98 flora species were identified, of which 62 were directly observed during field studies (Table 52).

Four (4) species were determined as endemic species, of which 1 (*Centaurea sakariyaensis*) is considered Local endemic and Restricted range (RR), while the other 3 (*Aubrieta olympica*, *Ferulago macrosciadia* and *Ornithogalum pascheanum*) are Regional endemic. These species were directly observed in the field.

According to the Red Data Book of Turkish Plants, 3 flora species were identified as threatened: 1 species (*Centaurea sakariyaensis*) is listed as CR (CRitically endangered), 2 species (*Aubrieta olympica, Ornithogalum pascheanum*) are classified as EN (Endangered). All other species are considered LC (Least Concern) according to the Red Data Book of Turkish Plants and the IUCN Red List.

No species are protected by the Habitat Directive, or the Bern Convention, or the CITES Convention.

Table 52 Flora species identified within the LSA

Species	IUCN Red List	RDB of Flora	End.	Bern Dir.	CITES	Habitat Dir.	Obs./ Lit.
Aetheorhiza bulbosa	NE	LC	-	-	-	-	O
Agrostis stolonifera	LC	-	-	-	-	-	L
Alisma lanceolatum	LC	-	-	-	-	-	L
Alisma plantago-aquatica	LC	-	-	-	-	-	L
Anemone blanda	NE	LC	-	-	-	-	O
Apium graveolens	LC	-	-	-	-	-	L
Apium nodiflorum	LC	-	-	-	-	-	L
Arbutus andrachne	LC	LC	-	-	-	-	O
Arbutus unedo	LC	-	-	-	-	-	L
Asparagus acutifolius	LC	LC	-	-	-	-	O
Asphodelus aestivus	LC	LC	-	-	-	-	O
Aubrieta olympica	NE	EN	Regional endemic	-	-	-	O
Bellis perennis	NE	LC	-	-	-	-	O
Calendula arvensis	NE	LC	-	-	-	-	O
Callitriche truncata	LC	-	-	-	-	-	L
Carlina corymbosa	NE	LC	-	-	-	-	O
Carpinus betulus	LC	-	-	-	-	-	L
Catabrosa aquatica	LC	-	-	-	-	-	L
Centaurea sakariyaensis	NE	CR	Local endemic	-	-	-	O
Ceratophyllum muricatum	LC	-	-	-	-	-	L
Cistus creticus	NE	LC	-	-	-	-	O
Cistus salviifolius	NE	LC	-	-	-	-	O
Crataegus monogyna	LC	LC	-	-	-	-	O
Crepis sancta	NE	LC	-	-	-	-	O
Cupressus sempervirens	LC	LC	-	-	-	-	O

Species	IUCN Red List	RDB of Flora	End.	Bern Dir.	CITES	Habitat Dir.	Obs./ Lit.
Dactylis glomerata	NE	LC	-	-	-	-	O
Eleocharis quinqueflora	LC	-	-	-	-	-	L
Elymus hispidus	LC	LC	-	-	-	-	O
Erica arborea	LC	LC	-	-	-	-	O
Eryngium creticum	NE	LC	-	-	-	-	O
Fagus orientalis	LC	-	-	-	-	-	L
Ferulago macrosciadia	NE	LC	Regional endemic	-	-	-	O
Festuca valesiaca	NE	LC	-	-	-	-	O
Fuirena pubescens	LC	-	-	-	-	-	L
Geranium sp.	NE	LC	-	-	-	-	O
Globularia trichosantha	NE	LC	-	-	-	-	O
Hypericum origanifolium	NE	LC	-	-	-	-	O
Inula heterolepis	NE	LC	-	-	-	-	O
Jasminum fruticans	NE	LC	-	-	-	-	O
Juncus acutus	LC	-	-	-	-	-	L
Juncus articulatus	LC	-	-	-	-	-	L
Juncus bufonius	LC	-	-	-	-	-	L
Juncus effusus	LC	LC	-	-	-	-	O
Juniperus excelsa	LC	LC	-	-	-	-	O
Juniperus oxycedrus	LC	LC	-	-	-	-	O
Laurocerasus officinalis	LC	-	-	-	-	-	L
Lemna perpusilla	LC	-	-	-	-	-	L
Lythrum junceum	LC	-	-	-	-	-	L
Medicaga minima	NE	LC	-	-	-	-	O
Muscari neglectum	NE	LC	-	-	-	-	O
Najas graminea	LC	-	-	-	-	-	L

Species	IUCN Red List	RDB of Flora	End.	Bern Dir.	CITES	Habitat Dir.	Obs./ Lit.
Najas minor	LC	-	-	-	-	-	L
Oenanthe pimpinelloides	LC	LC	-	-	-	-	O
Olea europaea	DD	LC	-	-	-	-	O
Origanum vulgare	LC	LC	-	-	-	-	O
Ornithogalum pascheanum	NE	EN	Regional endemic	-	-	-	O
Osyris alba	NE	LC	-	-	-	-	O
Paliurus spina-christi	NE	LC	-	-	-	-	O
Phillyrea latifolia	LC	LC	-	-	-	-	O
Picnamon acarna	NE	LC	-	-	-	-	O
Pinus brutia	LC	LC	-	-	-	-	O
Pinus nigra	LC	-	-	-	-	-	O
Pinus pinea	LC	LC	-	-	-	-	O
Piptatherum miliaceum	NE	LC	-	-	-	-	O
Pistacia terebinthus	LC	LC	-	-	-	-	O
Plantago afra	LC	LC	-	-	-	-	O
Poa annua	LC	LC	-	-	-	-	O
Populus tremula	LC	-	-	-	-	-	L
Potamogeton alpinus	LC	-	-	-	-	-	L
Potamogeton natans	LC	-	-	-	-	-	L
Potamogeton nodosus	LC	-	-	-	-	-	L
Potamogeton pusillus	LC	-	-	-	-	-	L
Potamogeton trichoides	LC	-	-	-	-	-	L
Pyrus elaeagnifolia	NE	LC	-	-	-	-	O
Quercus cerris	LC	LC	-	-	-	-	O
Quercus coccifera	LC	LC	-	-	-	-	O
Quercus petraea	LC	LC	-	-	-	-	O

Species	IUCN Red List	RDB of Flora	End.	Bern Dir.	CITES	Habitat Dir.	Obs./ Lit.
Rhamnus oleoides	NE	LC	-	-	-	-	O
Rubus sanctus	NE	LC	-	-	-	-	O
Ruscus aculeatus	LC	LC	-	-	-	-	O
Salvia tomentosa	LC	LC	-	-	-	-	O
Salvia virgata	NE	LC	-	-	-	-	O
Scabiosa argentea	NE	LC	-	-	-	-	O
Schoenoplectus tabernaemontani	LC	-	-	-	-	-	L
Sorbus torminalis	LC	-	-	-	-	-	L
Sparganium emersum	LC	-	-	-	-	-	L
Spartium junceum	NE	LC	-	-	-	-	O
Spirodela polyrhiza	LC	-	-	-	-	-	L
Stipa bromoides	LC	LC	-	-	-	-	O
Stuckenia pectinata	LC	-	-	-	-	-	L
Teucrium divaricatum	NE	LC	-	-	-	-	O
Thymbra spicata	NE	LC	-	-	-	-	O
Tordylium sp.	NE	LC	-	-	-	-	O
Trapa natans	LC	-	-	-	-	-	L
Typha angustifolia	LC	-	-	-	-	-	L
Vallisneria spiralis	LC	-	-	-	-	-	L
Verbascum sinuatum	NE	LC	-	-	-	-	O
Zannichellia palustris	LC	-	-	-	-	-	L

7.2.8 Fauna Species

7.2.8.1 Fish species

The permanent water courses of Karacay River and the Nilufer River cross the LSA several times flowing into the Simav river respectively 3 km and 10 km from Karcabey city. Other smaller tributaries of these water courses (e.g. Hayırlar Stream, Yaman Stream, are likely seasonal rivers. Finally, numerous artificial irrigation canals are present along the entire footprint.

As results of literature review 36 fish species were identified, based on their known distribution range and the suitability of the habitat, as potentially present within the LSA (Table 53).

According to IUCN Red List, 5 species are classified as threatened: *Anguilla Anguilla* is considered CRitically endangered (CR), 1 species (*Cobitis puncticulata*) is Endangered (EN), *Cyprinus carpio* is determined as Vulnerable (VU), while *Barbus niluferensis* is classified as Neat Threatened (NT); all other species are listed as Least Concern (LC).

Among the species, 3 are protected by the Habitat Directive, 2 species (*Alosa fallax, Leuciscus aspius*) are reported in both Annex II and V, while *Barbus niluferensis* is listed in Annex V.

Eight species (*Salaria fluviatilis, Leucaspius delineatus, Vimba vimba, Neogobius fluviatilis, Silurus glanis, Syngnathus abaster, Alosa fallax, Leuciscus aspius*) are listed in Annex III of the Bern Convention.

In accordance with the CITES Convention, only *Anguilla Anguilla* species is listed in Annex II.

Only 2 species, *Cobitis puncticulata* and *Barbus niluferensis*, are determined as endemic and restricted range species (RR).

Table 53 Fish species identified within the LSA

Family	Species	IUCN Red List	End.	Habitat Dir.	Bern Conv.	CITES Conv.
Acipenseridae	*Acipenser gueldenstaedtii*	CR	-	V	-	II
	Acipenser stellatus	CR	-	V	III	II
	Acipenser sturio	CR	-	II, IV	II	I
Anguillidae	*Anguilla anguilla*	CR	-	-	-	II
Atherinidae	*Atherina boyeri*	LC	-	-	-	-
Blenniidae	*Salaria fluviatilis*	LC	-	-	III	-
Clupeidae	*Alosa fallax*	LC	-	II, V	III	-
	Clupeonella cultriventris	LC	-	-	-	-
	Clupeonella muhlisi	EN	-	-	-	-
Cobitidae	*Cobitis kurui*	LC	-	-	-	-
	Cobitis pontica	LC	-	-	-	-
	Cobitis puncticulata	EN	End.	-	-	-
Cyprinidae	*Abramis brama*	LC	-	-	-	-
	Alburnus alburnus	LC	-	-	-	-
	Alburnus istanbulensis	LC	-	-	-	-
	Barbus niluferensis	NT	-	V	-	-
	Blicca bjoerkna	LC	-	-	-	-
	Cyprinus carpio	VU	-	-	-	-

Family	Species	IUCN Red List	End.	Habitat Dir.	Bern Conv.	CITES Conv.
	Leucaspius delineatus	LC	-	-	III	-
	Leuciscus aspius	LC	-	II, V	III	-
	Petroleuciscus borysthenicus	LC	-	-	-	-
	Rhodeus amarus	LC	-	-	-	-
	Rutilus rutilus	LC	-	-	-	-
	Scardinius erythrophthalmus	LC	-	-	-	-
	Vimba vimba	LC	-	-	III	-
Gobiidae	*Babka gymnotrachelus*	LC	-	-	-	-
	Knipowitschia caucasica	LC	-	-	-	-
	Neogobius fluviatilis	LC	-	-	III	-
	Proterorhinus semilunaris	LC	-	-	-	-
Moronidae	*Dicentrarchus labrax*	LC	-	-	-	-
	Morone saxatilis	LC	-	-	-	-
Mugilidae	*Chelon labrosus*	LC	-	-	-	-
	Chelon ramada	LC	-	-	-	-
	Chelon saliens	LC	-	-	-	-
	Mugil cephalus	LC	-	-	-	-
	Mugil cephalus	LC	-	-	-	-
Percidae	*Sander lucioperca*	LC	-	-	-	-
Pleuronectidae	*Platichthys flesus*	LC	-	-	-	-
Siluridae	*Silurus glanis*	LC	-	-	III	-
Syngnathidae	*Syngnathus abaster*	LC	-	-	III	-

7.2.8.2 Amphibians species

As results of literature review, 10 amphibians species were identified, based on their known distribution range and the suitability of the habitat, as potentially present within the LSA (Table 54).

According to IUCN Red List, only the species *Ommatotriton ophryticus* is classified as Near Threatened species (NT), while all other species are determined as Least Concernc (LC), with the exception of *Bufotes variabilis* classified as Data Deficit (DD).

Four (4) species are protected by the Habitat Directive, of which 1 species (*Triturus karelinii*) is listed both in Annex II and IV, while 3 species (*Hyla arborea, Pelobates syriacus, Rana dalmatina*) are reported only in Annex IV.

All the species are protected by the Bern Convention, in particular 4 species (*Triturus karelinii, Hyla arborea, Pelobates syriacus, Rana dalmatina*) are listed in Annex II, while the other 6 species are reorted in Annex III.

No endemic species are identified as potentially present within the LSA and no species are listed in the CITES Convention.

Table 54 Amphibinas species identified within the LSA

Family	Species	IUCN Red List	Habitat Directive	Bern Convention	CITES Convention
Bufonidae	*Bufo bufo*	LC	-	III	-
	Bufotes variabilis	DD	-	III	-
Hylidae	*Hyla arborea*	LC	IV	II	-
Pelobatidae	*Pelobates syriacus*	LC	IV	II	-
Ranidae	*Pelophylax ridibundus*	LC	-	III	-
	Rana dalmatina	LC	IV	II	-
	Pelophylax bedriagae	LC	-	III	-
Salamandridae	*Lissotriton vulgaris*	LC	-	III	-
	Ommatotriton ophryticus	NT	-	III	-
	Triturus karelinii	LC	II, IV	II	-

7.2.8.3 Reptiles species

As results of literature review, 29 reptiles species were identified, based on their known distribution range and the suitability of the habitat, as potentially present within the LSA (Table 55).

According to IUCN Red List, 2 species are classified as threatened species: *Testudo graeca* is listed as Vulnerable (VU), and *Emys Orbicularis* is determined as Neat Threatened (NT). All other species are determined as Least Concernc (LC).

Twenty (20) species are protected by the Habitat Directive: 3 species (*Zamenis situla, Emys orbicularis, Testudo graeca*) are listed both in Annex II and IV, while 17 are reported only in Annex IV.

All the species are mentioned in the Bern Convention: in particular 17 species are listed in Annex II, and the other 12 species are reorted in Annex III.

According to the CITES Convention, 14 species are protected by Annex II. No endemic species are identified as potentially present within the LSA.

Table 55 Reptiles species identified within the LSA

Family	Species	IUCN Red List	Habitat Directive	Bern Convention	CITES Convention
Agamidae	*Stellagama stellio*	LC	IV	II	-
Anguinidae	*Pseudopus apodus*	LC	IV	II	-
Boidae	*Eryx jaculus*	LC	IV	III	II
Chamaeleonidae	*Chamaeleo chamaeleon*	LC	IV	II	II
Colubridae	*Coronella austriaca*	LC	IV	II	II
	Dolichophis caspius	LC	IV	III	II
	Eirenis modestus	LC	IV	III	II
	Elaphe sauromates	LC	-	III	II
	Hemorrhois ravergieri	LC	-	III	II
	Natrix natrix	LC	-	III	II
	Natrix tessellata	LC	IV	II	II
	Platyceps collaris	LC	-	III	II
	Platyceps najadum	LC	IV	II	II
	Telescopus falax	LC	IV	II	II
	Zamenis situla	LC	II, IV	II	II
Emydidae	*Emys orbicularis*	NT	II, IV	II	-
	Mauremys rivulata	LC	-	III	-
Gekkonidae	*Hemidactylus turcicus*	LC	-	III	-
	Mediodactylus kotschyi	LC	IV	II	-
Lacertidae	*Darevskia rudis*	LC	-	III	-
	Lacerta trilineata	LC	IV	II	-
	Lacerta viridis	LC	IV	II	-
	Ophisops elegans	LC	IV	II	-
	Podarcis muralis	LC	IV	II	-
Scincidae	*Ablepharus kitaibeili*	LC	IV	II	-
	Heremites auratus	LC	-	III	-

Family	Species	IUCN Red List	Habitat Directive	Bern Convention	CITES Convention
Testudinidae	*Testudo graeca*	VU	II, IV	II	II
Typholophidae	*Xerotyphlops vermicularis*	LC	-	III	-

7.2.8.4 Birds species

Based on literature review, 231 bird species were identified, based on their known distribution range and the suitability of the habitat, as potentially present within the LSA (Table 56).

According to the IUCN Red List, 24 species are considered as threatened, of which 4 species (Aq*uila nipalensis, Neophron percnopterus, Oxyura leucocephala, Falco cherrug*) are listed as EN (Endangered), 7 species (*Aquila heliaca, Clanga clanga, Anser erythropus, Aythya ferina, Marmaronetta angustirostris, Streptopelia turtur, Otis tarda*) are classified as VU (Vulnerable), and 13 species are listed as NT (Near Threatened); all others species are considered LC (Least Concern).

One hundred seventeen (117) bird species are protected by the Bird Directive, of which 76 species are listed in the Annex I of which 1 is also present in Annex II, 30 species are in Annex II, 10 are listed in both Annex II and Annex III, while *Pluvialis apricaria* is listed in each Annex.

According to the Bern Convention, 104 speices are listed in Annex II, 102 species are present in Annex III, while 18 species are both in Annex II and III.

Based on the CITES Convention, 4 species (Falco p*eregrinus, Pelecanus crispus, Aquila heliaca, Haliaeetus albicilla*) are listed in the Annex I and 9 species (Falco *Subbuteo, Falco tinnunculus, Ciconia nigra, Falco cherrug, Falco columbarius, Falco eleonorae, Falco naumanni, Falco vespertinus, Platalea leucorodia*) are protected by Annex II.

In the table below is also reported the status of the species in accordance with the Birdlife assessment.

Table 56 Birds species identified within the LSA

Family	Species	IUCN Red List	Birdlife Status	Bird Directive	Bern Convention	CITES Convention
Accipitridae	*Accipiter brevipes*	LC	Extant (breeding) (passage)	I	III	-
	Accipiter gentilis	LC	Extant (resident)	-	III	-
	Accipiter nisus	LC	Extant (resident)	-	III	-
	Aegypius monachus	LC	Extant (non-breeding)	I	III	-
	Aquila chrysaetos	LC	Extant (non-breeding) (resident)	I	III	-
	Aquila heliaca	VU	Extant (resident)	-	III	I
	Aquila nipalensis	EN	Extant (passage)	-	III	-
	Buteo buteo	LC	Extant (breeding) (non-breeding)	-	III	-
	Buteo lagopus	LC	Extant (resident)	-	III	-
	Buteo rufinus	LC	Extant (resident) (passage)	I	II	-
	Circaetus gallicus	LC	Extant (breeding)	I	III	-
	Circus aeruginosus	LC	Extant (non-breeding) (resident)	I	III	-
	Circus cyaneus	LC	Extant (non-breeding)	I	III	-
	Circus macrourus	NT	Extant (passage)	I	III	-
	Circus pygargus	LC	Extant (passage)	I	III	-
	Clanga clanga	VU	Extant (passage)	I	III	-

Family	Species	IUCN Red List	Birdlife Status	Bird Directive	Bern Convention	CITES Convention
	Clanga pomarina	LC	Extant (breeding) (passage)	I	II	-
	Gypaetus barbatus	NT	Extant (resident)	I	III	-
	Gyps fulvus	LC	Extant (non-breeding)	I	III	-
	Haliaeetus albicilla	LC	Extant (breeding) (non-breeding) (passage)	I	III	I
	Hieraaetus pennatus	LC	Extant (breeding) (passage)	I	III	-
	Milvus migrans	LC	Extant (breeding) (non-breeding)	I	III	-
	Milvus milvus	NT	Extant (passage)	I	III	-
	Neophron percnopterus	EN	Extant (passage)	I	III	-
	Pernis apivorus	LC	Extant (breeding) (passage)	I	II	-
Acrocephalidae	*Acrocephalus arundinaceus*	LC	Extant (breeding)	-	III	-
	Acrocephalus melanopogon	LC	Extant (breeding) (non-breeding)	-	III	-
	Acrocephalus palustris	LC	Extant (breeding)	-	III	-
	Acrocephalus schoenobaenus	LC	Extant (breeding)	-	III	-
	Acrocephalus scirpaceus	LC	Extant (breeding) (passage)	-	III	-
	Hippolais olivetorum	LC	Extant (breeding)	I	III	-
Aegithalidae	*Aegithalos caudatus*	LC	Extant (resident)	-	III	-

Family	Species	IUCN Red List	Birdlife Status	Bird Directive	Bern Convention	CITES Convention
Alaudidae	*Alauda arvensis*	LC	Extant (resident)	II-B	III	-
	Calandrella brachydactyla	LC	Extant (breeding)	I	I	-
	Galerida cristata	LC	Extant (resident)	-	III	-
	Lullula arborea	LC	Extant (breeding) (resident)	I	III	-
	Melanocorypha calandra	LC	Extant (resident)	I	II	-
Alcedinidae	*Alcedo atthis*	LC	Extant (non-breeding) (resident)	I	II	-
Anatidae	*Anas crecca*	LC	Extant (non-breeding)	II-A, III-B	III	-
	Anas platyrhynchos	LC	Extant (resident)	II-A, III-A	III	-
	Anser albifrons	LC	Extant (non-breeding)	II-B, III-B	III	-
	Anser anser	LC	Extant (breeding) (non-breeding)	II-A	III	-
	Anser erythropus	VU	Extant (passage)	-	II	-
	Aythya ferina	VU	Extant (non-breeding)	II-A, III-B	III	-
	Aythya fuligula	LC	Extant (non-breeding)	II-A, III-B	III	-
	Aythya nyroca	NT	Extant (breeding) (non-breeding)	I	III	-
	Bucephala clangula	LC	Extant (non-breeding)	II-B	III	-
	Cygnus cygnus	LC	Extant (non-breeding)	I	II	-
	Mareca strepera	LC	Extant (non-breeding)	-	III	-

Family	Species	IUCN Red List	Birdlife Status	Bird Directive	Bern Convention	CITES Convention
	Marmaronetta angustirostris	VU	Extant (passage)	-	III	-
	Mergellus albellus	LC	Extant (non-breeding)	-	III	-
	Netta rufina	LC	Extant (non-breeding) (resident)	II-B	III	-
	Oxyura leucocephala	EN	Extant (non-breeding) (passage)	I	II	-
	Tadorna ferruginea	LC	Extant (breeding)	I	II, III	-
Apodidae	*Apus apus*	LC	Extant (breeding)	-	III	-
	Tachymarptis melba	LC	Extant (breeding)	-	III	-
Ardeidae	*Ardea alba*	LC	Extant (non-breeding)	I	II	-
	Ardea cinerea	LC	Extant (non-breeding)	-	III	-
	Ardea purpurea	LC	Extant (breeding) (passage)	I	II	-
	Ardeola ralloides	LC	Extant (passage)	I	II	-
	Botaurus stellaris	LC	Extant (breeding) (non-breeding)	I	II	-
	Bubulcus ibis	LC	Extant (resident)	-	II	-
	Egretta garzetta	LC	Extant (breeding)	I	II	-
	Ixobrychus minutus	LC	Extant (breeding)	I	II	-
	Nycticorax nycticorax	LC	Extant (breeding)	I	II	-
Burhinidae	*Burhinus oedicnemus*	LC	Extant (breeding)	I	II	-

Family	Species	IUCN Red List	Birdlife Status	Bird Directive	Bern Convention	CITES Convention
Caprimulgiformes	*Caprimulgus europaeus*	LC	Extant (breeding)	I	II	-
Certhiidae	*Certhia brachydactyla*	LC	Extant (resident)	-	II	-
	Certhia familiaris	LC	Extant (resident)	-	II	-
Charadriidae	*Charadrius alexandrinus*	LC	Extant (breeding) (resident)	I	II	-
	Charadrius dubius	LC	Extant (breeding)	-	II, III	-
	Pluvialis apricaria	LC	Extant (non-breeding)	I, II-B, III-B	III	-
	Vanellus spinosus	LC	Extant (breeding)	-	III	-
	Vanellus vanellus	NT	Extant (non-breeding) (resident)	II-B	III	-
Ciconiidae	*Ciconia ciconia*	LC	Extant (breeding)	I	II	-
	Ciconia nigra	LC	Extant (breeding) (passage)	I	II	II
Cinclidae	*Cinclus cinclus*	LC	Extant (resident)	-	III	-
Cisticolidae	*Cisticola juncidis*	LC	Extant (resident)	-	III	-
Columbidae	*Columba livia*	LC	Extant (resident)	II-A	III	-
	Columba palumbus	LC	Extant (non-breeding) (resident)	II-A, III-A	No III	-
	Spilopelia senegalensis	LC	Extant (resident)	-	III	-
	Streptopelia decaocto	LC	Extant (resident)	II-B	III	-
	Streptopelia turtur	VU	Extant (breeding)	II-B	III	-

Family	Species	IUCN Red List	Birdlife Status	Bird Directive	Bern Convention	CITES Convention
Coraciidae	*Coracias garrulus*	LC	Extant (breeding)	I	II	-
Corvidae	*Corvus corax*	LC	Extant (resident)	-	II	-
	Corvus cornix	LC	Extant (resident)	II-B	No III	-
	Corvus corone	LC	Extant (resident)	II-B	II	-
	Corvus frugilegus	LC	Extant (non-breeding) (resident)	II-B	No III	-
	Corvus monedula	LC	Extant (resident)	II-B	II	-
	Garrulus glandarius	LC	Extant (resident)	II-B	No III	-
	Pica pica	LC	Extant (resident)	II-B	No III	-
	Pyrrhocorax graculus	LC	Extant (resident)	-	II	-
	Pyrrhocorax pyrrhocorax	LC	Extant (resident)	I	II	-
Cuculidae	*Clamator glandarius*	LC	Extant (breeding)	-	II	-
	Cuculus canorus	LC	Extant (breeding)	-	III	-
Emberizidae	*Emberiza cirlus*	LC	Extant (resident)	-	II	-
	Emberiza citrinella	LC	Extant (resident)	-	II	-
	Emberiza hortulana	LC	Extant (breeding)	I	III	-
	Emberiza melanocephala	LC	Extant (breeding)	-	II	-
	Emberiza schoeniclus	LC	Extant (non-breeding) (resident)	-	II	-

Family	Species	IUCN Red List	Birdlife Status	Bird Directive	Bern Convention	CITES Convention
	Miliaria calandra	LC	Extant (resident)	-	III	-
Falconidae	*Falco cherrug*	EN	Extant (non-breeding) (passage)	I	II	II
	Falco columbarius	LC	Extant (non-breeding)	I	II	II
	Falco eleonorae	LC	Extant (passage)	I	II	II
	Falco naumanni	LC	Extant (passage)	I	II	II
	Falco peregrinus	LC	Extant (non-breeding)	I	II	I
	Falco subbuteo	LC	Extant (breeding)	-	II	II
	Falco tinnunculus	LC	Extant (resident)	-	II	II
	Falco vespertinus	NT	Extant (passage)	I	II	II
Fringillidae	*Carduelis carduelis*	LC	Extant (resident)	-	II, III	-
	Carpodacus erythrinus	LC	Extant (breeding)	-	II	-
	Chloris chloris	LC	Extant (resident)	-	II	-
	Fringilla coelebs	LC	Extant (resident)	I	III	-
	Fringilla montifringilla	LC	Extant (non-breeding)	-	III	-
	Linaria cannabina	LC	Extant (resident)	-	II	-
	Serinus pusillus	LC	Extant (non-breeding)	-	II	-
Glareolidae	*Glareola pratincola*	LC	Extant (breeding)	I	III	-

Family	Species	IUCN Red List	Birdlife Status	Bird Directive	Bern Convention	CITES Convention
Gruidae	*Anthropoides virgo*	LC	Extant (passage)	-	II	-
	Grus grus	LC	Extant (resident)	-	II	-
Haematopodidae	*Haematopus ostralegus*	NT	Extant (passage)	I, II-B	III	-
Hirundinidae	*Cecropis daurica*	LC	Extant (breeding)	-	II, III	-
	Delichon urbicum	LC	Extant (breeding)	-	II	-
	Hirundo rustica	LC	Extant (breeding)	-	II, III	-
	Ptyonoprogne rupestris	LC	Extant (resident)	-	II	-
	Riparia riparia	LC	Extant (breeding)	-	II	-
Laniidae	*Lanius collurio*	LC	Extant (breeding)	I	II	-
	Lanius excubitor	LC	Extant (non-breeding)	-	II	-
	Lanius minor	LC	Extant (breeding)	I	II	-
	Lanius nubicus	LC	Extant (breeding)	I	II	-
	Lanius senator	LC	Extant (breeding)	-	II, III	-
Laridae	*Chlidonias hybrida*	LC	Extant (breeding)	-	II	-
	Chlidonias niger	LC	Extant (breeding) (passage)	-	II	-
	Larus cachinnans	LC	Extant (non-breeding)	II-B	III	-
	Larus canus	LC	Extant (non-breeding)	II-B	III	-

Family	Species	IUCN Red List	Birdlife Status	Bird Directive	Bern Convention	CITES Convention
	Larus fuscus	LC	Extant (passage)	II-B	No III	-
	Larus michahellis	LC	Extant (non-breeding) (resident)	-	III	-
	Larus ridibundus	LC	Extant (non-breeding)	II-B	III	-
	Sterna hirundo	LC	Extant (breeding)	-	II	-
Locustellidae	*Locustella fluviatilis*	LC	Extant (passage)	-	III	-
	Locustella luscinioides	LC	Extant (breeding)	-	III	-
Meropidae	*Merops apiaster*	LC	Extant (breeding)	-	III	-
Motacillidae	*Anthus campestris*	LC	Extant (breeding)	I	II	-
	Anthus pratensis	NT	Extant (non-breeding)	-	II, III	-
	Anthus spinoletta	LC	Extant (non-breeding)	-	II, III	-
	Motacilla alba	LC	Extant (resident)	-	II, III	-
	Motacilla cinerea	LC	Extant (non-breeding) (resident)	-	II	-
	Motacilla flava	LC	Extant (breeding)	-	II	-
Muscicapidae	*Cercotrichas galactotes*	LC	Extant (breeding)	-	II	-
	Cyanecula svecica	LC	Extant (passage)	-	II	-
	Erithacus rubecula	LC	Extant (resident)	-	II	-
	Luscinia megarhynchos	LC	Extant (breeding)	-	II	-

Family	Species	IUCN Red List	Birdlife Status	Bird Directive	Bern Convention	CITES Convention
	Monticola saxatilis	LC	Extant (resident)	-	II	-
	Monticola solitarius	LC	Extant (resident)	-	II	-
	Oenanthe hispanica	LC	Extant (resident)	-	II	-
	Oenanthe isabellina	LC	Extant (resident)	-	II	-
	Oenanthe oenanthe	LC	Extant (breeding)	-	II	-
	Phoenicurus ochruros	LC	Extant (breeding) (passage)	-	II, III	-
	Saxicola torquatus	LC	Extant (breeding)	-	II, III	-
Oriolidae	*Oriolus oriolus*	LC	Extant (breeding)	-	II, III	-
Otididae	*Otis tarda*	VU	Extant (resident)	I	II	-
Pandionidae	*Pandion haliaetus*	LC	Extant (passage)	I	III	-
Panuridae	*Panurus biarmicus*	LC	Extant (resident)	-	III	-
Paridae	*Parus major*	LC	Extant (resident)	-	II, III	-
	Periparus ater	LC	Extant (resident)	I	II, III	-
	Poecile lugubris	LC	Extant (resident)	-	II	-
	Poecile palustris	LC	Extant (resident)	-	II	-
Passeridae	*Passer domesticus*	LC	Extant (resident)	-	No III	-
	Passer hispaniolensis	LC	Extant (breeding)	-	III	-

Family	Species	IUCN Red List	Birdlife Status	Bird Directive	Bern Convention	CITES Convention
	Passer montanus	LC	Extant (resident)	-	III	-
Pelecanidae	*Pelecanus crispus*	NT	Extant (resident) (passage)	I	II	I
	Pelecanus onocrotalus	LC	Extant (passage)	-	II	-
Phalacrocoracidae	*Microcarbo pygmaeus*	LC	Extant (non-breeding) (resident)	I	II	-
	Phalacrocorax carbo	LC	Extant (breeding) (passage)	-	-	-
Phasianidae	*Alectoris chukar*	LC	Extant (resident)	II-B	III	-
	Phasianus colchicus	LC	Extant (resident and introduced)	II-A, III-A	III	-
Phylloscopidae	*Phylloscopus trochilus*	LC	Extant (passage)	-	III	-
Picidae	*Dendrocopos leucotos*	LC	Extant (resident)	I	III	-
	Dendrocopos major	LC	Extant (resident)	I	II	-
	Dendrocopos medius	LC	Extant (resident)	I	II	-
	Dendrocopos syriacus	LC	Extant (resident)	I	II	-
	Dryobates minor	LC	Extant (resident)	-	II	-
	Dryocopus martius	LC	Extant (resident)	I	II	-
	Picus viridis	LC	Extant (resident)	-	II	-
Podicipedidae	*Podiceps cristatus*	LC	Extant (non-breeding)	-	III	-
	Podiceps nigricollis	LC	Extant (non-breeding)	-	II	-

Family	Species	IUCN Red List	Birdlife Status	Bird Directive	Bern Convention	CITES Convention
	Tachybaptus ruficollis	LC	Extant (non-breeding) (resident)	-	II	-
Prunellidae	*Prunella collaris*	LC	Extant (resident)	-	II	-
Rallidae	*Fulica atra*	LC	Extant (non-breeding) (resident)	II-A, III-B	III	-
	Gallinula chloropus	LC	Extant (resident)	II-B	III	-
	Rallus aquaticus	LC	Extant (non-breeding) (resident)	II-B	III	-
	Zapornia pusilla	LC	Extant (breeding) (passage)	I	III	-
Recurvirostridae	*Himantopus himantopus*	LC	Extant (resident)	I	III	-
Regulidae	*Regulus ignicapilla*	LC	Extant (non-breeding)	-	II	-
Remizidae	*Remiz pendulinus*	LC	Extant (resident) (passage)	-	III	-
Scolopacidae	*Calidris alpina*	LC	Extant (non-breeding)	-	II	-
	Calidris minuta	LC	Extant (non-breeding)	-	II	-
	Gallinago gallinago	LC	Extant (non-breeding)	II-A, III-B	III	-
	Gallinago media	NT	Extant (passage)	I	III	-
	Limosa limosa	NT	Extant (non-breeding) (passage)	II-B	III	-
	Numenius arquata	NT	Extant (non-breeding)	II-B	III	-
	Scolopax rusticola	LC	Extant (non-breeding)	II-A, III-B	III	-
	Tringa erythropus	LC	Extant (non-breeding)	II-B	III	-

Family	Species	IUCN Red List	Birdlife Status	Bird Directive	Bern Convention	CITES Convention
	Tringa ochropus	LC	Extant (non-breeding)	-	II	-
	Tringa totanus	LC	Extant (resident)	II-B	III	-
Scotocercidae	*Cettia cetti*	LC	Extant (resident)	-	III	-
Sittidae	*Sitta europaea*	LC	Extant (resident)	-	II	-
	Sitta krueperi	LC	Extant (resident)	I	II	-
Strigidae	*Asio flammeus*	LC	Extant (non-breeding)	I	II	-
	Asio otus	LC	Extant (resident)	-	II	-
	Athene noctua	LC	Extant (resident)	-	II	-
	Otus scops	LC	Extant (breeding)	-	II	-
	Strix aluco	LC	Extant (resident)	-	II	-
Sturnidae	*Sturnus vulgaris*	LC	Extant (resident)	II-B	No III	-
Sylviidae	*Iduna pallida*	LC	Extant (breeding)	-	II, III	-
	Phylloscopus collybita	LC	Extant (breeding) (non-breeding) (resident)	-	II	-
	Sylvia atricapilla	LC	Extant (breeding)	-	II, III	-
	Sylvia borin	LC	Extant (passage)	-	II	-
	Sylvia communis	LC	Extant (breeding)	-	III	-

Family	Species	IUCN Red List	Birdlife Status	Bird Directive	Bern Convention	CITES Convention
	Sylvia crassirostris	LC	Extant (resident)	-	II	-
	Sylvia curruca	LC	Extant (breeding) (passage)	-	II	-
	Sylvia melanocephala	LC	Extant (breeding) (resident)	-	II, III	-
	Sylvia nisoria	LC	Extant (breeding)	I	II	-
	Sylvia ruppeli	LC	Extant (breeding)	I	II	-
Threskiornithidae	*Platalea leucorodia*	LC	Extant (non-breeding) (resident)	I	II	II
	Plegadis falcinellus	LC	Extant (breeding)	I	II	-
Troglodytidae	*Troglodytes troglodytes*	LC	Extant (resident)	I	II	-
Turdidae	*Turdus iliacus*	NT	Extant (non-breeding)	-	III	-
	Turdus merula	LC	Extant (resident)	II-B	III	-
	Turdus philomelos	LC	Extant (non-breeding) (resident)	II-B	III	-
	Turdus pilaris	LC	Extant (non-breeding)	II-B	III	-
	Turdus viscivorus	LC	Extant (non-breeding) (resident)	II-B	III	-
Tytonidae	*Tyto alba*	LC	Extant (resident)	-	III	-
Upupidae	*Upupa epops*	LC	Extant (breeding)	-	II, III	-

7.2.8.5 Mammals species

As results of literature review, 74 mammals species were identified, based on their known distribution range and the suitability of the habitat, as potentially present within the LSA (Table 57).

According to IUCN Red List, 8 species are considered as threatened species, of which 3 species (*Nyctalus lasiopterus, Myotis capaccinii, Rhinolophus mehelyi*) are listed as Vunerable (VU), and 5 species (*Miniopterus schreibersii, Miniopterus schreibersii ssp. schreibersii, Lutra lutra, Rhinolophus euryale, Barbastella barbastellus*) are classified as Near Threatened (NT); all other species are determined as Least Concernc (LC), with the exception of *Nannospalax nehringi, Nannospalax xanthodont,* and *Myotis alcathoe* classified as Data Deficit (DD).

Forty one (41) mammals species are protected by the Habitat Directive, of which 13 species are listed both in Annex II and IV, 1 species (*Canis aureus*) is present both in Annex II and V, 24 species are in Annex IV, 1 species (Canis lupus) is protected by Annex IV and V, while 2 species (*Lepus europaeus, Martes martes*) are listed only in Annex V.

According to the Bern Convention, 35 speices are listed in Annex II, and 12 species are present in Annex III.

Based on the CITES Convention, 1 species (*Lutra lutra)* is listed in Annex I*,* 3 species *(Ursus arctos, Felis slivestris, Canis lupus)* are classified in Annex II, while *Martes foinea* is protected by Annex III.

No endemic species are identified as potentially present within the LSA.

Table 57 Mammals species identified within the LSA

Family	Species	IUCN Red List	Habitat Directive	Bern Convention	CITES Convention
Canidae	*Canis aureus*	LC	II, V	-	-
	Canis lupus	LC	IV, V	II	II
	Vulpes vulpes	LC	-	-	-
Cervidae	*Capreolus capreolus*	LC	-	III	-
	Cervus elaphus	LC	-	-	-
Cricetidae	*Arvicola amphibius*	LC	-	-	-
	Cricetulus migratorius	LC	-	-	-
	Microtus guentheri	LC	-	-	-
	Microtus levis	LC	-	-	-
	Microtus subterraneus	LC	-	-	-
	Myodes glareolus	LC	-	-	-
	Nannospalax nehringi	DD	-	-	-
Erinaceidae	*Erinaceus concolor*	LC	-	-	-

Family	Species	IUCN Red List	Habitat Directive	Bern Convention	CITES Convention
Felidae	*Felis slivestris*	LC	IV	II	II
Gliridae	*Dryomys nitedula*	LC	IV	III	-
	Glis glis	LC	IV	-	-
	Muscardinus avellanarius	LC	IV	-	-
Leporidae	*Lepus europaeus*	LC	V	-	-
Miniopteridae	*Miniopterus schreibersii*	NT	II, IV	II	-
	Miniopterus schreibersii ssp. schreibersii	NT	-	II	-
Molossidae	*Tadarida teniotis*	LC	IV	II	-
Muridae	*Apodemus flavicollis*	LC	-	-	-
	Apodemus mystacinus	LC	-	-	-
	Apodemus uralensis	LC	-	-	-
	Apodemus witherbyi	LC	-	-	-
	Mus domesticus	LC	-	-	-
	Mus macedonicus	LC	-	-	-
	Mus musculus	LC	-	-	-
	Rattus norvegicus	LC	-	-	-
	Rattus rattus	LC	-	-	-
Mustelidae	*Lutra lutra*	NT	II, IV	II	I
	Martes foinea	LC	-	III	III
	Martes martes	LC	V	III	-
	Meles meles	LC	-	III	-
	Mustela nivalis	LC	-	-	-
Rhinolophidae	*Rhinolophus blasii*	LC	II, IV	II	-
	Rhinolophus euryale	NT	II, IV	II	-
	Rhinolophus ferrumequinum	LC	II, IV	II	-

Family	Species	IUCN Red List	Habitat Directive	Bern Convention	CITES Convention
	Rhinolophus hipposideros	LC	II, IV	II	-
	Rhinolophus mehelyi	VU - A4c	II, IV	II	-
Sciuridae	*Sciurus anomalus*	LC	IV	II	-
Soricidae	*Neomys anomalus*	LC	-	III	-
	Sorex satunini	LC	-	III	-
	Sorex volnuchini	LC	-	III	-
	Suncus etruscus	LC	-	III	-
	Crocidura leucodon	LC	-	III	-
	Crocidura suaveolens	LC	-	III	-
Spalacidae	*Nannospalax xanthodon*	DD	-	-	-
Suidae	*Sus scrofa*	LC	-	-	-
Talpidae	*Talpa levantis*	LC	-	-	-
Ursidae	*Ursus arctos*	LC	II, IV	II	II
Vespertilionidae	*Barbastella barbastellus*	NT	II, IV	II	-
	Eptesicus serotinus	LC	IV	II	-
	Hypsugo savii	LC	IV	II	-
	Myotis alcathoe	DD	IV	II	-
	Myotis aurascens	LC	IV	II	-
	Myotis blythii	LC	II, IV	II	-
	Myotis brandtii	LC	IV	II	-
	Myotis capaccinii	VU - A4bce	II, IV	II	-
	Myotis daubentonii	LC	IV	II	-
	Myotis emarginatus	LC	II, IV	II	-
	Myotis myotis	LC	II, IV	II	-
	Myotis mystacinus	LC	IV	II	-

Family	Species	IUCN Red List	Habitat Directive	Bern Convention	CITES Convention
	Myotis nattereri	LC	IV	II	-
	Nyctalus lasiopterus	VU	IV	II	-
	Nyctalus leisleri	LC	IV	II	-
	Nyctalus noctula	LC	IV	II	-
	Pipistrellus kuhlii	LC	IV	II	-
	Pipistrellus nathusii	LC	IV	II	-
	Pipistrellus pipistrellus	LC	IV	III	-
	Pipistrellus pygmaeus	LC	IV	II	-
	Plecotus auritus	LC	IV	II	-
	Plecotus austriacus	LC	IV	II	-
	Vespertilio murinus	LC	IV	II	-

7.2.9 Critical Habitat Assessment

A first screening based on available information was conducted in order to identified the potential presence of Critical Habitats (CHs) within the LSA according to IFC Performance Standard 6 (PS6).

According to IFC PS6, the definition of Critical Habitat is assessed below.

7.2.9.1 Criterion I: habitat of significant importance to Critically Endangered and/or Endangered species

As a result, 20 species were identified as potentially triggering CH based on this criterion. These species include:

- 3 flora species;
- 2 fish species;
- 1 bird species.

The Criterion 1 thresholds (Guidance Note 6, GN72, IFC 2019) were applied on all fauna and flora species having Endangered (EN) or Critically Endangered (CR) conservation status according to global IUCN criteria or local assessments. In the absence of a Global IUCN assessment (e.g. Not Evaluated - NE, or Data Deficient - DD), local assessments were considered (e.g. The Turkish Red Data Book of Flora).

All other Vulnerable species listed as potentially present have a very wide distribution range, therefore it is excluded that they could meet the thresholds for Criterion 1b: “Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in GN72” (Guidance Note 6, GN72, IFC 2019).

In order to apply the threshold identified in criterion 1 an “ecologically appropriate area of analysis” has been identified for each species. The results of the critical habitat screening are detailed below and are reported in Table 58.

Species that could trigger critical habitats but that are considered only potentially present based on literature information and/or species for which not sufficient data are available are identified as triggering “Potential Critical Habitat”. Where the critical habitat has been confirmed in at least one occasion it is identified as “Critical habitat” and mapped. The ecology of species screened as triggering CH is described in detail in section 7.2.10.

Flora species

Three CR or EN flora species were observed in the LSA during field surveys: *Aubrieta olympica, Centaurea sakariyaensis* were identified at sampling station no. T16 (Figure 67), which was located at about 417 m and characterized by the coniferous woodland (G3.9)” and sparsely-vegetated cliffs (H3.2), while *Ornithogalum pascheanum* was found between 60 m and 130 m of altitude at sampling stations no. T06, T08 and T09 (Figure 70), characterized by the presence of pseudo-maquis (F5.3), dry mediterranean lands (E1.C) and deciduous woodland (G1.7), respectively.

The ecologically appropriate area of analysis to determine the presence of critical habitat for flora species is identified as the LSA plus the altitudinal range 0-1000 m within 25 km from the LSA. This ecologically appropriate area of analysis corresponds to 10,011 km^2. The area was eventually cut based on the known Extent of Occurrence (EOO) of the species.

Since an exact numerical estimation of the global population of these flora species does not exist, the ecologically appropriate area of analysis is compared with the EOO in order to identify if the ecologically appropriate area of analysis could potentially “support globally important concentrations of an IUCN Red-listed EN or CR species (> 0.5% of the global population AND >5 reproductive units of a CR or EN species)” according to Criterion 1a. The results of the critical habitat screening are detailed below and are reported in Table 58.

All three flora species have a relatively limited distribution (*Aubrieta olympica:* 154,140 km^2; *Centaurea sakariyaensis:* 32,341 km^2; *Ornithogalum pascheanum:* 89,347 km^2), and for all of them the ecologically appropriate area of analysis corresponds to > 0.5% of the EOO.

Therefore, using a precautionary approach, all flora species are considered as triggering Critical habitat for Criterion 1*a “*Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (≥ 0.5% of the global population AND ≥ 5 reproductive units of a CR or EN species)” (Guidance Note 6, GN72, IFC 2019).

Fish species

The ecologically appropriate area of analysis to determine the presence of critical habitat for fish species is identified as the catchment of the main rivers crossed by the projects (Karacay River and the Nilufer River) which corresponds to 95,146 km^2. The area was eventually cut based on the known Extent of Occurrence of the species (Table 58).

Since an exact numerical estimation of the global population of these flora species does not exist, the EOO is compared with the specie range in order to identify if the ecologically appropriate area of analysis could potentially “support globally important concentrations of an IUCN Red-listed EN or CR species (> 0.5% of the global population AND >5 reproductive units of a CR or EN species)” according to Criterion 1a. The results of the critical habitat screening are detailed below and are reported in Table 58.

The European Eel *(Anguilla Anguilla)* is a widely distributed species with a range of about 8,047,098 km² in Europe and parts of North Africa (Moriarty and Dekker 1997), which becomes considerably larger when marine distribution is considered. The ecologically appropriate area of analysis corresponds to <0.5% of the EOO. Therefore, this species is not considered to trigger critical habitat.

Considering that *Cobitis puncticulata* has a relatively limited distribution (12,128 km^2), using a precautionary approach, this species is considered as triggering Critical Habitat for Criteria 1a, since the ecologically appropriate area of analysis corresponds to > 0.5% of the EOO.

Also considering that the species are included as a trigger species in an of the Manyas Lake KBA, , this species is considered as triggering Critical Habitat for Criterion 1c (areas containing nationally/regionally-important concentrations of an IUCN Red-listed EN or CR species).

Bird species

Aquila nipalensis (EN) and *Neophron percnopterus* (EN) are considered only passage species for this area and are therefore excluded from the assessment.

Falco cherrug (EN) and White-headed Duck (*Oxyura leucocephala*, EN) are considered non-breeding species spending the winter season in the area of the IBAs and the possibility of triggering Critical Habitat within the Project LSA according to Criterion 1 ids therefore discussed. The results of the critical habitat screening are detailed below and are reported in Table 58.

The ecologically appropriate area of analysis to determine the presence of critical habitat for flora species is identified as the LSA plus the Manyas Lake (Kuş Lake) Important Bird Area (IBA) and Kocaçay Delta Important Bird Area (IBA) which are marginally overlapping with it. This ecologically appropriate area of analysis corresponds to 833 km^2.

The White-headed Duck (*Oxyura leucocephala*, EN) population is estimated at 5,300-8,700 mature individuals, therefore the ecologically appropriate area of analysis should support at least 27 wintering individuals to meet the thresholds for Criterion 1a (> 0.5% of the global population AND >5 reproductive units of a CR or EN species). Manyas Lake (Kuş Lake) IBA latest bird count indicated 20-34 wintering individuals, the species in also one of the triggering species for Manyas Lake IBA.

Therefore, the White-headed Duck (*Oxyura leucocephala*, EN) can be considered as triggering Critical Habitat for the in the Manyas Lake IBA for both Criterion 1a and 1c, however this species is strictly connected to the presence of eutrophic lakes or large wetland system with a fringe of dense emergent vegetation, which are not present in the Project LSA. Therefore, no Critical Habitat is present for this species within the Project LSA.

The Saker Falcon (*Falco cherrug*, EN) population is estimated at 6,100-14,900 breeding pairs, therefore the ecologically appropriate area of analysis should support at least 61 wintering individuals to meet the thresholds for Criterion 1a (> 0.5% of the global population AND >5 reproductive units of a CR or EN species).

This number, although high, does not appear completely unrealistic for the ecologically appropriate area of analysis considering that the habitats present in the LSA could be suitable for wintering. Therefore, based on a precautionary approach, the LSA could potentially meet the thresholds for Criteria 1a “areas that support globally important concentrations of an IUCN Red-listed EN or CR species”.

Table 58 Screening of species potentially triggering Critical Habitat according to Criterion 1 (IFC PS6, 2019)

Taxon	Scientific Name	Common Name	IUCN Red List / Flora RDB	Endemism	Obs. / Lit.	Ecologically appropriate area of analysis (km^2)	Extent of Occurrence (EOO) (km^2)	Critical Habitat in the LSA
Flora	*Aubrieta olympica*	-	EN	Regional endemic	O	10,011	154,140	Criterion 1a
	Centaurea sakariyaensis	-	CR	Local endemic / RR	O	10,011	32,341	Criterion 1a
	Ornithogalum pascheanum	-	EN	Regional endemic	O	10,011	89,347	Criterion 1a
Fish	*Anguilla anguilla*	European eel	CR	-	L	95,146	8,047,098	-
	Cobitis puncticulata	Brown spined loach	EN	Endemic / RR	L	23,967	12,128	Potential Criterion 1a, 1c
Bird	*Oxyura leucocephala*	White-headed duck	EN	-	L	833	5,735,650	-
	Falco cherrug	Saker falcon	EN	-	L	833	21,990,765	Potential Criterion 1a

7.2.9.2 Criterion II: habitat of significant importance to endemic and/or restricted-range species

As a result, 3 species were identified as potentially triggering CH based on this criterion. These species include:

- 1 flora species;
- 2 fish species.

The terrestrial and freshwater restricted range criteria were applied on all fauna and flora species having local endemic status (Guidance Note 6, GN74, IFC 2019). If the species met the restricted range criteria, the threshold for Criterion 2 was applied whenever possible (Guidance Note 6, 75, IFC 2019). In absence of reliable data a precautionary approach was applied.

In order to apply the threshold identified in criterion 1 an "ecologically appropriate area of analysis" has been identified for each species. The results of the critical habitat screening are detailed below and are reported in Table 59.

Species that could trigger critical habitats but that are considered only potentially present based on literature information and/or species for which not sufficient data are available are identified as triggering "Potential Critical Habitat". Where the critical habitat has been confirmed in at least one occasion it is identified as "Critical habitat" and mapped. The ecology of species screened as triggering CH is described in detail in section 7.2.10.

Flora species

During field surveys, the local endemic *Centaurea sakariyaensis* flora species was observed within the LSA at the sampling station no. T16, which was located at about 417 and characterized by the presence of the 2 habitats of "Coniferous woodland dominated by Cupressaceae or Taxaceae (G3.9)" and "Basic and ultra-basic inland cliffs (H3.2)". Its ground cover has been estimated at between 1% and 2% (Figure 67).

The ecologically appropriate area of analysis to determine the presence of critical habitat for flora species is identified as the LSA plus the altitudinal range 0-1000 m within 25 km from the LSA. This ecologically appropriate area of analysis corresponds to 10,011 km^2. The area was eventually cut based on the known Extent of Occurrence of the species.

Since an exact numerical estimation of the global population of this flora species does not exist, the ecologically appropriate area of analysis is compared with the EOO in order to identify if the ecologically appropriate area of analysis could potentially "b) areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a species" according to Criterion 2a. The results of the critical habitat screening are detailed below and are reported in Table 59.

Considering the species relatively limited distribution (EOO 32,341 km^2), using a precautionary approach, *Centaurea sakariyaensis* is considered as triggering Critical habitat for Criterion 2 (Guidance Note 6, GN75, IFC 2019), since the ecologically appropriate area of analysis is ≥10% of the EOO.

Fish species

Two (2) endemic and restricted range (RR) fish species (Barbus niluferensis, Cobitis puncticulata) were identified based on literature review as potentially present within the LSA and as potentially meeting the thresholds for Criterion 2. Both species are known to be present in the Simav drainage.

The ecologically appropriate area of analysis to determine the presence of critical habitat for flora species is identified as the catchment of the main rivers crossed by the projects (Karacay River and the Nilufer River) which corresponds to 95,146 km^2. The area was eventually cut based on the known Extent of Occurrence of the species.

Since an exact numerical estimation of the global population of these species does not exist, the ecologically appropriate area of analysis is compared with the EOO in order to identify if the ecologically appropriate area of analysis could potentially "b) areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a species" according to Criterion 2a. The results of the critical habitat screening are detailed below and are reported in Table 59.

Cobitis puncticulata presence is witnessed in the Kocacay River at the outlets of Manyas Lake with an estimate area of occupancy (AOO) of 100-500 km^2 and extent of occurrence (EOO) of about 12,128 km^2.

Barbus niluferensis species is also endemic to the Gönen drainage, reaching an extent of occurrence (EOO) less than 30,000 km^2 (but more than 20,000 km^2).

Using a precautionary approach, these species are considered as triggering Critical Habitat for Criteria 2a, since the ecologically appropriate area of analysis corresponds to > 10% of the EOO.

Table 59 Screening of species potentially triggering Critical Habitat according to Criterion 2 (IFC PS6, 2012)

Taxon	Species	IUCN Red List / Flora RDB	Endemism / RR	Obs. / Lit.	Ecologically appropriate area of analysis (km^2)	Extent of Occurrence (km^2)	Critical Habitat in the LSA
Flora	*Centaurea sakariyaensis*	CR	Local endemic / RR	O	10,011	32,341	Criterion 1a
Fish	*Barbus niluferensis*	NT	Endemic / RR	L	23,967	12,128	Potential Criterion 2a
	Cobitis puncticulata	EN	Endemic / RR	L	23,967	23,763	Potential Criterion 2a

7.2.9.3 Criterion III: habitat supporting globally significant concentrations of migratory and/or congregatory species

The Project LSA partially falls within the internationally recognized Manyas Lake (Kuş Lake) Key Biodiversity Area (KBA) and Important Bird Area (IBA), substantially coinciding with the Kuş Lake Ramsar Site (Wetlands of International Importance), and minimally overlaps the internationally recognized Kocaçay Delta Key Biodiversity Area (KBA) and Important Bird Area (IBA).

Manyas Lake, which is considered of global importance for the presence of 8 breeding populations species, is located on the Western Palearctic migration route between Asia and Europe. Thus, many species of birds stop over at Bird Paradise, which provides food, shelter and breeding grounds for them. The LSA intersects exclusively with the buffer zone of Manyas Lake but not with the wetland or the absolute protection zone. Although the LSA overlaps partially with the borders of the Ramsar Lake Site, and KBA and IBA boundaries (Figure 47), these areas are characterized exclusively by modified habitats and agricultural areas. Therefore, the LSA does not contain any habitats of interent for the breeding populations of waterfowl.

Similarly Kocaçay Delta KBA and IBA intersection with the Project LSA is minimal, it occurred on the outskirt of the KBA and IBA and only in correspondence of modified agricoltural habitats (Figure 48).

Based on the consideration above, the presence of migratory species individuals within the LSA is possible, however, the area does not meet the threshold identified Guidance Note 6, GN76 (IFC 2019). Therefore, no Critical Habitat is expected to be present in the Project LSA according to this criterion.

7.2.9.4 Criterion IV: highly threatened and/or unique ecosystems

No EUNIS habitats identified within the LSA are considered highly threatened (CR or EN) or unique ecosystems according to the “European Red List of Habitats”.

Therefore, no Critical habitat is expected to be present within the LSA base on this criterion.

7.2.9.5 Criterion V: areas associated with key evolutionary processes

The LSA is not known to contain landscape feature and/or subpopulations of species with unique evolutionary history. In fact, the LSA is not characterized by a particular level of isolation, spatial heterogeneity, and wealth of environmental gradients or edaphic interfaces. Moreover, the area is not considered to be of demonstrated importance as to climate change adaptation or as biological corridor. These considerations suggest that the LSA does not support any key evolutionary processes.

Therefore, no Critical Habitat is expected to be present in the LSA according to this criterion.

7.2.10 Ecology of species triggering Critical Habitat

7.2.10.1 Flora Species

The presence and ecological requirements of the observed flora species potentially triggering critical habitats are discussed below.

***Aubrieta olympica* (Regional endemic)**

Aubrieta olympica is a perennial herbaceous species (Figure 63), characterized by toothed evergreen leaves and purple flowers between 11-19 mm in diameter. Flowering period has been observed from early April to early May. The species is typically of sunny cliffs and rocky areas located between altitude of 200-2400 m.

The species is classified as regional endemic to Turkey (Figure 64), since it is found in three regions: Southern Marmara Section (1ç), Western Black Sea Section (2a), and Adana Section (6b).

Aubrieta olympica was observed in the LSA with *Centaurea sakariyaensis* at the sampling point (SP) no. T16 in correspondence of one of the borrow pit. This SP was located at about 417 m and characterized by the presence of the 2 habitats of “Coniferous woodland dominated by Cupressaceae or Taxaceae (G3.9)” and “Basic and ultra-basic inland cliffs (H3.2)”. The ground cover of *A. olympica* has been estimated at between 2% and 5% (Figure 67).

Figure 63: *Aubrieta olympica* flower (photo taken on April 6th, 2021 during the fieldwork)

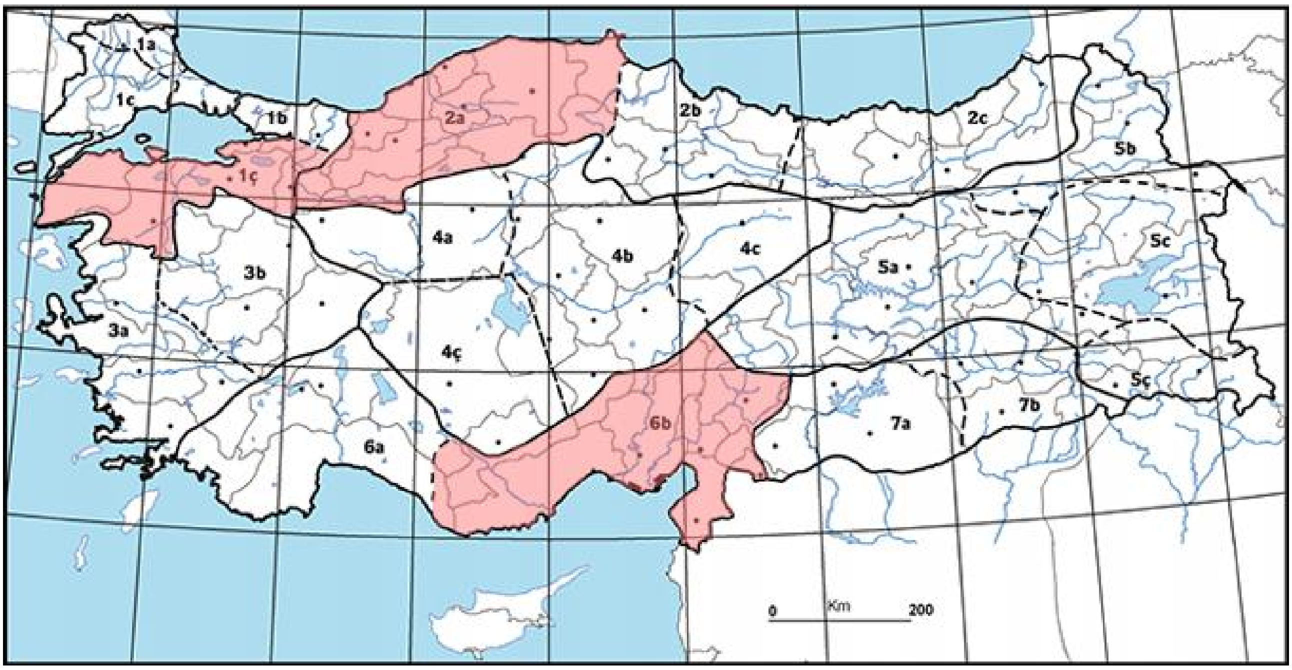


Figure 64: *Aubrieta olympica* known distribution range (source: http://www.bizimbitkiler.org.tr/)

***Centaurea sakariyaensis* (local endemic and restricted range)**

Centaurea sakariyaensis is a perennial herbaceous species (Figure 65) with a woody rootstock and a creeping and short stem, branched from middle part with 1–3 capitula and with erect-ascending branches of 2.5–6 cm. It is characterized by typically tomentose toothed evergreen leaves, which gradually change upward from pinnatisect to pinnatilobed and become smaller. Phyllaries are pluseriate, lanceolate and striate, with acicular appendages that gradually reduce at the apex, usually entire without cilia at the margins.

Flowering occurs between May and June, while fruiting in July: flowers are typically pink-purple with 11-19 mm of diameter; achenes are narrowly ovoid-oblong, light brown in color with longitudinally and sparsely sericeous hairy stria; double pappus. The species is a chamaephyte growing in limestone rock crevices or on rocky slopes, occurring far away from stream beds between altitude of 50 and 100 m a.s.l.

Centaurea sakariyaensis is classified as local endemic to Turkey, since it is found only in 1 region, Southern Marmara Section (1ç) (Figure 66). Additionally, because of the rather small population size, this species should is considered as “Critically Endangered” (CR).

Centaurea sakariyaensis was observed in the LSA with *Aubrieta olympica* at the sampling point (SP) no. T16 in correspondence of one of the borrow pit (Figure 67). This SP was located at about 417 m and characterized by the presence of the 2 habitats of “Coniferous woodland dominated by Cupressaceae or Taxaceae (G3.9)” and “Basic and ultra-basic inland cliffs (H3.2)”. The ground cover of *C. sakariyaensi* has been estimated at between 1% and 2%.

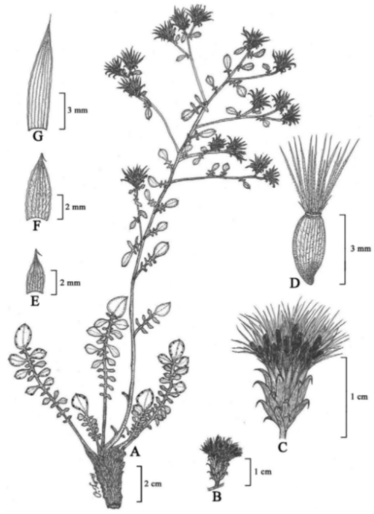


Figure 65: *Centaurea sakariyaensis* habitus (photo taken on April 6th, 2021 during the fieldwork) and habitus drawing: A) Habit.; B)-C) Capitulum; D) Achene and pappus; E)-G) Phyllaries.

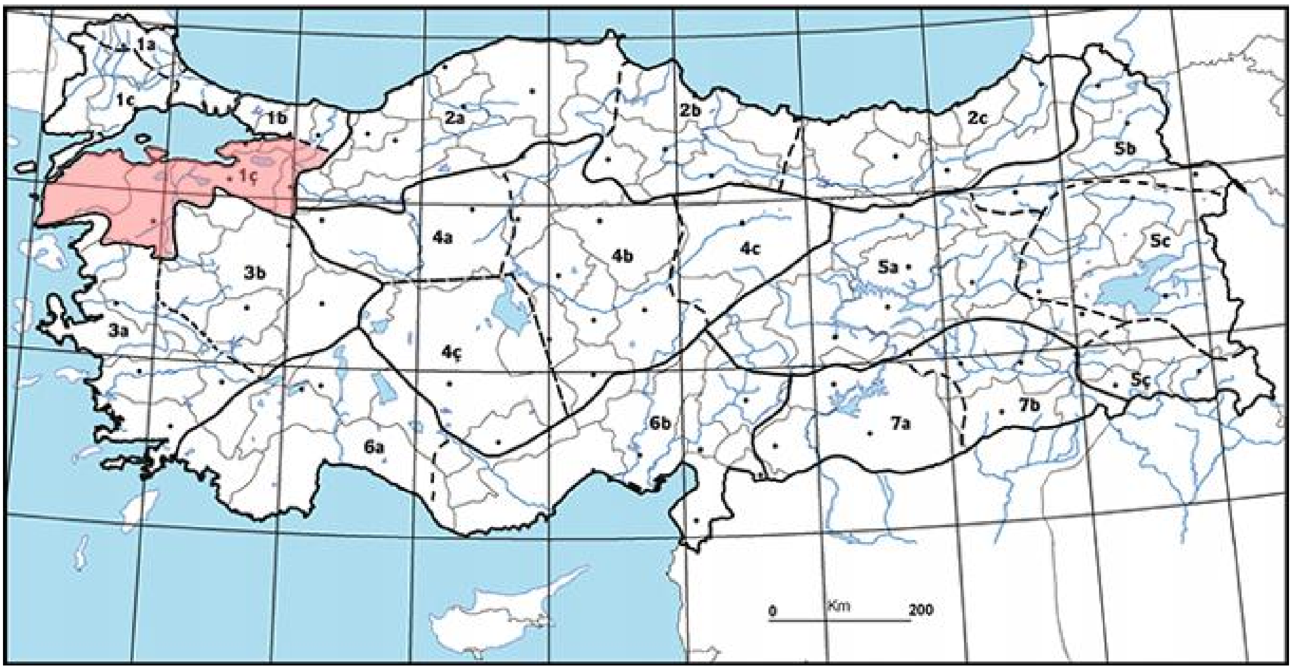


Figure 66: ***Centaurea sakariyaensis*** **known distribution range (source: http://www.bizimbitkiler.org.tr/)**

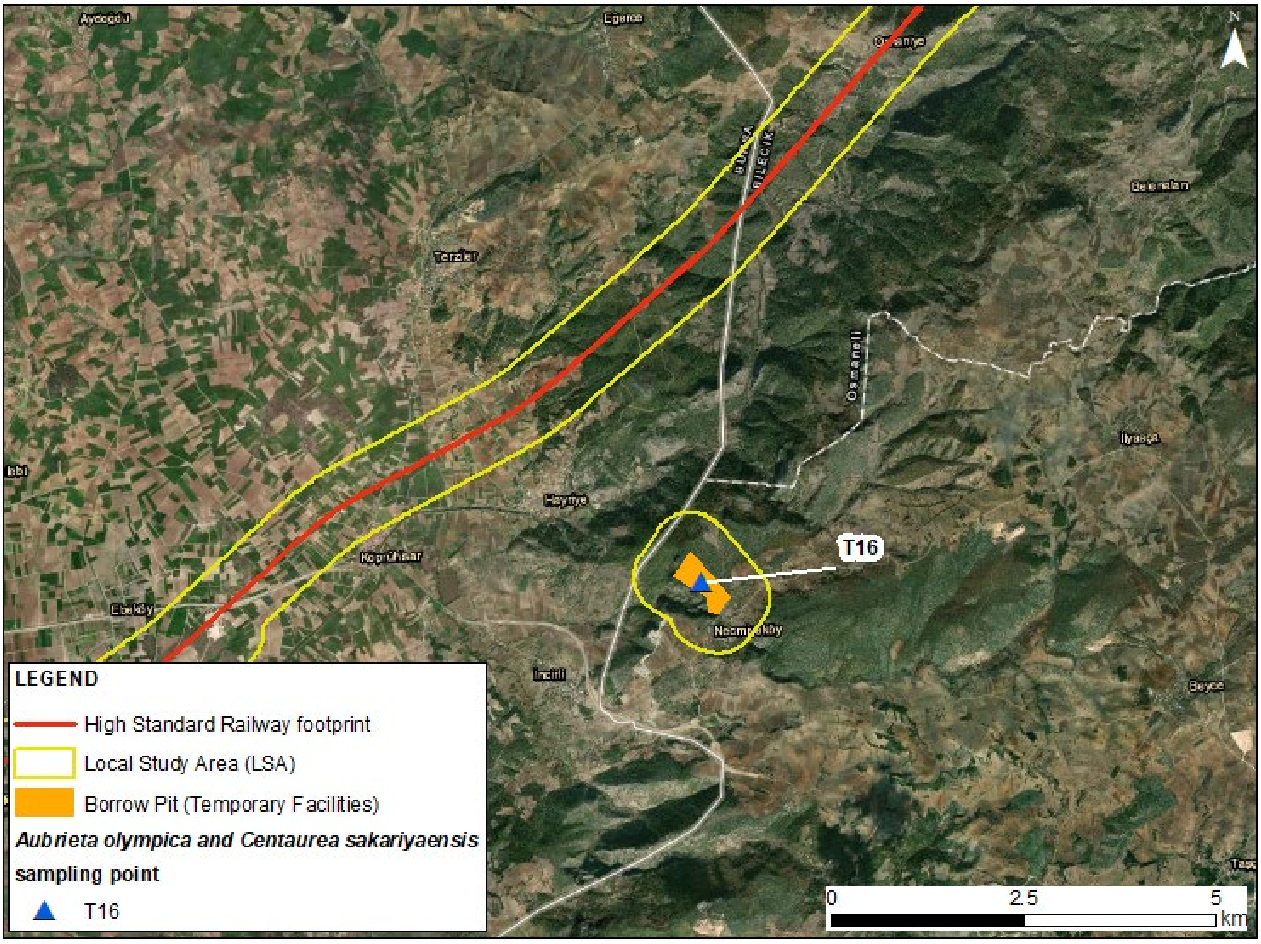


Figure 67 ***Centaurea sakariyaensis*** **sampling point observation**

Ornithogalum pascheanum **(Regional endemic)**

Ornithogalum pascheanum is a perennial herbaceous species (Figure 68) with erect and lanceolate to filiform leaves. Flowering occurs between April and June and it is characterized by a racemic inflorescence with 2-10 white or white flowers with green dorsal band, peduncles erect or enlarged to anthesis, and bracts from lanceolate to ovate-sharp, with filiform apex. Fruits are capsules subglobose, while seeds are typically black, irregularly flattened, outline sub- to semicircular.

Ornithogalum pascheanum is determined as regional endemic to Turkey (Figure 69), since it is found in two regions: Southern Marmara Section (1ç), and Western Black Sea Section (2a).

The species is a bulb geophyte growing in bare stony places, meadows, and forests. The species was observed in the LSA between 60 m and 130 m of altitude at the sampling points (SPs) no. T06, T08 and T09, in correspondence of two storage areas and a borrow pit, respectively. The SPs were characterized by the presence of pseudo-maquis (F5.3), dry mediterranean lands (E1.C) and deciduous woodland (G1.7), respectively. Its ground cover has been estimated at between 1% and 2% in grassland and shrubland, and between 2% and 5% in the deciduous forest (Figure 70).

Figure 68 ***Ornithogalum pascheanum*** **habitus (photos taken on April 6th, 2021 during the fieldwork) at SP T06 and T08, respectively**

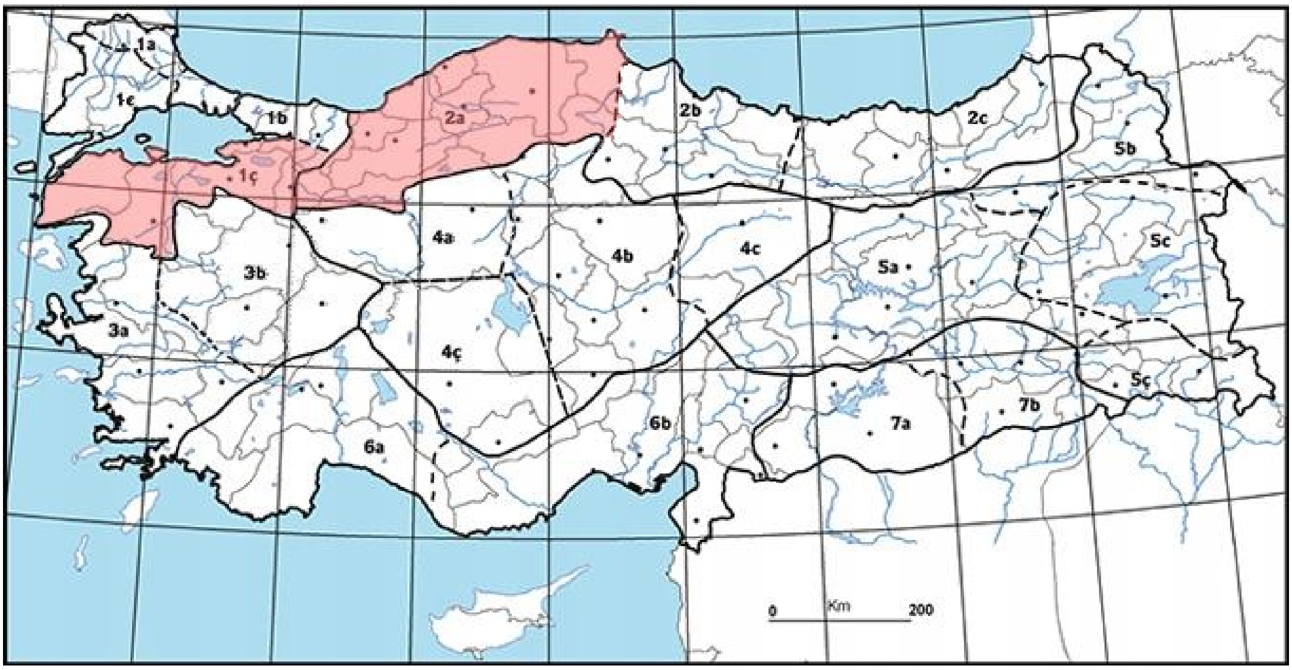


Figure 69: ***Ornithogalum pascheanum*** **known distribution range (source: http://www.bizimbitkiler.org.tr/)**

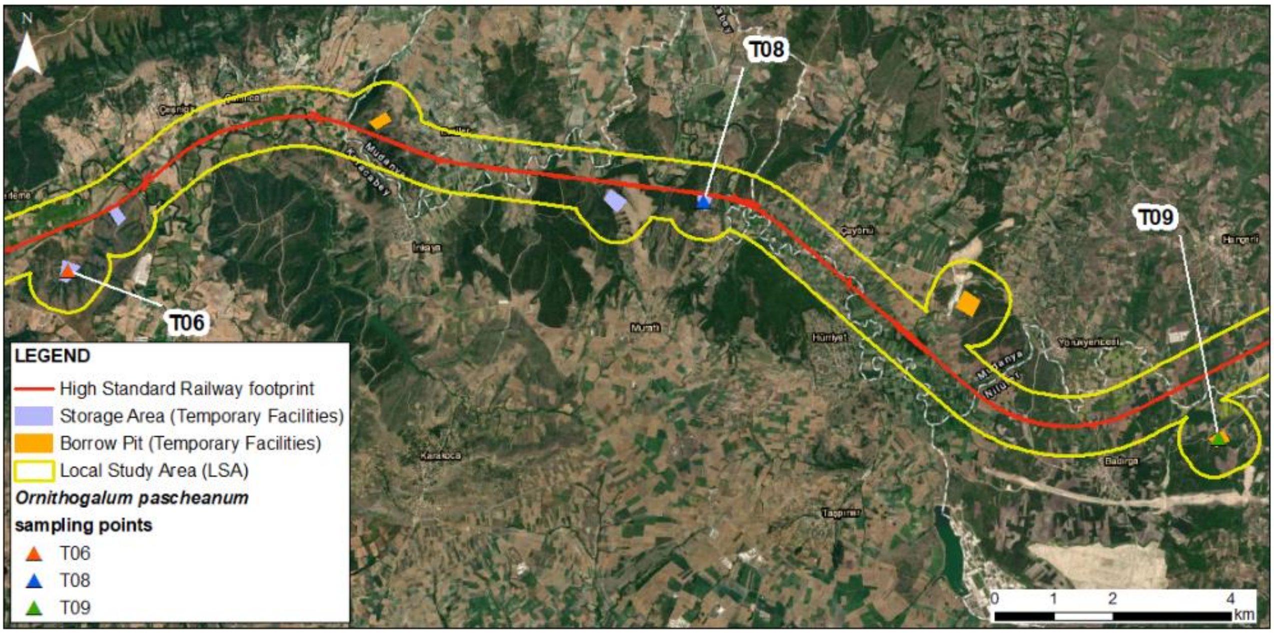


Figure 70 ***Ornithogalum pascheanum*** **sampling point observation**

7.2.10.2 Fauna Species

The presence and ecological requirements of the fauna species potentially triggering critical habitats are discussed below.

Cobitis puncticulata

Cobitis puncticulata is a benthopelagic fish species typically found in well-oxygenated moderately flowing streams and lake shore with muddy bottom and abundant submerged vegetation.

It appears unique in its morphological features: it is characterized by an unusual colour pattern consisting of small dark-gray dots throughout the relatively high body and the small head. The eyes are placed in the anterior part, while the mouth is slightly arched with three pairs of long barbels and finely furrowed lips.

Its distribution range includes only three locations: the lower Matiza/Evros river in Greece, while in Turkey it is found in the Simav drainage at the outlet of Uluabat Lake and in the Kocacay River at the outlets of Manyas Lake. As result, its area of occupancy is less than 500 km² and it is classified as endemic restricted range species.

Apparently, the species is not rare in appropriate habitats. No population trends are known but the species is expected to suffer from massive threats in the area: *Cobitis puncticulata* is severely impacted by water reduction, due to water extraction, and by pollution, typically from agriculture and industry.

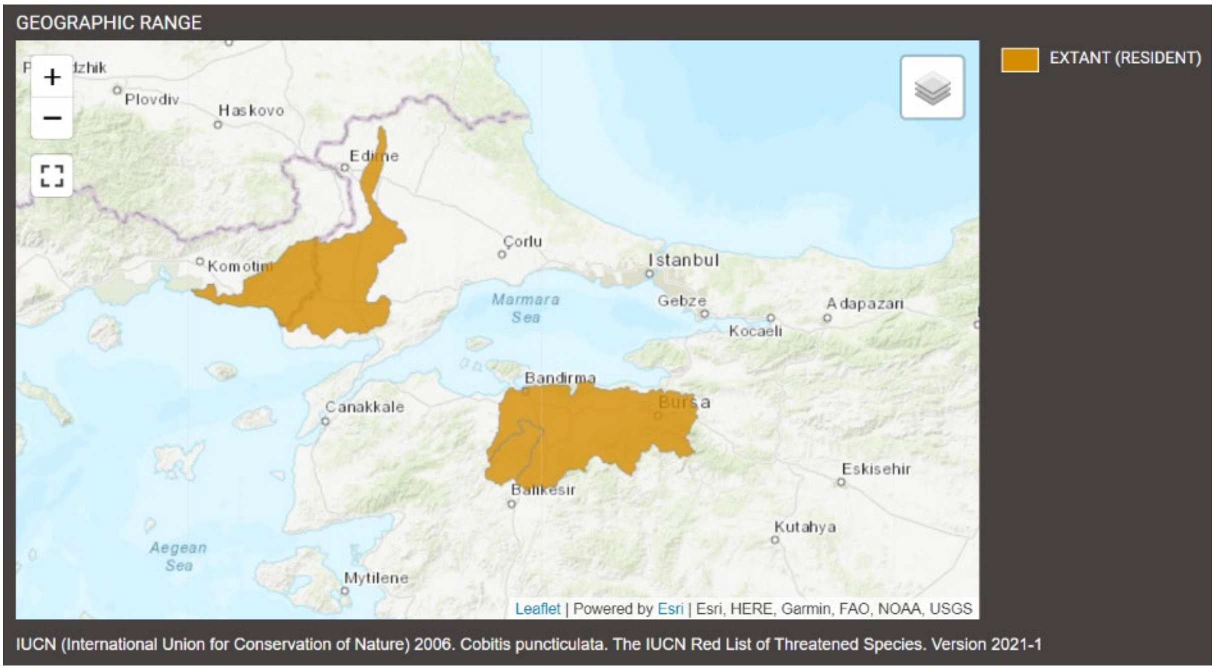


Figure 71: *Cobitis puncticulata* distribution range (source: https://www.iucnredlist.org/species)

Barbus niluferensis

Barbus niluferensis is a pelagic fish species, endemic to Turkey where it occurs in the Simav and Gönen drainages in southern Marmara basin. It has a relatively limited distribution, with an extent of occurrence (EOO) less than 30,000 km² (but more than 20,000 km²).

This species is characterized by a small body (largest known specimen 14.6 cm SL) with short caudal fin, large and many irregular black spots on the back, as well as on the fins and flank, and small black spots on the head, extending downwards to the cheek. The head length range between 23.3-25.7 with the last simple dorsal-fin ray weakly ossified and with fewer serrae along the proximal part of its posterior margin and with fewer gill rakers on the first gill arch.

Barbus niluferensis is typically found in headwater streams with fast to moderately running water and gravel bottom.

There are no data about the population trend, however, due to major threats in its habitat, such as heavily agricultural and industrial pollution, a negative trend is expected.

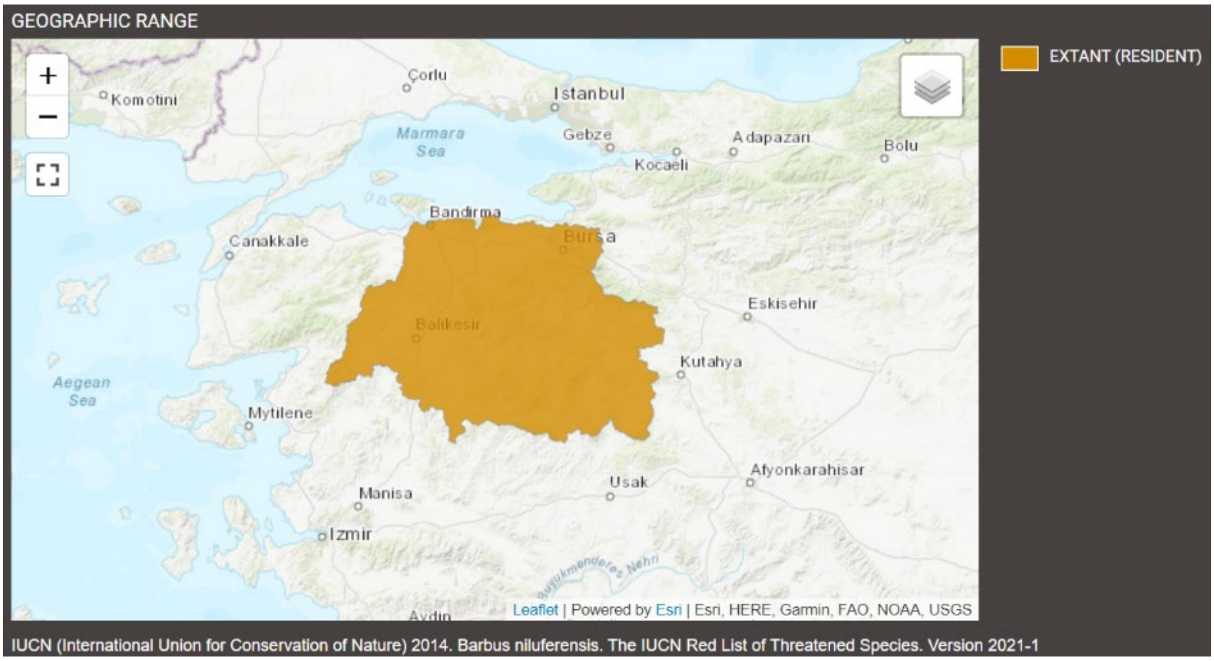


Figure 72 *Barbus niluferensis* distribution range (source: https://www.iucnredlist.org/species)

***Falco cherrug* (Saker Falcon, EN)**

The Saker Falcon has been up listed to Endangered because a revised population trend analysis indicates that it may be undergoing a very rapid decline. This classification is highly uncertain and may be revised when new information becomes available. The historical and present global population size remains subject to considerable uncertainty; however, a revised analysis of available data has resulted in a global population estimate of 6,100-14,900 breeding pairs (median 10,500). The species is precautionary estimated to be declining by at least 50% over three generations. The rate of decline appears to be particularly severe in the specie's central Asian breeding grounds.

The Saker Falcon occurs in a wide range across the Palearctic region from eastern Europe to western China (Figure 73). In the LSA the species has not been observed but the presence of both passage and wintering individuals is possible according to literature. Migrant birds generally leave their breeding grounds in September and October, returning between February and May.

The Saker Falcon is specialized in hunting mid-sized diurnal terrestrial rodents in some areas, particularly near water, it switches to birds as key prey. It hunts close to the ground in open terrain of grassy landscapes such as semi-desert, steppes, agricultural and arid montane areas. These habitats are present within the LSA.

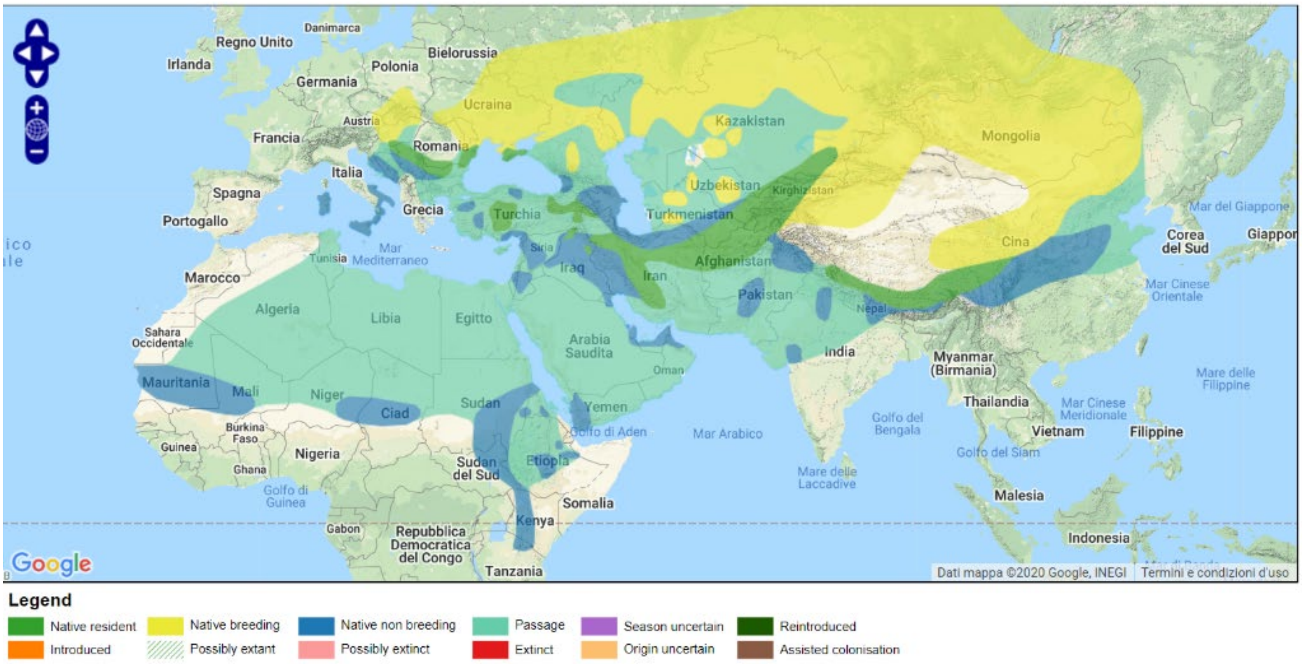


Figure 73 ***Falco cherrug (Saker Falcon)*** **known distribution range (source: http://www.birdlife.org/)**

7.3 Social Components

7.3.1 Study Area

The AoI is the zone that may be influenced by a project. Understanding the AoI is an essential requirement for a social impact assessment (SIA). Following that, the social baseline must focus on the AoI, although the baseline may have a broader focus, depending on the nature and impact of the project.

In short, the AoI should include all project related structures and ancillary facilities (owned or managed) by the client and subcontractors and the associated activities strongly dependent on the project. In addition, areas and communities directly impacted upon by the proposed project and ancillary facilities form part of the AoI. Cumulative impacts and potential unintended, but predictable, project consequences should also be considered in the delineation of the AoI. From a social viewpoint, the AoI perspective is also influenced by direct and induced socio-economic influences (including resettlement, economic displacement, livelihood, health, and safety aspects), spatial implications, intrusion impacts and stakeholder typology.

Based on the considerations indicated in above section the Project AoI is set as follows:

Table 60 Settlements located in AoI

Sections	Province	District	Village/Neighbourhood
Section 3: Bandırma-Bursa (97+000 km) 	**Balıkesir**	**Bandırma**	1. Kirazlı
			2. Ömerli
			3. Kuşcenneti
			4. Akçapınar
			5. Doğruca
	Bursa	**Karacabey**	6. Akçakoyun
			7. ÇamlıcA
			8. Danişment
			9. Fevzipaşa
			10. Hayırlar
			11. Hürriyet
			12. Karasu
			13. Muratlı
			14. Şahinköy
			15. Taşlık
			16. Harmanlı
		Mudanya	17. Çekrice

Sections	Province	District	Village/Neighbourhood
			18. Balabancık
			19. Dedeköy
			20. Hasköy
Section 2: Bursa-Yenişehir (55+700 km) 	**Bursa**	**Osmangazi**	21. Aksungur
			22. Alaşar
			23. Çağlayan
			24. Dereçavuş
			25. Geçit
			26. İsmetiye
			27. Nilüfer
			28. Barbaros
		Gürsu	29. İğdir
			30. Karahıdır
			31. Kazıklı
		Kestel	32. Barakfakih
			33. Dudaklı
			34. Gölbaşı

Sections	Province	District	Village/Neighbourhood
			35. Narlıdere
			36. Seymen
		Nilüfer	37. Badırga
			38. Balat
			39. Doğanköy
			40. Yolçatı
Section 1: Yenişehir-Osmaneli (47+970 km) 	**Bursa**	**Yenişehir**	41. Akdere
			42. Çardak
			43. Ebeköy
			44. Karacaali
			45. Köprühisar
			46. Papatya
	Bilecik	**Osmaneli**	47. Çiftlik
			48. Düzmeşe

7.3.2 Methodology

This methodology describes the approach adopted for data collection to develop a socio-economic survey for the Project within the scope of the SIA. This baseline study was performed in order to:

- Understand the characteristics of the social context that may be subject to change point.
- Understand what resources are available at the household level in terms of livelihoods strategies and coping/resilience mechanisms through profiling households' economic, social and cultural activities.
- Identifying particular groups deemed vulnerable in the local context and potentially less able to cope with the changes brought about by the Project, or less able to benefit from its positive effects.

Introduction

Kick-off and introduction meetings were conducted with the Kalyon representatives to understand the Project status and extend of the land requirement of the Project. Following the meetings, Project related documentations including the project description file, presentations that provide Project information, kmz of the Project and land acquisition lists were presented by Kalyon.

Based on the received information, Social Impact Assessment has been completed according to the following steps.

Questionnaire Preparation

Community Level Surveys (CLS)

The aim of this survey is to determine the socio-economic status of each settlement inclusive of population, migration and reasons of migration, ethnic composition, age distributions, social facilities education level, local conflicts and problems, livelihoods and main income generation activities, economic production in the settlement, land use, land ownership, river and forest usage, services and infrastructure, vulnerable groups and perceptions of project impacts in the settlement.

Household Surveys (HHS)

The sampling approach includes households in closest proximity to Project infrastructure and local transport routes, to ensure that these were well understood, as well as those further afield (and therefore likely to include secondary/indirect impacts). The household surveys include, household information, the income of each person in a household impacted by the expropriation as property owner or user, income sources, number of people employed, seasonal migration and total income of the impacted household and the relative impact of the expropriation on their sources of income and their own perception for being affected by the project and the impacts of the land acquisition.

Table below presents the baseline topics and details that were covered during the SIA process through community level surveys and household surveys.

Table 61: Context of Socioeconomic Survey

Topics	Details
Demographics and socio-politics	■ Population, broken down by age and gender and including an indication of population trends; ■ Seasonal difference on population and reasons

Topics	Details
	■ Cultural conflicts and social cohesion ■ Vulnerability ■ In and out migration rates ■ Origin of migrant and duration in the area ■ In-migration patterns
Economy	■ Main economic sector ■ Agricultural and animal husbandry activities ■ Salaries and wages per person by sector
Education, skills and employment	■ Details regarding the education ■ Availability and quality of human resources, material and infrastructure
Land-use and land-based livelihoods	■ Number and location of landowners in the Project area ■ Types/proportion/location of permanent and non-permanent crops grown / ■ Types of land based livelihoods e.g. agriculture/livestock/fishing/beekeeping/commercial business ■ Status of project land acquisition including number of affected land owners and users ■ Changes to access to natural resources
Public Services and Infrastructure	■ Availability, source and adequacy of water sources ■ Availability and adequacy of waste disposal (raw and sewerage) ■ Availability and adequacy of energy (types) ■ Availability and adequacy of public transport and roads ■ Availability and adequacy of telecommunications ■ Availability and adequacy of education services ■ Availability and adequacy of health services

Sampling

Before the field studies, the sampling study (detailed in below Table) was carried out by conducting a desktop study. The settlements within the Project impact area were identified through the kmz file, and then the population of these settlements and the approximate average number of households were obtained through the data of TURKSTAT 2020. According to the data obtained, it was identified that there are approximately 32,000 households within the project impact area. With the sample determination formulation developed by

Golder in Excel, it was planned to interview 268 households with a margin error of 5% within a 90% confidence interval. The sample calculation formulation is presented below.

Table 62: Sampling Methodology

Methodology	Figures
X=Z score (level of accuracy based on confidence level) 90% = 1.645 95% = 1.960 99% = 2.576	1.645
P = population proportion usually 50 %. That means no bias in expected results	50.00%
% Margin of error (m): Typically 5% =0.05	5.00%
Total Target Population Number	32555
AS= sample size for known population **AS=(S)/1+((S-1)/population)**	**268**

A random sampling technique was used, meaning that each individual participating in the surveys or interviews was selected randomly, so that members of the population had an equal chance of being included in the sample. Due to Covid-19, the number targeted sampling could not be reached, and 137 household surveys were applied.

Training on the Questionnaires

On 22nd of March 2021, an online training was held with field researchers via zoom. The scope of the training consists of the following issues.

- The scope of the Project,
- The structure of the questionnaires,
- Answers to possible questions from the public

After the training, both questionnaires were applied online and the questionnaires were finalized according to the comments of the participants.

Social Field Study Team

Social fieldwork was carried out over an 8-day period between 24 March 2021 and 31 March 2021. Within the scope of the social field study, the neighbourhoods and villages on the project route were visited and a community level survey and household questionnaire were applied. The names and specialties of the people who participated in the field studies are presented in the table below.

Table 63: Field Study Team

Position	Name
Social Field Lead/Sociologist	Elçin Kaya
Enumerator/Sociologist	Onur Ali Taşkın
Enumerator/Sociologist	Büşra Ayna
Enumerator/Statistician	Deniz Kozanlı
SPSS Data Specialist	Gülçin Uçak

Limitations

During social field studies, there were various limitations due to the Covid-19 pandemic. These limitations are as follows;

- The households were not visited, the people affected by the Project were invited to the centers of the villages or neighbourhoods, and outdoor work was carried out whenever possible,
- Governmental and nongovernmental institutions within the area of influence of the project have not been visited,
- Female participants could not be reached, as the studies were generally carried out in village coffees.
- Due to pandemic some Mukhtars were refused to conduct a survey within the settlements,
- Some villages were in quarantine and they were not visited,
- No women or livelihood focus group meetings were organized.

As a result, the social impact assessment study was conducted based on the community level surveys and household surveys.

Summary of Field Research

The demographic information of the neighbourhoods was collected through the community level questionnaire, and through the household questionnaire, both the demographic structure of the households and the Project impacts, including expropriation, were asked to the participants. Social studies were carried out in the provinces of Bilecik, Bursa and Balıkesir, which are located on the route, and a total of nine districts of these provinces were visited. The survey numbers of the conducted study and the villages and neighbourhoods visited within the scope of the project are presented in the table below. All questionnaires were entered SPSS program and the results are presented in the relevant chapters of this report.

Table 64: Performed Social Surveys

Province	District	CLSs	HHSs
Balıkesir	Bandırma	5	6
Bursa	Karacabey	11	29
Bursa	Mudanya	5	15
Bursa	Gürsu	3	17
Bursa	Kestel	5	16
Bursa	Nülüfer	4	7
Bursa	Osmangazi	7	31
Bursa	Yenişehir	6	15
Bilecik	Osmaneli	2	1
TOTAL		48	137

7.3.2.1 Socioeconomic Structure

In this section, while presenting the social current situation, first the provincial level information is presented according to the data obtained from the secondary sources, and then the data of the settlements within the Project impact area are presented according to the data obtained from the field study. Social baseline analysis has been examined on the basis of the district and the villages/ neighbours (V/N) located in the main three Sections. General information about the Sections is provided below.

<u>Administrative Structure</u>

Turkey is subdivided into 81 provinces. Each province is further divided into districts, and each district is divided into villages or neighbourhoods according to the respective rural or urban setting. Provincial administrative structure consists of provincial governors, special provincial administrations, municipalities, and district level administrative structure consist of district governors and district municipalities and villages/neighbourhoods are the sub administrative units of the districts. The following sections describe the details and responsibilities of these administrative structures. Figure 74 presents the administrative structure as found in the AoI.

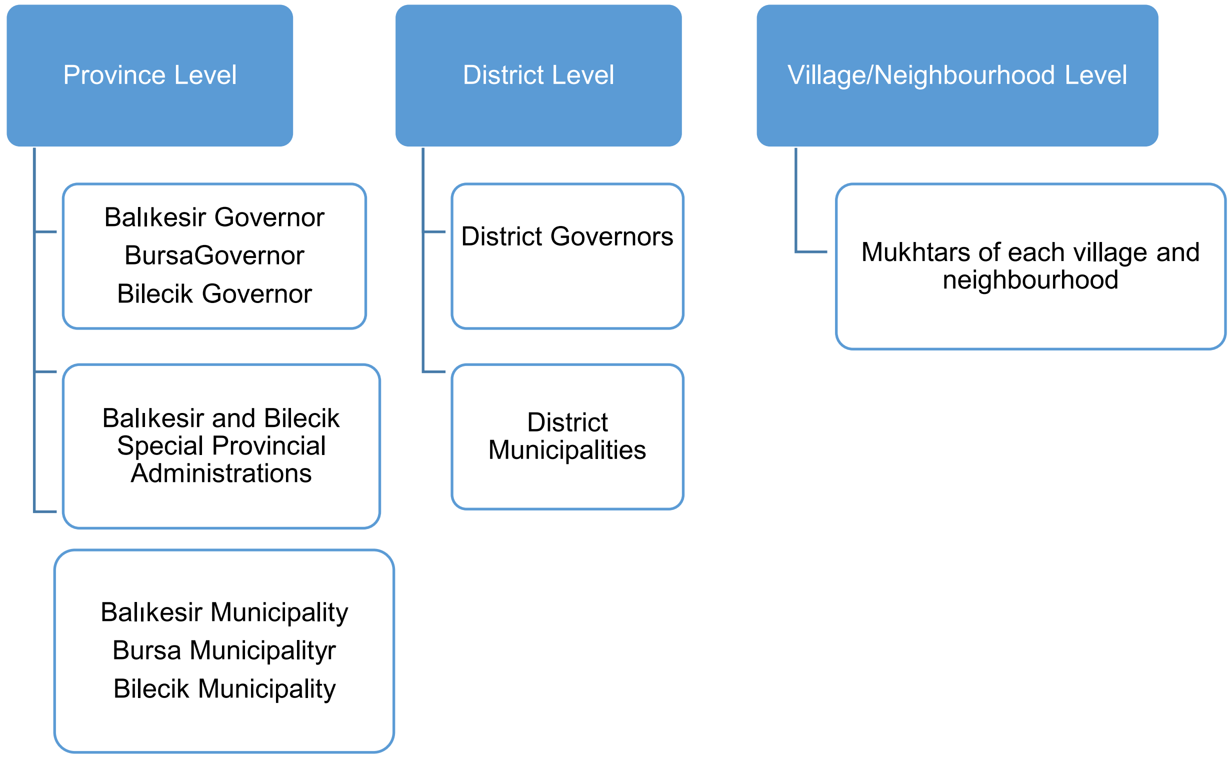


Figure 74: Administrative Structure

In reference to Figure 74, the following sections expand on the administrative structure.

7.3.2.1.1 Provincial Governors

The Governor of a province represents the Turkey Central Administration as the principal agent of the central government at a provincial level. The Governor is appointed by the Council of Ministers with the approval of the President and reports to the Ministry of Interior. The Governor represents the province.

In compliance with the Law number 5442, the responsibilities of the governors as follows:

- To ensure the security of the citizens and the public order,
- To guarantee the coordination and cooperation of different government and non-governmental organisations and institutions,
- To declare and implement legislation and governmental decrees,
- To supervise all provincial public institutions and organizations
- To collect taxes and other state revenues
- To preside over official ceremonies as a chief representative of the state,
- To contact consuls and accept their applications and visits,

- To prevent offences by using the police and gendarmerie forces due to their security related power
- Taking security measures in civil airports, ports and border gates in order to provide border and coast safety
- Appealing for help from military forces directly in the case of security threatening event which are not able to be prevented by law enforcement forces originally under their authority
- Being the head of the social assistance and solidarity foundations of the province
- To be the head of the investment monitoring and coordinating unit which operates for the purpose of monitoring and coordinating public investments and public services of provincial organizations under the authority of the governor
- Having hierarchical authority over different ministries civil servants who provide public services in the province
- To permit judicial investigations concerning the formal roles and duties of the civil servants and municipal staffs.

7.3.2.1.2 Special provincial administrations

In Turkey, special provincial administrations (SPAs) function at a provincial level. SPAs also have a municipal function in the rural areas. The SPA work towards reducing poverty and improve physical and socio-economic infrastructure, particularly in rural villages.

SPAs provide a broad range of services. The SPAs are in charge of the construction and maintenance of the physical infrastructure for education, healthcare, and sports. The SPAs have a strong community development focus. The emphasis is on preventative health and social services, as well as contributing to the development of industry and trade sectors, including agriculture.

7.3.2.1.3 Municipalities

Municipalities are represented in the respective provincial and district capitals, and in communities with at least 5,000 inhabitants. Approximately 93% of the population of Turkey live within municipal boundaries. District Municipalities are responsible at the district level, while Metropolitan Municipality is responsible at the provincial level.

Municipalities prepare master plans and detailed development plans, authorise construction permits, control works and operate the territory of the municipality. Municipalities are responsible for the development of urban infrastructure and provide various services. These services include waste disposal, security, fire, emergency aid, relief, ambulance, traffic, cemeteries, parks and green areas, housing, culture and artworks and maintenance of education facilities.

7.3.2.1.4 District governors

As stated in Law No 5443 the main roles of the District governors as follows:

- Being a representative of the central government
- Ensuring the security of the citizens and the public order
- Preventing offences by using their security related powers

- Being the highest authority responsible for the district general administration
- Supervising and promoting the coordination and cooperation of all provincial and public institutions and organizations
- Controlling the district with the help of the ministries and district directorates
- Working with district in a hierarchical relationship based on the principles of cooperation and coordination

7.3.2.1.5 Villages/Neighbourhoods Mukhtars

Mukhtars represent the village and neighbourhoods. Mukhtars are elected by villagers through local elections held once every five years. The village, as a public legal entity, has full administrative and financial autonomy. Village administration consists of a Mukhtar, an executive committee and a village association. The state pays every village Mukhtar a salary approximately equal to the minimum wage for the public services. The Mukhtar discharges functions such as identifying the poor and the provision of assistance, renewing voter registers, informing the relevant agencies of problems and failures in education, health, security and sanitation services (Union of Municipalities of Turkey, 2016).

7.3.2.2 Population and Demography

The population of Balıkesir is determined as 1,240,285 in 2020. This population consists of 619.765 men and 620.520 women. The area of the province is 14.583 m². There are 82 people per km² in the province. The district with the highest density is Karesi with 254 people. The altitude of the province is 145 meters from the sea level. There are 20 districts and municipalities and 1129 neighbourhoods in these municipalities.

Bursa Province population is determined as 3.101.833 (end of 2020). The area of the province is 10,811 km^2. There are 287 people per km^2 in the province. The district with the highest density is Yıldırım with 5974 people. The annual population growth rate in the province has been 1.5%. According to TURKSTAT data, as of 4 February 2021 there are 17 districts and municipalities and a total of 1060 neighbourhoods in these municipalities.

Bilecik Province population is determined as 218,717. 85.2% of this population live in urban area (end of 2020). The total surface area of the province is 4.177 km^2. There are 52 people per km^2 in the province (This number is 98 in the central district). The annual population in the province has decreased by 0.32%.According to TURKSTAT data, as of 4 February 2021, there are 8 districts, 11 municipalities, 62 districts and also 244 villages in these municipalities, together with the central district.

7.3.2.2.1 Village/Neighbourhood Level

There are differences in population density according to the urbanization characteristics of the settlements. It is seen that the places with the lowest population are Gölbaşı in Kestel district and Çiftlik in Osmaneli district. It is observed that the population density of the settlements of Osmangazi and Nilüfer districts is high due to their proximity to city centers, employment opportunities and urbanization characteristics. In addition, it has been observed that there has been a significant increase in the population in the Nilüfer district in the last 10 years, due to the mega projects such as health campuses and zoning permits. Populations, household numbers and average household sizes of the settlements within the impact area of the project are presented in the table below.

Table 65 Population figures of V/N located in AoI

District	V/N	Population	Household Number	Average Household size
Bandırma	Akçapınar	200	80	2.5
	Doğruca	780	380	2.1
	Kirazlı	136	30	4.5
	Kuşcenneti	600	200	3.0
	Ömerli	650	170	3.8
Karacabey	Akçakoyun	263	135	1.9
	Çamlıca	220	100	2.2
	Danişment	400	130	3.1
	Fevzipaşa	300	60	5.0
	Harmanlı	700	469	1.5
	Hayırlar	250	50	5.0
	Hürriyet	240	110	2.2
	Karacaali	200	50	4.0
	Karasu	180	40	4.5
	Muratlı	280	110	2.5
	Şahinköy	200	70	2.9
	Taşlık	400	120	3.3
Mudanya	Balabancık	370	110	3.4
	Çekrice	160	60	2.7
	Dedeköy	450	120	3.8
	Hasköy	970	300	3.2
Gürsu	İğdir	710	220	3.2
	Karahıdır	870	180	4.8
	Kazıklı	900	240	3.8

District	V/N	Population	Household Number	Average Household size
Kestel	Barakfakih	2000	500	4.0
	Dudaklı	500	120	4.2
	Gölbaşı	25	15	1.7
	Narlıdere	870	150	5.8
	Seymen	500	140	3.6
Osmangazi	Aksungur	450	130	3.5
	Alaşar	2000	400	5.0
	Barbaros	21900	2000	11.0
	Çağlayan	1400	400	3.5
	Dereçavuş	600	130	4.6
	Geçit Köy	25000	5000	5.0
	İsmetiye	2800	500	5.6
	Nülifer köyü	2800	1200	2.3
Nilüfer	Badırga	500	80	6.3
	Balat	17000	6000	2.8
	Doğanköy	2200	700	3.1
	Yolçatı	5500	2000	2.8
Yenişehir	Akdere	200	41	4.9
	Çardak	275	58	4.7
	Ebeköy	310	92	3.4
	Köprühisar	340	130	2.6
	Papatya	200	60	3.3
Osmaneli	Çiftlik	70	18	3.9
	Düzmeşe	258	80	3.2

According to the results of the CLS it has been observed that there are seasonal changes in the population of villages and neighbourhoods depending on the agricultural production. In settlements where agricultural production is intense, it has been observed that there is a population increase due to agricultural work in the summer months from the eastern provinces of Turkey and Syrian and Afghan refugees work as paid agricultural workers in the neighbourhoods of Harmanlı, Fevzipaşa in Karacabey, Karahıdır and Kazıklı neighbourhoods in Gürsu, Barakfakih, Seymen and Narlıdere in Kestel are all districts of Osmangazi. The number agricultural workers varies between 100 and 750 people.

During the CLSs the population change of the settlements in last five years searched and it has been observed that;

- insufficient employment and education opportunities, income decrease in agricultural production, and increased input prices during the agricultural production leaded population decrease,
- Following the Covid-19 pandemic some V/N experienced population increase and retired people returned back;
- Building permission, industrialization and mega project leaded population increase in some V/Ns.

The reason of the population chance of the settlements are provided in below Table.

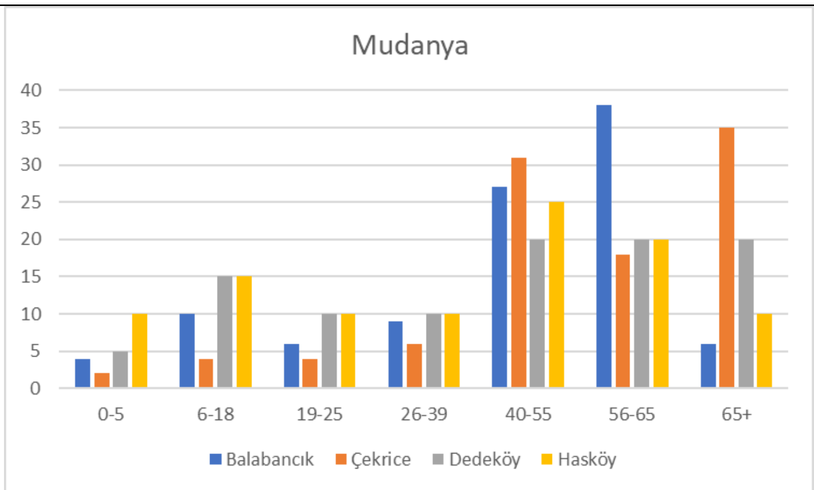
Table 66 Population change reasons

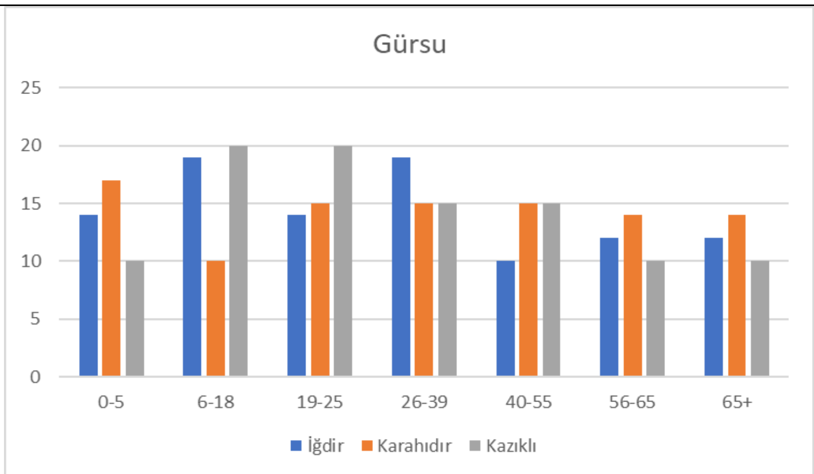
District	V/N	Change	Reason of population change
Bandırma	Akçapınar	↓	General economic problems
	Doğruca	↓	Insufficient job and education opportunities
	Kirazlı	↓	Insufficient job and education opportunities
	Kuşcenneti	↓	Insufficient job and education opportunities
	Ömerli	↓	Insufficient income from agriculture
Karacabey	Akçakoyun	Same	_
	Çamlıca	↓	Insufficient job and education opportunities
	Danişment	Same	_
	Fevzipaşa	Same	_
	Harmanlı	↓	Insufficient job and education opportunities
	Hayırlar	↑	Retired people turned back after COVID.
	Hürriyet	Same	_
	Karacaali	↓	Insufficient income from agriculture

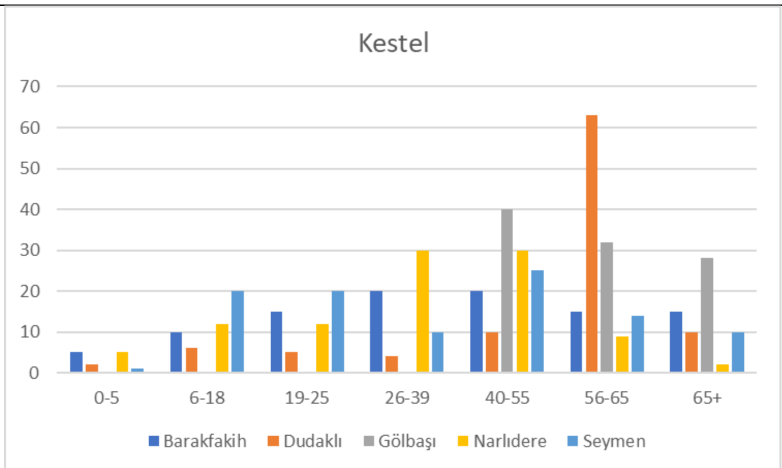
District	V/N	Change	Reason of population change
	Karasu	↓	Insufficient agricultural lands
	Muratlı	↓	General economic problems
	Şahinköy	↓	Insufficient income from agriculture
	Taşlık	↑	Advantage of being close to the city center and valuable lands
Mudanya	Balabancık	↑	COVID
	Çekrice	↓	Insufficient job and education opportunities
	Dedeköy	↑	_
	Hasköy	↑	Advantage of being close to the city center
Gürsu	İğdir	↑	_
	Karahıdır	↑	Natural population growth
	Kazıklı	↑	Natural population growth
Kestel	Barakfakih	Same	_
	Dudaklı	↓	Insufficient income from agriculture
	Gölbaşı	↑	Retired people turned back after COVID.
	Narlıdere	↓	Insufficient income from agriculture
	Seymen	↑	Transportation availability and retired people turned back after COVID.
Osmangazi	Aksungur	Same	_
	Alaşar	Same	_
	Barbaros	↑	Job opportunities, industrialization
	Çağlayan	↑	Job opportunities, industrialization
	Dereçavuş	Same	_
	Geçit Köy	↑	Job opportunities, industrialization

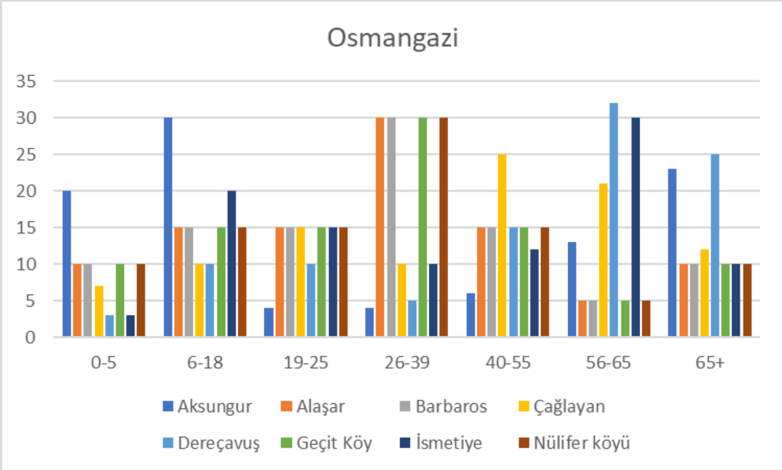
District	V/N	Change	Reason of population change
	İsmetiye	Same	_
	Nülifer köyü	↑	Building permission is given and considering the surrounding industrial areas the village experienced population influx.
Nilüfer	Badırga	Same	_
	Balat	↑	Building permission is given and considering the surrounding industrial areas the village experienced population influx.
	Doğanköy	↑	Its proximity to the Bursa Health Campus hospital
	Yolçatı	↑	Industrialization
Yenişehir	Akdere	↓	Deaths caused by COVID
	Çardak	↓	Agricultural and financial difficulties
	Ebeköy	↓	Reduced job opportunities. Increase in input prices in agriculture and livestock
	Köprühisar	Same	_
	Papatya	↑	Retired people turned back
Osmaneli	Çiftlik	↓	Insufficient job and education opportunities
	Düzmeşe	↓	Insufficient job and education opportunities

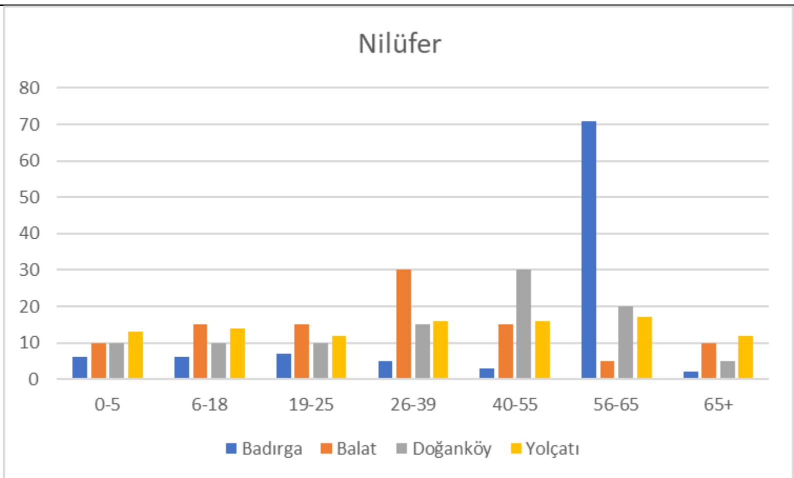
The distribution chart of the age groups of the settlements within the influence area is presented below. The density of the age groups varies according to the industrialization and urbanization characteristics of the districts. While the elderly population is dense in rural areas, it is observed that the density of the age groups are distributed in a balanced way in Nülüfer and Osmangazi. Age distribution according to the districts is presented in the following charts.

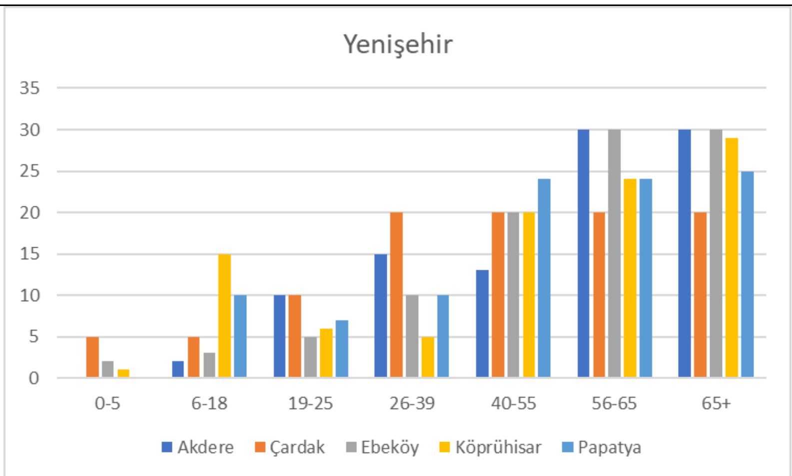

Mudanya
40
35
30
25
20
15
10
5
0
0-5
6-18
19-25
26-39
40-55
56-65
65+
Balabancık
Çekrice
Dedeköy
Hasköy


Gürsu
25
20
15
10
5
0
0-5
6-18
19-25
26-39
40-55
56-65
65+
İğdir
Karahıdır
Kazıklı


Kestel
70
60
50
40
30
20
10
0
0-5
6-18
19-25
26-39
40-55
56-65
65+
Barakfakih
Dudaklı
Gölbaşı
Narlıdere
Seymen


Osmangazi
35
30
25
20
15
10
5
0
0-5
6-18
19-25
26-39
40-55
56-65
65+
Aksungur
Alaşar
Barbaros
Çağlayan
Dereçavuş
Geçit Köy
İsmetiye
Nülifer köyü


Nilüfer
80
70
60
50
40
30
20
10
0
0-5
6-18
19-25
26-39
40-55
56-65
65+
Badırga
Balat
Doğanköy
Yolçatı


Yenişehir
35
30
25
20
15
10
5
0
0-5
6-18
19-25
26-39
40-55
56-65
65+
Akdere
Çardak
Ebeköy
Köprühisar
Papatya

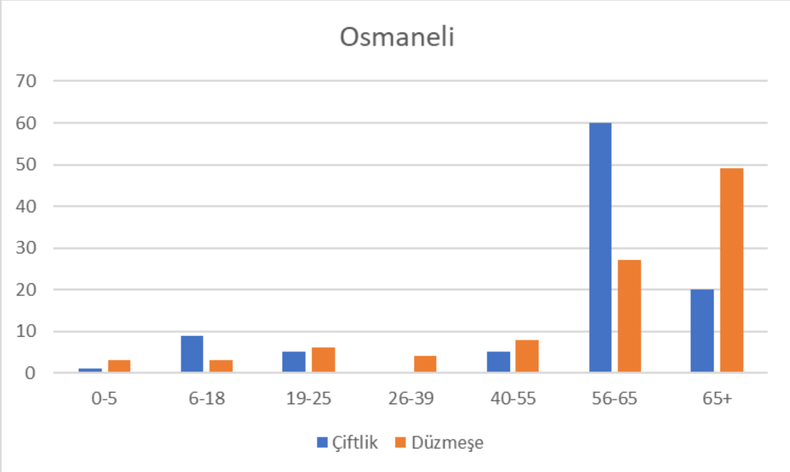


Figure 75 Age distribution according to the districts

7.3.2.2.2 Economy and Employment

The economy of Balıkesir is based on agriculture mostly. As the site and climate is adequate every kind of agricultural product can be produced in Balıkesir. Grain, tobacco, sugar beet, cotton, tomatoes are among the most produced agricultural products. Agriculture and livestock production is done by conscious approaches. It is at an advanced level in farmer, machine and fertilizers. It has a high potential of livestock production. It has 358.100 great cattle, 638.000 small cattle. With the development of the cultural stock it became one of the most productive regions of Turkey in milk and dairy production.

In Bursa, the leading and value-producing sectors are textile, automotive, machinery&metal, agriculture&food and furniture. Bursa is a global center of attraction due to its developed manufacturing industry and commerce and has a significant share in Turkey's economic growth and being one of the main rising economies.

In Bilecik, the sectors with the top share in employment are marble sector (34%) and ceramic sector (25%). Bilecik has very rich mining reserves including clay, kaolin and feldspar reserves used in ceramic and glass industries.The marble (lime stones) called "Bilecik Stone" in Bilecik is very famous. Bilecik incorporates 4 of the 7 ceramic companies in the list of the first 500 in the year 2016 (Eczacıbaşı, Vitra, Bien, Seranit).

7.3.2.2.3 Village/Neighbourhood Level

It has been observed that the main income generating economic activities of the settlements are agricultural production. The second source of income is pension, the third source is animal husbandry. Retired persons are also engaged in agriculture and animal husbandry. Among the settlements, it is seen that the service sector is the primary source in Balat in Nülüfer, construction and industrial work is the main source of income in Yolça, and construction and industrial work is done in Barbaros, Geçit and Nilüferköy in Osmangazi. The sources of income by location are presented below.

Table 67 Income sources of the Settlements

District	V/N	First income source	Second income source	Third income source
Bandırma	Akçapınar	Agricultural production	Retirement pension	Animal husbandry
	Doğruca	Animal husbandry	Agricultural production	Retirement pension

District	V/N	First income source	Second income source	Third income source
	Kirazlı	Agricultural production	Animal husbandry	Retirement pension
	Kuşcenneti	Agricultural production	Animal husbandry	Retirement pension
	Ömerli	Retirement pension	Animal husbandry	Agricultural production
Karacabey	Akçakoyun	Agricultural production	Animal husbandry	Retirement pension
	Çamlıca	Agricultural production	Retirement pension	Animal husbandry
	Danişment	Agricultural production	Animal husbandry	Retirement pension
	Fevzipaşa	Agricultural production	Animal husbandry	Retirement pension
	Harmanlı	Agricultural production	Retirement pension	N/A
	Hayırlar	Agricultural production	Animal husbandry	Retirement pension
	Hürriyet	Agricultural production	Retirement pension	N/A
	Karacaali	Animal husbandry	Agricultural production	N/A
	Karasu	Agricultural production	Animal husbandry	N/A
	Muratlı	Animal husbandry	Agricultural production	Retirement pension
	Şahinköy	Agricultural production	Animal husbandry	Retirement pension
	Taşlık	Agricultural production	Animal husbandry	Retirement pension
Mudanya	Balabancık	Agricultural production	Construction and industy worker	Retirement pension
	Çekrice	Agricultural production	Animal husbandry	Retirement pension
	Dedeköy	Agricultural production	Animal husbandry	Retirement pension
	Hasköy	Agricultural production	Animal husbandry	Retirement pension
Gürsu	İğdir	Agricultural production	Agricultural production	Retirement pension
	Karahıdır	Agricultural production	Agricultural production	Retirement pension
	Kazıklı	Tarım/bitkisel üretim (bahçe)	Animal husbandry	Retirement pension
Kestel	Barakfakih	Agricultural production	Tarım/bitkisel üretim (bahçe)	Retirement pension
	Dudaklı	Agricultural production	Retirement pension	Animal husbandry

District	V/N	First income source	Second income source	Third income source
	Gölbaşı	Agricultural production	Retirement pension	Animal husbandry
	Narlıdere	Agricultural production	Agricultural production	Animal husbandry
	Seymen	Agricultural production	Agricultural production	Animal husbandry
Osmangazi	Aksungur	Agricultural production	Retirement pension	N/A
	Alaşar	Agricultural production	Retirement pension	İnşaat ve sanayi işçiliği
	Barbaros	Construction and industy worker	Retirement pension	N/A
	Çağlayan	Agricultural production	Agricultural production	N/A
	Dereçavuş	Agricultural production	Retirement pension	N/A
	Geçit Köy	Construction and industy worker	diğer	N/A
	İsmetiye	Agricultural production	İnşaat ve sanayi işçiliği	Retirement pension
	Nülifer köyü	Construction and industy worker	N/A	N/A
Nilüfer	Badırga	Agricultural production	Retirement pension	N/A
	Balat	Service industry	Construction and industy worker	N/A
	Doğanköy	Agricultural production	Ticaret	Retirement pension
	Yolçatı	Construction and industy worker	Agricultural production	N/A
Yenişehir	Akdere	Agricultural production	Animal husbandry	Retirement pension
	Çardak	Agricultural production	Animal husbandry	Retirement pension
	Ebeköy	Agricultural production	Animal husbandry	Retirement pension
	Köprühisar	Agricultural production	Animal husbandry	Retirement pension
	Papatya	Agricultural production	Animal husbandry	Retirement pension
Osmaneli	Çiftlik	Agricultural production	Animal husbandry	Retirement pension
	Düzmeşe	Retirement pension	Animal husbandry	Agricultural production

The main products produced by the settlements where agricultural production is the main source of income are presented in the table below. The main products in settlements where irrigation is possible are vegetables and fruits. In Karacabey, where irrigation is stated to be insufficient, it is seen that the main product produced is wheat. Fruit gardening is predominantly carried out in Mudanya, Gürsu and Kestel districts. Details are presented in the table below.

Table 68 Main agricultural products according to settlements

District	V/N	Main product	Kg per year	Second product	Kg per year	Third product	Kg per year
Bandırma	Akçapınar	Canola	1000000		N/A		N/A
	Doğruca	Wheat	500000	Barley	150000	Sunflower	200000
	Kirazlı	melon	N/A	olive	N/A		N/A
	Kuşcenneti	Wheat	200000	Barley	1000000	Sunflower	600000
	Ömerli	Canola	70000	walnut	N/A		N/A
Karacabey	Akçakoyun	tomato	10000		N/A		N/A
	Çamlıca	Wheat	400000	Barley	200000	Sunflower	400000
	Danişment	Wheat	400000	Barley	100000	Sunflower	500000
	Fevzipaşa	Wheat	500000	Barley	200000		N/A
	Harmanlı	industrial tomato	24000000	Industry beet	2250000	Watermelon	750000
	Hayırlar	tomato	1000000	Wheat	200000		N/A
	Hürriyet	Wheat	4000000	Sunflower	2000000	Egypt	1000000
	Karacaali	vegetables	400000	Sunflower	500000	Egypt	500000
	Karasu	tomato	1000000	onion	300000	watermelon	3200000
	Muratlı	olive	250000	Wheat	250000	Barley	400000
	Şahinköy	tomato	1000000	onion	400000		N/A
	Taşlık	tomato	3000000	cauliflower	800000	peach	150000
Mudanya	Balabancık	olive	10000	Wheat	300000		N/A
	Çekrice	onion	150000	500000		N / A	Ayçiçeği
	Dedeköy	peach	6000000	FIG	500000	olive	400000

District	V/N	Main product	Kg per year	Second product	Kg per year	Third product	Kg per year
	Hasköy	olive	250000	peach	1500000	vegetables	300000
Gürsu	İğdir	peach	5000	pear	10000	Quince	1000
	Karahıdır	pear	5000	peach	2000	apple	500
	Kazıklı	Pear	20000000	Peach	5000000	FIG	3000000
Kestel	Barakfakih		N/A		N/A		N/A
	Dudaklı	peach	2500000	pear	3000000	cherry	50000
	Gölbaşı	olive	30000	peach	500000	pear	400000
	Narlıdere		N/A		N/A	lettuce, arugula, parsley	250000
	Seymen	artichoke	450000	peach	250000	pear	250000
Osmangazi	Aksungur	olive	300000	mullet	500000		N/A
	Alaşar	black fig	500000	olive	100000	pear	50000
	Barbaros		N/A		N/A		N/A
	Çağlayan	black fig	5000000	pear	3000000	olive	300000
	Dereçavuş	pear	3500000	peach	1500000		N/A
	Geçit Köy	olive	20000		N/A		N/A
	İsmetiye	pear	30000	peach	1000	apple	1000
	Nülifer köyü		N/A		N/A		N/A
Nilüfer	Badırga	Watermelon	22500000	Wheat	3000000		N/A
	Balat		N/A		N/A		N/A
	Doğanköy	okra	200000	Wheat	200000	Barley	10000
	Yolçatı		N/A		N/A		N/A
Yenişehir	Akdere	potato	150000	beans	50000	Wheat	200000
	Çardak	green beans	400000	corn seed	1500000		N/A
	Ebeköy	Wheat	600000	Barley	250000	Sunflower	250000

District	V/N	Main product	Kg per year	Second product	Kg per year	Third product	Kg per year
	Köprühisar	Pepper	5000000	Kidney bean	300000	Pea	700000
	Papatya	Wheat	3000000		N/A	Sunflower	250000
Osmaneli	Çiftlik	Peach	100000	Plum	10000	Sunflower	N/A
	Düzmeşe	Peach	400000	Quince	300000		N/A

In most of the settlements, cattle breeding is carried out for household use only. The settlements that earn income from cattle breeding are determined as Direct in Bandırma, Karacabey, Muratlı Şahinköy and Taşlık, Seymen in Kestel, Çardak in Yenişehir. The number of bovine animals in the villages is presented in the table below.

Table 69 Number of Bovines according to villages

District	V/N	Number of Bovines
Bandırma	Akçapınar	200
	Doğruca	2350
	Kirazlı	N/A
	Kuşcenneti	150
	Ömerli	N/A
Karacabey	Akçakoyun	90
	Çamlıca	15
	Danişment	80
	Fevzipaşa	N/A
	Harmanlı	150
	Hayırlar	70
	Hürriyet	N/A
	Karacaali	400
	Karasu	300
	Muratlı	650

District	V/N	Number of Bovines
	Şahinköy	1000
	Taşlık	1400
Mudanya	Balabancık	150
	Çekrice	N/A
	Dedeköy	250
	Hasköy	500
Gürsu	İğdir	20
	Karahıdır	150
	Kazıklı	N/A
Kestel	Barakfakih	25
	Dudaklı	150
	Gölbaşı	N/A
	Narlıdere	50
	Seymen	600
Osmangazi	Aksungur	N/A
	Alaşar	N/A
	Barbaros	N/A
	Çağlayan	N/A
	Dereçavuş	4
	Geçit Köy	N/A
	İsmetiye	N/A
	Nülifer köyü	N/A
Nilüfer	Badırga	250
	Balat	N/A
	Doğanköy	50

District	V/N	Number of Bovines
	Yolçatı	200
Yenişehir	Akdere	150
	Çardak	5000
	Ebeköy	160
	Köprühisar	350
	Papatya	250
Osmaneli	Çiftlik	100
	Düzmeşe	270

It is seen that sheep and goat breeding is more common within the impact area, except for the Osmangazi district. Numbers are presented below.

Table 70 Number of sheep and goat according to villages

District	V/N	Number of sheep and goat
Bandırma	Akçapınar	400
	Doğruca	3000
	Kirazlı	N/A
	Kuşcenneti	600
	Ömerli	N/A
Karacabey	Akçakoyun	2000
	Çamlıca	300
	Danişment	2500
	Fevzipaşa	N/A
	Harmanlı	2000
	Hayırlar	800
	Hürriyet	N/A
	Karacaali	2000

District	V/N	Number of sheep and goat
	Karasu	1000
	Muratlı	600
	Şahinköy	2000
	Taşlık	1000
Mudanya	Balabancık	600
	Çekrice	79
	Dedeköy	200
	Hasköy	2000
Gürsu	İğdir	500
	Karahıdır	2000
	Kazıklı	N/A
Kestel	Barakfakih	N/A
	Dudaklı	500
	Gölbaşı	300
	Narlıdere	600
	Seymen	900
Osmangazi	Aksungur	N/A
	Alaşar	N/A
	Barbaros	N/A
	Çağlayan	N/A
	Dereçavuş	N/A
	Geçit Köy	N/A
	İsmetiye	N/A
	Nülifer köyü	N/A
Nilüfer	Badırga	1000

District	V/N	Number of sheep and goat
	Balat	N/A
	Doğanköy	100
	Yolçatı	1000
Yenişehir	Akdere	250
	Çardak	4000
	Ebeköy	700
	Köprühisar	350
	Papatya	500
Osmaneli	Çiftlik	400
	Düzmeşe	400

The number of beehives learned during community level studies is presented in the table below. It has been stated that the beekeeping activity is generally carried out for hobby purposes, and as an income generating purposeit is carried out only in Narlıdere of Kestel and Köprühisar of Yenişehir.

Table 71 Number of beehives

Distrcit	V/N	Number of beehives
Bandırma	Akçapınar	15
	Doğruca	250
	Kirazlı	N/A
	Kuşcenneti	N/A
	Ömerli	N/A
Karacabey	Akçakoyun	N/A
	Çamlıca	100
	Danişment	200
	Fevzipaşa	N/A
	Harmanlı	150

Distrcit	V/N	Number of beehives
	Hayırlar	15
	Hürriyet	N/A
	Karacaali	100
	Karasu	N/A
	Muratlı	50
	Şahinköy	N/A
	Taşlık	N/A
Mudanya	Balabancık	360
	Çekrice	N/A
	Dedeköy	250
	Hasköy	50
Gürsu	İğdir	50
	Karahıdır	100
	Kazıklı	N/A
Kestel	Barakfakih	200
	Dudaklı	150
	Gölbaşı	N/A
	Narlıdere	870
	Seymen	250
Osmangazi	Aksungur	N/A
	Alaşar	N/A
	Barbaros	N/A
	Çağlayan	N/A
	Dereçavuş	N/A
	Geçit Köy	N/A

Distrcit	V/N	Number of beehives
	İsmetiye	N/A
	Nülifer köyü	N/A
Nilüfer	Badırga	N/A
	Balat	N/A
	Doğanköy	N/A
	Yolçatı	N/A
Yenişehir	Akdere	50
	Çardak	10
	Ebeköy	100
	Köprühisar	1000
	Papatya	50
Osmaneli	Çiftlik	N/A
	Düzmeşe	200

7.3.2.2.4 Land Use Patterns

Balıkesir area; It is 1,447,300 hectares (including lakes) of which 387,975 hectares are used as agricultural land, 81,916 hectares of meadow pastureland, 649,116 hectares of forest land and 328,294 hectares of non-agricultural land.

Table 72 Land distribution of Balıkesir

Land Types	Surface area (hectare)	Percentage (%)
Agricultural land	387,975	26.81
Pasture land	81,915	5.66
Forest land	649,116	44.85
Non agricultural land	328,294	22.68
TOTAL	**1,447,300**	**100**

Bursa area; (Including lakes) 1081300 of which 297000 hectares are used as agricultural land, 78000 hectares of land, 485000 hectares of forest and 198588 hectares .non-agricultural land.

Table 73 Land distribution of Bursa

Land Types	Surface area(hectare)	Percentage (%)
Agricultural land	319100	30
Pasture land	78012	7.2
Forest land	485600	49
Non agricultural land	198588	18
TOTAL	1081300	**100**

Bilecik area; It is 430700 hectares (including lakes), of which 125080 is used as agricultural land, 6008 hectares as meadow pasture area, 228641 as forest area and 70969 area as non-agricultural land.

Table 74 Land distribution of Bilecik

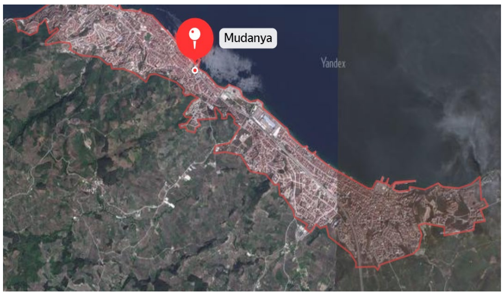
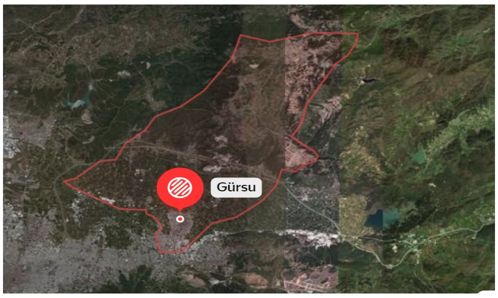
Land Types	Surface area(hectare)	Percentage (%)
Agricultural land	125,080	29.4
Pasture and	6,008	1.4
Forest land	228,641	53.09
Non agricultural land	70,969	16.48
TOTAL	430,700	**100**

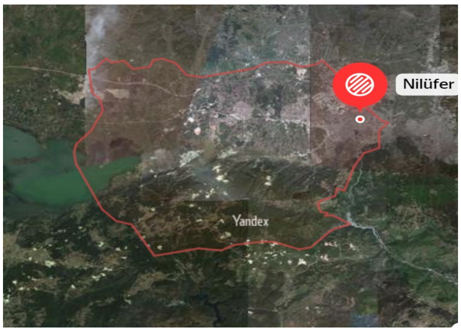
7.3.2.2.4.1 Village/Neighbourhood Level

The land use information of the villages including the residential, forestry, pasture and treasure and the and the impacted proportion of this lands due to the Project were questioned, but the detailed information on the land use at the village level could not reached. District level land use pattern is presented in the table below.

Table 75 Land Use of the Districts

Distrcit	Map	Remark
Bandırma		It is seen that 60% of the district of Bandırma are settlements, although most of the remaining areas are agricultural scolds, there is also a small amount of forest land in the district.
Karacabey		Looking at the land use of Karacabey, it is seen that 70% of them are settlements. Of the remaining part, 10% is forest land and 20% is agricultural land.

Distrcit	Map	Remark
Mudanya		Mudanya is a town with a coastline. A large part of the land use of Mudanya is also composed of residential areas. However, there are large agricultural lands and forest lands surrounding the district.
Gürsu		In parallel with the low population density, the residential area is very low. The district mainly consists of agricultural and forestry lands.
Kestel		The proportion of residential areas in Kestel district is also very low. The district generally consists of agricultural and forestry lands.
Osmangazi		It is a diverse field in terms of land use pattern. The northern part of the district is used as a residential area. The southern part consists of forest and agricultural lands.

Distrcit	Map	Remark
		
Nilüfer		It is a diverse field in terms of land use pattern. The northern part of the district is used as a residential area. The southern part consists of forest and agricultural lands.
Yenişehir		Although most of the Yenişehir district consists of residential areas, the district is surrounded by agricultural lands.

Distrcit	Map	Remark
Osmaneli		Although most of the Osmaneli district consists of residential areas, the district is surrounded by forest lands and agricultural lands.

7.3.2.2.5 Infrastructure and Services

Health

According to the Ministry of Health 2019 data, some health indicators by provinces located in AoI is presented in below table.

Table 76 Health indicators according to provinces

Province	Number of Hospitals	Number of Bed	Number of Hospital Bed per 10,000 population	Number of Qualified Bed	Number of Intensive Care Unit Bed	Number of Family Medicine Unit	Population per Family Medicine Unit
Balıkesir	25	3,334	27.1	2,323	4	410	2,997
Bilecik	8	335	15.3	111	2	74	2,965
Bursa	42	8,079	26.4	5.595	4.1	953	3,207

Source: Ministry of Health Health Statistics Yearbook 2019

The healthcare facilities in the districts within the impact area of the project are presented below.

Table 77 Health indicators of districts

Districts	Indicators
Bandırma	There is a public hospital and a private hospital in Bandırma. In addition, there are 12 family health centers serving at the neighbourhood and village levels.
Karacabey	There is a public hospital. In addition, there are 5 family health centers serving at the neighbourhood and village levels.

Districts	Indicators
Mudanya	There is a public hospital and two private hospitals. In addition, there are 6 family health centers serving at the neighbourhood and village level.
Gürsu	There is a public hospital. In addition, there are 3 family health centers serving at the neighbourhood and village levels.
Kestel	There is a public hospital. In addition, there are 9 family health centers serving at the neighbourhood and village levels.
Osmangazi	There are 5 state hospitals, a university hospital and 10 private hospitals. In addition, there are 193 family health centers serving at the neighbourhood and village levels.
Nilüfer	There is a state hospital, a university hospital and 8 private hospitals. In addition, there are 29 family health centers serving at the neighbourhood and village level.
Yenişehir	There is a public hospital. In addition, there are 5 family health centers serving at the neighbourhood and village levels.
Osmaneli	There is a public hospital. In addition, there are 2 family health centers serving at the neighbourhood and village levels.

There are health centers in 25 of the settlements within the influence area. the family doctor comes from the Family Health Centers once a week. The doctor is using the Mukhtar's room as an examination room.

Table 78 Heath N/A of Settlements

District	V/N	Availibility of health facility
Bandırma	Akçapınar	×
	Doğruca	√
	Kirazlı	×
	Kuşcenneti	√
	Ömerli	√
Karacabey	Akçakoyun	√
	Çamlıca	×
	Danişment	×
	Fevzipaşa	√
	Harmanlı	√
	Hayırlar	×
	Hürriyet	×
	Karacaali	×
	Karasu	×
	Muratlı	√

District	V/N	Availibility of health facility
	Şahinköy	√
	Taşlık	×
Mudanya	Balabancık	×
	Çekrice	×
	Dedeköy	×
	Hasköy	√
Gürsu	İğdir	√
	Karahıdır	×
	Kazıklı	×
Kestel	Barakfakih	√
	Dudaklı	√
	Gölbaşı	√
	Narlıdere	√
	Seymen	√
Osmangazi	Aksungur	×
	Alaşar	×
	Barbaros	×
	Çağlayan	√
	Dereçavuş	×
	Geçit Köy	√
	İsmetiye	×
	Nülifer köyü	√
Nilüfer	Badırga	×
	Balat	√
	Doğanköy	×
	Yolçatı	√
Yenişehir	Akdere	√
	Çardak	√
	Ebeköy	√
	Köprühisar	√

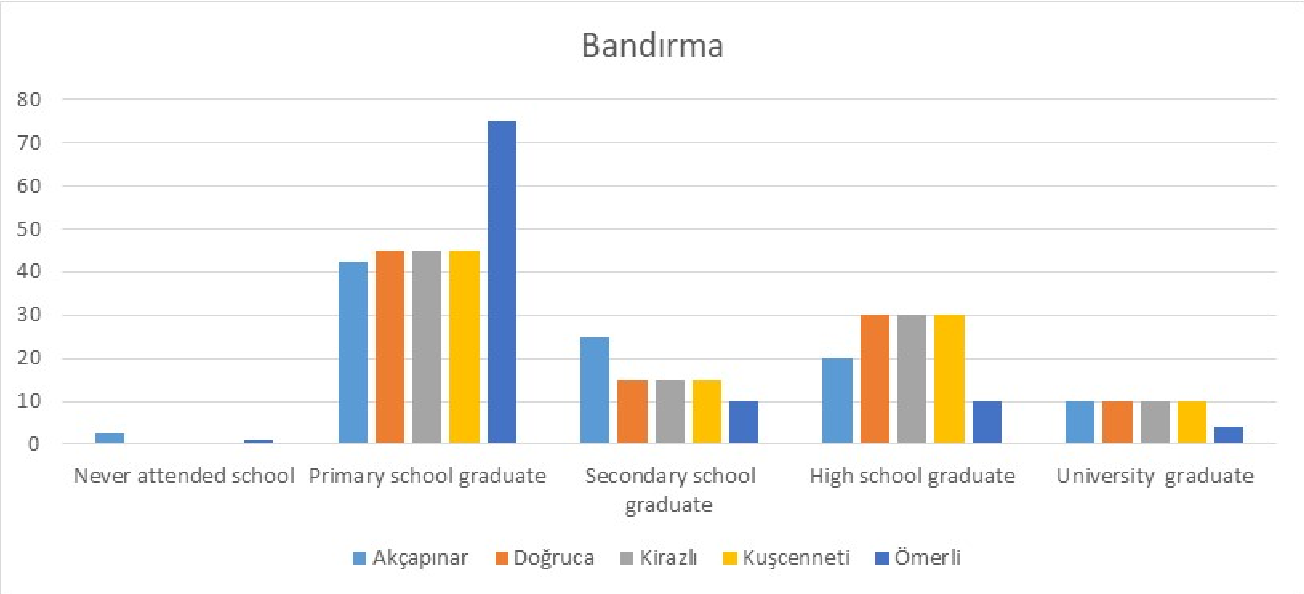
District	V/N	Availibility of health facility
Osmaneli	Papatya	×
	Çiftlik	×
	Düzmeşe	√

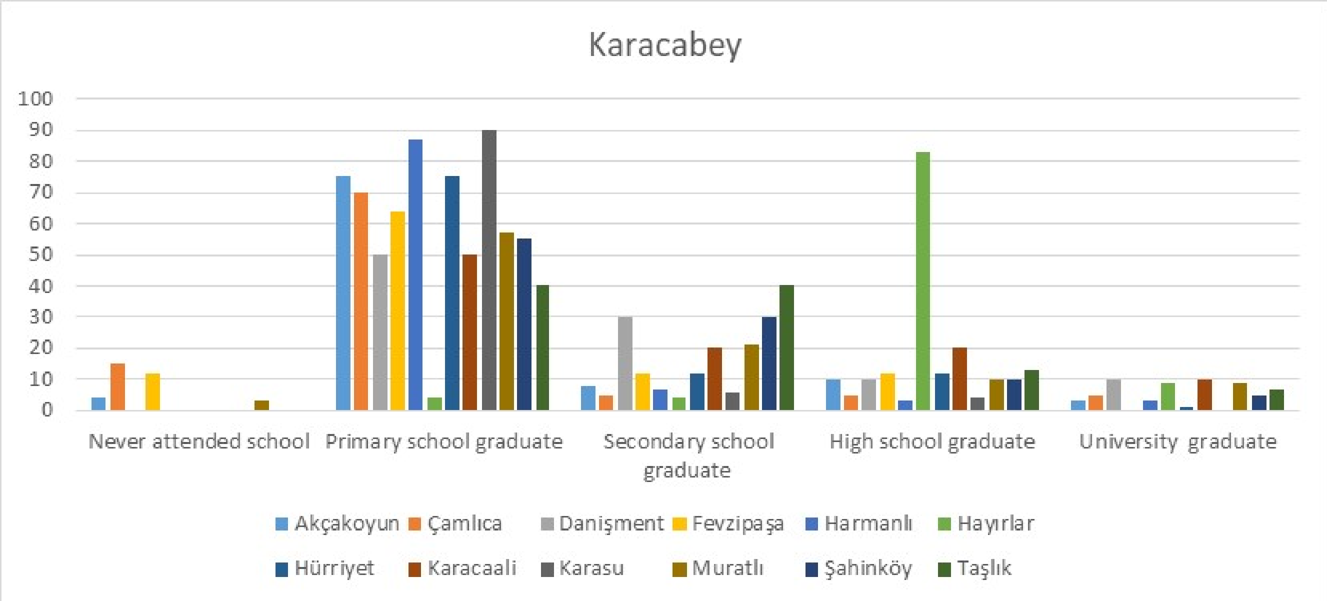
Education

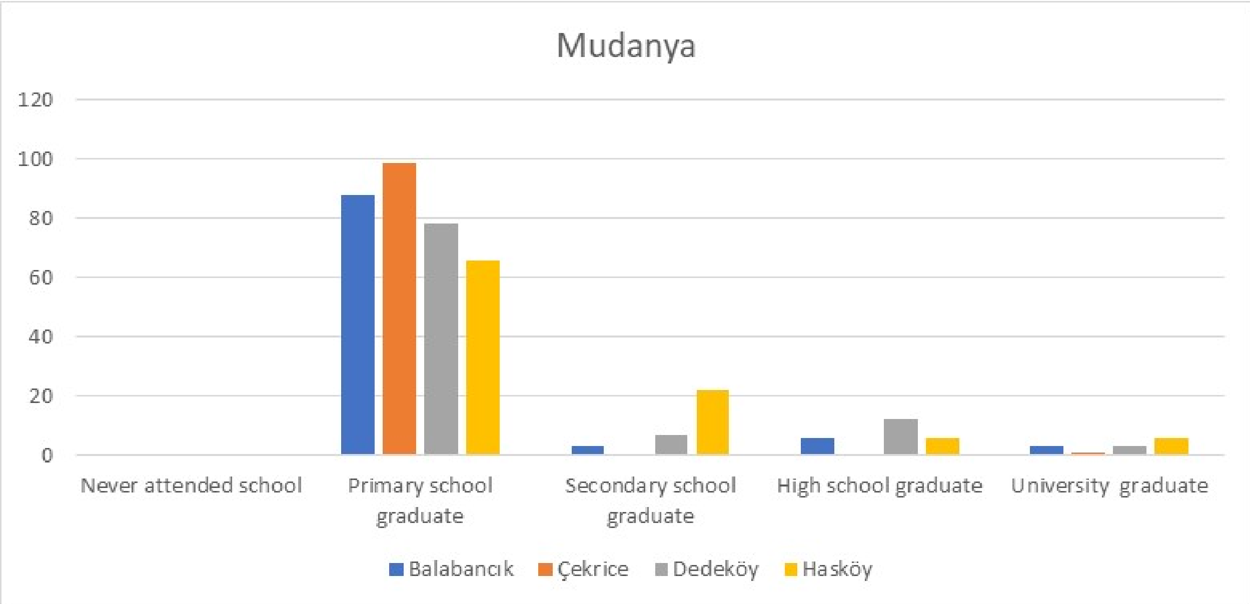
The education information of the Provinces where the BBYO route passes along are presented in Table 79 below and the education information for the districts and villages are presented in the following figures.

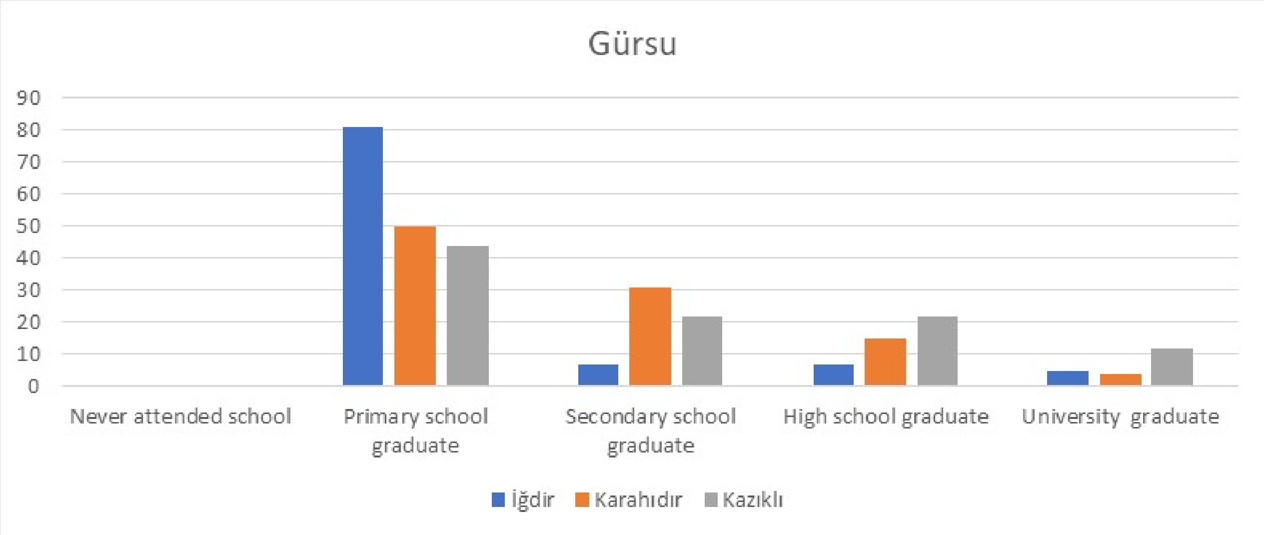
Table 79 Education information of provinces

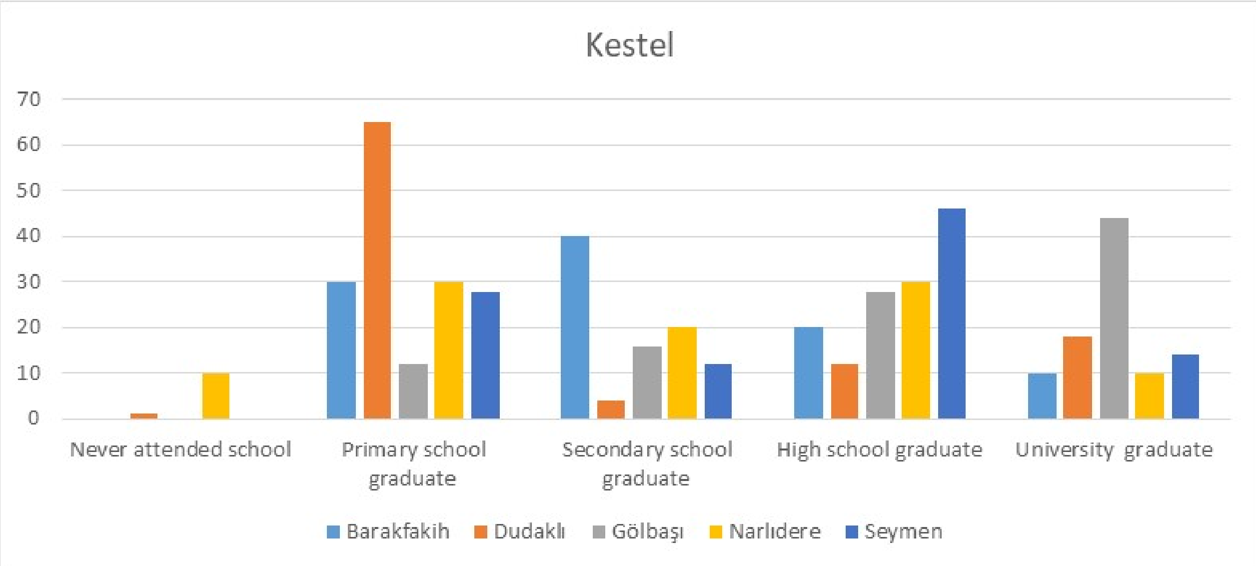
Province	Literacy rate (%)	Number of secondary schools	Number of secondary school students	Number of secondary school teachers	Number of secondary school	Number of secondary education students	Number of secondary education teachers	Number of primary schools	Number of primary school students	Number of primary school teachers
Balıkesir	97,62	263	60.795	5.089	190	66.137	5.587	330	54.822	3.910
Bursa	97,15	531	196.287	11.468	436	193.586	14.680	499	188.698	9.964
Bilecik	97,84	54	11.704	822	46	12.695	864	57	10.938	650

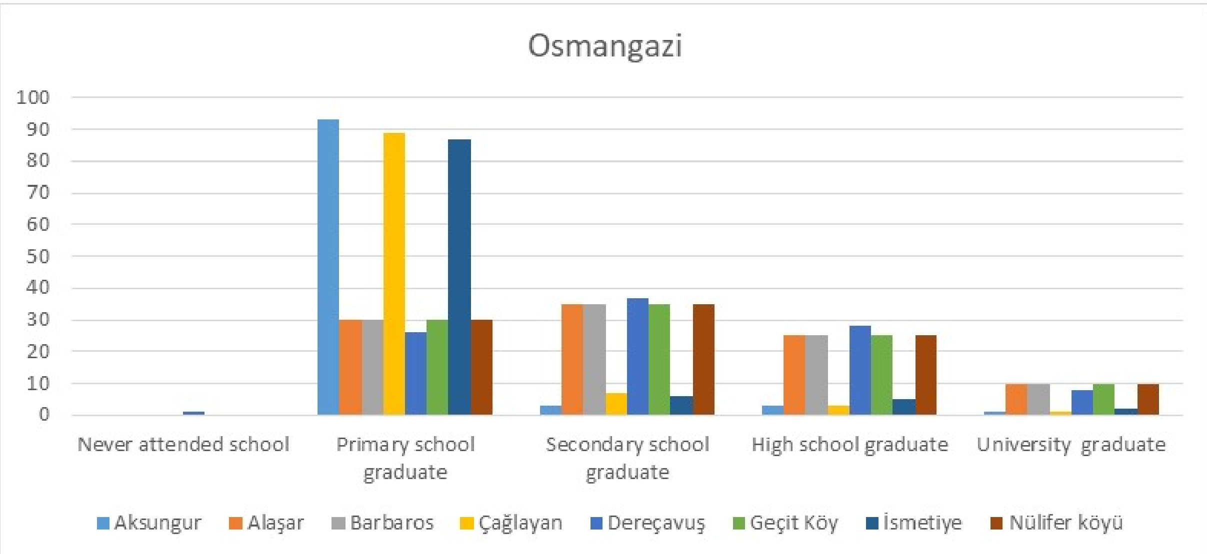


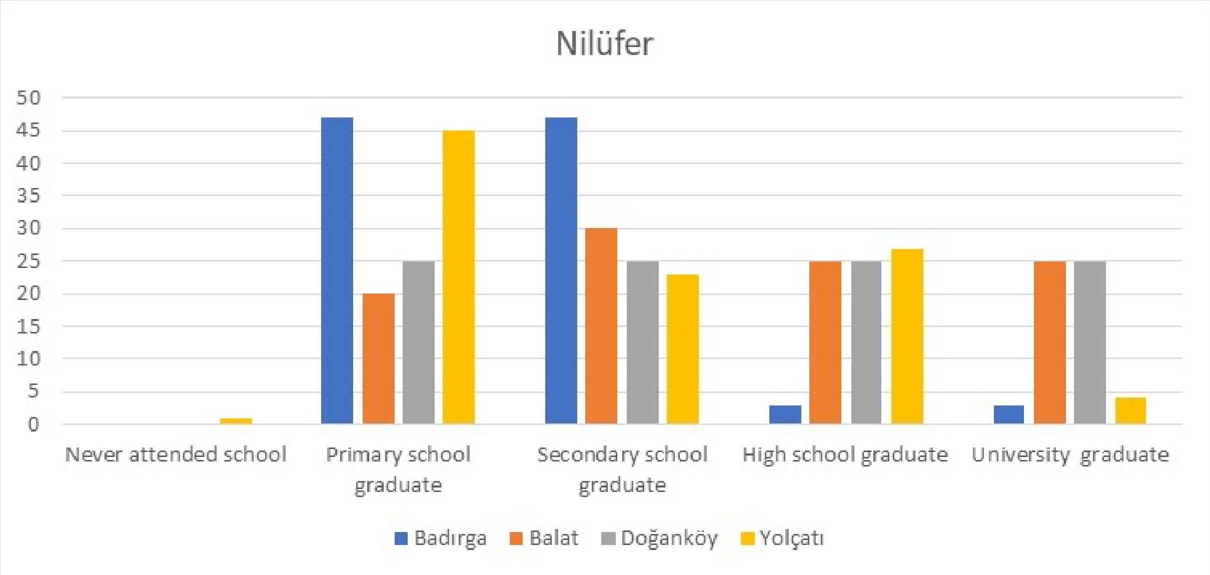

Karacabey
100
90
80
70
60
50
40
30
20
10
0
Never attended school
Primary school graduate
Secondary school graduate
High school graduate
University graduate
Akçakoyun
Çamlıca
Danişment
Fevzipaşa
Harmanlı
Hayırlar
Hürriyet
Karacaali
Karasu
Muratlı
Şahinköy
Taşlık

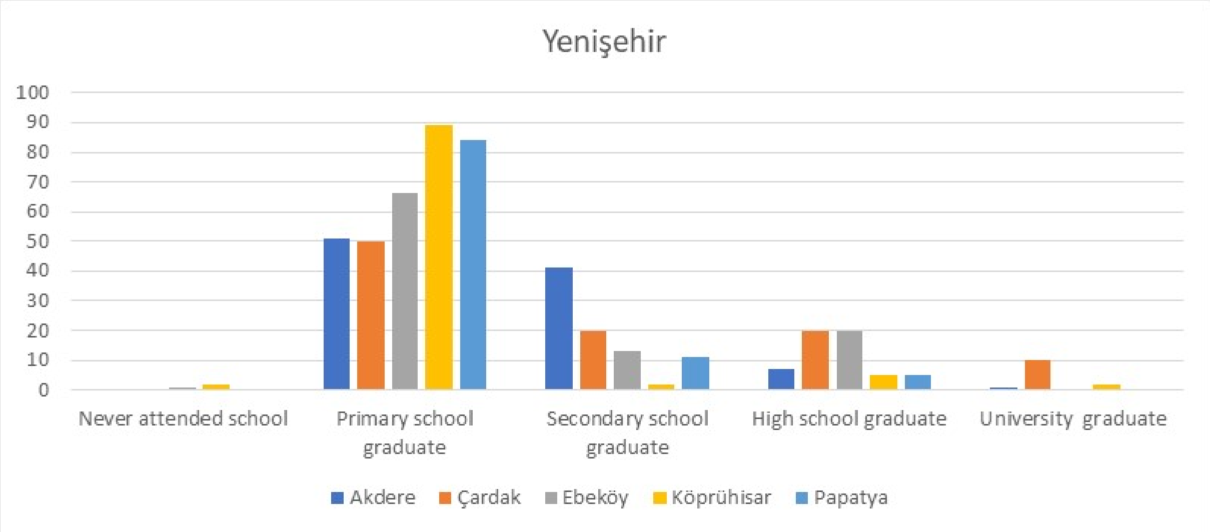

Mudanya
120
100
80
60
40
20
0
Never attended school
Primary school graduate
Secondary school graduate
High school graduate
University graduate
Balabancık
Çekrice
Dedeköy
Hasköy


Gürsu
90
80
70
60
50
40
30
20
10
0
Never attended school
Primary school graduate
Secondary school graduate
High school graduate
University graduate
İğdir
Karahıdır
Kazıklı


Kestel
70
60
50
40
30
20
10
0
Never attended school
Primary school graduate
Secondary school graduate
High school graduate
University graduate
Barakfakih
Dudaklı
Gölbaşı
Narlıdere
Seymen


Osmangazi
100
90
80
70
60
50
40
30
20
10
0
Never attended school
Primary school graduate
Secondary school graduate
High school graduate
University graduate
Aksungur
Alaşar
Barbaros
Çağlayan
Dereçavuş
Geçit Köy
İsmetiye
Nülifer köyü





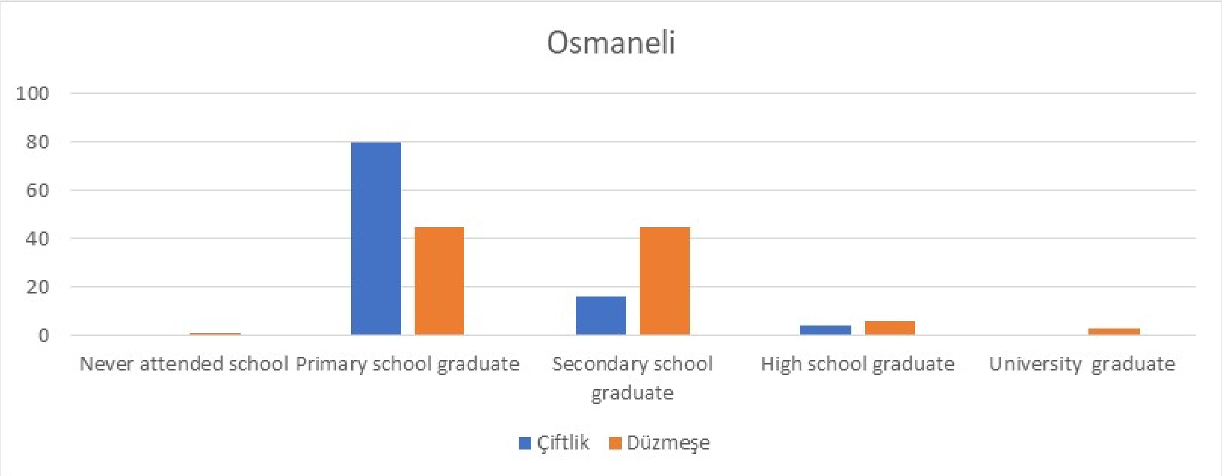


Figure 76 Education Information of the Districts

7.3.3 Cultural Heritage

The cultural heritage study aims to report immovable and archaeological assets identified on the planned route for BBYO Project and its impact area description of their expansion limits, assessment of the potential impact of the construction works on these assets and the suggestions for mitigation measures. National legislation (laws and regulations) and international standards were closely followed during the study.

The main objectives of the archaeological survey and possible further activities that may be required to be completed before the commencement of construction activities are as follows:

- To assess the potential for cultural entities and their characteristics in specific locations before construction starts, and to develop plans and design strategies for the prevention of construction damage in those areas located on the project route;
- To provide data on the identified potential areas to be included in reports for the purposes of proper planning of the construction project (including project calendar) to avoid delays in the high standard railway project construction activities;
- To determine the locations where a possible change in the Project route might be required following the result of the fieldwork;
- To develop strategies following the legal procedures, and to propose changes in routing/transposition of above-ground installations in the areas of high archaeological value. To propose further actions to be taken where re-routing/transposition of above-ground installations is not possible;
- To collect and record archaeological data scattered over the construction area through the use of scientific methods described below, and to facilitate the transportation of movable cultural heritage items to the relevant museums;
- To archive, all data gathered on archaeological sites and to prepare identification and registration tags of archaeological assets for being reported to the Ministry of Culture and Tourism of the Republic of Turkey;
- To enrich the cultural and archaeological inventory of Turkey with the attested new archaeological finds and features.

A detailed archaeological survey was realized for the BBYO Project by HERMES Çevre & Sosyal ve Arkeoloji Danışmanlığı with a focus on the route of the planned project. The survey took place between 08.03.2021 and 20.03.2021. The details of the study findings are provided in the below sections.

7.3.3.1 Methodology

In Turkey, the movable and immovable cultural and natural assets are under protection and conservation with the “Law on Preservation of Cultural and Natural Assets”, 2863 that was amended by law numbered 3386 (Date of Acceptance: 21.07.1983, published in the Official Newspaper numbered 18113 and dated 23.07.1983).20 According to the Law, essential assets which are identified as cultural and natural heritage under legal protection are identified as follows.

Natural and immovable cultural assets belonging to 19th Century and before;

[20] https://www.mevzuat.gov.tr/MevzuatMetin/1.5.2863.doc

Any immovable cultural asset constructed after the end of the 19th Century but categorized as “a significant asset which requires preservation” by the Ministry of Culture and Tourism;

- Immovable cultural assets located within the Protection Sites (in the Law, Protection Sites are defined as ancient sites and city ruins that reflect the main social, economic or architectural characteristics of their era. Protection Sites may also be locations where fundamental historical events took place or areas containing considerable natural or cultural assets with natural or cultural features requiring preservation);
- Structures, buildings or places that have witnessed significant historical events during the Turkish Independence War or the foundation of the Turkish Republic, regardless of time and registration; and,
- All dwellings and buildings that have been used by Mustafa Kemal ATATÜRK without considering their time of construction or registration.

Within the scope of this Law, the Ministry of Culture and Tourism and its local branches (Boards for Preservation of Cultural and Natural Assets, Museums) are responsible to take decisions at a national level and to provide necessary legal actions to protect cultural and natural assets listed above. At the local level, Regional Boards for Preservation of Cultural and Natural Assets are responsible to register and classify the cultural and natural heritage, inspecting and taking decisions regarding land-use and construction works related to High Standard Railway projects which can affect these assets. Declaration of site protection, covering discovered cultural heritage located in their area of authorization, is also under the responsibility of the Regional Boards whose decisions can directly affect the Project too.

According to Law on Preservation of Cultural and Natural Assets numbered 2863, all natural and cultural assets meeting conditions for legal preservation are the property of the State. Therefore, Regional Boards have the power and the authority to ensure legal protection and conservation of relevant sites and to approve or reject all activities which have the potential for negative impact on these sites such as construction, destruction, road cut and excavation.

At present state Eskişehir, Bursa and Balıkesir Regional Boards for Preservation of Cultural and Natural Assets are the boards responsible for the Project Area.

Apart from the Law on Preservation of Cultural and Natural Assets numbered 2863, some additional regulations do exist for the governing of the procedures about the protection and preservation of cultural and natural assets. First of these is the Principle Decision of the Ministry of Culture and Tourism of Turkey named “Protection and Use Conditions of Archaeological Sites” (No. 658, issued 5 November 1999).[21] This decision states that all the archaeological sites need to be classified and protected according to their significant features. Three main categories are determined relevant to archaeological sites as:

- 1st Degree Archaeological Sites
- 2nd Degree Archaeological Sites
- 3rd Degree Archaeological sites

Principle Decision No: 658 defines these sites as follows:

[21] https://kvmgm.ktb.gov.tr/TR-44310/ilke-karari--karar-no-658--karar-tarihi-05111999.html

- **1st Degree Archaeological Sites:** Areas requiring the highest level of protection. They should be preserved except of scientific excavations. The area should be free of any type of buildings and construction. All kinds of construction, excavation, and modification activities are prohibited. However, for exceptional cases such as the necessity for infrastructure construction, Regional Preservation Boards may permit such activities based on the approval of the relevant museum and the head of the scientific excavation team.
- **2nd Degree Archaeological Sites:** Areas requiring a medium level of protection. They should be preserved based on the conditions of protection and utilisation set by the Regional Preservation Boards. Additional construction is prohibited. As for the 1st-degree archaeological sites, for exceptional cases such as the necessity for infrastructure construction, Regional Preservation Boards may permit such activities based on the approval of the relevant museum and the head of the scientific excavation team.
- **3rd Degree Archaeological Sites:** Lowest level protection area. In light of the protection and making use decisions new arrangements can be permitted in these archaeological areas. Construction is permitted based on the decisions of Regional Preservation Boards. Before applying for a construction permit, test pit excavations should be conducted and the outcomes of these excavations should be reviewed by the relevant museum and, if present, the head of the scientific excavation team. Reviews should be submitted to Regional Preservation Boards. The Boards may ask for an extension of the areal test pit coverage before taking any decision.

Furthermore, "Implementation Guidelines for Field Surveys, Test Pits and Excavation Works on Cultural and Natural Assets" of the Ministry of Culture and Tourism of Turkey with the approval number 94949537-160.99-51264, dated 13/03/201322 define the procedures for salvage excavations, archaeological test pits and other studies that might be required.

In addition to the regulations mentioned above, the following guidelines were taken into consideration during the study:

- International Finance Corporation-IFC, Performance Standard 8;
- European Bank for Reconstruction and Development- EBRD, Environmental and Social Policy, PR08, Cultural Heritage;
- Department for Transport UK, Design Manual For Roads and Bridges Part 2 HA 208/07 Cultural Heritage
- The World Bank Group
- International Council on Monuments and Sites (ICOMOS).

The research methodology used by the HERMES Archaeology Team, in general, is composed of three consecutive parts that could be listed as:

a) Desk based Studies,

c) Detail Research Activities

[22] https://teftis.ktb.gov.tr/TR-50815/kultur-ve-tabiat-varliklariyla-ilgili-yapilacak-yuzey-a-.html

d) Reporting

Desktop Studies

The provinces of Bilecik, Bursa and Balıkesir from which the Project route passes are among the regions with the highest archaeological risk where relatively sufficient inspections were made. The climate and landscape both favour the field surveys however the inspections in the region still remain to be insufficient due to various reasons. Nowadays field inspections and registration works are still on-going in the region under the authority of the staff of the Ministry of Culture and Tourism.

Climatic and topographical traits of the region are extremely favourable for field surveys. However, the region is still in need of updated field surveys when the number of numerous cultures that dominated it in antiquity is taken into consideration together with the continuous shifts of its streams. Following all these for getting a holistic picture of the impact area's archaeological potential, scientific publications, documents, archives of Regional Preservation Boards, Museums and the Ministry of Culture and Tourism were reviewed.

Firstly, data on provinces, districts and cities/villages located within the scope of the project route was thoroughly collected. All publications on previous archaeological works conducted in the relevant geographical regions and data on archaeological sites located in the vicinity of the Project route and impact area were studied.

Resources that were used during the office work:

- Academic publications about archaeological sites along the pipeline route and its surroundings;
- Historical maps;
- Reports on previous Cultural Heritage Works and Field Survey Results;
- Inventory Archives of the Ministry of Culture and Tourism.

Additionally, all archaeological sites identified during this pre-fieldwork phase with the help of 1:25,000 scaled maps and satellite imagery were transferred on route maps and were investigated on-site in detail.

During the pre-fieldwork phase, the document formats for collecting data were designed as "Site Description Form", "Impact Assessment Form" and "Archaeological Status Table". Impact Assessment Forms include all needed data for the GIS database. The data, given in Appendix G, was arranged for being opened on Google Earth (as kml/kmz) and additionally further supported as shp and dxf for being used more effectively as computational data. Site Description Forms include the features of spatial coverage and density of archaeological findings, recommendations for mitigation measures to minimize negative impacts of construction activities, geographical context and all other data necessary for archaeological evaluation.

As a result of the research conducted on the website of the Ministry of Culture and Tourism numbers related to immovable cultural assets were found and listed in Table 80, Table 81 and Table 82.

Table 80 Province of Bilecik, Statistics of Immovable Cultural Assets in Need of Protection, End of 2020

INMOVABLE CULTURAL ASSETS	Amount
Memorial and Monuments	*4*
Governmental Buildings	*43*

INMOVABLE CULTURAL ASSETS	Amount
Cultural Buildings	*62*
Martyrdoms	*3*
Industrial and Trade Buildings	*7*
Religious Buildings	*65*
Cemeteries	*28*
Civil Architecture	*226*
Remains	*10*
TOTAL	***448***

Table 81: Province of Bursa, Statistics of Immovable Cultural Assets in Need of Protection, End of 2020

INMOVABLE CULTURAL ASSETS	Amount
Streets under protection	*1*
Memorial and Monuments	*12*
Governmental Buildings	*94*
Cultural Buildings	*337*
Martyrdoms	*4*
Military Buildings	*50*
Industrial and Trade Buildings	*54*
Religious Buildings	*441*
Cemeteries	*177*
Civil Architecture	*3224*
Remains	*81*
TOTAL	***4575***

Table 82: Province of Balıkesir, Statistics of Immovable Cultural Assets in Need of Protection, End of 2020

UNMOVABLE CULTURAL ASSETS	Amount
Streets under protection	*2*
Memorial and Monuments	*13*
Governmental Buildings	*107*
Cultural Buildings	*273*
Martyrdoms	*7*
Military Buildings	*17*
Industrial and Trade Buildings	*97*
Religious Buildings	*211*
Cemeteries	*97*
Civil Architecture	*2703*
Remains	*29*
TOTAL	***3551***

Detailed Research Activities

The main principle of these activities was constituted by the on-site investigation of all archaeological areas, including the already known, and walking along all the route personally by the senior archaeologists from HERMES. Monitoring of the research activities and evaluations of their results were supervised by Asst. Prof. Hazar KABA from Sinop University, Department of Archaeology.

Extensive field walking was used as the principal methodology for the identification of movable and immovable archaeological and cultural assets along the Project route during the surveys. Areas with low or impossible chances of access (rice fields, dense vegetation, high altitude over 2500 m) were surveyed through satellite imagery and 1/25,000 scaled maps. Additionally, those areas were studied through the use of ancient sources and field surveys/excavations that were previously conducted.

The following activities were carried out within the scope of intensive surveys: determination of the ties of the Project route with the archaeological areas, identification of the spatial extension of the archaeological features by observing the surface findings, observing the locations where surface findings were concentrated and identification of sections where the pipeline route intercepts the concentration areas. All discoveries were exclusively reported on the Site Description Forms.

It must be noted that during all inspections that were conducted on the Project route solely archaeological objects that were visible on the surface were followed.

All fieldwork was realized by Senior Archaeologists Engin Coşar, Erkan Atay and Mehmet Sağır with previous experience in similar activities whose. The field studies were conducted between the dates 08.03.2021 and 20.03.2021. The Project route was taken as the main axis of the field survey to which its close vicinities were also integrated. The instant communication between the field archaeologists, advancing in parallel lines, was secured using walkie-talkie phones.

During the route walking, all observed archaeological traces on the soil surface (ceramic sherds and lithic/ bone/ ceramic small finds spread on the surface, architectural remains or traces, graves or traces of graves, mounds, tumuli, etc.), were recorded on Field Survey Forms and additionally were included in the daily fieldwork reports.

Reporting

As a result of the fieldwork the Site Description Forms, Impact Assessment Forms and Baseline Plan were prepared related to all archaeological movable/immovable cultural assets that were discovered.

All computational data on the forms were prepared through the preference of one of the UTM ED50 and WGS systems. Furthermore, all computational data (such as kmz/kml, shp, dxf) related to discovered areas were also prepared.

The interrelations between the discovered archaeological sites and the route and construction sites were studied. The interrelations identified are presented in this document together with their degree of importance, impact and sensitivity. The mitigation measures to be followed for minimizing the effects of construction activities are also presented.

7.3.3.2 Baseline Study Results

7.3.3.2.1 Historical Geography of the Region

Bilecik

The first human settlement in Bilecik dates earlier than 3000 BC. It is known that the region was one of the ancient places where tin was extracted starting from 3000 BC for the production of bronze. The oldest known mentions name the region either Agrilion or Agrillum. In the following era, Bilecik had become a settlement located within the borders of the Byzantine Empire. The city was referred to as Belekoma during this era. The settlement of that period was known to be developed around a castle that was built on a rock located in between the valleys formed by the Hamsu and Tabakhane rivers falling towards the east of modern-day Bilecik.

The city was a part of the ancient Bithynia Region. The recorded history of Bithynia commences with the migration of the Thracian tribe of Thyn to the region around 1950 BC. The region was later dominated by many including Hittites, Phrygians, Cimmerians, Lydians, Persians, Macedonians, Kingdom of Bithynia, Roman Empire, Byzantine Empire and finally by the Ottoman Empire.

Bilecik is famed as being the region where the “Kayı Clan” had migrated and settled with 400 tents in its Söğüt district later to establish the Ottoman State. The region, apart from this importance related to the establishment of the Ottoman State, was also known to be one of the main areas which had an important role in the success of the War of Independence. The cultural inventory of Bilecik includes Ottoman-era dated mosques, shrines, taverns, baths, civil architecture, imaret and other similar buildings as well as many archaeological remains.

Bursa

The first human settlement in Bilecik dates around 8500 BC. The region was of importance in the settling of the first agricultural communities that formed the European and Balkanian culture. The region houses many mounds which were numbered as many as 30 and possess importance for the prehistoric past of northwestern Anatolia. Among them Orhangazi-Ilıpınar Mound was dated to Neolithic whereas Yenişehir-Menteşe Mound to Chalcolithic, Nilüfer-Akçalar Aktopraklık Mound both to Late Neolithic-Early Chalcolithic, İnegöl Mound to Early Bronze Age.

The region following the vacuum of authority after the collapse of the Hittite Empire around 1200 BC was invaded by the tribes of Bityn and Tynin entering the Anatolia from the Balkans. These neighbouring tribes later joined to establish the Kingdom of Bithynia in the region. The people of the region were later dominated by the Achaemenids around 513/512 BC which invaded the region after ending the rule of the Kingdom of Lydia.

Modern-day Bursa had not been only part of ancient Bithynia but also of its neighbouring region of Mysia. The region was subject to intense colonization by Ionian states. The Ionian colonies whose ancient names formed the origin of many of today's settlements could be listed as Nikaiae-İznik, Kios-Gemlik, Otroia -Yenişehirde, Apameia-Mudanya, Kremastis-Karacabey, Adriani- Orhaneli, Miletepolis-M.K.Paşa and Apollonia-Gölyazı.

The region was first subjected to Persian domination around 545-333 BC to be followed by the rule of Alexander the III (Alexander the Great). The short lasted rule of Alexander the Great was followed by the rule of Nicomedes I (279-250) who had established the Kingdom of Bithynia in the region.

The modern-day Bursa, ancient Prusia, was founded by and named after Prusias I (228-185 BC). Another name of the city as Prusia Ad Olympum derives from its location at the skirts of the Olympos (Uludağ) meaning simply the “city of Prusias founded at the skirts of Olympus”. Thus it was also distinguished from the other cities such as Prusias Ad Mare (Gemlik) and Prusias Ad Hypum (Düzce) which were also named aster the King Prusias. The Kingdom of Bithynia was in the end became a vassal of the Roman Republic with the will of its last king Nicomedes IV (74 BC) continuing its existence as one of the Roman provinces in Asia Minor.

The region was of peculiar interest for the Christians following the II century AD resulting in the establishment of more than 50 churches and monasteries around Uludağ following the IV century AD. İznik, an important religious centre of the region for Christians, was the place where the First Consul met in 325 AD and the Seventh in 787 AD. The mount Olympos was known to be named in history as Oros Ton Kalegeron, as well as Keşişdağı in light of the various religious buildings that were built around it and as Ruhban Dağı by the Ottoman traveller Evliya Çelebi. The mount took its final name “Uludağ” in 1925.

Turks entered the region for the first time in 1080. İznik was conquered by the Sultanate of Rum around 1097 and instantly became the capital of the state. İznik, together with İnegöl, Bilecik and Yenişehir, was integrated into the Ottoman Beylik around 1299. The Ottoman effect on the region was intensified especially after 1302.

Balıkesir

Both research and excavations done in the region indicate that Bandırma had been settled intensively starting from 6000 BC during the Neolithic and 5000 BC during the Chalcolithic periods.

With the beginning of 4000 BC, the Yortan Culture had dominated the region whereas its place was taken around the 3000 BC, Early Bronze Age, by cultures that were similar to the so-called Trojan Culture. All settlements in the area remarkably decrease in number around 2000 BC due to reasons that remain obscure even today. The region gained back its importance with the Iron Age (1200-525 BC) during when migrations took place bringing people from both the Balkans and the Aegean abling the region to house new cultures. This ended with the establishment of a culture of mosaics which lasted until the beginning of the Ottoman era. Phrygians, Lydians, Mysians, Thracians, Persians, Macedonians, Romans and finally Byzantines followed each other chronologically.

Within the course of the whole of the Iron Age, the region constituted utmost importance especially during the Achaemenid rule between 550-334 as a satrapy was established in Daskyleion. The region became a Macedonian vassal by the conquest of Alexander the Great in 334 BC. The Macedonian era was followed by the Roman and Byzantine conquests.

The entering of Turkic tribes into the region took place around 1076 with the conquest of Kyzikos together with Aydıncık and Bandırma by the famed Kutalmışoğlu Süleyman Bey, the first-ever Turkish ruler to establish a state in Anatolia. Not after long, the region had once again become a Byzantine state following the death of Kılıçarslan I the famed sultan of the Seljuk. Turkish integration into the region continued with 1115 during when Bursa and Apollonia were conquered but attacks on Kyzikos and Panormos were halted by dense Crusader counterattacks. This in the end still rendered the region as a Byzantine state. With the 12th century AD, Seljuk frontier lords announced their independence and the Bandırma together with the rest of the region went under the Karesi Beylik. Centred in Balıkesir Karesi Beylik later added the shores of Marmara and Çanakkale together with Karabiga into its domination.

7.3.3.2.2 General State of the Project Area, Archaeological Findings

The archaeological research and field surveys that were focused on the BBYO Project planned to be built for a 201 km distance between the districts of Bandırma-Bursa-Yenişehir-Osmaneli were commenced by March 2021.

The staff of the Ministry of Culture and Tourism had noticed the Project firm related to the existence of 4 already registered areas around the Yenişehir Bilecik zone through report sharing. Despite the inexistence of exact coordinates of those areas, they were identified during the survey. However, the previous distances of these areas given to the Project axis by the Protection Board decision were found insufficient.

In this aspect, brief mentions will be made on the aforementioned registered areas through information given in the Board decision with peculiar additional information and suggestions that were the results of the recent field survey.

Information about the archaeological findings is for the Bilecik, Bursa and Balıkesir Provinces are provided in the following sections. The General Map of Archaeological Findings along the BBYO Route are presented in **Figure *77***.

The cultural heritage study details including the list of archaeological areas maps, digital data, site description forms, impact assessment forms and Cultural Heritage Management Plan prepared within the scope of the BBYO Project is provided in Appendix G.

Bilecik

The district of Osmaneli had been the starting point of field operations within the scope of the BBYO Project planned to be connected to İstanbul-Ankara High Standard Train Project. The works on this zone which has a route length of 23,5 km around the border of Bilecik were commenced on 08.03.2021 and lasted for 2 days. As a result of the fieldworks a total of 10 archaeological and cultural heritage findings, of which 1 was already registered, were inspected. Information on the inspected areas is given in Table 83.

Table 83: Province of Bilecik, Archaeological and Cultural Heritage Findings

No	Site Name	From TR Ministry of Culture and Tourism			Province	District/ Village	Distance Between Route
		Registered	Unregistered	Unknown			
1	İnönü Necropolis			X	Bilecik	Osmaneli/ İnönü	On the Route axis
2	Inönü Tumulus			X	Bilecik	Osmaneli/ İnönü	65 m
3	Büyükyenice Cemetery			X	Bilecik	Osmaneli/ İnönü	25 m
4	Büyükyenice Necropolis			X	Bilecik	Osmaneli/ İnönü	On the Route axis
5	Büyükyenice Tumulus			X	Bilecik	Osmaneli/ İnönü	55 m
6	Osmaneli Modern Cemetery			NA	Bilecik	Osmaneli/ Camicedit	8 m
7	Düzmeşe Roman Settlement			X	Bilecik	Osmaneli/ Düzmeşe	On the Route axis
8	Düzmeşe Tumulus			X	Bilecik	Osmaneli/ Düzmeşe	On the Route axis
9	Kuletepe Mound and Castle	Only the Castle Register			Bilecik	Osmaneli/ Orhaniye	On the Route axis
10	Kuletepe Necropolis			X	Bilecik	Osmaneli/ Orhaniye	70 m

İnönü Necropolis

This zone, overlooking the Sakarya River basin towards the east, is registered on the topographic maps as İnlihavuz Pınarı locality. The zone which is thought to be a necropolis is at the vicinity of the river over a dominant location on a hill. The area was ravaged with many looters' holes. An acceptable amount of late period (Byzantine-Ottoman) and Late Roman sherds, few sherds from the Roman period together with a few bones were located in the area.

All existing evidence points to the possible use of the area as a necropolis in antiquity. In this aspect, the Directorate of the Bilecik Museum should be informed of the existence of the zone for carrying out field inspections and if needed for registration to ensure its protection.

As the necropolis lies directly on the construction area of the Project route, considering that the route is finalized in this Section, Project operators should act in accordance with the decisions that will be taken by the Museum

Directorate or Eskişehir Regional Board for Preservation of Cultural and Natural Assets during construction activities. The construction works around the area requires archaeological on-site monitoring.

İnönü Tumulus

A mound whose top is covered with dense vegetation lies towards the west of the basin of the Sakarya river at a distance of 230 m to the north of the İnönü Necropolis. When this attention-grabbing mound whose top is covered in vegetation was inspected it was seen that its surface was full of ceramics. Additionally, a pile of well-cut ashlar blocks is evident around the mound. Those blocks were likely the elements of the sepulchral construction under the mound and must have been removed from their original locations through ploughing.

Being surrounded by trees and easily separated from the rest of the topography the tumulus stands as high as 3 m. Despite its relatively close extent to the project field with a distance of 65 m, it is less likely that this structure will be affected by any phase of the project. Despite the uncertainty on the state of registration of the aforementioned area the Directorate of the Bilecik Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

The construction works around the area requires archaeological on-site monitoring.

Büyükyenice Cemetery

The cemetery lies towards the direction of İstanbul, by being on the east bank of the Sakarya River at the İstanbul-Ankara joint of the High Standard Railway Project. The cemetery despite having its routes in Ottoman and Early Republic eras is still in use.

Graves are noted to be made in the form of cists through the use of local limestone blocks. The limestone used in the cemetery is the same as the blocks that were evident around the İnönü Tumulus. Tomb markers in the form of quilted turbans dated to the Ottoman era were widely used within the cemetery.

Despite the uncertainty on the state of registration of the aforementioned area the Directorate of the Bilecik Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

The construction works around the area requires archaeological on-site monitoring.

Büyükyenice Necropolis

The cemetery lies towards the direction of İstanbul, by being on the east bank of the Sakarya River at the İstanbul-Ankara joint of the High Standard Railway Project. The joint of the present project to the already existing İstanbul-Ankara line will take place at this point. The surface was densely covered with Late Ottoman era ceramics and seems to be used as a cemetery. The topography is also suitable for such use.

As the necropolis lies directly on the construction area of the Project route, considering that the route is finalized in this Section, operators should act in accordance with the decisions that will be taken by the Museum Directorate or Eskişehir Regional Board for Preservation of Cultural and Natural Assets. The construction works around the area requires archaeological on-site monitoring.

Büyükyenice Tumulus

The tumulus stands on the west bank of the Sakarya River towards 60 m west of the İstanbul-Ankara High Standard Railway line. Its location within the present Project route is towards 50 m distance to the joint point towards Ankara and it will not be directly affected by the Project route.

The construction works around the area requires archaeological on-site monitoring.

Modern Cemetery, Osmaneli District

It's the city cemetery positioned towards the west of the Osmaneli district. No traces of any historical remains could be located. However, it is noted that the cemetery is enlarged towards the Project route possessing a high potential to affect it.

The construction works around the area requires archaeological on-site monitoring.

Düzmeşe Roman Settlement

It is located at the edge of the Göksü Çayı which is a stream of the Sakarya River towards 1,5 km south of the Düzmeşe Village. Investigations that were conducted in an area positioned within the river basin suitable for cultivation revealed a dense amount of ceramics. Some of the ceramics were simple vessels of daily use that could be dated between the 3rd-4th centuries AD.

Additionally, a line of stones that could be related to an architectural setting was also located at the surface. This site must be a modest settlement of a few houses rather than being a large-scaled Roman settlement.

As the site lies directly on the construction area of the Project route, considering that the route is finalized in this Section, the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Eskişehir Regional Board for Preservation of Cultural and Natural Assets.

Furthermore, the construction works around the area requires archaeological on-site monitoring.

Düzmeşe Tumulus

It is located 400 m towards the east of the Düzmeşe Roman settlement. It rises as a conical mound on the cliff situated next to the Göksu river. Fossils of seashells are located around the area. The amount of covering tiles from the surface point to the possible further use of the area as a necropolis. Tile fragments possibly date to the Late Roman Period.

The Project route passes directly from the cliff where the aforementioned archaeological area was situated on. The construction works around the area requires archaeological on-site monitoring.

Considering that the route is finalized in this Section, the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Eskişehir Regional Board for Preservation of Cultural and Natural Assets.

Kuletepe Mound and Castle

The project route after passing the tunnels reaches a region that is in the form of a passage among the mountains. With its general topographical traits, this region reflects an extremely suitable nature for housing various settlements. Surveying of this region revealed the existence of a structure in the form of a watchtower positioned at a strategic location overlooking the river basin.

This remain may be the so-called “Göksü Towers” that was already mentioned as a registered asset within the Project Presentation Folder that was prepared in 2016. As the aforementioned remain was mentioned to be “…50 m distance to the Project route…” within the PPF its vicinity was inspected once again by the HERMES Archaeology Team.

Those re-inspections revealed data showed that there was either possible absence of extra investigations in the area back then by the responsible staff or not sharing of all related information from previous investigations with our firm. This is best revealed by the discovery of a previously not registered mound lying extremely close to the already registered Watch Tower by our team.

The mound reflects a settlement pattern of a castle part on the high ground overlooking a possible lower settlement. With its general location, this settlement was understood to spread on the hill as well as to its skirts and further towards the riverside. The remains from the mound showed that it was settled from the Early Roman Period (1st century BC) until the Middle Ages (Byzantine-Early Ottoman). Apart from archaeological surface finds additional architectural remains were also noted to exist on the surface especially on the higher castle part. The already planned Project route will pass over this mound for 400 m right after reaching this locality via a tunnel.

As the site lies directly on the construction area of the Project route, considering that the route is finalized in this Section, the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Eskişehir Regional Board for Preservation of Cultural and Natural Assets. The construction works around the area requires archaeological on-site monitoring.

Kuletepe Necropol

During the survey, a high amount of roofing tiles were located on the surface at a locality falling towards the north of the Kuletepe Mound and Castle. The tiles reflect the characteristic of ancient Roman tiles that were used to cover the burials. All this evidence points to the possible use of the area as a necropolis. Distance to this necropol to the project route is 70 m. It will not be directly affected by the Project. The construction activities conducted around the site requires archaeological on site monitoring.

Bursa

The district of Yenişehir from the Bursa Province had been the starting point within the scope of the second phase of field operations on the Bandırma-Yenişehir-Osmaneli High Standard Railway Project planned to be connected to İstanbul-Ankara High Standard Train Project. The works on this zone which has a route length of 155 km around the border of Bursa were commenced on 10.03.2021 and lasted for 7 days. As a result of the fieldworks, a total of 32 archaeological and cultural heritage findings were located. Information on those areas is given in **Table *84***.

Table 84 Province of Bursa, Archaeological and Cultural Heritage Findings

No	Site Name	From TR Ministry of Culture and Tourism			Province	District/ Village	Distance Between Route
		Registered	Unregistered	Unknown			
11	Ebeköy Plain Settlement			X	Bursa	Yenişehir/ Ebeköy	On the route axis

No	Site Name	From TR Ministry of Culture and Tourism			Province	District/ Village	Distance Between Route
		Registered	Unregistered	Unknown			
12	Akdere Mound			X	Bursa	Yenişehir/ Akdere	On the route axis
13	Akdere Cemetery			X	Bursa	Yenişehir/ Akdere	55 m
14	Üyücek Hill Mound			X	Bursa	Yenişehir/ Karaköy	165 m
15	Çardak Mound			X	Bursa	Yenişehir/ Çardak	290 m
16	Çardak Logging House Complex			X	Bursa	Yenişehir/ Çardak	5 m
17	Koyunhisar Mound	X			Bursa	Yenişehir/ Koyunhisar	On the route axis
18	Tulumbayanı Mevki Settlement			X	Bursa	Yenişehir/ Marmaracık	On the route axis
19	Narlıdere Village Cemetery			X	Bursa	Kestel/ Narlıdere	50 m
20	Narlıdere Ottoman Settlement			X	Bursa	Kestel/ Narlıdere	20 m
21	Karahıdır Ottoman Settlement			X	Bursa	Gürsu/ Karahıdır	On the route axis
22	Nilufer Hatun Bridge			X	Bursa	Nilüfer/ Doğanköy	50 m
23	Building Remains			X	Bursa	Nilüfer/ Doğanköy	10 m
24	Building Remains			X	Bursa	Nilüfer/ Doğanköy	28 m

No	Site Name	From TR Ministry of Culture and Tourism			Province	District/ Village	Distance Between Route
		Registered	Unregistered	Unknown			
25	Gökçetepe Tumulus			X	Bursa	Nilüfer/ Doğanköy	64 m
26	Tepeköy Geçidi Settlement			X	Bursa	Nilüfer/ Yolçatı	25 m
27	Tepeköy Geçidi Mound			X	Bursa	Nilüfer/ Yolçatı	On the route axis
28	Küçükyenice Necropolis			X	Bursa	Mudanya/ Balabancık	88 m
29	Orhaniye Necropolis			X	Bursa	Mudanya/ Orhaniye	150 m
30	Badırga Village Alevi Cemetery			X	Bursa	Nilüfer/ Badırga	85 m
31	Badırga Village Cemetery			X	Bursa	Nilüfer/ Badırga	300 m
32	Irmak Baba Alevi Turbe			X	Bursa	Nilüfer/ Badırga	410 m
33	İnkaya Cave			X	Bursa	Karacabey/ İnkaya	930 m
34	Hoca Çeşme Mevkii Mill			X	Bursa	Karacabey/ Çeşnigir	260 m
35	Hoca Çeşme Mevkii Tumulus			X	Bursa	Karacabey/ Çeşnigir	On the Route Axis
36	Ancient Bridge Abutment			X	Bursa	Karacabey/ Taşlık	On the route axis
37	Ottoman Bridge			X	Bursa	Karacabey/ Taşlık	On the route axis
38	Taşlık village Cemetery			X	Bursa	Karacabey/ Taşlık	23 m

No	Site Name	From TR Ministry of Culture and Tourism			Province	District/ Village	Distance Between Route
		Registered	Unregistered	Unknown			
39	Şahinköy Cemetery			X	Bursa	Karacabey/ Şahinköy	On the route axis
40	Casttle and Mound	X			Bursa	Karacabey/ Tophisar	103 m
41	Tophisar Village Cemetery			X	Bursa	Karacabey/ Tophisar	50 m
42	Harmanlı Slope Settlement			X	Bursa	Karacabey/ Harmanlı	On the route axis

Ebeköy Plain Settlement

At the vicinity of the plain settlement that was located towards the east of Ebeköy, many surface finds were observed which were all in the character of coarse ware of the Byzantine-Ottoman era. The small-scaled disperse of the ceramics on the surface indicate the possible existence of a smaller settlement of 1-2 houses rather than a village.

As the site lies directly on the construction area of the Project route, considering that the route is finalized in this Section, the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Eskişehir Regional Board for Preservation of Cultural and Natural Assets. , It is recommended that the Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

Akdere Mound

During the inspections that were realized in the Yenişehir Plain Göksü Stream Basin a mound with a relatively low height was discovered in the area between the Akdere and Papatya villages. The mound lies directly on the High Standard Railway Project route by being located only 450 m south of the Göksu Stream.

Surface inspections revealed the existence of ceramic sherds of the Roman period dated between the 3rd-4th centuries AD together with Late Roman assemblages of 5th-6th centuries AD. Dense amounts of coarse ware together with bricks were also scattered around the surface. The existence of pinkish so-called hydraulic mortar pieces further points to the possible existence of a building that was related either to water management or use (bath, water depot etc.). A destroyed building at the western slope of the mound dates to our era and possibly was used as a windmill. Rows of stones sunken to the soil were additionally detected at the same locality which must have been the remnants of an ancient road.

As the site lies directly on the construction area of the Project route, considering that the route is finalized in this Section, the Project operators should act in accordance with the decisions that will be taken by the Museum

Directorate or Bursa Regional Board for Preservation of Cultural and Natural Assets. The construction works around the area requires archaeological on-site monitoring.

It is recommended that the Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

Akdere Cemetery

The area of mention is located at the entrance of the Akdere Village. The cemetery is still in use by the locals. Known to be in use during the Early Republican era its existence could also be taken as back as the Ottoman era.

Graves are noted to be made in the form of cists through the use of local limestone blocks. The limestone used in the cemetery is the same as the blocks that were evident around the İnönü Tumulus. Tomb markers in the form of quilted turbans dated to the Ottoman era were widely used within the cemetery.

The construction works around the area requires archaeological on-site monitoring.

Üyücek Hill Mound

The area of discovery lies 150 m south of the Bursa-Yenişehir Highway and also towards the east of the Bursa-Yenişehir Airport.

Being used for agricultural purposes as a result of its flat top portion the mound had yielded ceramics from the Early Bronze Age and Chalcolithic Period. The surface finds stand out with their dense amount and scattering.

Standing at a 165 m distance to the Project area, it is definite that it will not be affected at all by any phase of the Project. The construction works around the area requires archaeological on-site monitoring.

Çardak Mound

During the inspections around the Yenişehir Airport, a mound with a relative height (10-12 m) was noted falling towards the northwest of the airport and east of the Çardak Village. Despite reflecting the characteristics of a natural topographical trait, the inspections on and around the mound had revealed many artefacts pointing to a long settlement life from Chalcolithic, Early Bronze Age, Early Iron Age and Middle Ages. The mound with a diameter of 500 m lies at a distance of 290 m to the Project route.

Despite the uncertainty on the state of registration of the aforementioned area the Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection..

The construction works around the area requires archaeological on-site monitoring.

Çardak Logging House Complex

The inspections on the Project route had shown that a certain portion of it passes through the Çardak Quarter. At this portion, the Project-settlement connection should be handled with care. The quarter is known to house certain Late Ottoman-Early Republican logging houses with delicate bay windows. Those houses which are still inhabited will likely be affected by the vibrations that will occur as a result of the passings from possible tunnels or viaducts that will be built in the area.

Despite the uncertainty on the state of registration of the aforementioned houses similars from other regions are known to be under protection through registration. When the existence of such regulations on similar houses from elsewhere is taken into consideration with their acceptable number in Çardak the area occupied by them could be declared an urban site area by the Directorate of Bursa Museum.

The proposal of the experts would be the declaration of this situation to the Museum Directorate of Bursa for the inspection of the area by the Museum staff and if found valid the protection of the area through registration.

The construction works around the area requires archaeological on-site monitoring.

Koyunhisar Mound

Koyunhisar Mound lies approximately 1 km south of the Koyunhisar Village. It does not reflect a remarkable height but stands out with its splayed structure. Its north and west are occupied by fruit orchards.

Inspections on and around the mound had revealed a dense number of ancient ceramics together with bricks from later periods. Some of the ceramic finds are noted to be from the Early Bronze Age. The surface finds from the south skirts of the mound point to the possible use of this portion as a necropolis.

The main Project axis will pass from the south skirts of the mound. As the site lies directly on the construction area, considering that the route is finalized in this Section, the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Bursa Regional Board for Preservation of Cultural and Natural Assets. Furthermore, the construction works around the area requires archaeological on-site monitoring. It is recommended that the Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

Tulumbayanı Mevki Settlement

The settlement is situated between the villages of Seymen and Marmaracık at a distance of 500 m towards the south of the Bursa-Yenişehir Highway. Known as the Düze settlement area the locality was densely covered with fragments of bricks and tiles on the surface. The number of coarse ware, on the other hand, was relatively less. The surface findings point to the existence of a single phased settlement most probably in use during the Late Byzantine and Ottoman eras.

As the site lies directly on the construction area of the Project route, considering that the route is finalized in this Section, the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Bursa Regional Board for Preservation of Cultural and Natural Assets. Furthermore, the construction works around the area requires archaeological on-site monitoring. It is recommended that the Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

If an on-site inspection will be done the archaeological area in mention could be proposed for being declared as a 3rd Degree Archaeological Site by the Museum.

Narlıdere Village Cemetery

The area of mention is the cemetery of the Narlıdere Village. It lies at a 50 m distance to the Project axis and will not be affected negatively from any phase of the construction works.

Narlıdere Ottoman Settlement

A plain settlement with not so much height lying in between the fruit orchards was discovered during the surveying of the Project route passing from the south of the Narlıdere Village. The area was covered with dense numbers of Byzantine-Ottoman ceramics together with bricks and tile fragments.

As the site lies directly on the construction area of the Project it is necessary that any construction phase on or around should be subjected to archaeological on-site monitoring. It is recommended that the Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

The Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Bursa Regional Board for Preservation of Cultural and Natural Assets. If an on-site inspection will be done the archaeological area in mention could be proposed for being declared as a 3rd Degree Archaeological Site by the Museum.

Karahıdır Ottoman Settlement

It is a plain settlement from the Byzantine-Ottoman era. The area is densely occupied on the surface by brick and tile fragments. Certain filling works concerning the construction phase of the Project were realized at the south of the area. The overall archaeological data obtained from the survey points to the existence of a single phased settlement.

As the site lies directly on the construction area of the Project it is necessary that any construction phase on or around should be subjected to archaeological on-site monitoring. It is also strictly proposed that the Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

The Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Bursa Regional Board for Preservation of Cultural and Natural Assets. If an on-site inspection will be done the archaeological area in mention could be proposed for being declared as a 3rd Degree Archaeological Site by the Museum.

Nilufer Hatun Bridge

The Project route continuing parallel to the Nilüfer Stream passes from 50 m south of a Late Byzantine-Early Ottoman bridge known as the Nilüfer Hatun Bridge. The historic bridge is 82 m in length, 5,45 m in width and bears 7 arches. It shows traces of a recent restoration. Showing a typical Ottoman-era structural character, the bridge is solely open to pedestrian access in the present day. Utmost care should be shown to it especially during the construction phase as explosions or use of heavy machinery around its close vicinities would harm the integrity of its architectural state.

The construction works around the area requires archaeological on-site monitoring..

Building Remains

Some architectural remains high probably from a single building possibly from the Late Byzantine and Early Ottoman eras were located next to the Nilüfer Stream.

The surface revealed a small number of ceramics during the survey. Furthermore, a pillar fragment was also located within the same area. Due to the extremely close distance that this location has to the Project route (merely 10 m), the construction works around the area requires archaeological on-site monitoring.

Building Remains

Some remains belonging to a building were located in an area falling towards the northwest of the city hospital. The building is preserved on foundation levels but showed an architectural layout with typical characteristics of the Early Republican era.

Since the location approximately 30 m to the Project route, the construction works around the area requires archaeological on-site monitoring. It is strictly proposed that the Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

Gökçetepe Tumulus

During the investigations that were done around the northwest of Bursa city hospital, a tumulus was located on a hill overlooking the Nilüfer Stream. The surface revealed a good number of tile fragments.

Due to the distance, this location has to the Project route (64 m), the construction works around the area requires archaeological on-site monitoring. It is strictly proposed that the Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

During the construction activities, this area needs to be marked and should be prevented from being damaged.

Tepeköy Geçidi Settlement

It is a single phased flat slope settlement that could be dated to the Late Byzantine-Ottoman era. Dense numbers of tiles, brick fragments, few ceramics and a single chiselled marble fragment were located on the surface during the surveys.

Since the location approximately 30 m to the Project route the construction works around the area requires archaeological on-site monitoring. It is strictly proposed that the Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

During the construction activities, this area needs to be marked and should be prevented from being damaged.

Tepeköy Geçidi Mound

A mound, named as Tepeköy Geçidi, was located at a point situated at the south of the Nilüfer Stream that overlooks a vast arable land. The mound stretches to an area of 1,3 x 1 km. This wide stretching of its area must be due to its continuous occupation which probably commenced from 5000 BC. Intense surveying revealed a vast amount of quality ceramics from the surface dated from Chalcolithic to the Roman period, stone tools from the Chalcolithic period together with various fragments from Roman glass objects

A looters hole was located at the top of the mound under a tree. The hole had revealed traces of architecture with remnants from a pithos (storage vessel). A vast amount of architectural fragments, fragments of coarse ware, fragments of Hellenistic black glazed ceramics and glass objects were scattered on the surface.

As the site lies directly on the construction area of the Project route, considering that the route is finalized in this Section, the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Bursa Regional Board for Preservation of Cultural and Natural Assets. Furthermore, the construction works around the area requires archaeological on-site monitoring. It is recommended that the

Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

Küçükyenice Necropolis

During the surveying of the area around the south of the Küçükyenice Village, a necropolis from the Roman period was located. A vast amount of tile fragments and architectural elements were scattered on the surface. The area in general is like a flat field and lies at a distance of 88 m from the Project route.

During the construction activities, this area needs to be marked and should be prevented from being damaged.. It is recommended that the Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection. If an on-site inspection will be done the archaeological area in mention could be proposed for being declared either as a 1st or 3rd Degree Archaeological Site by the Museum. The construction works around the area requires archaeological on-site monitoring.

Orhaniye Necropolis

A necropolis possibly from the Hellenistic and Roman periods was located during the surveying around the south of the Orhaniye Köyü. The necropolis is situated next to a river about a 150 m distance to the Project route. A vast amount of tile fragments and architectural elements were scattered on the surface. Thought to be used by means of carving of the rock for the building of graves the whole hill was repeatedly harassed by many looting holes.

During the construction activities, this area needs to be marked and should be prevented from being damaged.. It is recommended that the Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

The construction works around the area requires archaeological on-site monitoring.

Badırga Village Alevi Cemetery

The Project route while passing from the north of the Badırga Village will pass from nearby an Alevi cemetery belonging to the locals of the Badırga Village. The cemetery is situated on a hill lying 85 m away from the Project route.

Each tomb from the cemetery, where traditional customs are still practised, has a special niche at the head for receiving candles. The custom was known to be evident in the Alevi culture from Erzincan, Tunceli and Sivas regions and must have been brought to the region by people who had emigrated here from the aforementioned regions.

During the construction activities, this area needs to be marked and should be prevented from being damaged.. The construction works around the area requires archaeological on-site monitoring.

Badırga Village Cemetery

The cemetery lying towards the north of the Badırga Village is the second cemetery of the village. It is situated at a different location than the Alevi cemetery with a distance of 100 m. No traces of any historical value remain/object were located from the area. The area will not

During the construction activities, this area needs to be marked and should be prevented from being damaged.. The construction works around the area requires archaeological on-site monitoring.

Irmak Baba Alevi Shrine (Türbe)

It lies towards the north of the Badırga Village very close to the previously located 2 cemeteries. It is a shrine related to the Badırga Village Alevi cemetery.

The tomb within the shrine (türbe), where traditional customs are still practised, has a special niche at the head for receiving candles. The shrine (türbe) additionally houses a “sacred tree” used during the ceremonies in which pieces of clothing were ties on the branches for making wishes come true.

Despite lying distant to the Project area by being an asset of Intangible Cultural character it must be protected from the possible negative effects of vehicles passing from nearby during the construction phase. If its close vicinity was chosen for vehicle passings this route is strongly advised to be changed to a further locality.

During the construction activities, this area needs to be marked and should be prevented from being damaged.. The construction works around the area requires archaeological on-site monitoring.

İnkaya Cave

The caves located towards the entrance of the İnkaya Village are suitable for being used in antiquity either as caves or caverns. They lie at a 930 m distance to the Project route but were included in the report for preventing their future use as building and operating of breaking-screening plants.

During the construction activities, this area needs to be marked and should be prevented from being damaged.. The construction works around the area requires archaeological on-site monitoring.

Hoca Çeşme Mevkii Mill

It is a watermill located next to the Nilüfer Stream towards the southwest of the Çeşnigir Village. The mill is located 260 m north of the Project route. The building reflects strong characteristics of Ottoman architecture and candidates to be an important Cultural Asset.

During the construction activities, this area needs to be marked and should be prevented from being damaged.. It is proposed that the Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

The construction works around the area requires archaeological on-site monitoring.

Hoca Çeşme Mevkii Tumulus

The earthen mounds are located on a hill covered with oak trees that is located within the Nilüfer Stream basin towards the southwest of Çengir Köyü. The tumulus falling on the Project route reflects a two peaked structure. Surrounded by stones the whole earthen mound was covered with tile fragments and looting holes.

The construction works around the area requires archaeological on-site monitoring. It is proposed that the Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection. It is further proposed that the Directorate of the Bursa Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

Ancient Bridge Abutment

During the investigation of the Project route which will pass from the south of the Taşlık quarter two corresponding bridge abutments were detected on the Kara Dere. The Project route will pass from over the two abutments via a bridge.

The remains of a partial road that stretches inland from the back of the southwestern abutment were detected during the survey. Rubbles in between the abutments and inside the river point to the possible arched structure of the original bridge.

As the area lies directly on the construction area of the Project, considering that the route is finalized in this Section, the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Bursa Regional Board for Preservation of Cultural and Natural Assets. The construction works around the area requires archaeological on-site monitoring.

The passing of this point through a bridge should be realized in care with special attention given to the proper calculation of the abutment and bridge heights for being in accordance with the archaeological remains.

Ottoman Bridge

During the investigation of the Project route which will pass from the south of the Taşlık quarter remains of a bridge with 3 arches were detected on the old riverbed two corresponding bridge abutments were detected on the Kara Dere. The Project route will pass from over the two abutments via a bridge. The current state of the remains had shown that the bridge lost its proper function due to the change of the old route of the river.

As the area lies directly on the construction area of the Project, considering that the route is finalized in this Section, the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Bursa Regional Board for Preservation of Cultural and Natural Assets. The construction works around the area requires archaeological on-site monitoring.

The passing of this point through a bridge should be realized in care with special attention given to the proper calculation of the abutment and bridge heights for being in accordance with the archaeological remains.

Taşlık village Cemetery

The area of mention is the current cemetery of the Taşlık Village. It is situated at a distance of 23 m to the Project route and it will likely be affected by any of the construction works.

Şahinköy Cemetery

The area lies towards the north of the Şahinköy Village and reflects general traits of an Ottoman and Early Republican era cemetery. Tombs from the Ottoman era are inscribed with Ottoman inscriptions and decorated with quilted turbans.

The Project route passes directly over the cemetery. If the route will be accepted as so by the Project firm the cemetery should be handled according to the laws numbered 3998 as “Law for the Protection of the Cemeteries” and numbered 2863 as “Law on Preservation of Cultural and Natural Assets”.

As the area lies directly on the construction area of the Project, considering that the route is finalized in this Section, the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Bursa Regional Board for Preservation of Cultural and Natural Assets. The construction works around the area requires archaeological on-site monitoring.

Castle and Mound

The castle is situated at the east of the Tophisar Village, at a locality known as Kaletepe Locality on a high natural formation. The castle must be from the latest settlement layer of the natural formation which could be now attested to originally existed as a mound.

During the survey fragments of ceramics dated to the Roman period and Byzantine-Ottoman era were located. The castle was investigated and published by Prof. Dr. S. Yıldız ÖTÜKEN.

The remains lie at a distance of 103 m to the Project route and the passing from this point will be realized through a bridge.

During the construction activities, this potential area needs to be marked and should be prevented from being damaged..

Tophisar Village Cemetery

The area of mention is the current cemetery of the Tophisar Village. It is situated at a distance of 50 m to the Project route and it will likely be affected by any of the construction works.

It is recommended that any construction activities conducted on or around the site should be subjected to archaeological on-site monitoring.

Harmanlı Slope Settlement

During the investigation of the Project route which will pass from the north of the Harmanlı Village, a slope settlement was discovered at a locality that is situated towards 750 m southeast of the Susurluk River.

Surface finds point to the existence of an Ottoman-era slope settlement in the area. Dense amounts of ceramics and bricks could be seen on the surface. Additional architectural remains do also exist again partially visible on the surface.

As the archaeological area lies directly on the construction area of the Project, considering that the route is finalized in this Section, the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Bursa Regional Board for Preservation of Cultural and Natural Assets. The construction works around the area requires archaeological on-site monitoring.

Balıkesir

The district of Bandırma from the Balıkesir Province had been the starting point within the scope of the third phase of field operations on the Bandırma-Yenişehir-Osmaneli High Standard Railway Project planned to be connected to İstanbul-Ankara High Standard Train Project. The works on this zone which has a route length of 30 km around the border of Balıkesir were commenced on 10.03.2021 and lasted for 3 days. As a result of the fieldworks, a total of 14 archaeological and cultural heritage findings were located. Information on those areas is given in **Table *85***.

Table 85 Province of Balıkesir, Archaeological and Cultural Heritage Findings

No	Site Name	From TR Ministry of Culture and Tourism			Province	District/ Village	Distance Between Route
		Registered	Unregistered	Unknown			
43	Kazçeşme Tumulus and Necropolis			X	Balıkesir	Bandırma/ Yeşilçomlu	77 m
44	Kazçeşme Mevkii Settlement			X	Balıkesir	Bandırma/ Yeşilçomlu	On the route axis
45	İncirli Çeşme Locality Necropolis			X	Balıkesir	Bandırma/ Yeşilçomlu	105 m
46	İncirli Çeşme Locality Slope Settlement			X	Balıkesir	Bandırma/ Yeşilçomlu	On the route axis
47	Halvadca Çeşme Slope Settlement			X	Balıkesir	Bandırma/ Yeşilçomlu	On the route axis
48	Söğütçe Çeşme Locality Settlement			X	Balıkesir	Bandırma/ Kuşcenneti	On the route axis
49	Karakova Locality Tumulus			X	Balıkesir	Bandırma/ Kuşcenneti	113 m
50	Late Ottoman Bridge 1			X	Balıkesir	Bandırma/ Doğruca	141 m
51	Late Ottoman Bridge 2			X	Balıkesir	Bandırma/ Doğruca	122 m

No	Site Name	From TR Ministry of Culture and Tourism			Province	District/ Village	Distance Between Route
		Registered	Unregistered	Unknown			
52	Late Ottoman Bridge 3			X	Balıkesir	Bandırma/ Doğruca	121 m
53	Arch Culvert 1			X	Balıkesir	Bandırma/ Doğruca	117 m
54	Arch Culvert 2			X	Balıkesir	Bandırma/ Doğruca	93 m
55	Late Ottoman Bridge 4			X	Balıkesir	Bandırma/ Doğruca	73 m
56	Doğruca Hilltop Settlement			X	Balıkesir	Bandırma/ Doğruca	10 m

Kazçeşme Tumulus and Necropolis

A mound covered in bushes on top, situated at the southeast of Yeşilçomlu Village attracts attention at first sight. The site of mention has its whole top surface covered with ceramics. Furthermore, a pile of stone blocks from nearby the mound are of interest too.

The tumulus being independent of the rest of the topography lies at a height of 1-2 m. Despite being 77 m distance to the Project area the tumulus is less likely to be affected from any part of the Project.

Furthermore, the construction works around the area requires archaeological on-site monitoring.

Kazçeşme mevkii Settlement

During the survey, coarse ware ceramic fragments from the Early Roman period and Byzantine-Ottoman eras were located in dense numbers at a plain settlement situated towards the southeast of the Yeşilçomlu Village. When thearea that those ceramics were dispersed is into consideration the locality could be easily ascribed as a widespread village settlement.

As the archaeological area lies directly on the construction area of the Project route, it is recommended to change the project route on the portion that falls within the construction corridor., The construction activities conducted around the area requires archaeological on-site monitoring. Additionally, the Directorate of the Bandırma Museum should be informed of the existence of the area to carry out on-site field inspections and if needed for registration to ensure its protection.

If a route change is impossible the Museum Directorate or Balıkesir Regional Board for Preservation of Cultural and Natural Assets should be informed and construction activities need to be conducted accordingly.

İncirli Çeşme Mevkii Necropolis

It is situated at the south of the Yeşilçomlu Village under a hill whose top is dominated by a quarry. The surface of the area was densely covered with ceramic fragments from the Roman Period. Further surveys around the area also revealed the existence of a looted tumulus and a yet excavated second tumulus.

The tumulus, being independent of the rest of the topography, lies at a height of 1-2 m. Despite being at a 105 m distance to the Project area the tumulus is less likely to be affected from any part of the Project. The existence of other tombs hewn to the bedrock the area is likely to house additional rock-cut tombs.

Despite the uncertainty on the state of registration of the aforementioned area the Directorate of the Bandırma Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

Any construction activities will be conducted around the area, it is recommended to conduct archaeological on-site monitoring.

İncirli Çeşme Mevkii Slope Settlement

It is a settlement that is situated at the south of the Yeşilçomlu Village under a hill whose top is used as a quarry. It lies adjacent to the previously mentioned necropolis that stands at the same height as the settlement. The surface is densely covered with ceramic fragments from the Byzantine-Ottoman era. It was probably a vast village settlement.

As the archaeological area lies directly on the construction area of the Project route the expert opinion proposes a route change especially on the portion that falls within the construction corridor. Furthermore, if construction works will be realized around the area following a route change, it is recommended to conduct archaeological on-site monitoring. Additionally, the Directorate of the Bandırma Museum should be informed of the existence of the area to carry out on-site field inspections and if needed for registration to ensure its protection.

If a route change is impossible the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Balıkesir Regional Board for Preservation of Cultural and Natural Assets.

Halvadca Çeşme Slope Settlement

It is located at southwest of Yeşilçomlu Village next to a forested area. The surface of its vicinity was covered in dense ceramics fragments dated to the Byzantine-Ottoman eras. The settlement could be a small building complex with a nearby water well.

As the archaeological area lies directly on the construction area of the Project route the expert opinion proposes the opening of trial pits in the area. Furthermore, if construction works will be realized around the area it is recommended to conductarchaeological on-site monitoring. Additionally, the Directorate of the Bandırma Museum should be informed of the existence of the area to carry out on-site field inspections and if needed for registration to ensure its protection.

If a route change is impossible the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Balıkesir Regional Board for Preservation of Cultural and Natural Assets.

Söğütçe Çeşme Mevkii Settlement

It is situated next to the present railway on the route of the junction line towards the direction of Bandırma-İzmir. The settlement reflects the traits of a mound lying next to a water source. The surface finds point to the existence of a possible Roman and Middle Age settlement. The area yielded architectural blocks together with ceramics.

As the archaeological area lies directly on the construction area of the Project route the expert opinion proposes a route change especially on the portion that falls within the construction corridor. Furthermore, if construction works will be realized around the area following a route change, it is recommended to conduct archaeological on-site monitoring. Additionally, the Directorate of the Bandırma Museum should be informed of the existence of the area to carry out on-site field inspections and if needed for registration to ensure its protection.

If a route change is impossible the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Balıkesir Regional Board for Preservation of Cultural and Natural Assets.

Karakova Mevkii Tumulus

The tumulus lies next to the Bandırma-İzmir highway with a view of the Manyas Lake. Its distance to the Project route is 113 m. The artificial mound has many looters holes on and around surrounded by ceramic fragments from the Roman Period and marble architectural elements.

Despite the uncertainty on the state of registration of the aforementioned area the Directorate of the Bandırma Museum should be informed of its existence to carry out on-site field inspections and if needed for registration to ensure its protection.

Furthermore, if construction works will be realized around the area, it is recommended to conduct archaeological on-site monitoring.

Late Ottoman Bridge 2

The opposite landscape of the Bandırma Industrial Zone is constituted by arable pasture land. The landscape is blessed with many tributaries.

The discovered bridge lies on the trail of the old Bandırma-Bursa highway. The paving stones from the old road are still visible in the area.

Being built as a single arched structure the bridge lies 120 m to the Project area. It is less likely that the structure will be affected in any sense by the Project.

It is recommended to change the project route for the passing of heavy tonnage vehicles from the nearby of the bridge and their directing to other alternative routes. Furthermore, if construction works will be realized around the area, it is recommended to conduct archaeological on-site monitoring.

Late Ottoman Bridge 1

The opposite landscape of the Bandırma Industrial Zone is constituted by arable pasture land. The landscape is blessed with many tributaries.

The discovered bridge lies on the trail of the old Bandırma-Bursa highway. The paving stones from the old road are still visible in the area.

Being built as a single arched structure the bridge lies 141 m to the Project area. It is less likely that the structure will be affected in any sense by the Project.

It is recommended to change the project route for the passing of heavy tonnage vehicles from the nearby of the bridge and their directing to other alternative routes. Furthermore, if construction works will be realized around the area, it is recommended to conduct archaeological on-site monitoring.

Late Ottoman Bridge 3

The opposite landscape of the Bandırma Industrial Zone is constituted by arable pasture land. The landscape is blessed with many tributaries.

The discovered bridge lies on the trail of the old Bandırma-Bursa highway. The paving stones from the old road are still visible in the area.

Being built as a single arched structure the bridge lies 122 m to the Project area. It is less likely that the structure will be affected in any sense by the Project.

It is recommended to change the project route for the passing of heavy tonnage vehicles from the nearby of the bridge and their directing to other alternative routes. Furthermore, if construction works will be realized around the area, it is recommended to conduct archaeological on-site monitoring.

Arch Culvert 1

The discovered arch culvert lies on the trail of the old Bandırma-Bursa highway. The paving stones from the old road are still visible in the area.

Being built as a single arched structure the bridge lies 117 m to the Project area. It is less likely that the structure will be affected in any sense by the Project.

It is recommended to change the project routefor the passing of heavy tonnage vehicles from the nearby of the bridge and their directing to other alternative routes. Furthermore, if construction works will be realized around the area, it is recommended to conduct archaeological on-site monitoring.

Arch Culvert 2

The discovered arch culvert lies on the trail of the old Bandırma-Bursa highway. The paving stones from the old road are still visible in the area.

Being built as a single arched structure the bridge lies 93 m to the Project area. It is less likely that the structure will be affected in any sense by the Project.

It is recommended to change the project route for the passing of heavy tonnage vehicles from the nearby of the bridge and their directing to other alternative routes. Furthermore, if construction works will be realized around the area, it is recommended to conduct archaeological on-site monitoring.

Late Ottoman Bridge 4

The opposite landscape of the Bandırma Industrial Zone is constituted by arable pasture land. The landscape is blessed with many tributaries.

The discovered bridge lies on the trail of the old Bandırma-Bursa highway. The paving stones from the old road are still visible in the area.

Being built as a single arched structure the bridge lies 73 m to the Project area. It is less likely that the structure will be affected in any sense by the Project.

As the structure is strengthened with the addition of steel constructions it could be used for transportation. It is recommended to change the project routefor the passing of heavy tonnage vehicles from the nearby of the bridge and their directing to other alternative routes. Furthermore, if construction works will be realized around the area, it is recommended to conduct archaeological on-site monitoring.

Doğruca Hilltop settlement

It is situated east of the Doğruca Village, next to the river at a passage that falls between 2 mountains. An active marble quarry lies adjacent to it.

The surface around the area, which shows the characteristic trait of a hilltop settlement, is densely covered with ceramic fragments of Middle Age date together with roof tiles. Other archaeological findings constitute architectural blocks.

As the archaeological area lies 10 m towards the construction area of the Project route, it is recommended to change the project route especially on the portion that falls within the construction corridor. Furthermore, if construction works will be realized around the area following a route change, it is recommended to conduct detailed archaeological on-site monitoring. Additionally, the Directorate of the Bandırma Museum should be informed of the existence of the area to carry out on-site field inspections and if needed for registration to ensure its protection.

If a route change is impossible the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Balıkesir Regional Board for Preservation of Cultural and Natural Assets.

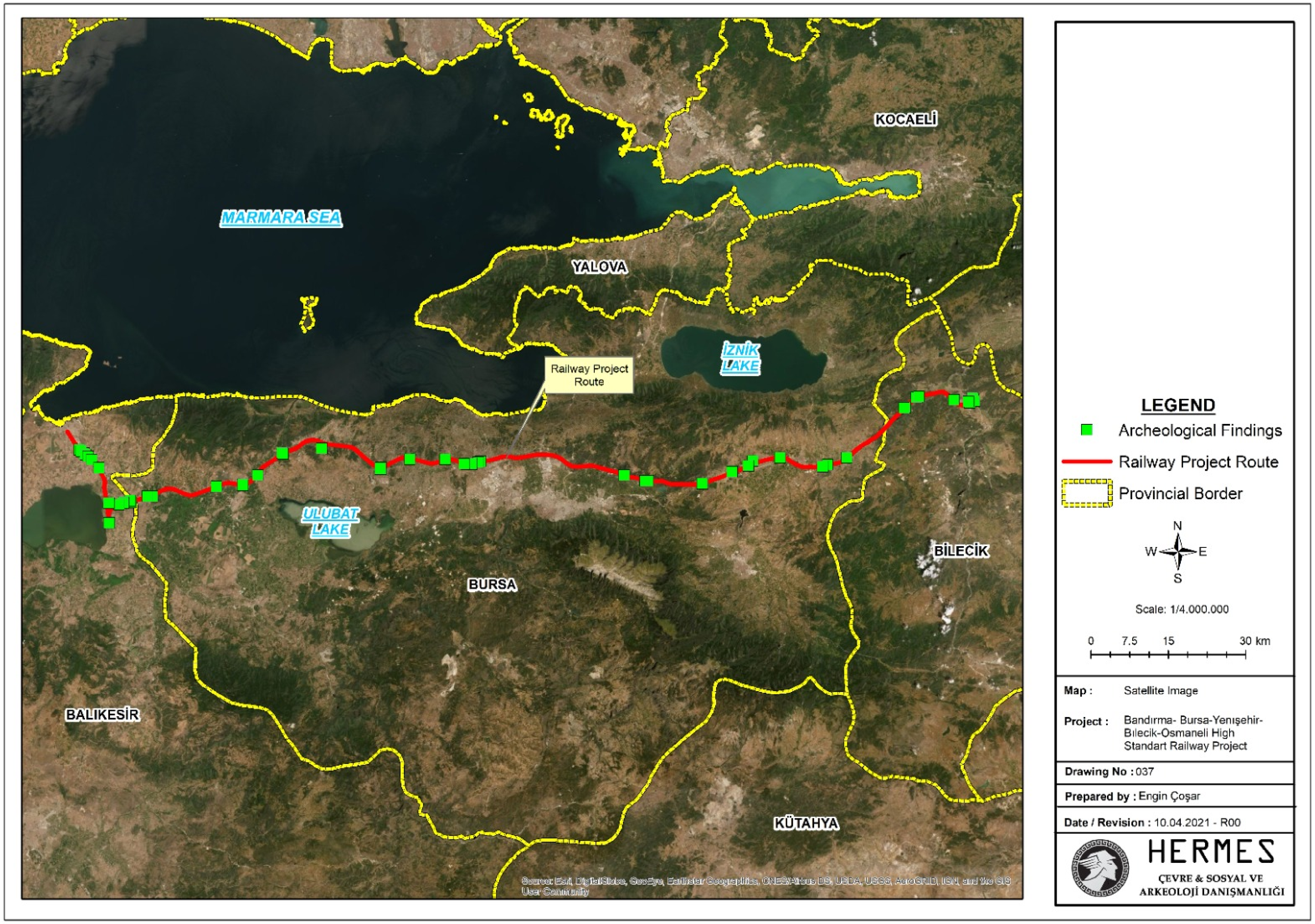


Figure 77 General Map of Archaeological Findings

7.3.3.2.3 Intangible Cultural Heritage

The United Nations Educational, Scientific and Cultural Organization (hereafter UNESCO) had accepted the “Convention for the Safeguarding of the Intangible Cultural Heritage” in 2003. Turkey had become party to the Convention in 2006.

According to the Article 2 of the Convention:

-The “intangible cultural heritage” means the practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artefacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognize as part of their cultural heritage. This intangible cultural heritage, transmitted from generation to generation, is constantly recreated by communities and groups in response to their environment, their interaction with nature and their history, and provides them with a sense of identity and continuity, thus promoting respect for cultural diversity and human creativity. For the purposes of this Convention, consideration will be given solely to such intangible cultural heritage as is compatible with existing international human rights instruments, as well as with the requirements of mutual respect among communities, groups and individuals, and of sustainable development.

a) The “intangible cultural heritage”, as defined in paragraph 1 above, is manifested inter alia in the following domains:

b) oral traditions and expressions, including language as a vehicle of the intangible cultural heritage;

c) performing arts;

d) social practices, rituals and festive events;

e) knowledge and practices concerning nature and the universe;

f) traditional craftsmanship.

The information on intangible cultural heritage is compiled from Prof. Dr. Suavi Aydın’s personal investigations.

Turkey is a multicultural country. The people of Turkey composed of native populations and immigrants from the Balkans, Caucasia, Crimea and Inner Asia by the 19th century and onwards. People moving into Turkey during the late Ottoman and Early Republican era included mainly Muslim refugees, referred to as Muhacir, from the Balkans which were formerly ruled by Ottoman Empire. Additionally, Turkic-speaking Crimean Tatars and Nogays; Azerbaijanis, Uzbeks, Turkmens, Kazakhs, Kyrgyz and other Inner Asian Turkic-speaking peoples that were deported by the Russian Empire and later by USSR as well as the war-torn Turkic Afghans; Northern and Southern Caucasian peoples like Circassians, Abkhazians, Daghestanis, Karachay-Balkars, Chechenians and Muslim Georgians had immigrated to Turkey. Besides Turkish-speaking Muhacirs, also non-Turkish speakers exist within the Balkan immigrants, such as Bosniaks, Pomaks, Albanians, Macedonians, Greek Muslims etc.

Turks, including local rural and urban Turks, ex-nomadic Turkmens and semi-nomadic Yörüks, constitute the majority among the native peoples of the country. The secondary major native groups could be listed as the Kurds and Zazas, who speak western Iranian languages. There exist Laz people speaking a Southern Caucasian language. Sunnite and Nusayri Arabs follow them. Also, under-populated Muslim Pontic Greeks, Muslim Armenians (Hamsheni) and Muslim Georgians live in Turkey. There are some non-Muslim minorities in Turkey like Orthodox Greeks, Gregorian and Catholic Armenians, Jews, Syriacs and Chaldeans and a few Molokans (Russian peasants that refused to obey the Russian Orthodox Patriarchate).

The majority of the population in Turkey is Muslim (98.8%). Muslims are divided into two major groups as Sunnites and Alevis. Sunni Turks and Kurds are predominant in Turkey, but Turkish, Kurdish and Arabic Alevis have an important population too, comprising approximately 20% of the total population. Alevi rituals are generally performed in Turkish, no matter their ethnic origin. Even though Alevi worship is related to Imam Shia, it is far from the regular Shia doctrine in terms of either conviction or beliefs.

In addition to their allegiance to a formal version of a religion, such as a proper mosque or church attendance, people in Turkey also develop believes and ritual practices based on their local environments, which can be assessed under the rubric of folk religion. At the centre of these practices lays the creation of cultic figures. They can be seen as similars of Christian saints. In local Muslim culture, they are known with many names such as “Evliya” (friends of God) and “yatır” (entombed saints) in Sunni Islam or “dede/baba” (holy or wise man, dervish) or “ocak” (healer) in Alevism. These figures are taken as mediators between people and God. Holiness is attributed to the graves or tombs of these personages, and to the places connected, in one way or another, with particular periods of their lives. Besides, the tombs or graves of the ones, named as Sayyids, who are believed to have descended from the lineage of the Prophet through his grandson, are also granted as holy. These kinds of people, who are believed to be holy or graced, are buried in the places they have died or their blood flowed out. After their death, these places are visited by people who perform certain practices of worship with an expectation of their wishes to come true. Also in the religious feasts, these places are visited by people who pray and praise these holy figures for accumulating good deeds in the sight of God, known mainly as sevab. People visit these places for a variety of reasons: for instance, a woman, who cannot give birth, could visit for having a child; or a person, who is ill, for having a remedy; another one who is in trouble, for overcoming his/her difficulties, and so on. The graves of these people can be later turned into dome-shaped buildings surrounded by stones to protect them and provide people with a much comfortable setting for worship.

The persons buried in these places are sometimes forgotten or unknown, but visiting, praying and vowing in these places are maintained by people. In somewhere the graves belong to forgotten Christian saints or monks transformed into Muslim ones in time, or converted people to Islam protected and continued their beliefs to them under cover of folk Islam. It is enough for people who perform these ritual practices to know that a holy or saintly person is laid in them In some shrines and tombs, vowing is practised for a wish to come true. If it comes true, the place is visited once again, an animal is sacrificed (Kurban) as a vow for the soul of whoever the mediatory personage is. Sacrificial meat and other prepared meals are not consumed by the person who made the dedication but rather distributed to the neighbours and the needy. In some parts of Turkey, tree worship (dendrolatry) or practices related to tree cult are performed. The most popular practice among all is the tying of pieces of clothing to a wish on a sacred tree, an act referred to in Turkish as “çaput bağlamak”.

Many religious or non-religious practices are performed ritually and periodically such as village fests, pro bono village feasts, sacrifice, rites of passages (i.e. circumcision feast and baptism), Islamic memorial services (Mevlids), Bayram (Ramadan and Sacrifice Holiday) and Cuma (Friday) prayers, Kandils (the memorial days related the acts of Prophet Mohammad), Martyrs Days and even Rain Prays do also exist. These are generally invented traditions except for rites of passages, prays and fests which belongs to old tradition such as “Koç Katımı” (mating of sheep), “Hıdrellez”, Bayram and Cuma prayers, harvest fests, baptism and circumcision feasts.

Newroz and Hıdırellez, principal Spring festivals, are celebrated along the Project route.

Newroz is celebrated annually on the 21st of March and takes place generally in the settlement centrums or fairgrounds. Common practices in Nawroz could be listed as the setting of symbolic fires and jumping over them as well as painting eggs and playing other games related to eggs.

General Situation of the Project Route

During the archaeological works that were realized on the Project route, Muhtars were asked about any festivals or cultural activities organized in the villages, any particular assets/practices the village is famous for, any sites of cultural importance and the reason for their significance as well as visiting dates of people. All such processes were kept at a minimum level due to the Covid-19 Pandemic.

Bilecik-Osmaneli

The Province of Bilecik lies on a passage among the Interior Anatolia, the Black Sea on north and Marmara regions. This position of it being on the trade routes in antiquity had given Bilecik a continuous advantage throughout the whole of its history.

The Province of Bilecik is famed for its pottery workmanship as an intangible cultural heritage. Production of Earthen wares but mostly of pottery is especially developed in Kınık Village of the Pazaryeri District where this tradition had passed among generations through hundreds of years. The simple early repertory of the region, which was characterized by water jars, pitchers and jugs had developed into a wider and richer repertory of forms through the years. A similar enrichment was also attested in the number of workshops and potters too.

The field questionnaires informed the existence of periodical festivals that were held at the District of Osmaneli in which locals exhibited products that they had grown. For instance, Osmaneli had become to be known for the quality of its watermelons on a pan-country scale. A festival had been held for the promoting and wide-scaled advertising of this natural product. The festival is held for a day each August and September also serves as a platform for the promoting of other local productions.

Yenişehir

Bursa is among the most important cities of Turkey with its rich historical texture and all cultural depositum. The city, which had been the capital of the Ottoman Empire, still maintains its importance.

When Bursa is into consideration “Karagöz” is the first name that comes to one’s mind. Karagöz was inscribed on the Representative List of the Intangible Cultural Heritage of Humanity in 2009. Karagöz is a shadow puppetry realized in means of moving of figures of humans, animals or objects that were made from camel or ox skin over a lighted white curtain. The artist realizing the game is referred to as “hayali”. The hayalis are the creators of the play which change the course of the play, scenes or the plot according to the responses from the crowd. The plot of Karagöz plays are generally shaped around funny motives, word plays, mimicking and so.

Additionally, the Ministry of Culture and Tourism is still on the verge of preparing a folder for the acceptance of İznik Porcelain (Çini) into the “Intangible Heritage List”. Furthermore, certain cultural activities such as the Bursa Knife, Bath Tradition, Erguvan Bayram, Gezek Culture or Danışık are sustained in many regions of Bursa.

The fieldworks conducted within the Yenişehir District revealed the existence of an annual festival pepper festival in which locals came together and exhibited products that they had grown. During this festival, which lasts for few days, singers were also brought for giving concerts.

A shrine (türbe), named as the Karacaahmet Türbe, is also located at the village of Karacaahmet Village within the Yenişehir District. During a conversation with the Muhtar of Akdere, we were told that all villages of the region come together at this shrine during Hıdırellez where rice and meals were cooked and distributed, prayers were made and visits were realized. All these were realized within the concept of some kind of a Spring Festival.

Karacabey

One of the most prominent festivals of the region was the Leylek Festival that was held in the Eskiraraağaç Village.

The festival held at the Eskikaraağaç Village of the Karacabey District took place on the last week of May in every year. The village as being one of the stomping grounds of storks during migrations is also known as "Leylek Köyü (Stork Village)". The festival organized for the celebration of the arrival of storks and the Spring hosts many attendants both from Turkey and other countries. Many events as lantern processions, Uluabat Lake trips, bicycle trips and "Stork Marathon" closely engages the attendants with the nature. On the other hand, folk dances and music concerts create an entertainment atmosphere whereas local productions were sold in various stands. Another information was given related to the organization of a "Linden Festival" in the Boğaz Village (see Photograph 1).

Photograph 1 Taşlık Village,

Nilüfer

The Badırga Village from the District of Nilüfer of the Bursa Province is a settlement in which Alevi and Sunni Muslims live together. As stated previously a cemetery exists on the north of the village. The cemetery comprises of two parts of which one belongs to the Alevi and the other to the Sunni communities.

The Irmak Baba Shrine (türbe) related to the Alevi graves was recorded by our survey (see Photograph 2).

Photograph 2 Irmak Baba Shrine (türbe), the Holy Tree

Some of the graves bear inscriptions indicating that their owners once had immigrated to the region from Tuncel and Tercan District of Erzincan. Muhtar of the village gave information on the organizing of Semah/Cem every Thursday night as that specific night was sacred for the Alevis.

The custom of “lighting candles” is very common around the graves. The tombs were built with special niches for being used for this purpose (see Photograph 3).

Photograph 3 Niches on the graves for lighting of the candles

The same ritual is also evident in the Baba Shrine (türbe). Türbe is decorated with the Turkish flag and a sacred tree is evident next to it. This tree received the clothing which was offered by the people coming to the locality for seeking divine help.

8.0 IMPACT ASSESSMENT

8.1 Physical Component

8.1.1 Geology and Geomorphology

8.1.1.1 Impact Analysis

8.1.1.1.1 Construction Phase

During the construction phase, impacts will be mainly associated to the following ***impact factor***:

- changes in the local morphology.

The ***project actions*** related to the abovementioned impact factor are the following: surface levelling and grading, temporary stockpiling of material and construction of the turbines and facilities.

Additional impacts on geology and geomorphology also related to hydrology, hydrogeology and soil are discussed in the Sections 7.1.3, 7.1.5, 7.1.6 of this report.

The impact is mainly related to the changes inflicted on the current morphology of the area due to the earthworks and excavations, and for the site preparation (scarified, excavated, filled with proper material, and flattened) and the construction of the buildings' foundations.

8.1.1.1.2 Commissioning and Operation Phase

As a result of the impact screening no impacts on the geology and the geomorphological components are expected during the commissioning and operation phase.

8.1.1.1.3 Decommissioning and Closure Phase

In general, the decommissioning activities would comprise the removal of the plants and the associated facilities. Also, the foundations of the structures would be removed. The site is expected to be restored for its future use.

As a result of the impact screening no impacts on the geology and the geomorphological components are expected during the decommissioning and closure phase.

Decommissioning of infrastructures could have a ***positive impact*** if the natural state of the land is recovered.

8.1.1.2 Mitigation Measures

The mitigation measures, for the impacts on the geology and geomorphology are listed below for the construction phase:

- worksite will be minimized to the smallest extent possible in order to meet Project's works and activities;
- the foundations' footprints and depths have been properly dimensioned; hence the excavations and the consequent physical-mechanical disturbances will be minimized;
- construction site will be minimized to the smallest extent possible in order to meet Project's works and activities;

- the flattening and excavation operation will be minimized to the extent possible in order to limit the morphological disturbances;
- part of the removed material will be re-used as fill at the Project Area, if it presents the suitable geotechnical characteristics, in order to limit the use of raw material.

8.1.1.3 Residual Impacts

8.1.1.3.1 Construction Phase

The residual impact on the geology and geomorphology component after the application of the above-mentioned mitigation measures during construction phase is presented in the following table.

Table 86 Impact Assessment Matrix for Geology and Geomorphology During Construction Phase After Mitigation

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features		Impact Value	Mitigation effectiveness	Residual impact value
Morphological Change	Duration:	Medium-short	Medium	Reversibility:	Long term	**Medium**	Medium-high	**Low**
	Frequency:	Sporadic						
	Geo. Extent:	Local						
	Intensity:	Low						

8.1.1.3.2 Commissioning and Operation Phase

As stated before, during the commissioning and operation phase, no impacts are expected on the geology and geomorphology component.

8.1.1.3.3 Decommissioning and Closure Phase

As a result of the impact screening no impacts on the geology and the geomorphological components are expected during the decommissioning and closure phase

8.1.1.4 Monitoring

No specific monitoring activities are required for this component.

8.1.2 Seismology

8.1.2.1 Impact Analysis

As a result of the impact screening no impacts on the seismology component is expected during the construction, commissioning and operation and decommissioning and closure phase.

The major geo-hazard, expected during all phases of the Project, would be an earthquake. According to the Geotechnical Report, with the geotechnical investigations, the peak ground acceleration is found as 0.40g in the Study Area and this is corresponding to the 1st hazard class according to the Turkey Earthquake Hazard Map. The design and construction activities will be conducted in accordance with the geological structure.

In the event of earthquakes, during all phases of the Project, significant impact on the community and the workers' health and safety, such as accidents, fire etc., may arise. Additionally, an earthquake may cause adverse impacts on the environment, such as spills, leaks and erosion.

8.1.2.2 Mitigation Measures

During the construction activities in the Project Area, the project design and engineering will comply with the provisions of the "Turkey Building Earthquake Regulation" published in the 30364 numbered and 18.03.2018 dated Official Gazette. The Regulation requires certain parameters to be determined prior to the construction. These parameters were determined by the geological and geotechnical investigations for the Project Area.

8.1.3 Hydrology and Surface Water Quality

8.1.3.1 Impact Analysis

8.1.3.1.1 Construction Phase

Impacts on the hydrology and surface water quality component during the construction phase are related to the following **impact factors**:

- hydrological change,
- surface water pollution, and
- surface water run-off.

Impacts could be due to the following ***project actions***: increase of water needs, wastewater generation, disposal of waste deriving from construction (including excavated soil), suspended sediments in surface water run-off and construction of the facilities.

Hydrological change: During construction phase, there will be water needs for the construction activities such as dust suppression. This need will be supplied from water bodies close to the Project Area.

Surface water pollution: Surface water pollution can be cause by the not properly managed wastewater and construction wastes.

*Wastewater generatio*n: wastewater during the construction phase will consist of the domestic wastewater from the worksite and wastewater from the construction works. During the construction phase, domestic wastewater would be collected in impermeable septic tanks and disposed according to the provisions of the Water Pollution Control Regulation (WPCR, Issued on 31.12.2004 in the Official Gazette No: 25687) and other relevant regulations. Domestic wastewater would be collected in leak-proof septic tanks and the septic tanks would be emptied periodically by a vacuum truck and disposed of to the wastewater sewage system. At the construction sites where there are more than 84 people, a package treatment plant will be established. Project approval will be obtained by preparing a Wastewater Treatment Plant Project for the treatment facility within the scope of the Wastewater Treatment/Deep Sea Discharge Project Approval circular numbered (2018/14) dated 20.11.2018. The wastewater generation and water requirements during the construction and operation phases of the project given in the Section 3.5.1.

Waste deriving from construction; can lead to surface water pollution if it is not properly managed. The temporary storage of waste and/or hazardous substances deriving from the construction activities, if not properly managed, could induce a release of pollutants onto the soil surface/ground. Accidental leakages from the use of hazardous substances or refuelling or maintenance operations of machineries are also potential hazards. During construction, pollution may reach groundwater through soil. No particularly hazardous material is predicted to be used during construction; accidental spills of pollutants from machinery/vehicles would reach groundwater only if the spilled material is in large quantities and the material is spilled over a period of time.

Surface water run-off: The surface water runoff patterns in the Project Area would be impacted by the Project with the changes in the characteristics of the surface and the topography.

8.1.3.1.2 Commissioning and Operation Phase

Impacts on the hydrology and surface water quality component during the commissioning and operation phase are related to the following ***impact factors***:

- surface water pollution, and
- surface water run-off.

Impacts could be due to the following ***project actions***: wastewater generation and disposal of waste deriving from operation, suspended sediments in surface water run-off and presence of the facilities.

Abovementioned project actions for the operation phase are same as the construction phase.

The wastewater generation are detailed in the previous section (construction phase). Similar treatment methods shall apply if there is no city sewage system network connection.

The waste deriving from operation is mainly composed of domestic wastes, hazardous wastes from maintenance works, gear oil used in the turbines and the transformer oil which is used in the switchyard.

8.1.3.1.3 Decommissioning and Closure Phase

The impacts during the decommissioning phase are likely to be similar to the construction phase hence the activities will be similar to construction activities. The same considerations described for this component during the construction phase would be applicable to the decommissioning phase for the all three impact factors.

In general, the decommissioning activities would comprise the removal of the plants and the associated facilities. Also, the foundations of the structures would be removed. The site is expected to be restored for its future use. Decommissioning of infrastructures could have a ***positive impact*** if the natural state of the land is recovered.

8.1.3.2 Mitigation Measures

The mitigation measures related to hydrology and surface water quality for the construction, the commissioning/operation and decommissioning/closure phase are as follow:

Measures incorporated in the Project Design:

- the Project will comply with safety requirements to avoid leakages from hazardous chemicals/material and liquids (diesel fuel, oil etc.) stored on-site;
- the areas, where the diesel/fuel storage tanks located (can be named as hazardous material storage areas), will be designed and constructed to avoid potential contamination into the soil (paved areas with sufficient secondary containment, proper drainage systems , collection ponds etc.);
- the temporary waste storage areas will be constructed based on the requirements listed in the Regulation on Regular Storage of Wastes issued on March 26, 2010, at Official Gazette no:27533 and Regulation on Waste Management issued on April 02, 2015 Official Gazette no: 29314.

General mitigation measures:

- Consultations will be held with DSI and SYGM regarding the hydrological studies and surface water quality and any additional studies will be conducted upon the opinions of these institutions prior to the construction phase.
- during the construction phase, the surface drainage and site runoff, particularly in heavy rainy seasons will be properly managed by constructing temporarily or permanent channels which were designed to manage maximum flow capacity against the flood risk;
- at the construction areas without cover, ground will be seeded and the areas with highest slopes will be flattened to prevent erosion and sediment transport with surface run-off water;
- surface improvement will be considered during the construction phase such as paving or spreading gravel to the road surface (unpaved areas);

- during the operation phase, the grids of the drainage system will be controlled and cleaned on a periodical basis, in order to prevent possible blockages during heavy rains;
- regular maintenance of vehicles and machinery/equipment will be undertaken to ensure that leakages of oil/fuel or any other hazardous material is prevented;
- use of machinery/vehicles will be strictly limited within the construction sites and along the appropriate access roads;
- impervious (concrete etc.) surfaces will be designated for the refuelling of the machinery/vehicles, if it is not possible according to the nature of the Project, all refuelling tankers and all heavy machinery used at the Site will have an iron plate trays, and these trays will be placed under the pipe connection points to prevent accidental leakage to the soil during refuelling operations;
- During the repair and maintenance of the vehicles and machinery/equipment (if needed) necessary spill control measures will be taken with secondary containment measures;
- portable spill containment and clean-up materials (spill kits) will be made available and easily accessible at the construction site, instructions on how to use spill containment and clean-up materials will be included in the kits;
- training on spill response, use of containment and clean-up material (spill kits) will be provided to works (including the subcontractor workers);
- adequate and properly maintained tanks, paved ground, spill containment materials and proper secondary containment systems with sufficient volume will be provided for fuel/oil storage and for the storage of other fluids and hazardous substances;
- wastewater flows from any field activities (i.e., excavations, drillings, re-fuelling and vehicle/equipment washing) will be properly managed;
- polluted water (if any generated as a result of accidental leakages) will be properly collected or managed to prevent mixing with any water body;
- concerning potential surface water run-off due to dust and traffic, during the construction phase, mitigations measures could consist in the following:
  - Vehicle restrictions; such as limiting the speed, weight, or number of vehicles;
  - Surface improvement; such as paving or spreading gravel to the road surface;
  - Surface treatment; periodic wetting of the roads;
  - For trucks; covering powdery materials transported on trucks.

8.1.3.3 Residual Impacts

8.1.3.3.1 Construction Phase

The residual impact on the hydrology and surface water quality component after the application of the abovementioned mitigation measures during construction phase is presented in the following table.

Table 87 Impact Assessment Matrix for Hydrology and Surface Water Quality During Construction Phase After Mitigation

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features		Impact Value	Mitigation effectiveness	Residual impact value
Hydrological Change	Duration:	Long	Low	Reversibility:	Long term	**Low**	Medium-high	**Negligible**
	Frequency:	Continuous						
	Geo. Extent:	Local						
	Intensity:	Low						
Surface Water Pollution	Duration:	Medium-short	Very high	Reversibility:	Long term	**High**	Medium-high	**Low**
	Frequency:	Frequent						
	Geo. Extent:	Local						
	Intensity:	Low						
Surface Water Run-off	Duration:	Medium	Low	Reversibility:	Mid term	**Low**	Medium	**Negligible**
	Frequency:	Continuous						
	Geo. Extent:	Local						
	Intensity:	Low						

8.1.3.3.2 Commissioning and Operation Phase

The residual impact on the hydrology and surface water quality component after the application of the abovementioned mitigation measures during commissioning and operation phase is presented in the following table.

Table 88 Impact Assessment Matrix for Hydrology and Surface Water Quality During Commissioning and Operation Phase After Mitigation

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features		Impact Value	Mitigation effectiveness	Residual impact value
Surface Water Pollution	Duration:	Medium-short	Very high	Reversibility:	Long term	**High**	Medium-high	**Low**
	Frequency:	Frequent						
	Geo. Extent:	Local						
	Intensity:	Low						
Surface Water Run-off	Duration:	Medium	Low	Reversibility:	Mid term	**Low**	Medium	**Negligible**
	Frequency:	Continuous						
	Geo. Extent:	Local						
	Intensity:	Low						

8.1.3.3.3 Decommissioning and Closure Phase

Decommissioning phase activities are likely to be very similar to the construction phase. Decommissioning of infrastructures could have a ***positive impact*** if the natural state of the land is recovered. Same considerations describe for the construction phase are applicable here as well.

8.1.3.4 Monitoring

Following monitoring activities are foreseen to ensure the implementation and effectiveness of the proposed mitigation measures:

- Design checks, to ensure the measures listed above are in place (like concrete pavement in storage areas, collection pond underneath, gravel spread to the unpaved areas etc.) will be undertaken;
- Routine site inspections will be carried out and reported to identify any possible leakages;
- Routine site inspections will be carried out for the road construction and dust suppression activities and these inspections should be recorded;

- The provided trainings on spill response, use of containment and clean-up material for the workers (including the subcontractors' workers) will be recorded;
- Routine site inspections will be carried out to ensure adequate amount of spill-response material such as spill-kits and metal trays will be present at the site and in each heavy machinery and records will be kept;
- Routine maintenance programme will be or asked to be set-up and maintenance records will be kept for all vehicles and machinery/equipment.

8.1.4 Hydrogeology and Groundwater Quality

8.1.4.1 Impact Analysis

8.1.4.1.1 Construction Phase

Impacts on this component, during the construction phase are related to the following ***impact factors:***

- hydrogeological change, and
- groundwater pollution.

Impacts could be due to the following ***project actions:*** increase of water needs, wastewater generation, disposal of waste deriving from construction (including excavated soil) and construction of the facilities.

Hydrogeological change: During the construction phase; drinking and potable water for the workers would be provided from the city water network or external sources. In addition to these, there will be water needs for the construction activities such as dust suppression.

Construction of a groundwater well and groundwater abstraction for the Project might be needed in the Project which will require the treatment, storage and disposal should be done according to the regulatory requirements after necessary analyses have been performed and relevant permits are obtained. In case of encountering groundwater in tunnel excavations planned along the railway line, a local hydrogeological impact is expected, since dewatering may be required. In that case; these waters will be collected at the sump locations inside the tunnel and pumped out of the tunnel & outside the construction area by suitable pumps and discharged in line with the regulatory requirements.

A Dewatering Plan will be prepared for the Project and groundwater samples will be taken from suitable wells around the tunnels to be dewatered, and the study on regional groundwater quality will be completed before the construction phase.

Groundwater pollution: Groundwater pollution can be cause by the not properly managed wastewater and construction wastes.

*Wastewater generatio*n; during the construction phase will consist of the domestic wastewater from the worksite and wastewater from the construction works. During the construction phase, domestic wastewater would be collected in impermeable septic tanks and disposed according to the provisions of the Water Pollution Control Regulation (WPCR, Issued on 31.12.2004 in the Official Gazette No: 25687) and other relevant regulations. Domestic wastewater would be collected in leak-proof septic tanks and the septic tanks would be emptied periodically by a vacuum truck and disposed of to the wastewater sewage system. At the construction sites where there are more than 84 people, a package treatment plant will be established. Project approval will be obtained by preparing a Wastewater Treatment Plant Project for the treatment facility within the scope of the Wastewater Treatment/Deep Sea Discharge Project Approval circular numbered (2018/14) dated 20.11.2018. The wastewater generation and water requirements during the construction and operation phases of the project given in the Section 3.5.1.

Waste deriving from construction; can lead to groundwater pollution if it is not properly managed. The temporary storage of waste and/or hazardous substances deriving from the construction operations, if not properly managed could induce a release of pollutants onto the soil surface/ground. Accidental leakages from the use of hazardous substances or refuelling or maintenance operations of machineries are also potential hazards. During construction, pollution may reach groundwater through soil if the effectiveness of the taken mitigation measures cannot be ensured. No particularly hazardous material is predicted to be used during construction; accidental spills of pollutants from machinery/vehicles would reach groundwater only if the spilled material is in large quantities and the material is spilled over a period of time.

In case groundwater is encountered during the construction, groundwater should be abstracted from the work area; treatment, storage and disposal should be done according to the regulatory requirements after necessary analyses have been performed and relevant permits are obtained.

8.1.4.1.2 Commissioning and Operation Phase

Impacts on this component during the commissioning and operation phase will be same as the construction phase and are related to the following ***impact factors:***

- hydrogeological change, and
- groundwater pollution.

Impacts could be due to the following ***project actions***: increase of water needs (construction of groundwater well), wastewater generation and disposal of waste deriving from operation.

The details related to this project actions are detailed in the previous section (construction phase).

8.1.4.1.3 Decommissioning and Closure Phase

The impacts during the decommissioning phase are likely to be similar to the construction phase hence the activities will be similar to construction activities. The same considerations described for this component during the construction phase would be applicable to the decommissioning phase for the groundwater pollution impact factor.

The impact factor hydrogeological changes will not be related to the decommissioning phase, hence if there will be any impact on this factor, it will already have occurred during construction or operation phase.

In general, the decommissioning activities would comprise the removal of the plants and the associated facilities. Also, the foundations of the structures would be removed. The site is expected to be restored for its future use. Decommissioning of infrastructures could have a ***positive impact*** if the natural state of the land is recovered.

8.1.4.2 Mitigation Measures

The mitigation measures related to hydrogeology and groundwater quality for the construction, the commissioning/operation and decommissioning/closure phase are as follow:

- Measures incorporated in the Project Design:
  - worksite will be minimized to the smallest extent possible in order to meet Project's works and activities;
  - the foundations' footprints and depths have been properly dimensioned; hence the excavations and the consequent physical-mechanical disturbances will be minimized;

- the Project will comply with safety requirements to avoid leakages from hazardous chemicals/materials and liquids stored on-site;
- the areas, where the diesel/fuel storage tanks located (can be named as hazardous material storage areas), will be designed and constructed to avoid potential contamination into the soil (paved areas with sufficient secondary containment, proper drainage systems etc.);
- the temporary waste storage areas will be constructed based on the requirements listed in the Regulation on Regular Storage of Wastes issued on March 26, 2010, at Official Gazette no:27533 and Regulation on Waste Management issued on April 02, 2015 Official Gazette no: 29314.

- General mitigation measures:
  - Consultations will be held with DSI and SYGM regarding the hydrogeological studies and groundwater quality and any additional studies will be conducted upon the opinions of these institutions prior to the construction phase.
  - regular maintenance of vehicles and machinery/equipment will be undertaken to ensure that leakages of oil/fuel or any other hazardous material is prevented;
  - use of machinery/vehicles will be strictly limited within the construction sites and along the appropriate access roads;
  - impervious (concrete etc.) surfaces will be designated for the refuelling of the machinery/vehicles, if it is not possible according to the nature of the Project, all refuelling tankers and all heavy machinery used at the Site will have an iron plate trays, and these trays will be placed under the pipe connection points to prevent accidental leakage to the soil during refuelling operations;
  - maintenance of the vehicles and machinery/equipment (if needed) will be conducted in designated area where there is impermeable surface (concrete floor etc.) and if needed secondary containment system present;
  - portable spill containment and clean-up materials (spill kits) will be made available and easily accessible at the construction site, instructions on how to use spill containment and clean-up materials will be included in the kits;
  - training on spill response, use of containment and clean-up material (spill kits) will be provided to works (including the subcontractor workers);
  - adequate and properly maintained tanks, paved ground, spill containment materials and proper secondary containment systems with sufficient volume will be provided for fuel/oil storage and for the storage of other fluids and hazardous substances to prevent loss into the soil;
  - wastewater flows from any field activities (i.e. excavations, drillings, re-fuelling and vehicle/equipment washing) will be properly managed;
  - polluted water (if any generated as a result of accidental leakages) will be properly collected or managed to prevent mixing with any water body and the topsoil/soil pollution.

8.1.4.3 Residual Impacts

8.1.4.3.1 Construction Phase

The residual impact on the hydrogeology and groundwater quality component after the application of the abovementioned mitigation measures during construction phase is presented in the following table.

Table 89 Impact Evaluation Matrix for Hydrogeology and Groundwater Quality Component During Construction Phase After Mitigation

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features		Impact Value	Mitigation effectiveness	Residual impact value
Hydrogeological Change	Duration:	Medium-short	Medium	Reversibility:	Long term	**Medium**	Medium-high	**Low**
	Frequency:	Continuous						
	Geo. Extent:	Local						
	Intensity:	Low						
Groundwater Pollution	Duration:	Medium-short	Very high	Reversibility:	Long term	**High**	Medium-high	**Low**
	Frequency:	Frequent						
	Geo. Extent:	Local						
	Intensity:	Low						

8.1.4.3.2 Commissioning and Operation Phase

The residual impact on the hydrogeology and groundwater quality component after the application of the abovementioned mitigation measures during commissioning and operation phase is presented in the following table.

Table 90 Impact Evaluation Matrix for Hydrogeology and Groundwater Quality Component During Commissioning and Operation Phase After Mitigation

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features		Impact Value	Mitigation effectiveness	Residual impact value
Hydrogeological Change	Duration:	Medium	Medium	Reversibility:	Long term	**High**	Medium-high	**Low**
	Frequency:	Continuous						
	Geo. Extent:	Local						
	Intensity:	Low						
Groundwater Pollution	Duration:	Medium-short	Very high	Reversibility:	Long term	**High**	Medium-high	**Low**
	Frequency:	Frequent						
	Geo. Extent:	Local						
	Intensity:	Low						

8.1.4.3.3 Decommissioning and Closure Phase

Decommissioning phase activities are likely to be very similar to the construction phase. The same considerations described for hydrogeology and groundwater quality during the construction phase would be applicable to the decommissioning phase for the groundwater pollution impact factor.

Decommissioning of infrastructures could have a ***positive impact*** if the natural state of the land is recovered.

8.1.4.4 Monitoring

Following monitoring activities are foreseen for ensuring the implementation and effectiveness of the proposed mitigation measures:

- Design checks, to ensure the measures listed above are in place (like concrete pavement in storage areas, collection pond underneath etc.) and, will be undertaken;
- The provided trainings on spill response, use of containment and clean-up material for the workers (including the subcontractors' workers) will be recorded;
- Routine site inspections will be carried out to ensure adequate amount of spill-response material such as spill-kits and metal trays will be present at the site and in each heavy machinery and records will be kept;
- Routine maintenance programme will be set-up and maintenance records will be kept for all vehicles and machinery/equipment.

8.1.5 Soil and Subsoil

8.1.5.1 Impact Analysis

8.1.5.1.1 Construction Phase

During the construction phase, impacts on the soil and subsoil characteristics component will be mainly associated to the following ***impact factors:***

- topsoil and lower soil removal;
- pollutant emissions to the soil, and
- the occupation of land.

The ***project actions*** related to the abovementioned impact factors are the following: surface levelling and grading, temporary stockpiling of material, transport of construction material, construction of the facilities and disposal of waste deriving from construction (including excavated soil).

Topsoil and lower soil removal: In the construction phase, activities related to civil engineering will involve excavation and removal of top and lower soil. It is planned to re-use the excavated material as much as possible, when technically feasible, and approximately 90% of the excavated soil planned to be used at site for refilling.

Pollutant emissions to the soil: Potential pollutant emissions to the soil can be caused by;

- pollution from vehicles such as oil spills;
- accidental spill of any chemicals or hazardous materials that might be used during the construction;
- runoff from area where chemical, oil and fuel are temporarily stored (i.e. areas where paving and covers are not present);
- runoff from the re-fuelling and vehicle/equipment washing areas (if such areas are present; i.e. area where paving and covers are not present);
- pollution caused by temporary storage of hazardous materials and/or wastes;
- disposal of wastes, wastewater and liquid wastes;
- emissions from truck traffic and transport of construction materials and excavated materials.

Occupation of land: There will be construction camp sites and stores established along the BBYO Route.

8.1.5.1.2 Commissioning and Operation Phase

During the commissioning and operation phase, impacts on the soil and subsoil characteristics component will be mainly associated to the following ***impact factors:***

- occupation of land/ increase of artificial land use, and
- pollutant emissions to the soil.

The ***project actions*** related to the abovementioned impact factors are the following: temporary storage and disposal of waste (including hazardous wastes such as diesel, oil and gear oil), presence of fuel storage tanks, switchyard and operation building and also operations of the facilities.

Occupation of land/ increase of artificial land: The presence of buildings and facilities will increase the artificial surfaces, as the structures are planned to be constructed on undeveloped land. Occupation of land/ increase of artificial land will occur due to the construction of new infrastructure (switchyard, operation building) and new roads.

<u>*Pollutant emissions to the soil:*</u> Impacts on soil/topsoil might arise from pollution due to:

- accidental leakages from areas where chemicals, oil and fuel (hazardous materials) are not properly stored (i.e. areas where properly maintained paving, closed interception drains and covers are not present);
- accidental leakages of hazardous materials/products or chemicals from the machinery/equipment;
- runoff from waste storage areas (especially hazardous waste storage area);
- leaks or spills of chemicals, oil and fuel from the diesel/fuel storage tanks, pipes and operations;
- accidental oil leakage.

8.1.5.1.3 Decommissioning and Closure Phase

The impacts during the decommissioning phase are likely to be similar to the construction phase hence the activities will be similar to construction activities. The same considerations described for soil and subsoil during the construction phase would be applicable to the decommissioning phase for the pollutant emissions to the soil. Traffic load will increase in the decommissioning and closure phase like in the construction phase and heavy trucks will cause emission of dust and pollutants on soil. The dust emissions will be increased during the demolition of the buildings, surface levelling, grading and temporary stockpiling of the material.

The decommissioning phase of the Project may result in the land use triggered by demolition activities. In such a case, a Demolition and Decommissioning Plan shall be prepared to include the management strategies for both environmental and social impacts.

At the end of the decommissioning phase, the soil restoration in the areas, once occupied by buildings and infrastructures might have an overall ***positive impact*** on the component. The impact factors; occupation of land and topsoil and lower soil removal will not be related to the decommissioning phase.

For the restoration activities; import soil from outside of the Project Area may be needed. If this will be the case;transportation of polluted soil and import of polluted soil is considered as a negative impact. In order to avoid such situations related mitigation measures (listed in the next section such as soil quality measurement before the transport of the soil from outside sources) should be taken into consideration.

8.1.5.2 Mitigation Measures

The mitigation measures for the construction, the commissioning/operation and decommissioning/closure phase are as follow:

- Measures incorporated in the Project Design:
  - worksite will be minimized to the smallest extent possible in order to meet Project's works and activities;
  - the foundations' footprints and depths have been properly dimensioned; hence the excavations and the consequent physical-mechanical disturbances will be minimized;
  - excavations and soil/subsoil abstractions will be minimized as possible in order to meet the building design and construction requirements;

  - part of the removed/excavated material might be re-used for fillings when it has the proper geotechnical characteristics in order to limit the use of raw material;
  - the areas, where the diesel/fuel storage tanks located (can be named as hazardous material storage areas), will be designed and constructed to avoid potential contamination into the soil (paved areas with sufficient secondary containment, proper drainage systems etc.);
  - the temporary waste storage areas will be constructed based on the requirements listed in the Regulation on Regular Storage of Wastes issued on March 26, 2010, at Official Gazette no:27533 and Regulation on Waste Management issued on April 02, 2015 Official Gazette no: 29314.
- General mitigation measures:
  - the Project will comply with relevant legal and project safety requirements to avoid leakages from hazardous materials (chemicals, liquids etc.) storage facilities on-site;
  - regular maintenance of vehicles and machinery/equipment will be undertaken to ensure that leakages of oil/fuel or any other hazardous material is prevented;
  - use of machinery/vehicles will be strictly limited within the construction sites and along the appropriate access roads;
  - impervious (concrete etc.) surfaces will be designated for the refuelling of the machinery/vehicles, if it is not possible according to the nature of the Project, all refuelling tankers and all heavy machinery used at the Site will have an iron plate trays, and these trays will be placed under the pipe connection points to prevent accidental leakage to the soil during refuelling operations;
  - maintenance of the vehicles and machinery/equipment (if needed) will be conducted in designated area where there is impermeable surface (concrete floor etc.) and if needed secondary containment system present;
  - portable spill containment and clean-up materials (spill kits) will be made available and easily accessible at the construction site, instructions on how to use spill containment and clean-up materials will be included in the kits;
  - training on spill response, use of containment and clean-up material (spill kits) will be provided to works (including the subcontractor workers);
  - adequate and properly maintained tanks, paved ground, spill containment materials and proper secondary containment systems with sufficient volume will be provided for fuel/oil storage and for the storage of other fluids and hazardous substances to prevent loss into the soil;
  - wastewater flows from any field activities (i.e. excavations, drillings, re-fuelling and vehicle/equipment washing) will be properly managed;
  - polluted water (if any generated as a result of accidental leakages) will be properly collected or managed to prevent the topsoil/soil pollution;
  - if some construction areas need to be located onto vegetated and uncontaminated land, in order to reduce loss of topsoil due to project actions during the construction phase, the topsoil will be temporarily removed and properly stockpiled to be used for landscaping in the stripped areas upon completion of the works as required by the Regulation on Excavation, Construction and Demolition Wastes issued on March 18, 2004 at Official Gazette no.25406;

- if some vegetated/uncontaminated land is expected to be permanently removed (e.g. onto the new buildings' footprints and the roads), the topsoil should be properly stored (as required by the Regulation on Excavation, Construction and Demolition Wastes issued on March 18, 2004 at Official Gazette no.25406) and re-used for reclamation of nearby artificial sites;

- Specific mitigation measures for contaminated soil:
  - If soil contamination is suspected during construction related excavation, a detailed assessment should be conducted in order to determine if there are any contaminants sources present within the site or in the near vicinity and the provisions of "Regulation on Soil Pollution Control and Point Source Contaminated Sites" should be implemented;
  - In case that results of a soil assessment show the compliance with site-specific soil quality limits set by the regulation, materials coming from levelling activities could be excavated, transported, and used in the construction of embankments and/or backfill, after an assessment of physical properties;
  - If the soil is contaminated, it is recommended to work with the local regulatory agencies to select solutions for treatment or disposal, follow the provision of the abovementioned regulation and in general to follow a standard practice:
    - avoid or minimize temporary stockpiling of contaminated soils or hazardous material;
      - if temporary stockpiling is necessary:
        - isolate the stockpile with impermeable liner or tarps;
        - install a berm around the stockpile to prevent runoff, from leaving the area;
        - do not stockpile in or near storm drains or water bodies or unconfined aquifer zones with high groundwater elevation

8.1.5.3 Residual Impacts

8.1.5.3.1 Construction Phase

The residual impact on the soil and subsoil component after the application of the abovementioned mitigation measures during construction phase is presented in the following table.

Table 91 Impact Evaluation Matrix for Soil and Subsoil Characteristics During Construction Phase After Mitigation

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features		Impact Value	Mitigation effectiveness	Residual impact value
Topsoil and lower soil removal	Duration:	Short	Low	Reversibility:	Irreversible	**Low**	Medium-high	**Negligible**
	Frequency:	Frequent						
	Geo. Extent:	Local						
	Intensity:	High						
Pollutant emissions to the soil	Duration:	Medium-short	Medium	Reversibility:	Long term	**Medium**	Medium	**Low**
	Frequency:	Moderately frequent						
	Geo. Extent:	Local						
	Intensity:	Medium						
Occupation of land	Duration:	Medium-short	Low	Reversibility:	Long term	**Low**	Medium-high	**Negligible**
	Frequency:	Moderately frequent						
	Geo. Extent:	Project footprint						
	Intensity:	High						

8.1.5.3.2 Commissioning and Operation Phase

The residual impact on the soil and subsoil component after the application of the abovementioned mitigation measures during commissioning and operation phase is presented in the following table.

Table 92 Impact Evaluation Matrix for Soil and Subsoil Characteristics During Commissioning and Operation Phase After Mitigation

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features		Impact Value	Mitigation effectiveness	Residual impact value
Pollutant emissions to the soil	Duration:	Medium-long	Medium	Reversibility:	Long term	**Medium**	Medium	**Low**
	Frequency:	Frequent						
	Geo. Extent:	Project footprint						
	Intensity:	Low						
Occupation of land	Duration:	Medium-long	Medium	Reversibility:	Long term	**High**	Medium	**Medium**
	Frequency:	Continuous						
	Geo. Extent:	Project footprint						
	Intensity:	Medium						

8.1.5.3.3 Decommissioning and Closure Phase

Decommissioning phase activities are likely to be very similar to the construction phase. The same considerations described for soil and subsoil during the construction phase would be applicable to the decommissioning phase for the pollutant emissions to the soil.

At the end of the decommissioning phase, the soil restoration in the areas, once occupied by buildings and infrastructures might have an overall ***positive impact*** on the component if the natural state of the land is recovered

8.1.5.4 Monitoring

Following monitoring activities are foreseen to ensure the implementation and effectiveness of the proposed mitigation measures:

- Routine site inspections will be carried out and reported to identify any possible leakages;
- Routine site inspections will be carried out to ensure that the planned construction site boundaries are not expanded;
- Routine site inspections will be carried out for the road construction and dust suppression activities and these inspections should be recorded;
- The provided trainings on spill response, use of containment and clean-up material for the workers (including the subcontractors' workers) will be recorded;
- Routine site inspections will be carried out to ensure adequate amount of spill-response material such as spill-kits and metal trays will be present at the site and in each heavy machinery and records will be kept;
- Routine maintenance programme will be set-up and maintenance records will be kept for all vehicles and machinery/equipment;

Soil quality measurements will be conducted if any complaint received from local community and/or authorities, and the result will be compared with the baseline measurement conducted in the scope of ESIA

8.1.6 Air Quality

Considering the baseline measurement results and the proximity of the nearest sensitive locations to the railway line, the sensitivity of the AoI can be evaluated as Very High.

8.1.6.1 Air Quality Baseline Summary

In order to determine air quality baseline along the planned railway and in its vicinity, 16 representative receptors (mostly the closest sensitive receptor to the planned railway) have been identified within the assessment area. The air quality measurement studies were carried out by BATI Laboratuvarı Çevre Ölçüm Hizmetleri Bilişim Müh. Müş. San. ve Tic. LTD. ŞTİ. PM_{10} and $PM_{2.5}$ measurement studies were performed on 13-14 March of 2021 in line with TS EN 12341 standard.

The baseline measurement results were presented in Table 45. All the baseline measurement results (PM_{10} and $PM_{2.5}$) are under both Turkish and IFC limits.

Also, additional SO_2, NO_2 and settled dust measurements have been carried out for the same sampling locations. However, the laboratory measurement report is still in preparation.

During the modelling studies for PM_{10}, these 16 baseline measurement locations were included in the model runs as discrete receptors (sensitive receptor) and the modelling results assessed cumulatively with the measurement results in these locations.

Also, 3 discrete receptors for the lakes (Kuş, Gölbaşı, and Ulubatlı Lakes) close to the railway line were also included into the model runs. For these receptors, considering the proximity of the measurement points to the lakes, the following baseline measurement results were used as background concentrations in order to assess the model results cumulatively:

- Baseline Result of 15. Measurement Point were used for Kuş Lake,
- Baseline Result of 16. Measurement Point were used for Uluabat Lake, and
- Baseline Result of 8. Measurement Point were used for Gölbaşı Lake.

8.1.6.2 Air Quality Modelling Methodology

The construction phase emissions are calculated, and atmospheric dispersion of air pollutants are simulated by AERMOD (American Meteorological Society/Environmental Protection Agency Regulatory Model). AERMOD is a steady-state Gaussian dispersion model that represents the current state-of-the-science and preferred dispersion model of the U.S. EPA (U.S. Environmental Protection Agency). The model forecasts dispersion of the pollutants in the atmosphere, through mathematical formulations[23] which take into account the 1) hourly meteorological data (for at least one-year period), 2) topographical data for the modelling domain and receptor network, and 3) pollutant source data, which are described below in detail.

AERMOD, together with these data, estimates the concentration of pollutants at specified ground-level receptors surrounding an emissions source. AERMOD model is capable of calculating both short-term and long-term averages for any user-defined period.

AERMOD atmospheric dispersion modelling system includes 3 modules. These are;

- AERMOD

[23]https://www3.epa.gov/scram001/7thconf/aermod/aermod_mfd.pdf

- AERMAP, and
- AERMET.

AERMOD is a linear, steady state Plume modeling. It also has Gaussian Plume characteristics. AERMOD Modeling system can be applied in many different resource types. It incorporates advanced algorithms such as plume rise and buoyancy, penetration in the rising inversion, surface level at the source, vertical profile of the winds, turbulence and heat, land effect. The performance of the AERMOD program may vary according to the land topogrophy and different emission sources. It can give realistic results at high concentrations.

AERMAP is a terrain preprocessor. Its main purpose is to provide a physical relationship between air pollution behavior and terrain properties. It generates position and elevation data for each peak location.

AERMET is a meteorological data preprocessor. It accepts surface meteorological data and upper atmosphere layer data. AERMET calculates the atmospheric parameters required for the dispersion model such as atmospheric turbulence characteristics, friction velocity and heights. AERMOD requires hourly meteorological data in the upper atmosphere layer to simulate pollutant dispersion.

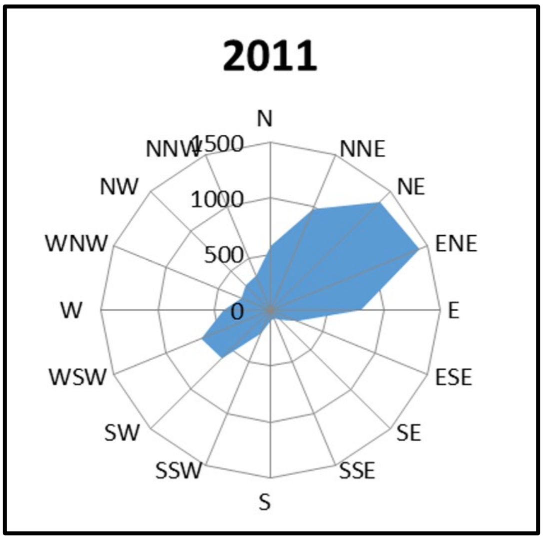
8.1.6.2.1 Meteorological Data

AERMOD model uses “hourly meteorological” data in order to define rising of the pollutant cloud, movement and accumulation. AERMET, the meteorological pre-processor of AERMOD model, requires two types of meteorological data inputs: hourly surface observations and twice-daily upper air soundings.

Turkish State Meteorological Service (TSMS) has been consulted for the determination of the meteorological stations and the meteorological data year that is representative of the long-term meteorological conditions in the region. With regards to the TSMS’ opinion, the hourly data of Aliağa Meteorological Station for 2018 has been used in the modelling studies. The official correspondence with the TSMS is presented in Appendix X.

To produce AERMET required data files; Meteorological data are obtained from existing meteorology stations in the region. For the AERMOD model, hourly surface station data measured at air conditioning, synoptic or automatic type stations and meteorological sounding data measured at ravinsonde type stations are required. Hourly meteorological data sets were obtained from Bursa Meteorology Station and the upper air sounding data set from Istanbul Regional Meteorology Station. Regional characteristics, such as surface roughness coefficient, Bowen ratio and albedo have been determined with regards to EPA AERMET user manual.

The annual wind rose is presented in Figure 78. The dominant wind direction for the region is East-North-East (ENE). Second and third most frequent wind directions are North (N) and North-North-East (NE) respectively.



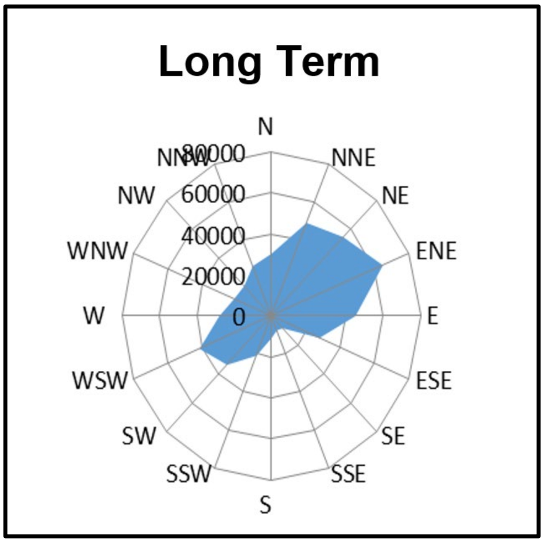


Figure 78: Wind Rose Belonging to 2011 and Long-term Data of Bursa Meteorological Station

8.1.6.2.2 Receptors and Topography

According to the Annex-2 of Regulation on Control of Industrial Air Pollution (SKHKKY), if the surface distribution of emission sources are larger than 0.04 km^2, the study area is a square-shaped area with a side length of 2 km, the source being in the middle of square area. Study area is taken as basis in determining the distribution of emission sources on the surface. As mentioned above, 6 different scenarios were modelled, therefore 6 different study areas were determined for each scenario.

When determining the study area and receptors for Scenario-1, Scenario-2, Scenario-3, Scenario-4 and Scenario-5, firstly four parallel lines were drawn at each 250-meter intervals on the right and left sides of the line (the railway line to be excavated and filled is in the center), and then three parallel lines were drawn at 1000-meter intervals. (Figure 79). Receptors are defined at 500 meters intervals on the parallel lines drawn on the right and left (upper and lower depending on the position of the line) of the line (Figure 80). Thus, study area of 4000 meters for one side and 8000 meters in total was determined.

1466 receptors for Scenario-1, 980 receptors for Scenario-2, 957 receptors for Scenario-3, receptors 1673 for Scenario-4, receptors 1393 for Scenario-5 with a total of 6469 receptor were identified. Thus, the settlements on both the right and left (both upper and lower depending on the position of the line) of the line will be defined as a receptor.

A square area with a side length of 4 km has been selected as study area for Scenario-6. This area was divided into 16 sub-study areas with a side length of 1 km, and 144 peaks were formed by determining the points where the 500 m radius, drawn on the emission source with successive angles of 10 degrees clockwise, cuts the arc remaining in the 16 square-shaped study area (Figure 85).

The representation of the study areas and receptors selected within the scope of the air quality dispersion modeling study are given in Figure 81,Figure 82,Figure 83,Figure 84,Figure 85 and Figure 86.

Also, the coordinates of the measurement points and the points where the contribution values to air pollution are calculated for Kuş Lake, Gölbaşı and Ulubat Lake, which are defined as discrete receptors in the model runs, are given in Table 93.

Table 93: Coordinates of Discrete Receptors (Sensitive Receptors) Included in the Model

Receptor	Coordinates (ED-50, UTM Zone 35)	
	X	Y
A1	583073.09	4465900.03
A2	593631.41	4451687.22
A3	612535.54	4455575.25
A4	630017.65	4464387.31
A5	647573.76	4460760.29
A6	666887.89	4461002.30
A7	686103.01	4458949.30
A8	705503.14	4455900.29
A9	761312.89	4469904.42
A10	761617.98	4471160.05
A11	729380.32	4459261.41
A12	725131.13	4459366.34
A13	715006.04	4459210.47
A14	678601.15	4460755.03
A15	590203.12	4454203.22
A16	617147.21	4455753.16
Kuş Lake	589890.10	4453002.91
Ulubat Lake	625411.10	4453020.01
Gölbaşı Lake	698831.48	4455379.52

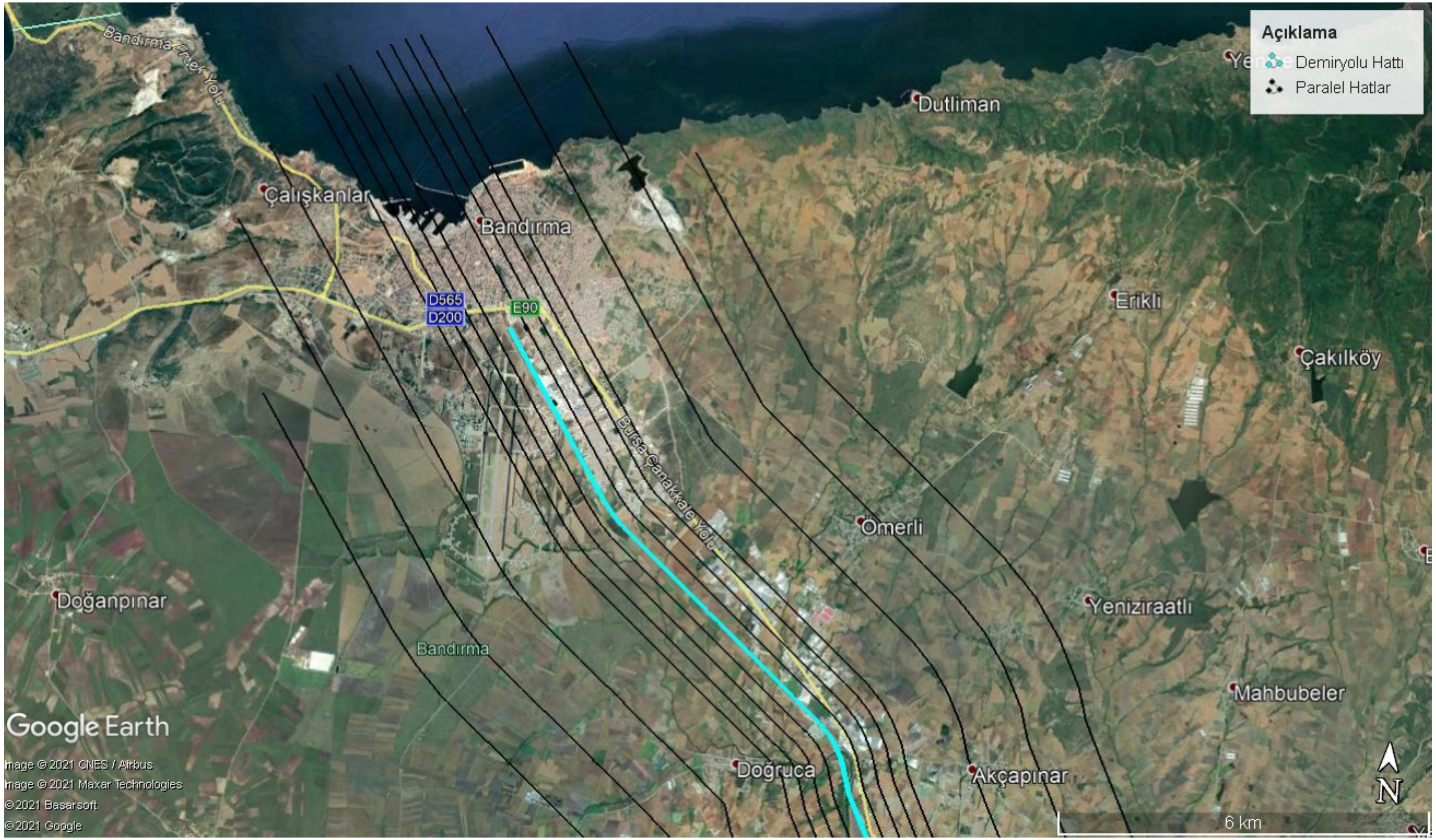


Figure 79: Railway Line and Parallel Receptor Lines Used in the Model

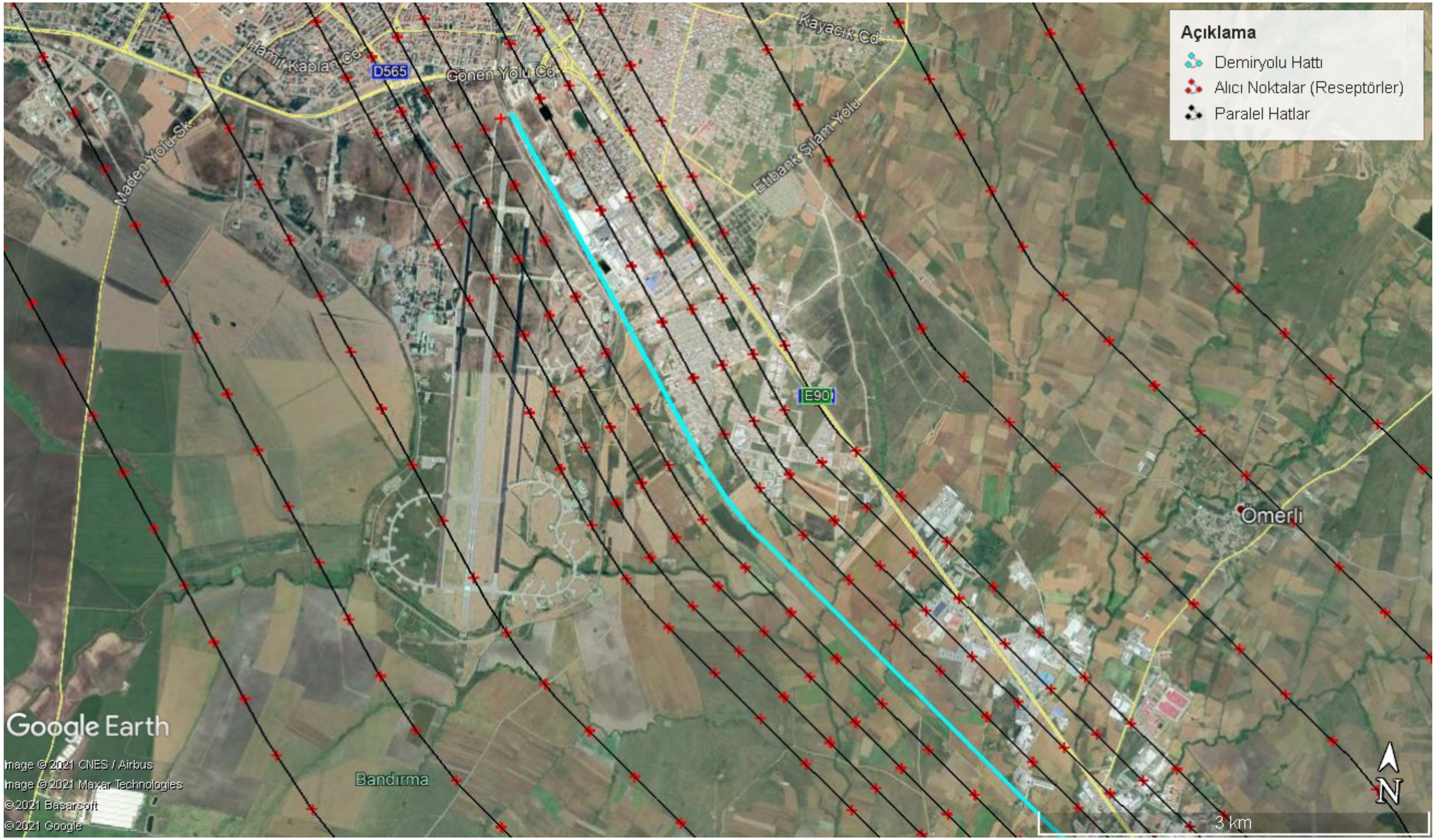


Figure 80: Grid Receptors Used in the Model

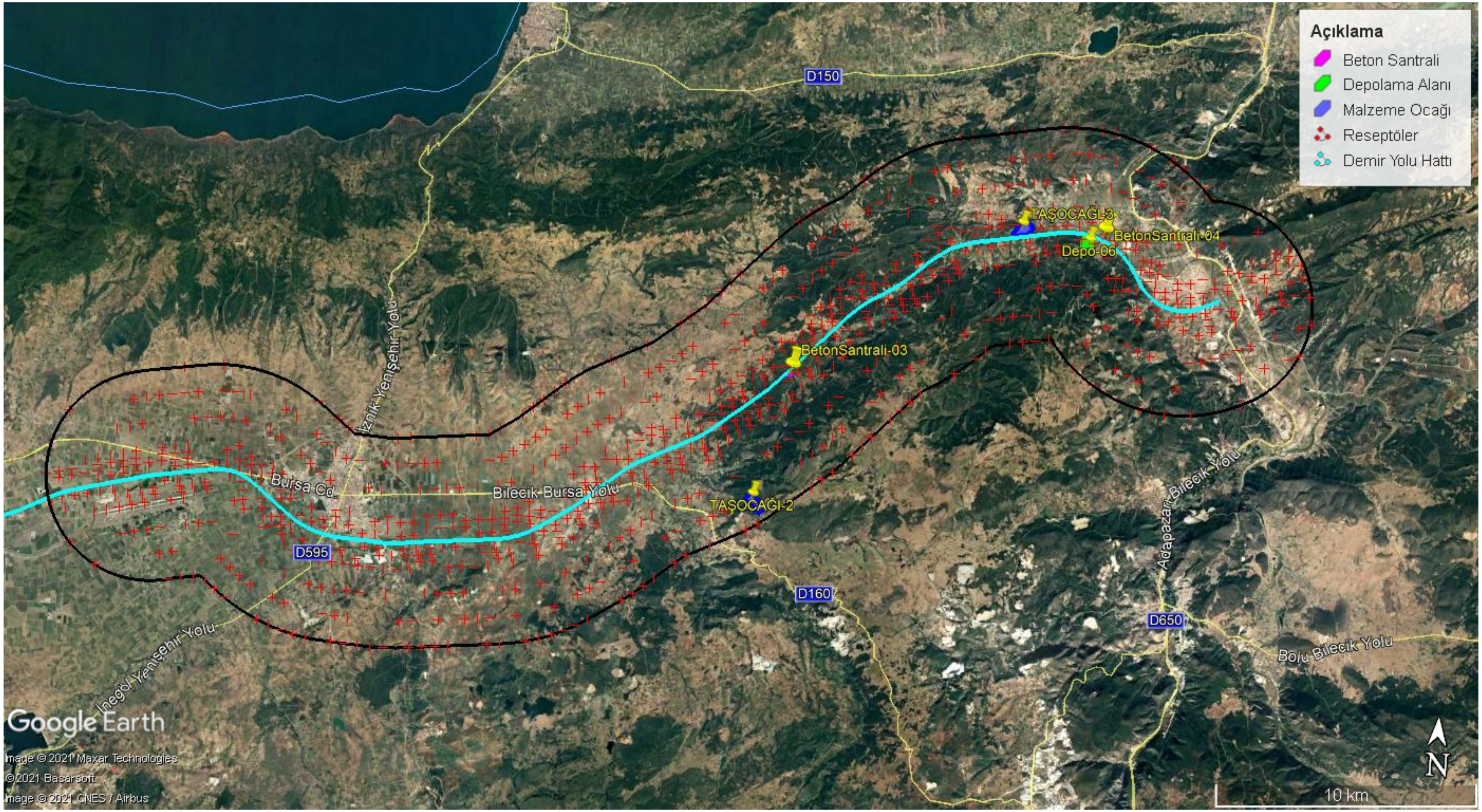


Figure 81: Scenario-1: Section-1 (Osmaneli Section) Study Area

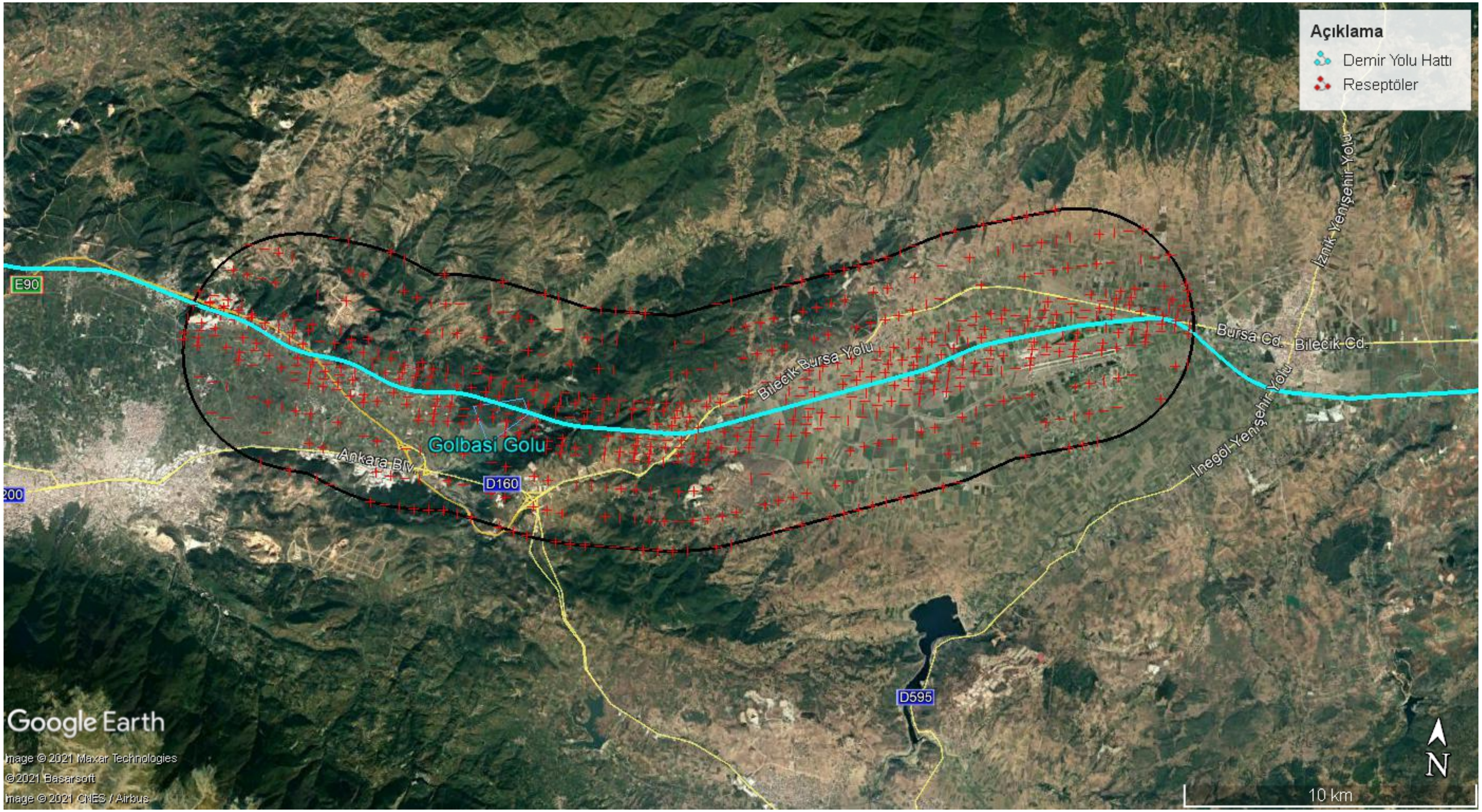


Figure 82: Scenario-2: Section-2 (Bursa – Yenişehir between 74.2 km – 101.7 km) Study Area

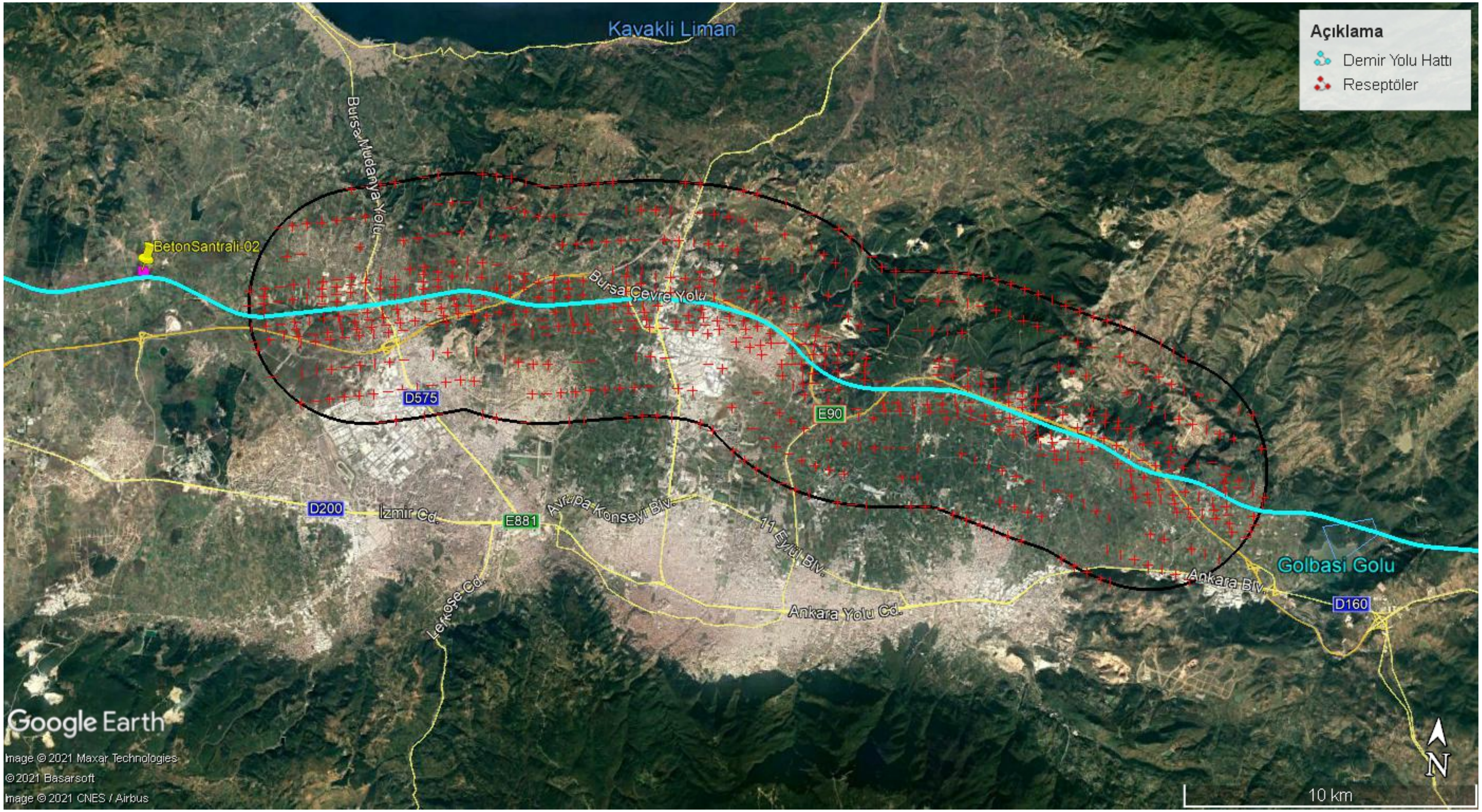


Figure 83: Scenario-3: Section-2 (Bursa – Yenişehir between 46.03 km – 74.2 km) Study Area

Figure 84: Scenario-4: Section-3 (Bandırma – Bursa Route between 53.8 km – 96.7 km) Study Area

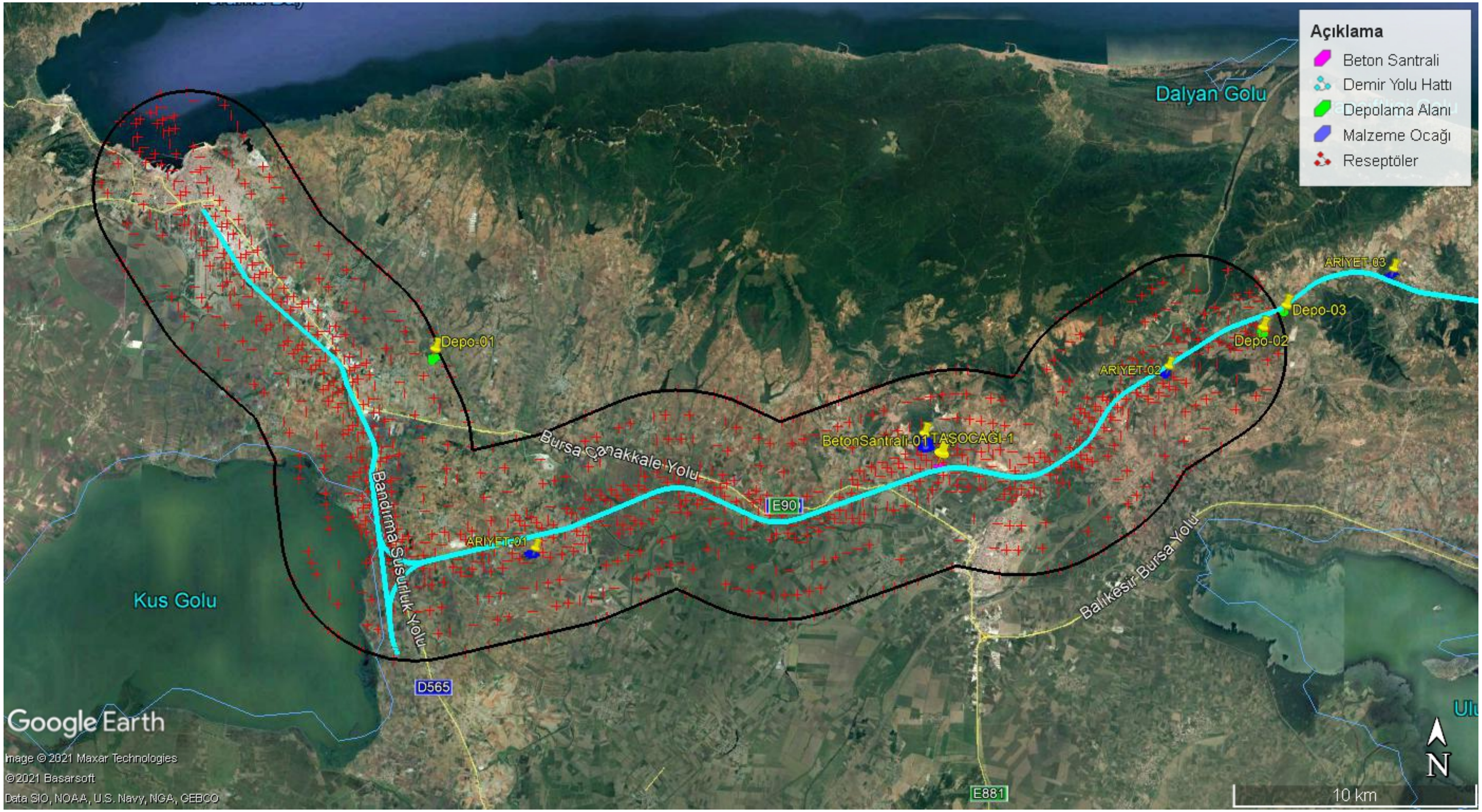


Figure 85: Scenario-5: Section-3 (Bandırma - Bursa Route between 0 – 53.8 km) Study Area

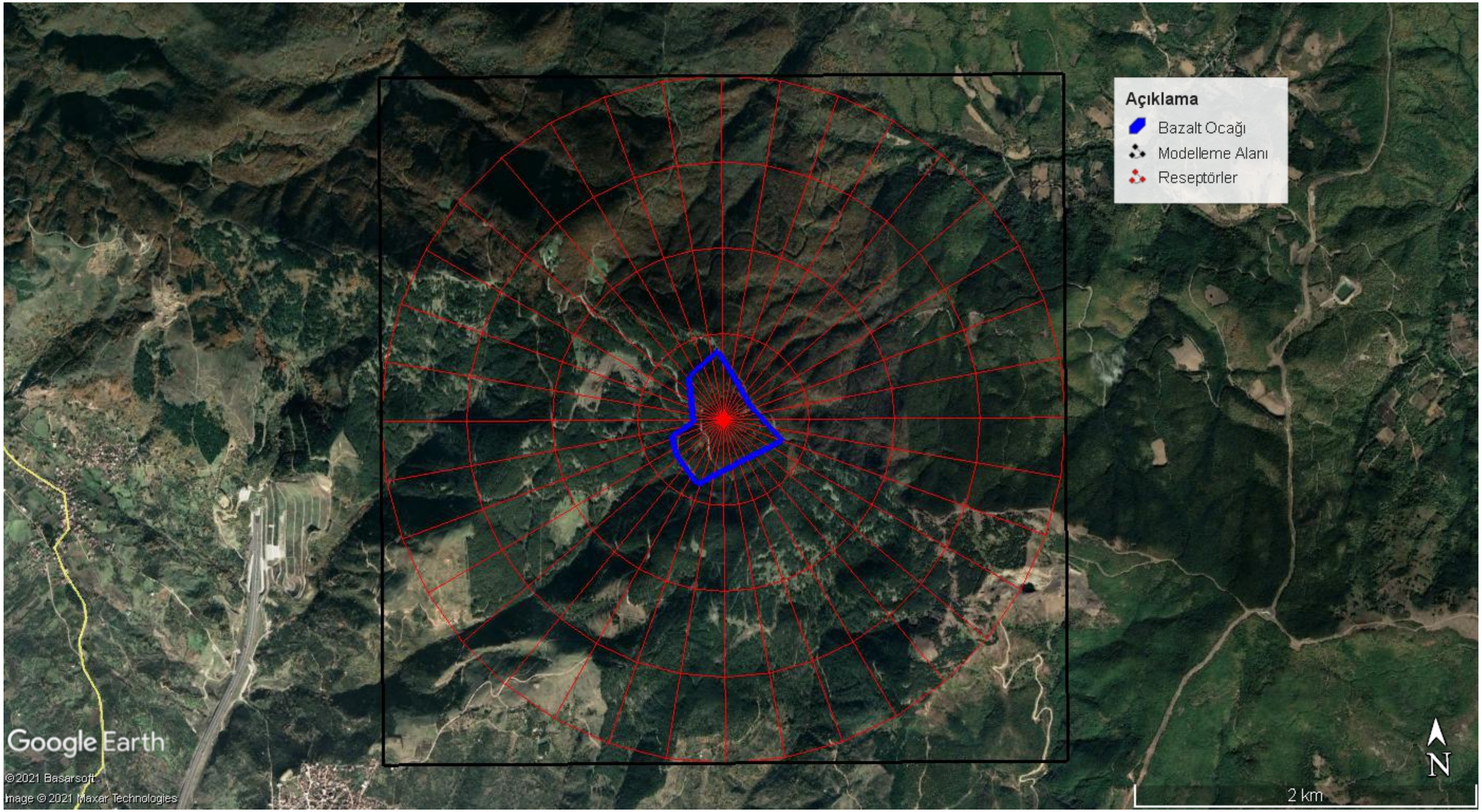


Figure 86: Scenario-6: Basalt Quarry Study Area

8.1.6.2.3 Pollutant Sources

The emission sources and emission rates for construction phase are discussed in detail in the following section.

8.1.6.3 Impact Analysis

In this section, construction and operation phase emissions were analysed. Construction phase emissions were estimated by use of emission factors taken from literature by modelling with 6 different scenarios covering all the Project units that emit sources.

8.1.6.3.1 Construction Phase

Construction activities may generate emission of fugitive dust caused by a combination of cut excavation / backfilling activities on the railway route, excavation activities to be carried out for the engineering structures, and the production activities in the material sites to be operated in order to supply the filling and concrete aggregate material required in the Project.

During the construction activities, the emission scenarios will be mainly focused on the dust suspension generated by excavation and filling, the stockpiling of the material, activities from quarries, activities from quarries and blasting.

Emissions factors (see Table 94) defined in the Regulation on Industrial Air Quality Pollution Control, Annex 12, are used to calculate dust emissions from excavation and fill operations. Uncontrolled emission factors represent the situations where activities are carried out without taking any mitigation measures. On the other hand, the controlled factors stand for the cases where activities are carried out with measures in place such sprinkling, using closed haulage systems, keeping materials moist, loading and unloading without skidding, etc.

Table 94: Emission Factors used in Dust Emission Estimation

Source of emission	Emission factors kg/ton	
	Uncontrolled Conditions	Controlled Conditions
Excavation (kg/ton)	0.025	0.0125
Loading (kg/ton)	0.010	0.005
Unloading (kg/ton)	0.010	0.005
Storage (kg/ha.day)	5.8	2.9
Transportation (total distance) (kg/km-vehicle)	0.7	0.35

8.1.6.3.1.1 Dust Emissions

For the control of dust emission during construction activities, the working area will be irrigated in certain periods. Since control measures will be taken in construction activities, the emission rate of dust emission from construction activities has been calculated by using the emission factors given for the controlled situation.

Dust Emissions from Cut Excavation and Backfilling Activities along the Railway Route

Bandırma-Bursa-Yenişehir-Osmaneli High Standard Railway Project Route consists of 3 main sections:

- Osmaneli-Yenişehir = Section 1

- Yenişehir - Bursa = Section 2
- Bursa – Bandırma = Section 3

Excavation and backfilling amounts are presented in below table:

Table 95: Excavation and Backfilling Materials Amount

Railway Section	Excavation (m^3)	Backfilling (m^3)	Concrete (m^3)
Section 1 (~ 51.690 km)	13.381.452	12.430.927	607.363
Section 2 (~ 55.670 km)	8.350.000	2.100.000	550.000
Section 3 (~ 96.000 km)	5.966.278	2.896.134	1.033.708

Construction activities of the project will take 3.5 years. Dust emissions calculeted in accordance with the excavation / backfilling amounts presented in Table 96, the dust emissions are shown in Table 97 and Table 98.

Table 96: Total Excavation and Backfilling Amounts

Section 1	Amount (m^3)	Annual (m^3)	Monthly (m^3)	Daily (m^3)	Hourly (m^3)	Hourly (ton) [Density=2 ton/m^3 assumed]
Total Excavation	13,381,452	3,823,272	318,606	10,620.2	885	1,770
Total Backfill	12,430,927	3,551,693.4	295,974.5	9,865.82	822.15	1,644.3
Section 2	**Amount (m^3)**	**Annual (m^3)**	**Monthly (m^3)**	**Daily (m^3)**	**Hourly (m^3)**	**Hourly (ton)**
Total Excavation	8,350,000	2,385,714	198,809.5	6,626.9	552.4	1,104.4
Total Backfill	2,100,000	600,000	50,000	1,666.6	138.8	277.7
Section 3	**Amount (m^3)**	**Annual (m^3)**	**Monthly (m^3)**	**Daily (m^3)**	**Hourly (m^3)**	**Hourly (ton)**
Total Excavation	5,966,278	1,704,650,916	142,054.2	4,735,141	394,595.1	789.2
Total Backfill	2,896,134	827,466,9666	68,955.58	2,298,519	191,543.3	383.1

Table 97: Dust Emission from Excavation Activities

Railway Section	Dismantling	Loading	Total
Section 1	1770 ton/h x 0.0125 kg/ton=22.13 kg/hr	1770 ton/h x 0.005 kg/ton=8.85 kg/h	**30.98 kg/hr**
Section 2	1104.4 ton/h x 0.0125 kg/ton=13.81 kg/hr	1104.4 ton/h x 0.005 kg/ton=5.52 kg/h	**19.33 kg/hr**
Section 3	789.2 ton/h x 0.0125 kg/ton=9.86 kg/hr	789.2 ton/h x 0.005 kg/ton=3.95 kg/h	**13.81 kg/hr**

Table 98: Dust Emission from Backfilling Activities

Railway Section	Loading	Unloading	Total
Section 1	1644,3 ton/h x 0,005 kg/ton=8,22 kg/hr	1644,3 ton/h x 0,005 kg/ton=8,22 kg/h	**16,44 kg/hr**
Section 2	277,7 ton/h x 0,005 kg/ton=1,38 kg/hr	277,7 ton/h x 0,005 kg/ton=1,38 kg/h	**2,76 kg/hr**
Section 3	383,1 ton/h x 0,005 kg/ton=1,92 kg/hr	383,1 ton/h x 0,005 kg/ton=1,92 kg/h	**3,84 kg/hr**

Dust Emissions from Storage Activities

Excavation material (excavation amount 3,663.6 kg/hr) generated during the construction activities of the Project will be stored in 6 storage areas with a total size of 50.4 ha, depending on the size of the storage areas. Dust emissions expected to occur in storage areas are given in Table 6.

Table 99: Dust Emission results from Storage Areas

Storage Area	Unloading	Storage	Total
Bandırma Akçapınar – 8 ha (WAREHOUSE-1)	581.4 ton/hr x 0.005 kg/ton = 2.91 kg/hr	2.9 kg/ha-day x 8 ha x 1 day/24 hr = 0.96 kg/hr	**3.87 kg/hr**
Karacabey Canbaz – 8 ha (WAREHOUSE-2)	581.4 ton/hr x 0.005 kg/ton = 2.91 kg/hr	2.9 kg/ha-day x 8 ha x 1 day/24 hr = 0.96 kg/hr	**3.87 kg/hr**
Karacabey Canbaz 2 – 5 ha (WAREHOUSE-3)	363.5 ton/hr x 0.005 kg/ton = 1.82 kg/hr	2.9 kg/ha-day x 5 ha x 1 day/24 hr = 0.6 kg/hr	**2.42 kg/hr**
Karacabey Muratlı – 8 ha (WAREHOUSE-4)	581.4 ton/hr x 0.005 kg/ton = 2.91 kg/h	2.9 kg/ha-day x 8 ha x 1 day/24 hr = 0.96 kg/hr	**3.87 kg/hr**
Karacabey Muratlı 2 – 5 ha (WAREHOUSE-5)	363.5 ton/hr x 0.005 kg/ton = 1.82 kg/hr	2.9 kg/ha-day x 5 ha x 1 day/24 hr = 0.6 kg/hr	**2.42 kg/hr**
WAREHOUSE-6 (16,4 ha)	1192.1 ton/hr x 0.005 kg/ton = 5.96 kg/hr	2.9 kg/ha-day x16.4 ha x 1 day/24 hr = 1.98 kg/hr	**7.94 kg/hr**

Dust Emissions from Borrow Pits (quarries)

The production capacities of the quarries planned to be operated for the project are given in Table 100, and dust emission calculations are given in Table 101.

Table 100: Production Capacities for Quarries

Material	Name	Total Production (m^3)	Annual (m^3)	Monthly (m^3)	Daily (m^3)	Hourly (m^3)	Hourly (ton) [d=2.6 ton/m^3 assumed]
Quarry-01	Karacabey Quarry	2,500,000	714,285.71	59,523.81	1984.13	165.34	429.89

Material	Name	Total Production (m^3)	Annual (m^3)	Monthly (m^3)	Daily (m^3)	Hourly (m^3)	Hourly (ton) [d=2.6 ton/m^3 assumed]
Quarry-02	Necmiyeköy Quarry	2,000,000	571,428.57	47,619.05	1587.30	132.28	343.92
Quarry-03	Düzmeşe Quarry	1,000,000	285,714.29	23,809.52	793.65	66.14	171.96
Basalt	Kalyon Mad.	500,000	142,857.1	11,904.7	396.83	33.07	85.98
Material	**Name**	**Total Production (m^3)**	**Annual (m^3)**	**Monthly (m^3)**	**Daily (m^3)**	**Hourly (m^3)**	**Hourly (ton) [d=1.8 ton/m^3 assumed]**
Borrowed Pit	Borrowed-01	500,000	142,857.1	11,904.7	396.83	33.07	59.5
Borrowed Pit	Borrowed -02	450,000	128,571.4	10,714.3	357.14	29.76	53.6
Borrowed Pit	Borrowed -03	650,000	185,714.3	15,476.2	515.87	42.99	77.4
Borrowed Pit	Borrowed -04	550,000	157,142.8	13,095.2	436.51	36.38	65.5
Borrowed Pit	Borrowed -05	850,000	242,857.1	20,238.1	674.60	56.22	101.2

Table 101: Dust Emissions from Borrowed Pits

Name	Dismantling	Loading	Total
Quarry-01	429.89 ton/hr x 0.0125 kg/ton =5.37 kg/hr	429.89 ton/hr x 0.005 kg/ton =2.15 kg/hr	**7.52 kg/h**
Quarry -02	343.92 ton/hr x 0.0125 kg/ton =4.3 kg/hr	343.92 ton/hr x 0.005 kg/ton =1.72 kg/hr	**6.02 kg/h**
Quarry -03	171.96 ton/hr x 0.0125 kg/ton =2.15 kg/hr	171.96 ton/hr x 0.005 kg/ton =0.86 kg/hr	**3.01 kg/h**
Basalt	85.98 ton/hr x 0.0125 kg/ton =1.07 kg/hr	85.98 ton/hr x 0.005 kg/ton =0.43 kg/hr	**1.5 kg/h**
Borrowed Pit -01	59.5 ton/hr x 0.0125 kg/ton =0.74 kg/hr	59.5 ton/hr x 0.005 kg/ton =0.29 kg/hr	**1.03 kg/h**
Borrowed Pit -02	53.6 ton/hr x 0.0125 kg/ton =0.67 kg/hr	53.6 ton/hr x 0.005 kg/ton =0.27 kg/hr	**0.94 kg/h**

Name	Dismantling	Loading	Total
Borrowed Pit -03	77.4 ton/hr x 0.0125 kg/ton =0.96 kg/hr	77.4 ton/hr x 0.005 kg/ton =0.39 kg/hr	**1.35 kg/h**
Borrowed Pit -04	65.5 ton/hr x 0.0125 kg/ton =0.82 kg/hr	65.5 ton/hr x 0.005 kg/ton =0.33 kg/hr	**1.15 kg/h**
Borrowed Pit -05	101.2 ton/hr x 0.0125 kg/ton =1.26 kg/hr	101.2 ton/hr x 0.005 kg/ton =0.51 kg/hr	**1.77 kg/h**

Dust Emissions from Concrete Plants

The capacity of the concrete plants to be used within the scope of the project has been accepted as 120 m^3/hr. 75% of the raw material used in concrete plants consists of aggregate (90 m^3/hr; 234 tons/hr). In Table 102, dust emission calculations originating from each concrete plant are given.

Table 102: Dust Emission Originated from Each Concrete Plant

Material Loading to Bunker	Total
234 ton/h x 0.005 kg/ton=2.93 kg/h	**1.17**

Dust Emissions from Blasting Activities

It is planned to conduct minimum of 4 blasting in every 2 days for each tunnel. It is planned to conduct 2 blasting activities weekly. It is planned to conduct 3 blasting each week in the borrow pits. Dust emission calculations due to blasting activities are given in Table 103.

Table 103: Dust Emissions from Blasting Activities

Blasting	Calculation
Quarries	According to the blasting pattern: the rise = 10 m, loading distance = 2.84 m, distance between holes = 3.55 m Surface area = loading distance x distance between holes x Number of holes = 2.84 m x 3.55 m x 62 holes = 625 m^2. Emission factor (PM ≤ 30µm) = 0.00022 x $A^{1,5}$ A: surface area(m^2), depth ≤ 21 m Emission factor unit: with the kg/blasting formula EF (PM<30µm) = **3.44 kg/blasting**.
Tunnels	According to the blasting pattern hole length= 2.3 m, loading distance = 0.96 m, distance between holes = 0.77 m Surface area = loading distance x distance between holes x Number of holes = 0.96 m x 0.77 m x 88 hole = 65 m^2. Emission factor (PM ≤ 30µm) = 0.00022 x $A^{1,5}$ A: surface area(m^2), depth ≤ 21 m

Blasting	Calculation
	Emission factor unit: with the kg/blasting formula EF (PM<30µm) = **0.11 kg/blasting**.
Along the route	According to the blasting pattern hole length = 10 m, loading distance = 3.28 m, distance between holes = 3.4 m. Surface area = loading distance x distance between holes x Number of holes = 3.28 m x 3.4 m x 65 holes = 725 m^2. Emission factor (PM ≤ 30µm) = 0.00022 x $A^{1,5}$ A: surface area(m^2), depth ≤ 21 m Emission factor unit: with the kg/blasting formula EF (PM<30µm) = **4.3 kg/blasting**.

Total Dust Emission

Total dust emission within the scope of the project is presented in Table 104.

Table 104: Total Dust Emissions

Activity	Emission (kg/hr)
Excavation	64.12
Backfilling	23.04
Stırage	24.39
Quarries	24.29
Concrete Plant	4.68
Blasting	7.85
TOTAL	**148.37**

Dust emissions originating from all emission sources are given in Table 104 and the total emission (148.37 kg/hr) is compared with the limit value (1 kg/hr) given in the Table 13 in Annex-2 of the SKHKKY. Since the calculated total dust emission is higher than 1 kg/hr, it is required to carry out air quality dispersion modelling study for dust emissions and calculate the contribution values to air pollution according to the SKHKKY.

8.1.6.3.1.2 Modelled Scenarios

Excavation and backfilling amounts are different for Section-1 (Osmaneli-Yenişehir), Section-2 (Yenişehir-Bursa) and Section-3 (Bursa-Bandırma), so the modelling studies have been conducted differently for each section.

The Aermod software models contribution values to air pollution up to a maximum of 50 km. For this reason, the modelling study has been carried out by dividing the Section-2 and Section 3 routes with a horizontal length of 2 parts.

Within the scope modeling studies, the quarries (except for basalt quarry which is modelled separately due the distance) that will provide raw materials to the project, concrete plants and storage areas are evaluated cumulatively.

Since the distance between the route and the basalt quarry is 35 km, the modelling study of this basalt quarry has been conducted differently.

Detail information regarding with the scenarios are presented in Table 105 and Figure 87.

Table 105: Modelled Scenarios

Scenario No	Sources
Scenario-1 **Section-1**	■ Yenişehir - Osmaneli Route, Escape Tunnels, ■ Quarry-2 ■ Quarry-3 ■ Concrete Plant-3 ■ Concrete Plant-4 ■ Storage Area-6
Scenario-2 **Section-2**	■ Bursa-Yenişehir (74,2 km -101,7 km) Route
Scenario-3 **Section-2**	■ Bursa-Yenişehir (46.03 km -74.2 km) Route
Scenario-4 **Section-3**	■ Bandırma - Bursa Route-1 (53,8 km-96,7 km) ■ Concrete Plant -2 ■ Borrowed Pit-2 ■ Borrowed Pit -3 ■ Borrowed Pit -4 ■ Borrowed Pit -5 ■ Storage Area-2 ■ Storage Area -3 ■ Storage Area -4 ■ Storage Area -5
Scenario-5 **Section-3**	■ Bandırma - Bursa Route-1 (0-53,8 km), ■ Concrete Plant -1 ■ Quarry-1 ■ Borrowed Pit -1 ■ Borrowed Pit -2 ■ Storage Area -1 ■ Storage Area -2
Scenario-6	■ Basalt Quarry

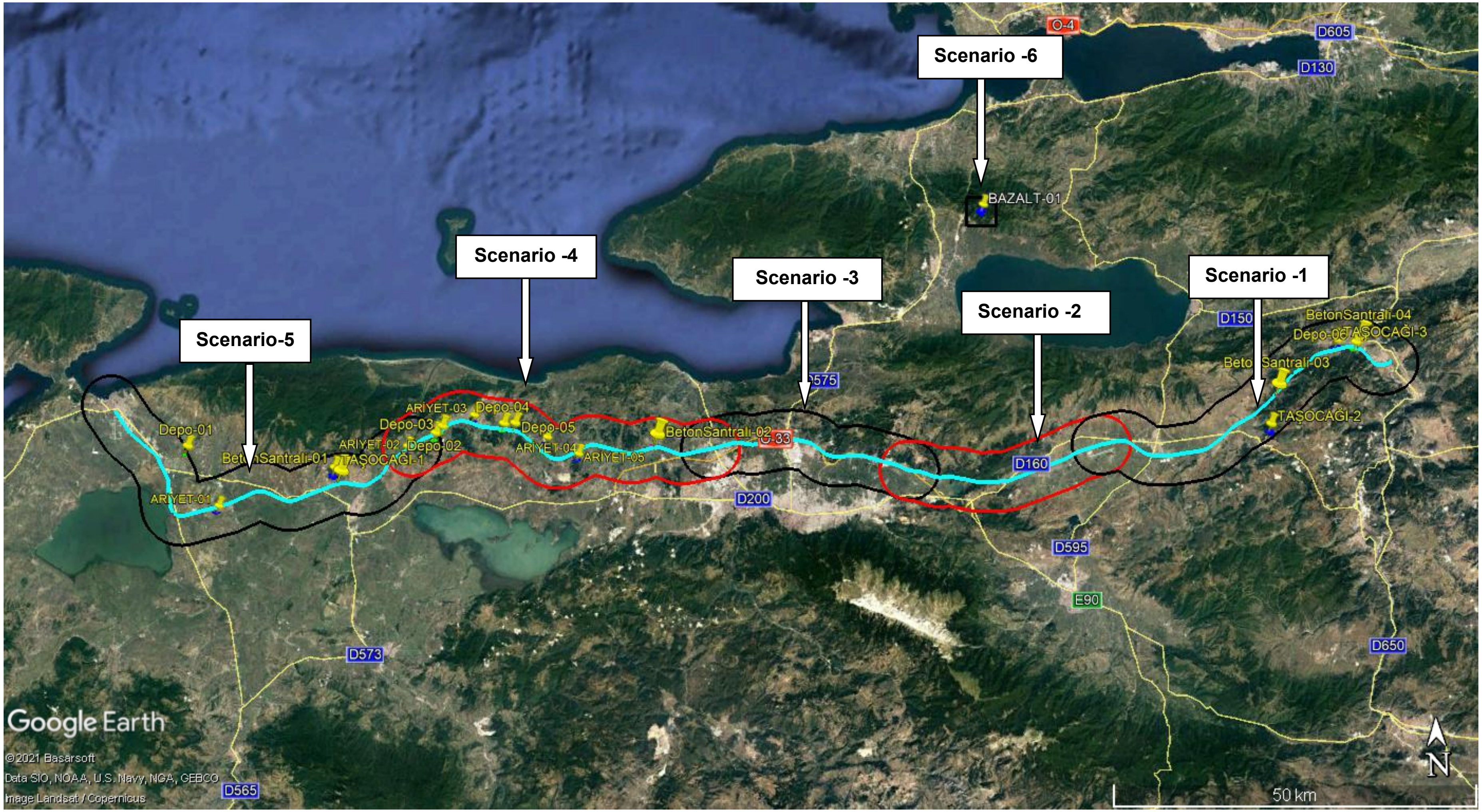


Figure 87: Scenarios Map

8.1.6.3.1.3 AERMOD Simulation Results

Modelling results for settled dust and PM_{10}, and also cumulative assessment of PM_{10} results were given detailly in below sections.

Settled Dust Emission Modelling Results

The highest modelling results for settled dust and the coordinates where the highest 24-hourly and yearly concentrations are calculated are presented in Table 106 for all the scenarios. It can be seen that all the settled dust modelling results for all scenarios are way below the limit values given in SKHKKY. The maximum modelled 24-hourly and yearly settled dust concentrations are calculated as 25.39 $mg/m^2/day$ and 3.66 $mg/m^2/day$ respectively.

Table 106: Settled Dust Result Table for all the Scenarios

Scenario	Averaging Period	Modelling Results ($mg/m^2/day$)	Coordinates (X; Y)	Limit Value (SKHKKY)
Scenario-1 Section-1	24 Hourly	18.69	753368.52; 4473739.06	390 $mg/m^2/day$
	Yearly	3.66	753368.52; 4473739.06	210 $mg/m^2/day$
Scenario-2 Section-2	24 Hourly	1.2	705503.14; 4455900.29	390 $mg/m^2/day$
	Yearly	0.3	705503.14; 4455900.29	210 $mg/m^2/day$
Scenario-3 Section-2	24 Hourly	0.92	686103.01; 4458949.30	390 $mg/m^2/day$
	Yearly	0.48	686103.01; 4458949.30	210 $mg/m^2/day$
Scenario-4 Section-3	24 Hourly	11.25	656692.91; 4460776.45	390 $mg/m^2/day$
	Yearly	1.93	637436.60; 4462798.29	210 $mg/m^2/day$
Scenario-5 Section-3	24 Hourly	25.39	627089.27; 4461832.00	390 $mg/m^2/day$
	Yearly	2.35	627089.27; 4461832.00	210 $mg/m^2/day$
Scenario-6 Basalt Quarry	24 Hourly	2.09	700938.97; 4491885.00	390 $mg/m^2/day$
	Yearly	0.47	701633.99; 4491915.15	210 $mg/m^2/day$

PM10 Emission Modelling Results

The 1st and 35th highest modelling results for PM_{10} and the coordinates where the highest 24-hourly and yearly concentrations are calculated are presented in Table 107 for all the scenarios. For 24-hourly results it is seen that the maximum PM_{10} concentrations for all the scenarios are below than the limit value of 50 $\mu g/m^3$ except Scenario-1. In Scenario-1, the limit value was exceeded 10 times which is under the limit for number of exceedances (35 times). The maximum modelled 24-hourly and yearly PM_{10} concentrations are calculated as 100.55 $\mu g/m^3$ and 17.56 $\mu g/m^3$ respectively.

Table 107: PM10 Result Table for all the Scenarios

Scenario	Averaging Period	Criteria	Result ($\mu g/m^3$)	Coordinates (X; Y)	Limit Values		
					Turkish[1] ($\mu g/m^3$)	EU[2] ($\mu g/m^3$)	IFC[3] ($\mu g/m^3$)
Scenario-1 Section-1	24 Hourly	1. Maximum	100.54711	751537.77; 4473309.71	50	50	50
		35. Maximum	38.32716	750759.93; 4472623.14			
		Number of Exceedance	**10**	750759.93; 4472623.14	35 times	35 times	-
	Yearly	1. Maximum	17.55738	750759.93; 4472623.14	40	40	20
Scenario-2	24 Hourly	1. Maximum	21.15066	705503.14; 4455900.29	50	50	50

Scenario	Averaging Period	Criteria	Result (µg/m^3)	Coordinates (X; Y)	Limit Values		
					Turkish[1] (µg/m^3)	EU[2] (µg/m^3)	IFC[3] (µg/m^3)
Section-2		35. Maximum	6.08036	705503.14; 4455900.29			
		Number of Exceedance	**0**	-	35 times	35 times	-
	Yearly	1. Maximum	2.16524	705503.14; 4455900.29	40	40	20
Scenario-3 Section-2	24 Hourly	1. Maximum	16.38633	666510.29; 4461051.49	50	50	50
		35. Maximum	4.15082	686103.01; 4458949.30			
		Number of Exceedance	**0**	-	35 times	35 times	-
	Yearly	1. Maximum	1.75786	686103.01; 4458949.30	40	40	20
Scenario-4 Section-3	24 Hourly	1. Maximum	33.52047	634513.16; 4462406.65	50	50	50
		35. Maximum	11.32870	627086.09; 4462300.11			
		Number of Exceedance	**0**	-	35 times	35 times	-
	Yearly	1. Maximum	5.50212	627086.09; 446300.11	40	40	20
Scenario-5 Section-3	24 Hourly	1. Maximum	45.39908	592155.07; 4459730.95	50	50	50
		35. Maximum	15.17295	592155.07; 4459730.95			
		Number of Exceedance	**0**	-	35 times	35 times	-
	Yearly	1. Maximum	6.30601	592155.07; 4459730.95	40	40	20
Scenario-6 Basalt Quarry	24 Hourly	1. Maximum	10.32674	702188.02; 4492063.61	50	50	50
		35. Maximum	2.53989	700938.97; 4491885.00			
		Number of Exceedance	**0**	-	35 times	35 times	-
	Yearly	1. Maximum	0.96660	701483.61; 4492001.98	40	40	20

[1] IFC General Environmental, Health, and Safety (EHS) Guidelines (WHO stands for World Health Organization) (Dated 30 April 2007)
[2] Directive 2008/50/EC, 21 May 2008, ambient air quality and cleaner air
[3] Regulation on Control of Industrial Air Pollution (Dated 03.07.2009 and Numbered 27277) and Regulation on Assessment and Management of Air Quality (Dated 06.06.2008 and Numbered 26898)

Cumulative Assessment of Modelling Results on Sensitive Receptors

The yearly and 24-hourly model results for the parameters PM10 and settled dust are given in Table 108 for the 19 discrete receptors defined in the model. In Table 109, the model resulting ambient air ground level concentrations for PM_{10} are provided together with the background concentrations and cumulative concentrations that has been calculated by adding up the model results with the background concentrations. The estimated ambient air concentrations have been compared with the Project Standards.

When the cumulative results are examined, all the 24-Hourly cumulative concentrations meet the Project Standard which is 50 µg/m^3. However, it is seen that all the yearly cumulative concentrations except A10 are higher than the Project Standard which is 20 µg/m^3. This is because the background concentrations except A9 and A13 are already higher than the project standard. Considering the current background concentration levels, the contribution of the Project activities on the existing air quality (in terms of PM_{10}) will not be significant, as it is estimated to increase the ambient PM10 concentration by maximum of 3.01 μg/m³ (A3) on annual average. The dispersion maps are presented in the Dust Emission Modelling Report (Appendix H).

Table 108: Modelling Results on Sensitive Receptors

Discrete Receptors	Modelling Results			
	24-Hourly PM10 (μg/m³)	Yearly PM10 (μg/m³)	24-Hourly Settled Dust (mg/m²/day)	Yearly Settled Dust (mg/m²/day)
A1	8.25	0.47	0.43	0.16
A2	5.10	0.47	0.40	0.10
A3	26.57	3.01	3.60	0.59
A4	10.41	1.46	1.07	0.19
A5	6.78	1.03	0.92	0.23
A6	2.30	0.09	0.08	0.01
A7	7.15	1.76	0.92	0.48
A8	21.15	2.17	1.20	0.30
A9	12.88	0.85	0.32	0.048
A10	3.22	0.17	0.23	0.028
A11	21.17	2.13	0.94	0.18
A12	26.13	2.63	0.93	0.24
A13	12.56	0.55	0.35	0.16
A14	3.02	0.78	0.46	0.12
A15	5.32	0.73	0.43	0.02
A16	8.25	0.81	1.12	0.05
Kuş Lake	3.54	0.63	0.19	0.06
Ulubat Lake	3.89	0.41	0.09	0.03
Gölbaşı Lake	2.83	0.50	0.21	0.07
IFC[1]	**50**	**20**	**-**	**-**
EU[2]	**50**	**40**	**-**	**-**
Turkish[3]	**50**	**40**	**390**	**210**

[1] IFC General Environmental, Health, and Safety (EHS) Guidelines (WHO stands for World Health Organization) (Dated 30 April 2007)

[2] Directive 2008/50/EC, 21 May 2008, ambient air quality and cleaner air

[3] Regulation on Control of Industrial Air Pollution (Dated 03.07.2009 and Numbered 27277) and Regulation on Assessment and Management of Air Quality (Dated 06.06.2008 and Numbered 26898)

Table 109: Cumulative Assessment of Modelling Results

Receptor	Averaging Period	ModelResults (μg/m³)	Background Concentration (μg/m³)	Cumulative Result (μg/m³)	Project Standards (μg/m³)		
					IFC[1]	EU[2]	Turkish[3]
A1	Yearly	0.47	24.3	24.77	20	40	40
	24-Hourly	8.25		32.55	50	50	50

Receptor	Averaging Period	ModelResults (µg/m³)	Background Concentration (µg/m³)	Cumulative Result (µg/m³)	Project Standards (µg/m³)		
					IFC[1]	EU[2]	Turkish[3]
A2	Yearly	0.47	22.5	22.97	20	40	40
	24-Hourly	5.10		27.60	50	50	50
A3	Yearly	3.01	23.2	26.21	20	40	40
	24-Hourly	26.57		49.77	50	50	50
A4	Yearly	1.46	21.8	23.26	20	40	40
	24-Hourly	10.41		32.21	50	50	50
A5	Yearly	1.03	20.3	21.33	20	40	40
	24-Hourly	6.78		27.08	50	50	50
A6	Yearly	0.09	21.2	21.29	20	40	40
	24-Hourly	2.30		23.50	50	50	50
A7	Yearly	1.76	28.7	30.46	20	40	40
	24-Hourly	7.15		35.85	50	50	50
A8	Yearly	2.17	26.8	28.97	20	40	40
	24-Hourly	21.15		47.95	50	50	50
A9	Yearly	0.85	19.2	20.05	20	40	40
	24-Hourly	12.88		32.08	50	50	50
A10	Yearly	0.17	18.8	18.97	20	40	40
	24-Hourly	3.22		22.02	50	50	50
A11	Yearly	2.13	23.0	24.13	20	40	40
	24-Hourly	21.17		44.17	50	50	50
A12	Yearly	2.63	20.4	23.03	20	40	40
	24-Hourly	26.13		46.53	50	50	50
A13	Yearly	0.55	19.6	20.15	20	40	40
	24-Hourly	12.56		32.16	50	50	50
A14	Yearly	0.78	22.5	23.28	20	40	40
	24-Hourly	3.02		25.52	50	50	50
A15	Yearly	0.73	20.8	21.53	20	40	40
	24-Hourly	5.32		26.12	50	50	50
A16	Yearly	0.81	19.9	20.71	20	40	40
	24-Hourly	8.25		28.15	50	50	50
Kuş Lake	Yearly	0.63	20.8	21.43	20	40	40
	24-Hourly	3.54		24.34	50	50	50
Ulubat Lake	Yearly	0.41	19.9	20.31	20	40	40

Receptor	Averaging Period	ModelResults (µg/m^3)	Background Concentration (µg/m^3)	Cumulative Result (µg/m^3)	Project Standards (µg/m^3)		
					IFC[1]	EU[2]	Turkish[3]
	24-Hourly	3.89		23.79	50	50	50
Gölbaşı Lake	Yearly	0.50	26.8	27.30	20	40	40
	24-Hourly	2.83		29.63	50	50	50

[1] IFC General Environmental, Health, and Safety (EHS) Guidelines (WHO stands for World Health Organization) (Dated 30 April 2007)

[2] Directive 2008/50/EC, 21 May 2008, ambient air quality and cleaner air

[3] Regulation on Control of Industrial Air Pollution (Dated 03.07.2009 and Numbered 27277) and Regulation on Assessment and Management of Air Quality (Dated 06.06.2008 and Numbered 26898)

8.1.6.3.2 Commissioning and Operational Phase

During the operational phase of the project, the trains will run on electrical energy. For this reason, no gas emissions associated with fuel use are expected during the operational phase.

During the operational phase of the railway, little amount of dust will be generated during the unloading and loading of the material to be stored for freight trains. However, small-sized materials that may cause dust emission due to wind effect will not be stored in open storage areas during freight transportation. Such materials (e.g., grain, sand, gravel, coal, etc.) will be stored in closed warehouses located in the loading area. Only the larger sized materials (e.g., brick, block stone, block marble, granite, machine parts etc.) and containers will be stored in open storage areas. Therefore, dust generation from these materials will also be at low level.

Considering the abovementioned facts, there will be a negligible impact on the existing air quality in the AoI due to the Project activities in the operational phase. Therefore, not any additional study has been performed (e.g., air quality modelling) for the operational phase.

8.1.6.3.3 Decommissioning and Closure Phase

A new impact is not expected other than those listed in the construction phases during the decommissioning and closure phase of the Project.

8.1.6.4 Mitigation Measures

The following actions are recommended to reduce the dust generation in the construction areas:

- use of water suppression at construction sites and transportation routes, especially in hot-dry seasons,
- loads in all trucks transporting dust-generating materials will be sprayed with water to suppress dust,
- use of water suppression for control of loose materials on paved or unpaved road surfaces,
- use of dust suppression techniques, such as covers, water suppression, or increased moisture content for open materials storage piles,
- speed reduction for the means travelling inside the construction site.

In order to reduce the air emissions from construction vehicles, the following actions shall be implemented

- activities will be conducted trying to use the minimum required number of means at the same time,
- vehicle engines and other machinery shall be kept turned on only if necessary, avoiding any unnecessary emission,
- all equipment and machinery must be maintained for compliance with standards and technical regulations for the protection of the environment and have appropriate certification,

- machinery and equipment shall be periodically checked and maintained to ensure their good working condition.
- Monthly monitoring campaign will be conducted during the construction phase at baseline locations

8.1.6.5 Residual Impacts

8.1.6.5.1 Construction Phase

According to the modelling results, low impact on the existing air quality in the AoI is expected due to the construction activities of the Project. The table below summarizes the identified impact factor involved in the construction phase of the Project.

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features		Impact Value	Mitigation effectiveness	Residual impact value
Construction Dust Emissions	Duration:	Short	Very high	Reversibility:	Short-term	**Low**	Medium-high	**Negligible**
	Frequency:	Continuous						
	Geo. Extent:	Regional						
	Intensity:	Low						

8.1.6.5.2 Commissioning and Operational Phase

A negligible negative impact on air quality is expected since particulate matter will be only originated due to loading and unloading activities. Therefore, impacts of dust emission will be localised and will not cause long-term or widespread changes on the local air quality. The table below summarizes the identified impact factor involved in the operation phase of the Project.

Table 110: Residual impact assessment matrix for air quality during operational phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features		Impact Value	Mitigation effectiveness	Residual impact value
Operational Dust Emissions	Duration:	Long	Very high	Reversibility:	Short-term	**Low**	Medium-high	**Negligible**
	Frequency:	Frequent						
	Geo. Extent:	Local						
	Intensity:	Negligible						

8.1.6.5.3 Decommissioning and Closure Phase

A new impact is not expected other than those listed in the construction and operation phases in the decommissioning and closure phase (after the mitigation) of the Project.

8.1.6.6 Monitoring

According to the yearly model results, project activities during the construction do not comply with the yearly IFC limit value of 20 μg/m^3. Periodic dust (24 hours PM10) monitoring should be conducted at the baseline locations, during construction stage and will be compared with the Regulation on the Control of Industrial Air Pollution and IFC General EHS Guidelines – Air Emission and Air Quality.

Exhaust emissions from construction and transportation vehicles should be periodically monitored along with the requirements in the Regulation on Control of Exhaust Gas Emission both in construction and operation period of the project.

8.1.7 Greenhouse Gas (GHG) Emissions

This section presents the GHG emission estimations and Project's contribution to climate change is assessed using both global data on climate change and Project GHG emissions. Within this purpose, this section includes calculation and assessments of greenhouse gas (GHG) emissions that will be released by the activities for the BBYO High Standard High Speed Railway Project.

The contribution of Project GHG emissions from operations and how these contributions are in keeping with current GHG emissions from Turkey are evaluated through estimating the GHG emissions associated with the Project. The GHG emissions estimation methods used in this assessment generally follow accepted practices for conducting Environmental Assessments. Where applicable, the Greenhouse Gas Protocol/A Corporate Accounting and Reporting Standard prepared by the World Business Council for Sustainable Development/World Resources (April 2004; hereafter referred to as the GHG Protocol) is applied. The GHG Protocol provides guidance for preparing corporate GHG inventories, as well as sector-specific and general calculation tools that can be used for estimating GHG emissions. The GHG protocol has been adopted by the Global Reporting Initiative (GRI). The GHG Protocol introduces the concept of direct and indirect emissions and scopes for GHG emission inventory under three broad categories, as follows:

Scope 1 – Direct GHG emissions:

Carbon emissions occurring from sources that are owned or controlled by the company (e.g., emissions from combustion in owned or controlled boilers, furnaces and vehicles, process and fugitive emissions).

Scope 2 – Indirect GHG emissions:

Carbon emissions from the generation of purchased electricity, heat or steam consumed by the company.

Scope 3 – Other indirect GHG emissions:

Carbon emissions which are a consequence of a company's activities but occur from sources not financially or operationally controlled by the company (e.g., emissions from waste, the extraction and production of purchased materials; and employee travel to and from work).

The GHG Protocol requires reporting of Scope 1 (direct emissions from site) and Scope 2 (emissions from on-site energy consumption) emissions only. Scope 1 and Scope 2 emissions are typically the focus of most corporate inventories, although many organizations choose to account for other activities such as employee travel and downstream emissions from waste. These sources are classified as Scope 3 (indirect) emissions and are reported optionally. Given the nature of Project operations, Scope 1 emissions will be the most significant. Accordingly, Scope 1 will be the primary focus of the GHG inventory. Additionally, Scope 2 emissions will be estimated by taken into consideration the electricity consumption is expected during Project life. Except these Scope 1 and Scope 2 emissions, additional Scope 3 emissions are not expected in significant amounts, therefore Scope 3 is not included in these estimations.

8.1.7.1 Legislative Framework

Climate change is a global phenomenon, which is the result of anthropogenic activities, mainly energy use and industrial processes. Because of its multidimensional nature, fight with climate change requires action in different scales, e.g., international, regional and local. This section briefly narrates legislative framework regarding climate change under three scales.

8.1.7.1.1 International Standards

Main international body on climate change is United Nations Framework Convention on Climate Change (UNFCCC), adopted in 1992 Rio Earth Summit and ratified by 195 countries. UNFCCC guides countries on cooperation to fight with climate change and to cope with its impacts. Currently two issues are under the focus

Ratification of Doha amendment to the Kyoto Protocol, covering 2013 – 2020 and Ratification and implementation of the new global climate change agreement, Paris Agreement.

8.1.7.1.2 European Directives

The European Union (EU) is the global leader of fight against climate change. Since 1990 the EU have been enacting laws on GHG emissions, renewable energies and energy efficiency. An EU-wide climate policy framework has been established, applied, and reviewed over decades. Therefore, EU legislation on climate change and GHG emissions are considered in the Project.

8.1.7.1.3 Turkish Legislation

Turkey's climate policy is shaped by National Climate Change Strategy (NCCS) (2010 – 2023) and National Climate Change Action Plan (2011 – 2023). Also 10th National Development Plan for 2014 – 2018 emphasizes green growth in sectors such as energy, industry, agriculture, transport, construction, services and urbanization. The below table lists Turkish legislation related with climate change and GHG emissions.

Table 111 Turkish Legislation on Climate Change and GHG Emissions

Date	Number	Title
28.12.2003	25330	Regulation on Availability of Customer Information regarding Fuel Economy and CO_2 Emissions of New Automobiles
09.10.2013	28790	Notice on Voluntary Carbon Market Project Registration
17.05.2014	29003	Regulation on Monitoring of Greenhouse Gas Emissions
22.07.2014	29068	Notice on Monitoring and Reporting Greenhouse Gas Emissions
02.12.2017	30258	Notice on Validation of Greenhouse Gas Reports and Accreditation of Validator Institutions
04.01.2018	30291	Regulation on Fluorinated Greenhouse Gases

Regulation on Monitoring of Greenhouse Gas Emissions aims to arrange the procedures and principles on monitoring, verifying and reporting the greenhouse gases emissions. Annex 1 of the Regulation includes the Projects that subject to this Regulation, and which should monitor, report and verify the GHG emissions in the GHG mechanism established by MoEU.

Since the Railway Project is not one of the listed Projects specified in Annex 1, the Project is not subject to this Regulation.

8.1.7.2 GHG Emission Calculation Methodology

The following sections summarize the emission calculation methods, input parameters and assumptions that are used to estimate the annual GHG emissions for the Project.

The GHG indicator compounds include Carbon dioxide (CO_2), Methane (CH_4), and Nitrous Oxide (N_2O). There are no Project activities which are expected to emit Sulphur hexafluoride (SF_6), Perfluorocarbons (PFCs) or Hydrofluorocarbons (HFCs), therefore, these compounds are not included in the GHG assessment.

The Project is anticipated to include sources that produce GHGs during the construction, the operation and closure phases. It is assumed that more GHG sources will be present during the construction phase than the closure phase. Therefore, the assessment for construction phase is used as a representative estimation for the closure phase since the activities at the closure phase yet to be clear right now.

The emissions estimation methods used to quantify annual GHGs follow generally accepted practices for conducting EIAs and, where applicable, the Regulation on Monitoring Greenhouse Gas Emissions.

GHGs have the potential to affect future climate as they contribute to the greenhouse effect by absorbing longwave radiation, emitted by the Earth, in the atmosphere, increasing temperature and changing weather patterns. There is a potential for the Project activities to release GHG emissions that could contribute incrementally to climate change.

The GHG assessment include changes in concentrations of the following compounds: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

GHG emissions are expressed as tonnes of equivalent CO_2, calculated by multiplying the annual emissions of each indicator compound by its 100-year global warming potential (GWP). A single measure is used when evaluating effects, namely the maximum annual GHG emissions resulting from the Project activities in tonnes of carbon dioxide equivalent (CO_2e). The maximum annual GHG emissions from the Project activities will put in context of the annual GHGs at both a national and global level.

The GHG Protocol provided by the World Business Council for Sustainable Development/World Resources Institute (WBCSD/WRI, 2004) outlines guidance for preparing corporate GHG emission inventories and introduces the concept of direct and indirect emissions and scopes for the inventory. Given the nature of the Project operations, the most significant emissions will be Scope 1, which are direct GHG emissions occurring from Stationary Sources (e.g., emissions due to fuel use in precast and concrete plants, and generators) and Mobile Sources that are owned or controlled by the Owner (e.g., emissions from combustion in construction vehicles, and fugitive emissions).

GHG emissions are assessed for mobile fuel combustion sources, stationary combustion sources, based on Project schedules and amounts of fuel use provided by the Client and for other potential sources. Scientifically accepted and well documented emission factors from the Turkey's 2019 National Inventory Report (NIR) released in 2021 under UNFCCC[24] are used. Where local guidance is not available then emission factors from the Intergovernmental Panel on Climate Change (IPCC), are also used. A discussion of the global warming potentials is provided by Section 8.1.7.2.1 below. Table 112 provides a summary of the activities for which GHG emissions are calculated.

Table 112: GHG Emission Sources for the Project

Phase	Source	GHG Emissions
Construction	Concrete and Precast Plants – Combustion of Diesel Oil	Emissions from Concrete and Precast Plants
	Generators – Combustion of Diesel Oil	Emissions from backup generator sets
	Vehicles - Combustion of Diesel Oil	On-site vehicle emissions, due to diesel combustion
	Blastings – Combustion of Fuel in Explosives	Emissions due to use of explosives for blasting activities
	Change of Land Use – Carbon Stock Change	Indirect emissions due to change in carbon stocks

[24] Turkey. 2019 National Inventory Report (NIR) for UNFCCC, 2021, https://unfccc.int/sites/default/files/resource/tur-2021-nir-13apr21.zip

Phase	Source	GHG Emissions
Operation	Electricity consumption	Indirect emissions due to used electricity

8.1.7.2.1 Global Warming Potentials

Emissions from CO_2, CH_4 and N_2O are converted to equivalent CO_2 (CO_2e). The GHG emissions are expressed as tonnes of CO_2e by multiplying the annual emissions of each GHG by its 100-year global warming potential (GWP). The GWP of each gas represents the ability of the gas to trap heat in the atmosphere in comparison to CO_2.

The GWPs are taken from the United Nations Framework Convention on Climate Change (UNFCCC) reporting guidelines for the preparation of GHG inventory reports (UNFCCC, 2014), which represents the values used to prepare the national and global emissions inventories referenced in the main report. Table 113 provides the GWPs used in the GHG calculations.

Table 113 Global Warming Potentials from the Intergovernmental Panel on Climate Change

GHG Compound	GWP
CO_2	1
CH_4	25
N_2O	298

8.1.7.2.2 Scope 1: Direct GHG Emissions

The Greenhouse Gas Protocol (GHG Protocol) provided by the World Business Council for Sustainable Development/World Resources Institute (WBCSD/WRI, 2004) outlines guidance for preparing corporate GHG emission inventories and introduces the concept of direct and indirect emissions and scopes for the inventory. Scope 1 accounts for direct GHG emissions from sources that are owned or controlled by Investor.

8.1.7.2.2.1 Stationary Combustion

Stationary combustion sources for the Project include gas turbines and diesel generators. GHG Emissions from Project is determined based on the fuel consumption, and maximum annual testing time of each generator, as provided by Investor.

The emission factors on an energy basis are obtained from the IPCC 2006 Guidelines (Volume 2), Chapter 2 – Stationary Combustion Table 2.2. These emission factors are presented in Table 114 below.

Table 114 Stationary Combustion - Energy-based Emission Factors and Net Calorific Value

Phase	Source	Net Calorific Value (TJ/Gg)	Reference	Emission Factor (kg GHG/TJ)			Reference	Fuel Density (kg/m³)*
				CO_2	CH_4	N_2O		
Construction	Operation of the Plants - Combustion of Diesel Oil	40.4	Turkish Notification on Monitoring and Reporting of GHG Emissions (Official Gazette Date/Number:	74100	3.0	0.6	IPCC 2006 guidelines, Chapter 2 – Stationary Combustion Table 2.3	832
Construction	Use of Generators - Combustion of Diesel Oil	40.4		74100	3.0	0.6	IPCC 2006 guidelines, Chapter 2 – Stationary Combustion Table 2.2	832

Phase	Source	Net Calorific Value (TJ/Gg)	Reference	Emission Factor (kg GHG/TJ)			Reference	Fuel Density (kg/m³)*
				CO_2	CH_4	N_2O		
			22.07.2014/29068), Table 5.1					

* Density of diesel oil is specified as 820 - 845 kg/m³ (15 °C) in Safety Data Sheet of Türkiye Petrolleri Safety Data Sheet. Average of the upper and lower limit values is calculated.

The equations for calculating the volume-based emission factors for CO_2, CH_4 and N_2O are the same as those presented below Section.

8.1.7.2.2.2 Mobile Fuel Combustion

The GHG emissions from mobile equipment from the Project are calculated based on fuel consumption and diesel-specific emission factors on an energy basis from the IPCC 2006 Guidelines (Volume 2), Chapter 3 – Mobile Combustion and related 2019 Refinement, where applicable, and Turkey's Seventh Communication report released in 2018 under UNFCCC. These emission factors are presented in Table 115 below.

Table 115 Mobile Combustion - Energy-based Emission Factors and Net Calorific Value

Phase	Source	Net Calorific Value (TJ/Gg)	Reference	Emission Factor (kg GHG/TJ)			Reference	Fuel Density (kg/m³)*
				CO_2	CH_4	N_2O		
Construction	Vehicles - Combustion of Diesel Oil	40.4	Turkish Notification on Monitoring and Reporting of GHG Emissions (Official Gazette Date/Number: 22.07.2014/29068), Table 5.1	74100	4.15	28.6	IPCC 2006 guidelines, Chapter 3 – Mobile Combustion Table 3.3.1	832

* Density of diesel oil is specified as 820 - 845 kg/m³ (15 °C) in Safety Data Sheet of Türkiye Petrolleri Safety Data Sheet. Average of the upper and lower limit values is calculated.

A sample equation provided below present the methods for calculating the volume-based emission factors (EF) for CO_2, CH_4 and N_2O:

<u>CO_2 Emission Factor</u>:

$$\mathrm{EF}_{\mathrm{CO_2}}\left(\frac{kg\ CO_2}{L}\right) = \text{Energy based EF}\left(\frac{\mathrm{t\ CO_2}}{\mathrm{TJ}}\right) \times \text{Net Calorific Value}\left(\frac{\mathrm{TJ}}{\mathrm{kT}}\right) \times \text{Density of Diesel}\left(\frac{\mathrm{kg}}{\mathrm{m^3}}\right) \times \frac{1{,}000\ \mathrm{kg\ CO_2}}{1\ \mathrm{t\ CO_2}} \times \frac{1\ \mathrm{kT}}{1{,}000{,}000\ \mathrm{kg}} \times \frac{1\ m^3}{1{,}000\ \mathrm{L}}$$

<u>Total CO_2 Emissions from Mobile Equipment</u>:

$$\mathrm{E}_{\mathrm{CO_2}} = \text{Fuel Combustion}\left(\frac{\mathrm{L}}{\mathrm{yr}}\right) \times \text{Emission Factor}\left(\frac{\mathrm{kg\ CO_2}}{\mathrm{L}}\right) \times \frac{1\ \text{tonne}}{1{,}000\ \mathrm{kg}}$$

8.1.7.2.2.3 Blasting

During the construction period of the Project, significant amount explosives will be used for the blasting activities. The combustion of diesel fuels in the explosives will result in emissions of GHGs. To calculate the GHG emisions due to the blasting activities using explosives, the emission factors provided by Australian Greenhouse Office[25]

[25] Australian Greenhouse Office (2006), AGO Factors & Methods Workbook, December 2006

for the explosive types are used (Table 116). For the calculation of th GHG emissions due to use of explosives, the following equation is used.

$$E_{CO_2} = \sum_i M_i * EF_i$$

where,

E_{CO2}: Total CO2 Emissions due to use of explosives (t CO2),

M_i: Amount of explosives used (tonnes),

EF_i: Emission Factor of the explosives used (t CO2/t explosive),

i: Explosive Type

Table 116: Emission Factors for the Explosive Types

Explosive type	Tonne CO_2/tonne explosive
ANFO	0.1673
Heavy ANFO	0.1778
Emulsion	0.1659

8.1.7.2.3 Scope 2: Indirect GHG Emissions

Scope 2 emissions are 'indirect' greenhouse gas emissions associated with the Project that are a consequence of the activities of the company but occur at sources owned or controlled by another company.

Scope 2 accounts indirect GHG emissions from the generation of purchased electricity, heat or steam consumed by the company.

8.1.7.2.3.1 Electricity Consumption

The Scope 2-Indirect GHG emissions are expected to be from electricity consumption. For the emission factor of electricity consumption, Turkish National Electricity Grid Emission Factor (0.6993 t CO_2/MWh) calculated by the Turkish Ministry of Energy and Natural Resources is used. The equation for calculating the indirect GHG emisisons due to the electricity purchased is given below.

$$E_{CO_2} = \sum_i E_i * EF$$

where,

E_{CO2}: Total indirect CO2 Emissions due to electricity consumption (t CO2),

E_i: Use of electricity for each activity (MWh),

EF_i: National Electricity Grid Emission Factor (t CO2/MWh),

i: Actvity that consumes electricity.

8.1.7.2.4 Emissions Not Included in Scope 1 or Scope 2

8.1.7.2.4.1 Carbon Stock Change

Land use change and loss of carbon sink are the reason for indirect CO_2 emission. Due to the constructional activities, the natural lands such as croplands, forestlands and grasslands are disturbed and occupied till the Project life end time. Both of these activities result in change in carbon stock. The following formulation, referring to IPCC 2006 Guidelines Volume 4 Chapter 2, is used to calculate change in biomass stocks.

$$\Delta C_{CONVERSION} = \sum_i \{(B_{AFTER_i} - B_{BEFORE_i}) * \Delta A_{TO\_OTHERS}\} * CF$$

where,

$\Delta C_{CONVERSION}$: initial change in biomass carbon stocks on land converted to another land category, tonnes C/year,

B_{AFTERi}: biomass stocks on land type i immediately after the conversion, tonnes d.m./ha,

$B_{BEFOREi}$: biomass stocks on land type i before the conversion, tonnes d.m./ha,

$\Delta A_{TO\_OTHERSi}$: area of land use i converted to another land use category in a certain year, ha/year,

C: carbon fraction of dry matter, tonne C/(tonnes d.m.),

i: type of land use converted to another land use category.

Table 117: Carbon Stock Change Values

Parameter	Values			Unit	Reference
	Forestland	Grassland	Cropland		
Annual area of Land Converted to Other Land	158.6	28.5	809.6	ha	IPCC 2006 IPCC Guidelines for National Greenhouse Gas Inventories V4 Chapter.4 Table 4.12, Chapter.5 Table 5.9, Chapter.6 Table 6.4.
Biomass stocks before the conversion	100.0	13.5	2.1	tonnes dm ha-1	
Biomass stocks after the conversion	0	0	0	tonnes dm ha-1	
Carbon fraction of dry matter	0.5	0.5	0.5	tonnes C (tonne dm)-1	

8.1.7.3 Impact Analysis

8.1.7.3.1 Construction Phase

8.1.7.3.1.1 GHG Emissions Calculations

Stationary Combustion Emissions

During the construction phase of the Project, Stationary Combustion GHG emissions will be due to:

- Combustion of diesel fuel due to the operation of Concrete and Precast Plants, and
- Combustion of diesel fuel due to use of generators during construction works.

During the construction phase of the Project, 4 Concrete Plants and 2 Precast Plants will be operated. Also, generators will be used on-site in the construction areas to provide electricity. Diesel fuel will be the main source for the operation of these plants and generators. The total estimated diesel consumption (24,000,000 liters) due to operation of these plants and use of generators during the construction period (3 years period) provided by the Client are converted to the annual consumption (8,000,000 liters/year). Then the total Stationary Combustion GHG Emissions were calculated using the equations given in Section 8.1.7.2.2.1. The yearly GHG emissions due to Mobile Combustion were calculated as 78,511 t CO_2/y.

Mobile Combustion Emissions

During the construction phase of the Project, Mobile Combustion GHG emissions will be due to the use of on-road and off-road vehicles, machinery and equipment. The primary fuel that will be used for machinery, vehicles and equipment will be diesel. The total estimated diesel consumption (61,668,008 liters) due to use of mobile vehicles for all the construction activities (3 years period) provided by the Client are converted to the annual consumption (20,556,003 liters/year). Then the total Mobile Combustion GHG Emissions were calculated using the equations given in Section 8.1.7.2.2.2. The yearly GHG emissions due to Mobile Combustion were calculated as 19,991 t CO_2/y.

Blasting

During the construction period of the Project, significant amount explosives will be used for the blasting activities. The combustion of diesel fuels in the explosives will result in emissions of GHGs. According to the information provided by the Client 3612.5 tonnes of ANFO and 289 tonnes of Emulsion explosives will be used during the construction period. Using the emission factors and the formula given in Section 8.1.7.2.2.3, the total GHG emission due to use of explosives during the construction periods were calculated as 217.4 t CO_2/y. The total calculated GHG emission (652.3 t CO_2/y) due to use of explosives for all the construction activities (3 years period) are converted to the annual GHG emission (217.4 t CO_2/y).

Carbon Stock Change

Indirect GHG emissions will arise from carbon stock change due to land use change during the construction phase of the Project. Emissions resulting from land use change have been estimated by making assumptions regarding the current use of the land and the quantity of carbon estimated to be stored within it. Since land clearing does not affect below ground carbon stocks, only above ground carbon stock is taken into consideration. According to the land use information obtained from the Project Company, the land (1,075 ha) comprises of 82.9% cropland, %2.7 grassland, 14.8% forest land. Also, all of the privately-owned lands are assumed to be agricultural lands (croplands). Total area was calculated by multiplying the railway length (i.e., 200 km) by the construction servitude width (~54m). Using the equation given in 8.1.7.2.4.1, the total indirect GHG emissions due to land use change is calculated as 46,239 t CO_2/y.

Total GHG Emissions in Construction Phase

The annual GHGs emissions for construction phase of Project are presented in Table 118. These annual emissions are calculated for the maximum construction scenario described above. They are based on rough estimates and may significantly overestimate the actual emissions.

Table 118: Annual Project GHG Emissions for Construction Phase

Source	Calculated GHG			Total GHG amount	
	t CO_2/y	t CH_4/y	t N_2O/y	tCO_2e	Percentage
Stationary Sources (Concrete&Precast Plants and Generators) – Combustion of Diesel Oil	19,926	1	0	19,991	16.26%
Mobile Sources – Combustion of Diesel Oil	51,199	3	20	56,516	45.96%

Source	Calculated GHG			Total GHG amount	
	t CO_2/y	t CH_4/y	t N_2O/y	tCO_2e	Percentage
Blasting	217	-	-	217	0.18%
Carbon Stock Change in Vegetation	46,239	-	-	46,239	37.60%
TOTAL				122,963	100.00%

The above tables present the emissions from the construction phase, with contribution of each source to the overall GHG emissions from the Project. Tonnes of CO_2e are calculated using the GWPs from Section 8.1.7.2.1 above.

Table 119: Comparison of Project GHG Emissions to National and Global Emissions

Source	Construction
Project GHG Emissions (tonnes CO_2eq/year)	122,963.42
Comparison to Turkey-wide Total (%)	0.024%
Comparison to Global Total (%)	0.00048%
Turkey-wide GHG Emissions (2019)[26] (tonnes CO_2eq/year)	**506,080,420.00**
UNFCCC Annex-I 2018 GHG Emissions[27] (tonnes CO_2eq/year)	**25,647,561,943.89**

Table 119 summarizes the annual overall emissions in tonnes of CO_2e for the Project construction phase. Data for GHG releases from Turkey are obtained from Turkey 2021 National Inventory Report (NIR) for UNFCCC and total of Annex-I countries GHG releases are obtained from UNFCCC GHG database for the last inventory year 2018. For the construction phase, the GHG emissions from the Project are an insignificant contribution to the totals reported for the country level and global reporting programs.

It is accepted that increased anthropogenic GHG emissions are contributing to climate change. However, the GHG emissions due to the Project represent an insignificant and unmeasurable increase in global GHG emissions. Country scale and global greenhouse gas emission levels are anticipated to be maintained.

The combined annual emissions from the construction phase of the Project are about **122,963 t CO_2e per annum**. this annual value surpasses the 25,000 t CO_2e threshold. Therefore, technically feasible and cost-effective mitigation options must in any case be considered.

[26] Obtained from TUIK, Turkey 2019 National Inventory Report (NIR) for UNFCCC

[27] Obtained from UNFCCC GHG database, https://di.unfccc.int/time_series

8.1.7.3.2 Commissioning and Operational Phase

8.1.7.3.2.1 GHG Emissions Calculations

Indirect Emissions from Purchased Electricity

The GHG emissions estimation for the operational phase of the Project draws upon the calculations made in the Bandırma - Bursa - Yenişehir - Osmaneli High Standard Railway Project Revised Feasibility Study dated March 2020.

Passenger Trains

In the feasibility study, passenger projections have been made starting from 2022 to 2051. It is projected that the Project would be capable of carrying a capacity of 14.8 million passengers (8,550 trips) two-ways on Bursa-Eskişehir-Ankara and Bursa-Kocaeli-İstanbul routes in 2051. For the calculations, average number of the passenger capacity (9.9 million) between years 2022 and 2051 and accordingly trips/year are taken into consideration.

In the feasibility study, average energy consumption of 2 different set of trains (CAF and Siemens) are calculated as 12.6 kWh/km. Energy consumption of a total of 5,754 trips (including two-ways and both routes) i.e., 3,078 trips along the Bursa-Kocaeli-İstanbul route and 2,677 trips along the Bursa-Eskişehir-Ankara route has been calculated below assuming each passenger travels the entire length of two-way trip for Bursa-İstanbul and Bursa-Ankara route.

The calculation made according to the equation and the emission factor given in Section 8.1.7.2.3.1 has been represented in Table 120 to estimate the annual GHG emissions associated with passenger trains. As shown, annual emissions from passenger trains are calculated as 8,554 t CO2e.

Table 120: Passenger Train GHG emissions

Direction	kWh/km	MWh/trip	Trips/year	MWh/year	t CO_2e/year
Bursa-Kocaeli-İstanbul (207 km)	12.6	2.6	3,078	8,012	4,575
Bursa-Eskişehir-Ankara (207 km)	12.6	2.6	2,677	6,968	3,979
TOTAL			**5,754**	**14,980**	**10,476**

Freight Trains

In the feasibility study, freight projections have been made starting from 2022 to 2051. It is projected that the Project would be capable of carrying a capacity of 21.6 million freight (29,517 trips) two-ways on Bursa-Ankara, Bursa-İzmir and Bursa- İstanbul routes in 2051. For the calculations, average number of the freight capacity (13,4 million tonnes) between years 2022 and 2051 and accordingly trips/year is taken into consideration.

In the feasibility study, average energy consumption of 2 different set of trains (CAF and Siemens) are calculated as 12.6 kWh/km. Energy consumption of a total of 16,070 trips (including two ways, all routes) i.e., 5,357 trips along the Bursa-Kocaeli-İstanbul route, 5,357 along the Bursa-İzmir route and 5,357 trips along the Bursa-

Eskişehir-Ankara route has been calculated below assuming each freight travels the entire length of two-way trip for Bursa-İstanbul, Bursa İzmir and Bursa-Ankara route.

The calculation made according to the equation and the emission factor given in Section 8.1.7.2.3.1 has been represented in Table 121 to estimate the annual GHG emissions associated with freight trains. As shown, annual emissions from freight trains are calculated as 8,554 t CO_2e.

Table 121: Freight Train GHG emissions

Direction	kWh/km	MWh/trip	Trips/year	MWh/year	tCO_2e
Bursa-Kocaeli-İstanbul (207 km)	12.6	2.6	5,357	13,944	7,962
Bursa-İzmir (153 km)	12.6	119	5,357	10,300	5,881
Bursa-Eskişehir-Ankara (207 km)	12.6	2.6	5,357	13,944	7,962
TOTAL			**5,754**	**38,188**	**26,705**

Total GHG Emissions in Operation Phase

The annual GHGs emissions for operation phase of Project are presented in Table 118. These annual emissions are calculated for the estimated operation scenario described above. They are based on rough estimates and may significantly overestimate or underestimate the actual emissions.

Table 122: Annual Project GHG Emissions for Operational Phase

Source	Calculated GHG			Total GHG amount	
	t CO2/y	t CH4/y	t N2O/y	tCO_2e	Percentage
Purchased electricity for the operations of passenger and freight trains	37,180	-	-	37,180	100.00%
TOTAL				37,180	100.00%

The above table present the emissions from the operational phase, with contribution of each source to the overall GHG emissions from the Project. Tonnes of CO_2e are calculated using the GWPs from Section 8.1.7.2.1 above.

Table 123: Comparison of Project GHG Emissions to National and Global Emissions

Source	Operational
Project GHG Emissions (tonnes CO_2eq/year)	37,180.38
Comparison to Turkey-wide Total (%)	0.007%
Comparison to Global Total (%)	0.00014%

Source	Operational
Turkey-wide GHG Emissions (2019)[28] (tonnes CO_2eq/year)	**506,080,420.00**
UNFCCC Annex-I 2018 GHG Emissions[29] (tonnes CO_2eq/year)	**25,647,561,943.89**

Table 119 summarizes the annual overall emissions in tonnes of CO_2e for the Project operational phase. Data for GHG releases from Turkey are obtained from Turkey 2021 National Inventory Report (NIR) for UNFCCC and total of Annex-I countries GHG releases are obtained from UNFCCC GHG database for the last inventory year 2018. For the operational phase, the GHG emissions from the Project are an insignificant contribution to the totals reported for the country level and global reporting programs.

The combined annual emissions from the operational phase of the Project which is considered as Scope 2 emissions arising from transportation activities (freight and passenger combined) are about **37,180 t CO_2e per annum**. This value surpasses the IFC standard threshold and places the operational phase emissions within the *medium* magnitude rating. Therefore, technically feasible and cost-effective mitigation options must be considered.

8.1.7.3.2.2 Operational Phase: Alternatives Assessment

The alternatives assessment has been undertaken for the operational phase of the Project and is based upon the key parameters (passenger/freight capacity, distance, etc.) of the Feasibility Study. The project operational GHG emissions have been assessed against three alternative scenarios/options as follows:

1) 100% passengers and 100% freight are transported using the existing diesel-powered MGR railway system;

2) 100% passengers and 100% freight are transported by road transport only. This scenario assumes the use of bus transportation for passenger movement and the use of mixed heavy/medium-weight goods vehicles for freight movement; and

3) A 50/50 modal split between Options 1 and 2 above.

The further assumptions are that all transportation within the alternative options will be by diesel vehicles (i.e. bus, truck, HGV or locomotive). The emissions factors used for this analysis have been taken from the GHG Protocol and are as shown in Table 124.

Table 124: GHG emissions factors for Alternatives Analysis

Type	Rail (diesel-hauled)	Road(diesel)	Units
Passenger	0.115	0.067	Kg CO_2e/passenger km
Freight	0.055	0.204	Kg CO_2e/tonne km

The comparison of the Project operations to the three alternative options is shown below in Table 125.

[28] Obtained from TUIK, Turkey 2019 National Inventory Report (NIR) for UNFCCC

[29] Obtained from UNFCCC GHG database, https://di.unfccc.int/time_series

Table 125: GHG Emissions Factors Comparison for Alternatives Analysis

ITEM	Base case Project	Option 1 Diesel-hauled Rail	Option 2 Road	Option 3 Diesel-hauled Rail & Road
Passengers per annum	9,900,000	9,900,000	9,900,000	9,900,000
Freight per annum	13,400,000	13,400,000	13,400,000	13,400,000
Km/trip	414	414	414	414
Passenger km per annum	4,098,600,000	4,098,600,000	4,098,600,000	4,098,600,000
Freight tonne km per annum	5,547,600,000	5,547,600,000	5,547,600,000	5,547,600,000
Passenger EF (tCO_2e/passenger km)	0.002×10^{-3}	0.115×10^{-3}	0.067×10^{-3}	0.091×10^{-3}
Freight EF (tCO_2e/tonne km)	0.004×10^{-3}	0.017×10^{-3}	0.204×10^{-3}	0.115×10^{-3}
Passenger tCO_2e per annum	8,554	471,339	274,606	372,973
Freight tCO_2e per annum	21,805	94,309	1,131,710	637,974
TOTAL tCO_2e per annum	**37,180**	565,648	1,406,317	1,010,947

The above table shows that overall, the BBYO High Standard High Speed Railway operations will result in significantly lower CO_2e emissions than the other three options assuming the same volumes of passengers and freight are transported along the Project route.

Conclusions of Alternative Assessment

GHG Savings: The absolute and percentage savings of SGR operations as compared to the three alternative options are shown below.

Table 126: GHG emissions savings against alternatives

ITEM	Base case SGR	Option 1 MGR	Option 2 Road	Option 3 MGR & Road
TOTAL tCO_2e per annum	**37,180**	565,648	1,406,317	1,010,947
GHG saving of SGR against alternatives as absolute tCO_2e per annum	-	535,289	1,375,958	980,588
GHG saving of SGR against alternatives as percentage per annum	-	95	98	97

As shown, the BBYO High Standard High Speed Railway operations would result in savings of GHG ranging **between 95 and 98 percent**, depending on the compared option.

8.1.7.3.3 Decommissioning and Closure Phase

A new impact is not expected in terms of GHG emissions other than those listed in the construction phases during the decommissioning and closure phase of the Project.

8.1.7.4 Mitigation Measures

The annual GHGs emission calculations for the construction and operational phases of Project are presented in above sections. These annual emissions are calculated by the rough data provided from the Client and rough estimations. Therefore, these calculations may be significantly underestimated or overestimated compared to the actual emissions. Considering these hesitations, GHG emission calculations for construction and operation phases should be renewed more precisely using the actual consumption amounts and design parameters.

Project resource efficiency and GHG emissions will be managed in accordance with the Resource Efficiency Management Plan and Air Quality and GHG Emissions Management Plan to be prepared for the Project.

Section 8.1.7.2 describes methodology for estimation of GHG emissions due to the Project and Section 8.1.7.3 evaluates potential contribution to global climate change. As stated above, the Project's contribution to national and global GHG emissions and climate change is insignificant since both the annual and total emissions are not high enough compared to Turkish and Global GHG emissions. Since, the annual GHG emissions are above the IFC and EP4 thresholds, GHG emissions that arise from Project activities will be quantified and reported publicly on an annual basis.

In addition to abovementioned actions, the following measures will be applied to reduce GHG emissions as much as possible:

- The Best Available Techniques will be taken into consideration in Project design as much as possible. The applicability of the Best Available Techniques (BATs) developed within the European regulatory framework [i.e., Integrated Pollution Prevention and Control, "IPPC", BAT Reference Documents (BREFs) according to the European Directive 2010/75/EU (IED)] should been evaluated and integrated into the Project design.
- Maintenance of all machinery and equipment will be periodically conducted to ensure efficient fuel use and effective operation.
- All employees will be provided climate, resource and energy efficiency awareness training.
- No idling and out-of-scope operation of the machinery and equipment will be allowed.
- Efficient resource and material use will be promoted to reduce direct and indirect GHG emissions from the Project.
- All the fuels and other energy sources will be chosen among those that have the highest calorific values and minimum emissions per unit consumed.
- The increase of renewable energy production in national grid electricity may induce a decrease in scope 2 related GHG emissions which is linked to the operation phase of the Project.

8.1.7.5 Residual Impacts

8.1.7.5.1 Construction Phase

According to the GHG calculations for the construction presented in above sections, the estimated contribution of the Project is assessed to be insignificant when compared to national and international GHG emission levels. The table below summarizes the identified impact factor involved in the construction phase of the Project.

Table 127: GHG Emissions Impact Matrix for Construction Phase

<table>
<tr><th>Impact Factor</th><th colspan="2">Impact Factor Features</th><th>Component Sensitivity</th><th colspan="2">Impact Features</th><th>Impact Value</th><th>Mitigation effectiveness</th><th>Residual impact value</th></tr>
<tr><td rowspan="4">Construction GHG Emissions</td><td>Duration:</td><td>Medium-long</td><td rowspan="4">Medium-low</td><td rowspan="4">Reversibility:</td><td rowspan="4">Mid term</td><td rowspan="4">Medium</td><td rowspan="4">Medium-high</td><td rowspan="4">Low</td></tr>
<tr><td>Frequency:</td><td>Continuous</td></tr>
<tr><td>Geo. Extent:</td><td>Global</td></tr>
<tr><td>Intensity:</td><td>Negligible</td></tr>
</table>

8.1.7.5.2 Commissioning and Operational Phase

In above sections contribution of the Project to climate change phenomenon is evaluated. When compared to national and international GHG emission levels, the estimated contribution of the operational phase is also assessed to be insignificant. Nevertheless, the mitigation measures listed above sections will be applied to reduce GHG emissions during the lifetime of the Project.

Because the GHGs, especially CO_2, have long life in the atmosphere, however cautiously applied the above-mentioned measures will not prevent occurrence of residual impacts. But, as stated before, the overall impact of the Project regarding climate change will be low.

Table 128: GHG Emissions Impact Matrix for Operational Phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features		Impact Value	Mitigation effectiveness	Residual impact value
Operational GHG Emissions	Duration:	Long	Medium-low	Reversibility:	Long term	**Medium**	Medium-high	**Low**
	Frequency:	Continuous						
	Geo. Extent:	Global						
	Intensity:	Negligible						

8.1.7.5.3 Decommissioning and Closure Phase

A new impact related to GHG emissions is not expected other than those listed in the construction phase in the decommissioning and closure phase (after the mitigation) of the Project.

8.1.7.6 Monitoring

The following table details the monitoring (measurement) activities identified for reporting and verifying of GHG emissions of the Project.

For each monitoring activity and measure/action identified, the table shows:

- The reference (or source) documents (i.e., ESIA, Turkish standard, permits, IFC Performance Standards and EHS Guidelines or other GIIP);
- Frequency/timing of the measurement,
- The Key Performance Indicator (KPI), and related quantitative target (if the target consists of a regulatory limit this will also be indicated); and,
- The related responsible party for implementing the related monitoring activity.

Table 129 Resource Efficiency and Energy Management Monitoring Actions

Source Document	Monitoring Action/Measure Description	Frequency/Timing	KPI	Target/Acceptance Criteria	Responsible Parties
GHG Protocol IPCC	Quantify the resource consumption and specifications on a periodic (i.e. monthly) basis by installing the appropriate devices; record and aggregate data on the consumption of the following resources: 1. Vehicles - Combustion of Diesel Oil (construction and closure); 2. Concrete and Precast Plants – Combustion of Diesel Oil (construction) 3. Generators - Combustion of Diesel Oil (construction and closure); 4. Electricity (Operation); Location of flow meters and counters must be clearly identified on a Site layout. Records on the data resources (such as fuel invoices that include consumption amounts) must be kept.	Monthly	Amounts consumed 1. [L] 2. [L] 3. [L] 4. [MWh]	N.A.	Investor / Contractors
GHG Protocol IPCC	Quantify the net calorific value and density of consumed resources and specifications on a periodic (i.e. monthly) basis by installing the appropriate devices; record and aggregate data on consumption of the following resources: 1. Vehicles - Combustion of Diesel Oil (construction and closure); 2. Concrete and Precast Plants – Combustion of Diesel Oil (construction)	Monthly	The example units are provided below, other similar related units are acceptable. Net calorific value: TJ/Gg Density: kg/lt	N.A.	Investor / Contractors

Source Document	Monitoring Action/Measure Description	Frequency/Timing	KPI	Target/Acceptance Criteria	Responsible Parties
	3. Generators - Combustion of Diesel Oil (construction and closure); Records on the data resources (such as fuel invoices that include consumption amounts) must be kept.				
EP4 Principle 10, IFC PS3	GHG emission levels (combined Scope 1 and Scope 2 Emissions, and, if appropriate, the GHG efficiency ratio) from the facilities owned or controlled within the physical project boundary, as well as indirect emissions associated with the off-site production of energy used by the Project, will be quantified and reported publicly on annual basis.	Annual	GHG Emission Report	Compliance with international standards	Investor / Contractors

8.1.8 Climate Change Risk Assessment (CCRA)

According to the "*Equator Principles 4 – Principle 2: Environmental and Social Assessment*", a Climate Change Risk Assessment (CCRA) is required to be prepared:

- For all Category A and, as appropriate, Category B Projects and will include consideration of relevant physical risks as defined by the TCFD[30], and
- For all Projects, in all locations, when combined Scope 1 and Scope 2 Emissions are expected to be more than 100,000 tonnes of CO_2 equivalent annually. Consideration must be given to relevant Climate Transition Risks (as defined by the TCFD) and an alternatives analysis completed which evaluates lower Greenhouse Gas (GHG) intensive alternatives.

Since the Project is proposed as "Category A" according to EP4, a Climate Change Risk Assessment (CCRA) is prepared considering:

- the current and anticipated climate risks (transition and/or physical as defined by the TCFD) of the Project's operations,
- the plans, processes, policies and systems in place to manage these risks (i.e., to mitigate, transfer, accept or control), and
- Project's compatibility with the host Turkey's national climate commitments, as appropriate.

In the Recommendations Report[31], TCFD divided climate-related risks into two major categories which are:

- **Transition Risks:** Risks related to the transition to a lower-carbon economy, and
- **Physical Risks:** Risks related to the physical impacts of climate change.

8.1.8.1 Risk Assessment

8.1.8.1.1 Transition Risks

In the Recommendations Report of TCFD, it is stated that extensive policy, legal, technology, and market changes due to transitioning to a lower-carbon economy for addressing the mitigation and adaptation requirements related to climate change may cause some risks ("Transition Risks") to the projects and organizations. Depending on the nature, speed, and focus of these changes, transition risks may pose varying levels of financial and reputational risk to organizations. The possible transition risks are given as:

- **Policy Risk:** Risks due to policy actions attempt to constrain actions that contribute to the adverse effects of climate, or policy actions that seek to promote adaptation to climate change.
- **Legal Risk:** Litigation risks due to failure of organizations to mitigate impacts of climate change, failure to adapt to climate change, and the insufficiency of disclosure around material financial risks.
- **Technology Risk:** Risks due to the technological improvements or innovations that support the transition to a lower-carbon, energy efficient and economic system.
- **Market Risk:** Risks due to shifts in supply and demand for certain commodities, products, and services

[30] Task Force on Climate-related Financial Disclosures (TCFD)

[31] TCFD. (2017). *Recommendations of the Task Force on Climate-related Financial Disclosures*. Task Force on Climate-Related Fiancial Disclosures, June.

- **Reputational Risk:** Risks due to changing customer or community perceptions of an organization's contribution to or detraction from the transition to a lower-carbon economy.

As assessed detailed in GHG Emissions Section, the annual GHG emission for the operational phase (minimum of 32 years) was calculated as average of 30,359 tonnes of CO_2 per year.

Considering the factors that; 1) the Project will use electrical energy, which is considered as of the cleanest energy sources for present and future, for the operation of the passenger and freight trains, 2) the major part of the GHG emissions of the Project will be due to the construction activities, and 3) the operational phase annual GHG emissions are expected to be less than 100,000 tonnes of CO_2 equivalent, the transition risks are not expected to be occur in the construction and operational phases of the Project, therefore they are not assessed in the CCRA.

8.1.8.1.2 Physical Risks

TCFD categorise physical risks resulting from climate change as Acute Risks (event driven) and Chronic Risks (longer-term shifts in climate patterns) that may have financial implications for organizations, such as direct damage to assets and indirect impacts from supply chain disruption. (E.g., financial effects due to changes in availability, sourcing, and quality of water, and food security; effects on organization's premises, operations, supply chain, transport needs, and employee safety due to the extreme temperature changes). The possible physical risks explained as:

- **Acute Risk:** Immediate physical risks which are event-driven, including increased severity of extreme weather events, such as Wildfire, Floods, Hurricane, etc.
- **Chronic Risk:** Longstanding physical risks due to longer-term shifts in climate patterns (e.g., sustained higher temperatures) that may cause sea level rise or chronic heat waves.

8.1.8.1.2.1 Acute Risks

Adopting the risk values of a web-based tool called "ThinkHazard"[32], which uses the local and global scale historical data, developed by GFDRR[33], and considering the possible acute effects on the Project, **Flood** and **Wildfire** are selected as potential hazards to be assessed under acute risks among the extreme weather events resulting from climate change.

Flood

Flood is one of the extreme weather events that can be caused by heavy precipitations, and river and sea overflows due to climate change.

<u>Possible Impacts</u>

Threat to worker safety, damage to materials equipment, vehicles, infrastructure, worker camps, quarries and buildings, delay of the construction, and impact on the surrounding business, environment, and communities can be counted as the potential adverse effects of a flood incident on the construction activities of the Project.

During the operational phase of the Project, flood can disrupt the stationery trains, railway, the buildings and infrastructure located at stations, and fencing along the railway. Flood may also pose risks damaging tunnels, underpass and overpasses, bridges, culverts and viaducts infrastructure during peak flow. Additionally, it may

[32] https://thinkhazard.org/en/

[33] The Global Facility for Disaster Reduction and Recovery

cause delays for customers, loss of operation, increased operating costs, and impact on the surrounding business, environment, and communities.

Historical Incidents

According to the flood map of Turkey between 1950–2019 period, it can be inferred that the flood risk increases from west to the east and from the south to north of Turkey. In Balıkesir, Bursa and Bilecik, which are the provinces crossed by the Project, respectively 55, 36 and 19 number of flood incidents have occurred in the given period. Considering the total of 110 flood incidents occurred in these provinces in 70 years, 0.64 flood incident occurred every year in the past. The total number of flood incidents occurred in these provinces corresponds to 1.6% of the total number of flood incidents in Turkey.

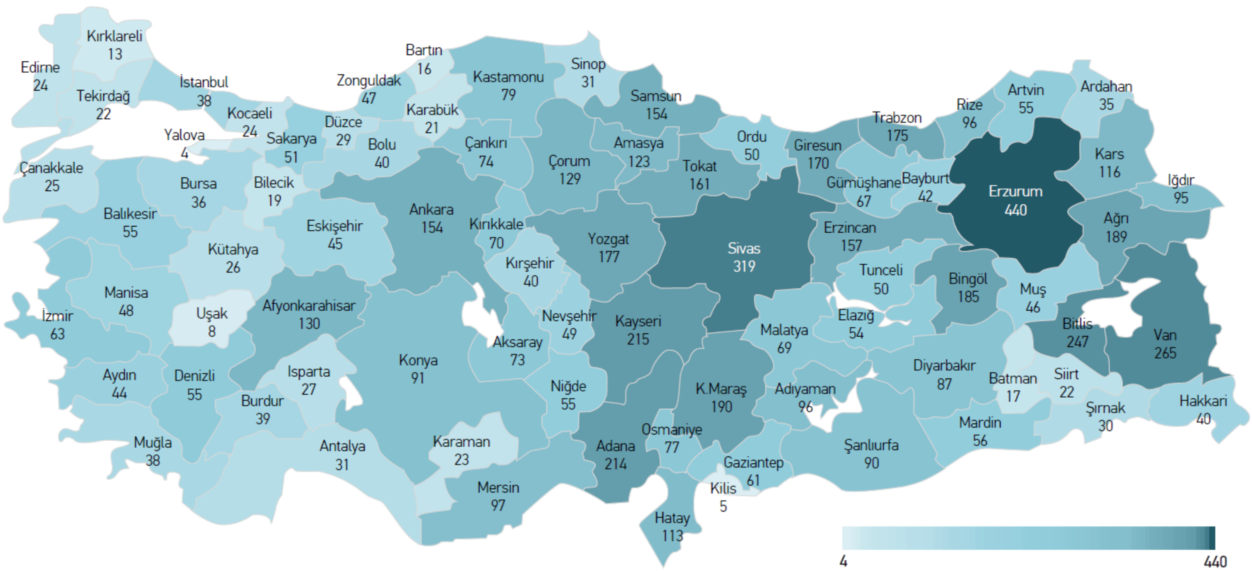


Figure 88: Historical Flood Numbers in Turkey between 1950-2019[34]

Adaptation Measures

General Directorate of Water Management has prepared Flood Management Plans for the Susurluk and Sakarya Basins which are the basins where the railway line is passing through. In these management plans flood risk assessments have been carried out at district level (including the Project districts) considering several factors including the climate change impacts. According to risk assessments conducted in these plans, the districts where the railway line is passes through are considered as high risk in terms of flood. However, lots of measures have been identified to be implemented in order to prevent and mitigate the flood risks in these areas. These are the regional adaptation examples against climate change developed by Turkey.

The Project design includes engineering structures such as tunnels, viaducts, underpasses, overpasses and culverts. All of these infrastructure units will be designed according to the Technical Specifications of General Directorate of Infrastructure Investments and other applicable standards including flood risks, as an internal adaptation.

[34] T.C. İçişleri Bakanlığı Afet ve Acil Durum Yönetimi Başkanlığı (2020), *AFET YÖNETIMI KAPSAMINDA 2019 YILINA BAKIŞ VE DOĞA KAYNAKLI OLAY İSTATISTIKLERİ*

Moreover, Emergency Response Plans (ERP) will be prepared both for the construction phase and operation phases in order to prevent the damages that can be caused by flood. Also, necessary trainings related to flood will be given to the workers for both phases of the Project.

Wildfire

Wildfire is another extreme weather event that can be caused by extreme heat combined with a reduction in precipitation due to climate change.

Possible Impacts

According to the land use information of the Project, around 15% of the Project area is in forest lands. Therefore, if there will be a wildfire incident occurs in these forests the Project will be very likely to be impacted for both construction and operational phases.

The possible impacts of wildfire during the construction phase of the Project are same with flood's impacts which are; Threat to worker safety, damage to materials equipment, vehicles, infrastructure, worker camps, quarries and buildings, delay of the construction, and impact on the surrounding business, environment, and communities.

During the operational phase of the Project, the stationery trains, railway, the buildings, infrastructure located at stations, and fencing along the railway can get damaged due to a potential wildfire incident. Wildfire can also damage the other infrastructure units such as bridges, culverts, overpasses and underpasses. Additionally, again it may cause delays for customers, loss of operation, increased operating costs, and impact on the surrounding business, environment, and communities.

Historical Incidents

Balıkesir, Bursa and Bilecik provinces, which are provinces crossed by the Project, are controlled and under the responsibility of Bursa Regional Directorate of Forestry (BRDoF). The number of forest fires and affected hectares under BRDoF between 2010 and 2019 presented in Table 130. According to these data, around 70 forest fires occur with a total of 216.6 ha were affected every year, and around 3% of the forest fires occurred in this region in the past 10 years. In Figure 89, Map of fire risk in Turkey, which was prepared according to the historical data by General Directorate of Forestry, is presented. It can be said that forest fire risk increases from east to west and from the north to south of Turkey. Balıkesir, Bursa and Bilecik corresponds to the 1st (highest) and 2nd degree fire risk according to this map.

Table 130: Historical Data of Forest Fire in Turkey and Bursa Regional Directorate of Forestry between 2010-2019

Years	Forest Fire	Bursa Region	Turkey	Percentage
2010	Number	53	1861	2.80%
	Hectare	108	3317	3.30%
2011	Number	72	1954	3.70%
	Hectare	121	3612	3.30%
2012	Number	81	2450	3.30%
	Hectare	343	10455	3.30%
2013	Number	118	3755	3.10%
	Hectare	532	11456	4.60%
2014	Number	64	2149	3.00%
	Hectare	40	3117	1.30%

Years	Forest Fire	Bursa Region	Turkey	Percentage
2015	Number	43	2150	2.00%
	Hectare	263	3219	8.20%
2016	Number	78	3188	2.40%
	Hectare	139	9156	1.50%
2017	Number	63	2411	2.60%
	Hectare	254	11993	2.10%
2018	Number	40	2167	1.80%
	Hectare	62	5644	1.10%
2019	Number	84	2688	3.10%
	Hectare	304	11332	2.70%

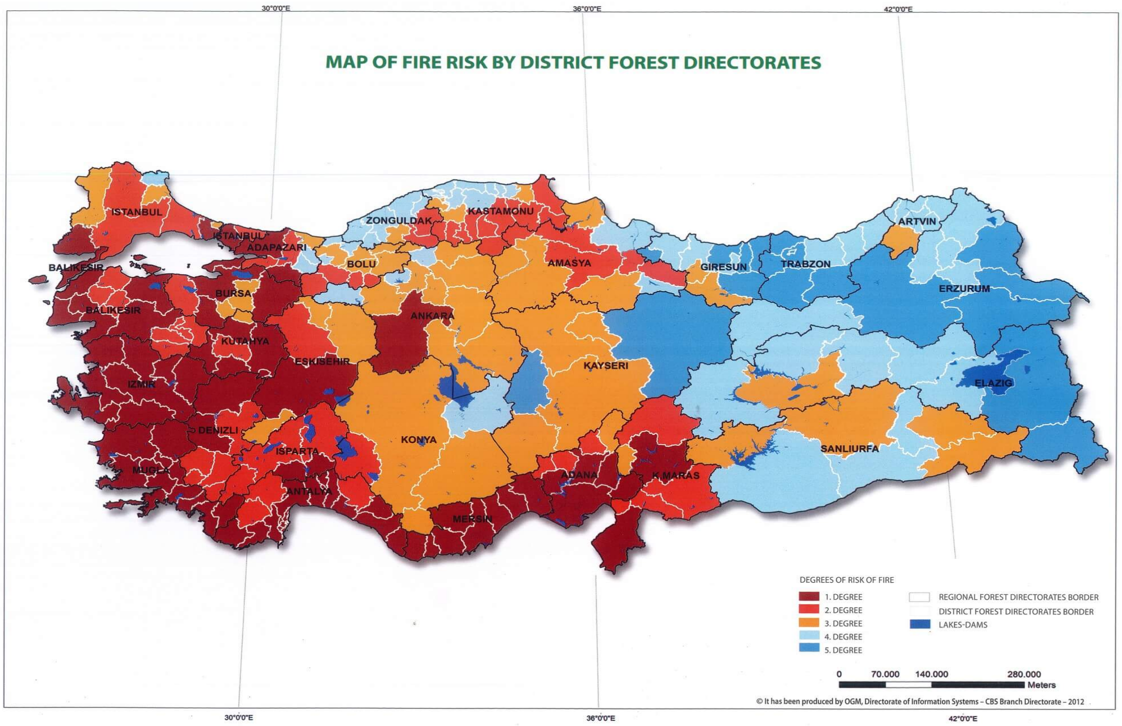


Figure 89: Map of Fire Risk by District Forest Directorates[35]

<u>Adaptation Measures</u>

Although Forest Fire Management Plans were prepared for some of the regions in Turkey, there is not any specific forest fire plan prepared for the Balıkesir-Bursa-Bilecik regions. Therefore, there is no regional adaptation measures against climate change developed by Turkey.

Emergency Response Plans (ERP) will be prepared both for the construction phase and operation phases in order to prevent the damages that can be caused by a potential fire incident. These plans will address special measures (such as assigning emergency crews, equipment for the tunnels, bridges and viaducts to provide easy access to the railway, fire safety measures including planting and management of fire-resistant species

[35] Obtained by General Directorate of Forestry Website, https://www.ogm.gov.tr

adjacent to the railway and monitoring of nearby vegetation according to fire risk as recommended by the GIIP. Also, necessary trainings against fire will be given to the workers for both phases of the Project.

8.1.8.1.2.2 Chronic Risks

Despite the indirect effects such as increase in severity and frequency of extreme weather events, which is assessed in the acute risks, chronic risks due to long-term shifts in climate patterns (e.g., sustained higher temperatures, changes in precipitation) are not expected to have a significant effect neither on the construction nor the operational phases of the Project. Therefore, no chronic risk is assessed in this chapter.

8.1.8.1.2.3 Overall Assessment of the Physical Risks

Construction Phase

Considering the possible impacts and historical frequency of the physical risks, sensitivity of the impacted areas, units and people, the duration of the construction phase (3 years), and the regional and internal adaptation measures that will be taken by the relevant institutions and the Client, the impacts of climate change on the Project during the construction phase can be evaluated as Negligible.

Operational Phase

When all the factors same above with the construction and the longer duration of the operational phase (minimum of 32 years) different from the construction phase are taken into account, it can be considered that the Project may be affected adversely during the operational phase by the Physical Risks defined above chapters. However, these impacts due to Climate Change in the operational phase are expected to be Low on the Project.

8.1.9 Noise

Exposure to prolonged or excessive noise has been shown to cause a range of health problems ranging from stress, poor concentration, productivity losses in the workplace, and communication difficulties and fatigue, from lack of sleep to more serious issues such as cardiovascular disease, cognitive impairment, tinnitus and hearing loss. Noise also has the potential to cause some animals to move away from otherwise suitable habitat (please see Biodiversity IA Section). Therefore, impact assessment for the noise generated by the Project activities has been carried out.

The Project has the potential to generate noise during the construction and operation phases. This section aims to assess impacts of noise.

Impacts have been assessed by taken into consideration the results of noise level measurements in the Area of Influence (AoI). The evaluation is performed also in the AoI which includes potentially affected settlements and sensitive environmental features as defined in the baseline section. During impact assessment, the Project actions and impact factors defined in Methodology Section are considered, and the mitigation and management measures are defined in this Section. As detailed below, the main approach to impact analysis is based on the calculations and modelling of predicted noise impacts during all main phases of the Project.

8.1.9.1 Noise Baseline Summary

In order to determine baseline noise levels along the planned railway and in its vicinity, 16 representative receptors (mostly the closest sensitive receptor to the planned railway) have been identified within the assessment area. The noise measurement studies are carried out by BATI Laboratuvarı Çevre Ölçüm Hizmetleri Bilişim Müh. Müş. San. ve Tic. LTD. ŞTİ. Noise measurement studies were performed on 13-15 March of 2021 in line with ISO 1996-2: 2017 standard.

All baseline noise levels are lower than both national and international standards. The conducted noise baseline measurement results are presented in Table 45 in the baseline section.

8.1.9.2 Noise Modelling Methodology

A noise modelling software "SoundPLAN Essential 5.0"[36] was used to determine the total noise level that will occur during the construction and operational phases of the planned Project. Information about the noise levels of vehicles and equipment identified as noise sources was obtained from the program's library.

Before starting the modelling studies, 20 different study areas (including the 16 areas where the noise measurements were carried out) were identified along the railway that wil mostly affected by both the construction and the operation of the Project to be used in the modelling studies. Then, modelling studies were carried out for each area both for the construction and the operation phases.

For the modelling studies for each study area, following steps were followed:

1) As a first step of modelling studies, the elevation model that directly affects the noise distribution of the natural terrain is created. In the meantime, elevation contours with 10 m intervals on the topographic map were digitized and loaded into the program. Interpolation of elevation contours was performed in the program and natural elevation data of the Railway and its surroundings were obtained to be used in the model. After the elevations are digitalized, Temporary DGM (Digitalized Ground Model) is generated.
2) At the second step, the humidity, temperature and air pressure data of the area, where the planned railway section passes through, were introduced to the model.
3) At the third step, the noise sources identified for the study area were put in th model together with their noise levels (dBA) using the library of the software.
4) At the fourth step, the determined receptors have also been digitized in the model.
5) At the fifth step, ground effects, which is another important parameter for the noise model, were also digitized in the model. Ground effects varies between 0 to 1, where 0 corresponds to hard, reflective surfaces and 0 corresponds to soft, absorptive surfaces.
6) Finally, the modelling process has been initiated by determining a calculation area that will include the all the noise sources and sensitive receptors in the study area. For the worst-case scenario simulation, all the noise sources are assumed to work at the same time and at the distances identified before. As a result of the model runs, noise levels in the identified receptors and grid noise maps for eac study area are obtained.

The Noise Model assumptions and approach are listed below;

- Noise model were developed by using equipment type and amount and noise levels which is defined in below sections;
- The humidity is taken as 60%, temperature as 15°C and air pressure is 1013 hPA for each of the study area by assuming a general average for region;
- The ground effects were taken differently for each study area, varying between 0.3 and 0.8, according to the rurality&urbanity intensity of the study area;
- The model is set considering the worst-case scenario, which represents the situation where all of the noise sources are operating at maximum volume at the same time;

[36] https://www.soundplan.eu/en/software/soundplanessential/

For the cumulative assessment of noise, Modelled Noise Levels were compared with the lowest (i.e. the quietest) baseline value to show the potential highest level of impact. The approach used (compare to quietest values) is appropriate since all baseline values were below guidance thresholds.

8.1.9.3 Impact Analysis

8.1.9.3.1 Construction Phase

Potential impacts from noise during the construction phase of the Project are mainly caused by the heavy equipment/machines that will be used in the infrastructure and superstructure construction.

During the construction phase, impacts will be mainly associated to the following ***impact factors***:

- Noise emissions

The Project actions related to the abovementioned impact factor are the following:

- Surface levelling and grading
- Operation of temporary facilities during the construction
- Transportation of construction materials
- Assembling the railway track

In this section, the environmental noise generated by the machinery and equipment to be used in the infrastructure and superstructure construction, is evaluated as cumulative for the purpose of displaying the worst-case scenario during the Project.

The equipment and machinery list that will be used during the whole Project are provided by the Owner and presented in Table 131. The noise levels of these equipment obtained from the library of Sound Plan Essential 5.0 are introduced to the model. The given equipment/machine list represents all the equipments that will be used in the whole railway line and the construction works will be carried out simultaneously in different sections of the planned railway and other units such as quarry, concrete plant, etc. Therefore, for model input following assumptions have been made for the noise sources:

- A section of 250 m * 25 m of rectangular construction area for the construction of railway have been identified in each study area. The cumulative Lw of construction machine and equipment that will be used in this rectangular construction area is calculated as 134.7 dBA using the total calculation formula for the equipments defined in the Roadway Construction Noise Model User's Guide (RCNM) of the United States (US) Federal Highway Administration. As a result, for each modelling study area, a rectangular noise Area Source (250 m * 25 m) with a sound power level (Lw) of **134.7 dBA** have been used in the model studies.
- For the construction of other project units (quarries, sores, concrete&precast plants, borrow sites, and camp sites), point sources with a sound level of **125 dBA** have been used in the model studies.

In the context of the worst-case approach, it has been accepted that the machines and equipment used in the construction are working simultaneously, in a collective way and at maximum sound power level.

Table 131 Construction Machine/Equipment List

Equipment Type	Equipment Number			Sound Power Level (Lw)
	Section 1	Section 2	Section 3	
Drilling Jumbo	16	23	29	123
Robot	18	25	32	118
Soil Drilling Rig	12	13	14	117
Excavator	50	55	60	108
Concrete Pump	9	10	11	109
Mixer	45	50	55	110
Truck	180	195	210	123
Grader	6	6	6	119
Dozer	7	8	8	117
Loader	20	22	24	116
Cylinder	14	15	16	118
Tank Truck	7	6	5	123
Crane	12	13	14	105
Maintenance Truck	7	6	5	115
Sprinkler Truck	10	12	14	123
Manitou	9	11	12	103
Other Equipments	90	105	120	105
Total	**512**	**575**	**635**	-

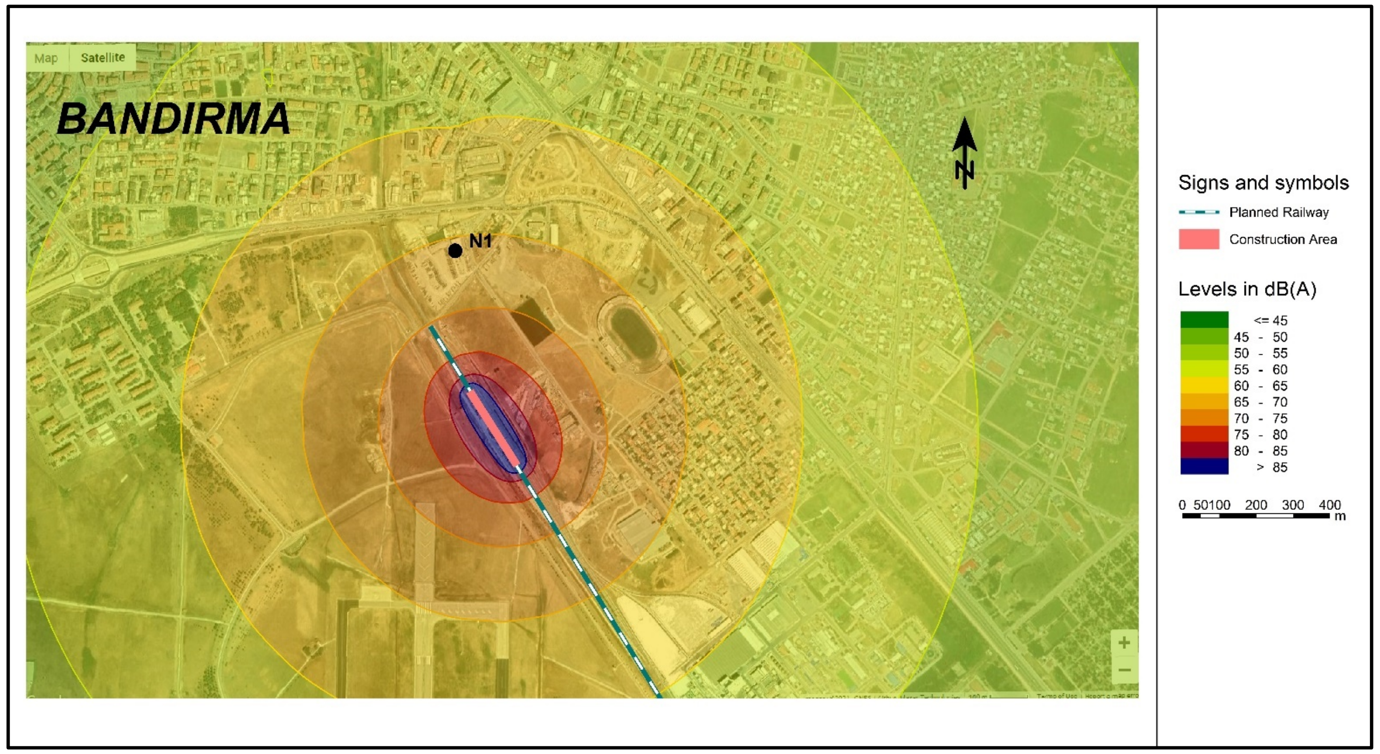
*Noise levels of the equipment are obtained from the library of Sound Plan Essential 5.0.

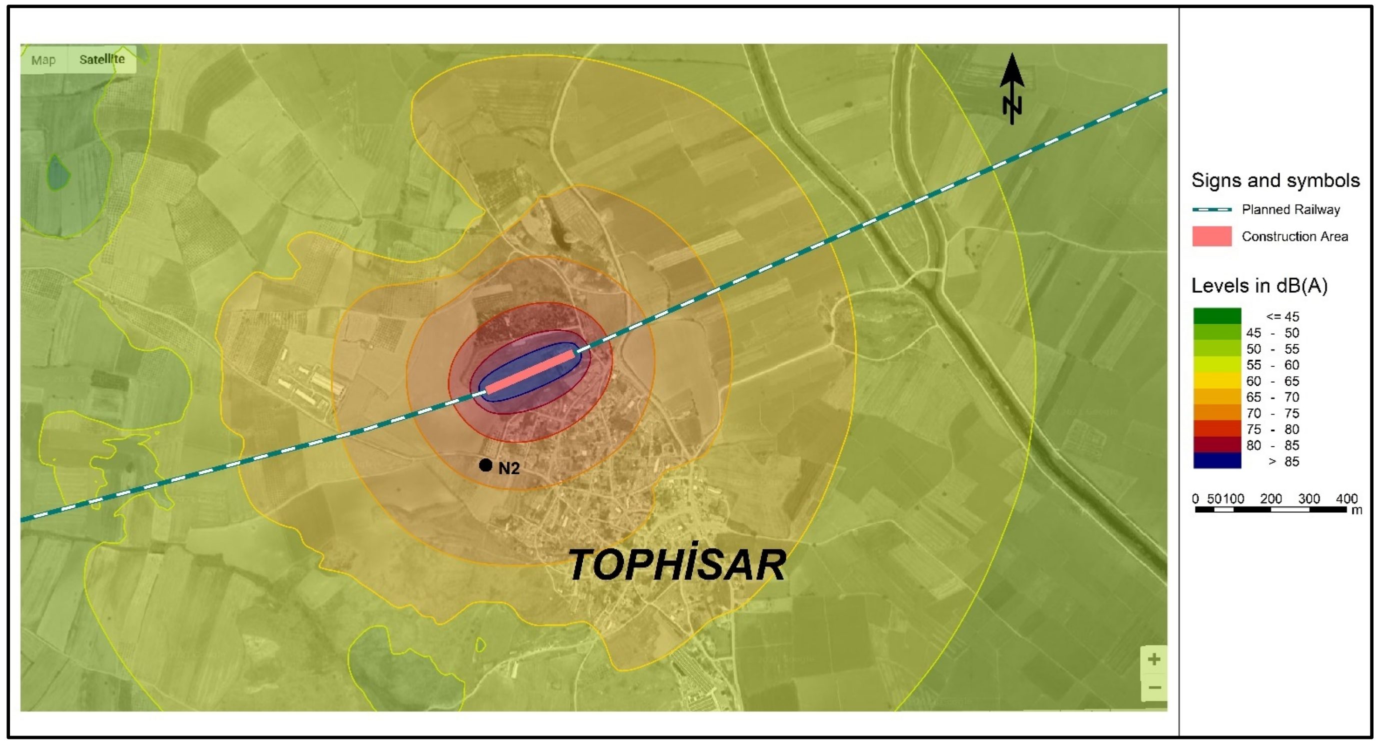
The determined 16 study area, where the baseline measurements were carried out, are modelled for the cumulative assessment of the construction phase. Also, additional 4 study area including Basalt Quarry, Stone Quarry-2, Stone Quarry-3 and Concrete Plant-2 were modelled to see the impact of noise generated on the closest settlements.

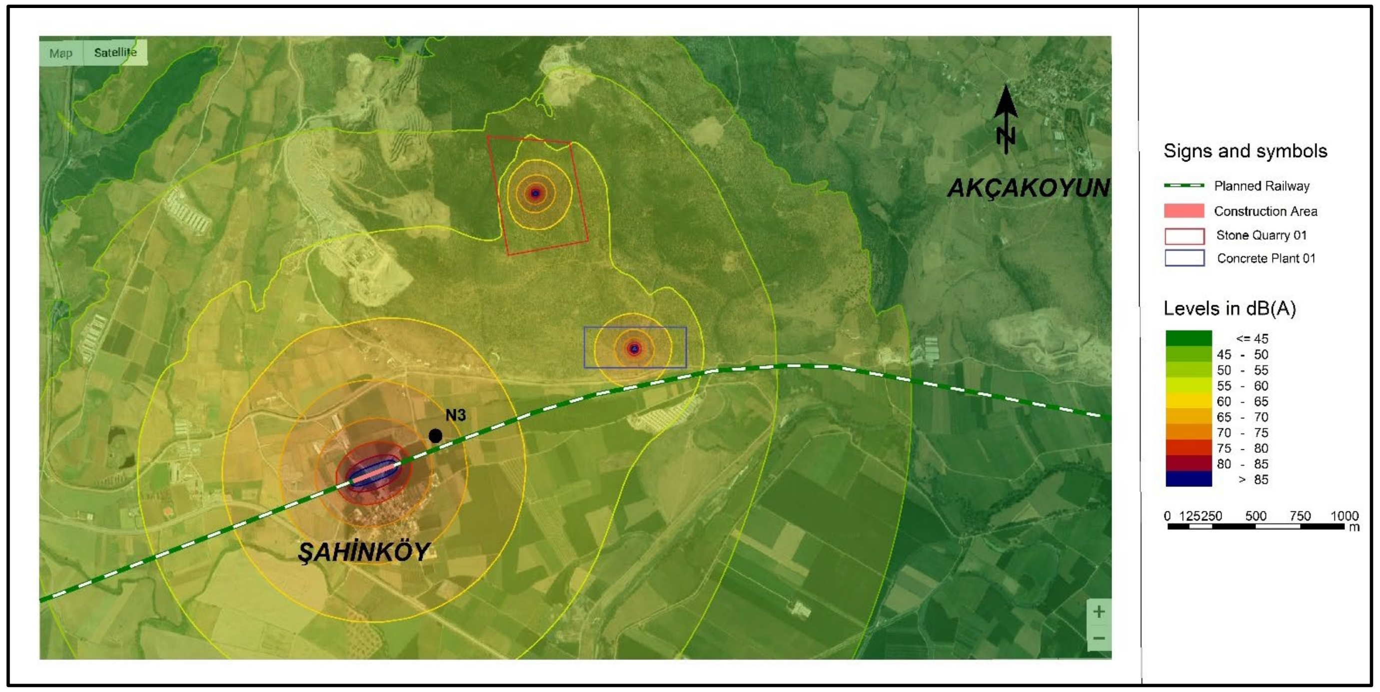
The calculated noise levels at the chosen receptors, where baseline noise measurements were conducted, the cumulative results and the comparison of the results with the IFC and Turkish standards are presented in Table 132. According to the modelling results, the cumulative results of all the receptors assessed are above the IFC and Turkish Regulatory noise limits. Also, the increase in background levels for these receptors are higher than 3 dBA. The daytime grid noise maps obtained for the construction phase are presented in Figure 90.

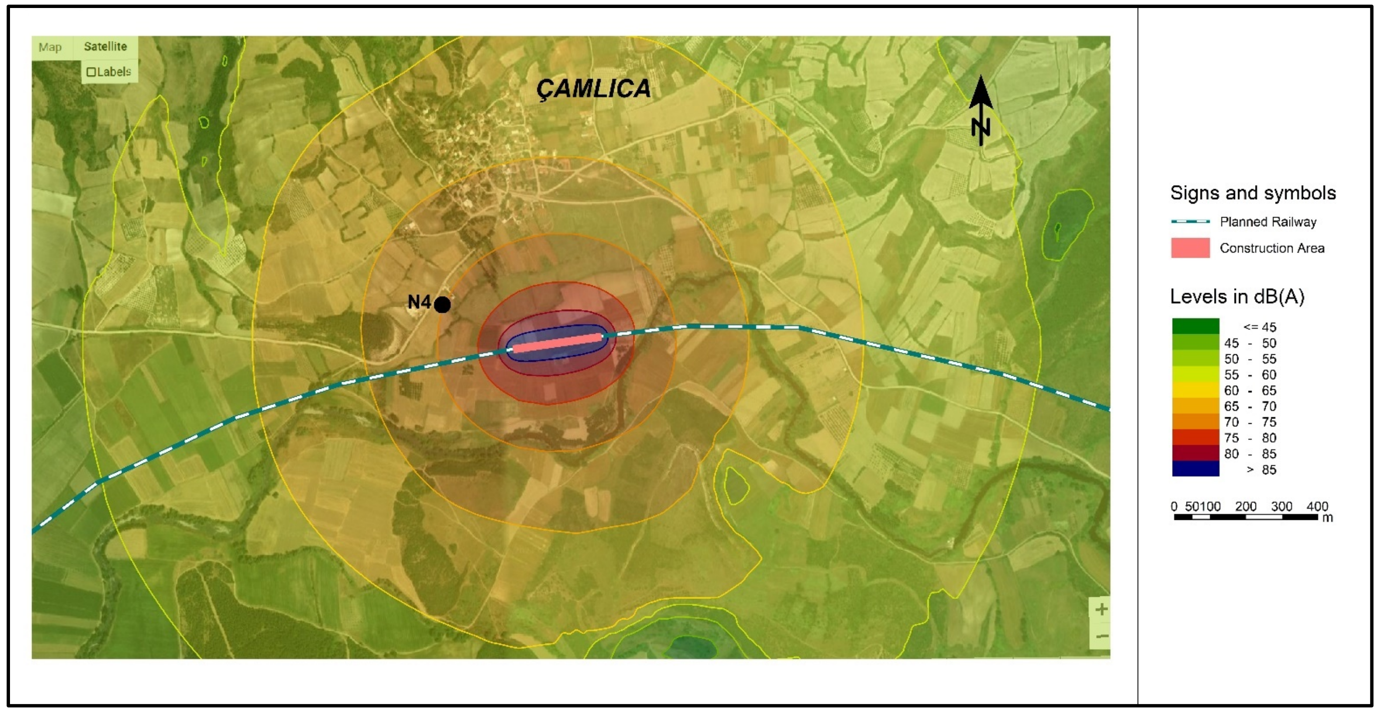
Table 132 Comparison between Modelled Construction Noise Levels and Baseline Noise Levels

Receptor	Corresponding Railway km	Distance to Railway Section (m)	Modelled Noise Level (originated from Project activities) (dBA)					The Baseline Noise Level (dBA)					Modelled Noise Level + The Ambient Noise Level (dBA)					Difference between ambient and modelled sound levels (dBA)				
			IFC		Turkish			IFC		Turkish			IFC		Turkish			IFC		Turkish		
			Day (07-22)	Night (22-07)	Day (07-19)	Evening (19-23)	Night (23-07)	Day (07-22)	Night (22-07)	Day (07-19)	Evening (19-23)	Night (23-07)	Day (07-22)	Night (22-07)	Day (07-19)	Evening (19-23)	Night (23-07)	Day (07-22)	Night (22-07)	Day (07-19)	Evening (19-23)	Night (23-07)
N1	000+000	225	65.7	65.7	65.7	65.7	65.7	50.3	42.6	51.3	45.1	42.8	65.8	65.7	65.9	65.7	65.7	15.5	23.1	14.6	20.6	22.9
N2	024+500	180	71.9	71.9	71.9	71.9	71.9	47.0	39.1	47.9	41.4	39.2	71.9	71.9	71.9	71.9	71.9	24.9	32.8	24.0	30.5	32.7
N3	039+450	55	67.8	67.8	67.8	67.8	67.8	47.6	40.0	48.5	42.6	40.2	67.8	67.8	67.9	67.8	67.8	20.2	27.8	19.4	25.2	27.6
N4	060+000	150	69.8	69.8	69.8	69.8	69.8	49.0	41.5	49.9	43.9	41.7	69.8	69.8	69.8	69.8	69.8	20.8	28.3	19.9	25.9	28.1
N5	079+360	35	60.3	60.3	60.3	60.3	60.3	48.9	40.8	49.8	43.8	40.8	60.6	60.3	60.7	60.4	60.3	11.7	19.5	10.9	16.6	19.5
N6	048+420	100	62.4	62.4	62.4	62.4	62.4	50.4	42.3	51.4	45.2	42.4	62.7	62.4	62.7	62.5	62.4	12.3	20.1	11.3	17.3	20.0
N7	068+400	70	57.3	57.3	57.3	57.3	57.3	51.7	41.6	52.7	46.4	41.5	58.4	57.4	58.6	57.6	57.4	6.7	15.8	5.9	11.2	15.9
N8	088+350	140	61.4	61.4	61.4	61.4	61.4	51.4	43.5	52.4	46.1	43.7	61.8	61.5	61.9	61.5	61.5	10.4	18.0	9.5	15.4	17.8
N9	121+850	75	72.7	72.7	72.7	72.7	72.7	44.9	39.2	45.4	42.2	39.1	72.7	72.7	72.7	72.7	72.7	27.8	33.5	27.3	30.5	33.6
N10	146+500	15	63.3	63.3	63.3	63.3	63.3	44.5	38.8	44.9	41.8	38.6	63.4	63.3	63.4	63.3	63.3	18.9	24.5	18.5	21.5	24.7
N11	113+700	60	79.5	79.5	79.5	79.5	79.5	49.3	41.8	50.2	44.2	42.0	79.5	79.5	79.5	79.5	79.5	30.2	37.7	29.3	35.3	37.5
N12	109+400	110	59.6	59.6	59.6	59.6	59.6	48.4	40.9	49.3	43.4	41.1	59.9	59.7	60.0	59.7	59.7	11.5	18.8	10.7	16.3	18.6
N13	098+350	75	80.2	80.2	80.2	80.2	80.2	47.0	39.8	47.9	42.1	40.0	80.2	80.2	80.2	80.2	80.2	33.2	40.4	32.3	38.1	40.2
N14	060+380	80	40.6	40.6	40.6	40.6	40.6	51.8	43.8	52.7	46.4	44.0	52.1	45.5	53.0	47.4	45.6	0.3	1.7	0.3	1.0	1.6
N15	014+400	245	69.0	69.0	69.0	69.0	69.0	50.1	40.4	51.1	44.9	40.2	69.1	69.0	69.1	69.0	69.0	19.0	28.6	18.0	24.1	28.8
N16	044+150	95	78.1	78.1	78.1	78.1	78.1	45.8	39.9	46.2	43.0	39.8	78.1	78.1	78.1	78.1	78.1	32.3	38.2	31.9	35.1	38.3
Yeniköy	-	-	44.8	44.8	44.8	44.8	44.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Küçükyenice	088+500	850	61.4	61.4	61.4	61.4	61.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Necmiyeköy	137+300	1100	50.3	50.3	50.3	50.3	50.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Düzmeşe	137+250	1100	28.9	28.9	28.9	28.9	28.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IFC Noise Standards[1,2]		Industrial; commercial areas											70.0	70.0	-	-	-	≤3 (Noise impacts should not result in a maximum increase in background levels of 3 dBa the nearest receptor location off-site.				
		Residential; institutional; educational areas											55.0	45.0	-	-	-					
Turkish Noise Standards[3,4]		Sensitive areas with Schools, libraries and conference rooms, hospitals and health centres											-	-	60.0	55.0	50.0	-				
		Industrial areas											-	-	70.0	65.0	60.0					
		Locations with commercial areas and sensitive areas (dominated by residential areas)											-	-	65.0	60.0	55.0					
		Locations with commercial areas and sensitive areas (dominated by commercial areas)											-	-	68.0	63.0	58.0					
		Construction sites											-	-	70.0	-	-					


BANDIRMA
N1
Signs and symbols
Planned Railway
Construction Area
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
> 85
0 50100 200 300 400 m


TOPHİSAR
N2
Signs and symbols
Planned Railway
Construction Area
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
> 85
0 50100 200 300 400 m


AKÇAKOYUN
ŞAHİNKÖY
N3
Signs and symbols
Planned Railway
Construction Area
Stone Quarry 01
Concrete Plant 01
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
> 85
0 125250 500 750 1000 m


ÇAMLICA
N4
Signs and symbols
Planned Railway
Construction Area
Levels in dB(A)
<= 45
45 - 50
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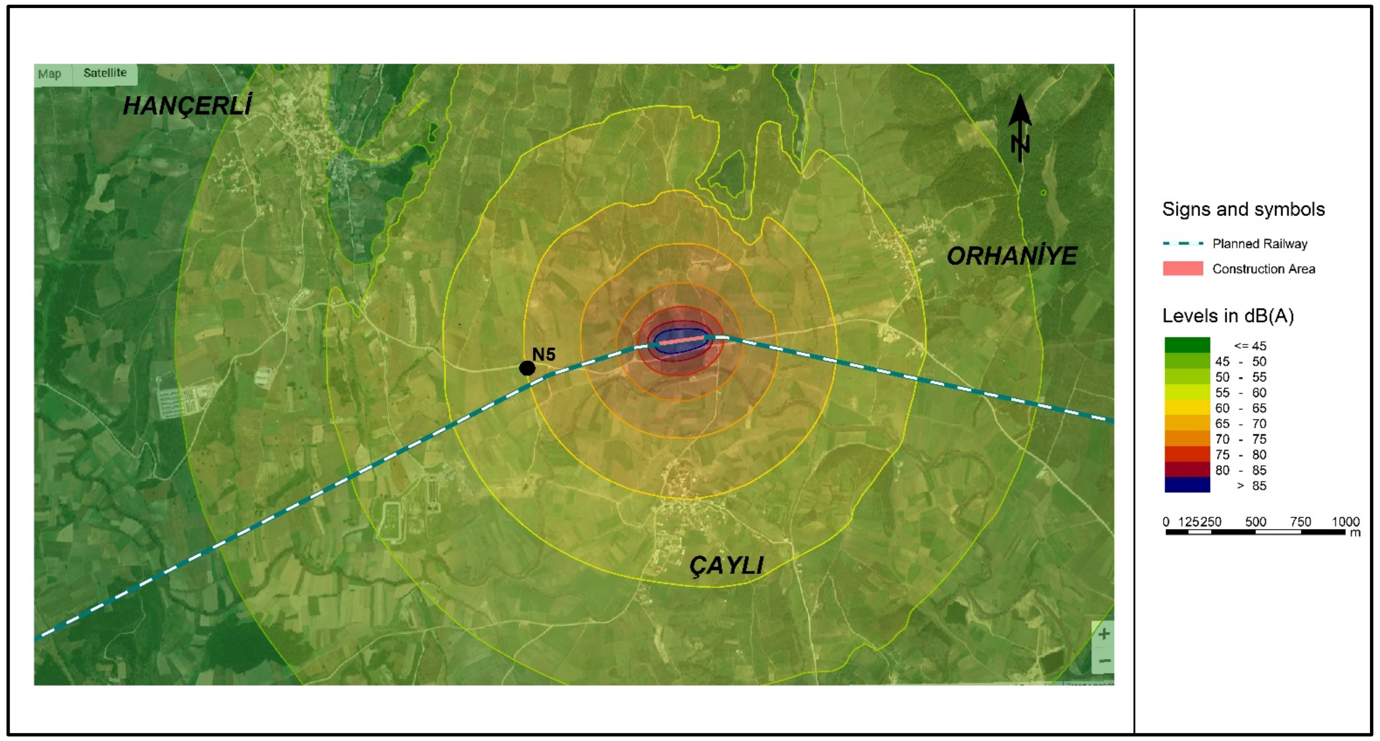
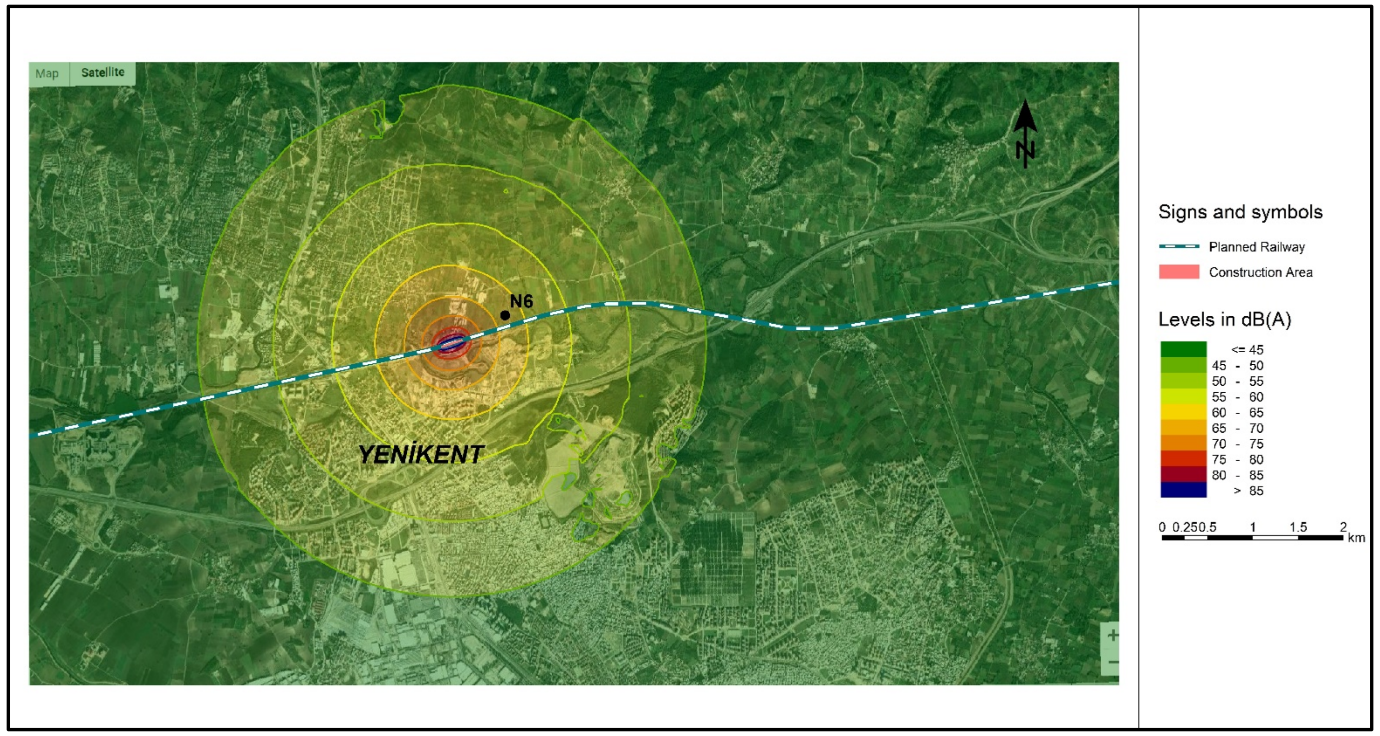
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
> 85
0 50100 200 300 400 m


HANÇERLİ
ORHANİYE
N5
ÇAYLI
Signs and symbols
Planned Railway
Construction Area
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
> 85
0 125250 500 750 1000
m


N6
YENİKENT
Signs and symbols
Planned Railway
Construction Area
Levels in dB(A)
<= 45
45 - 50
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60 - 65
65 - 70
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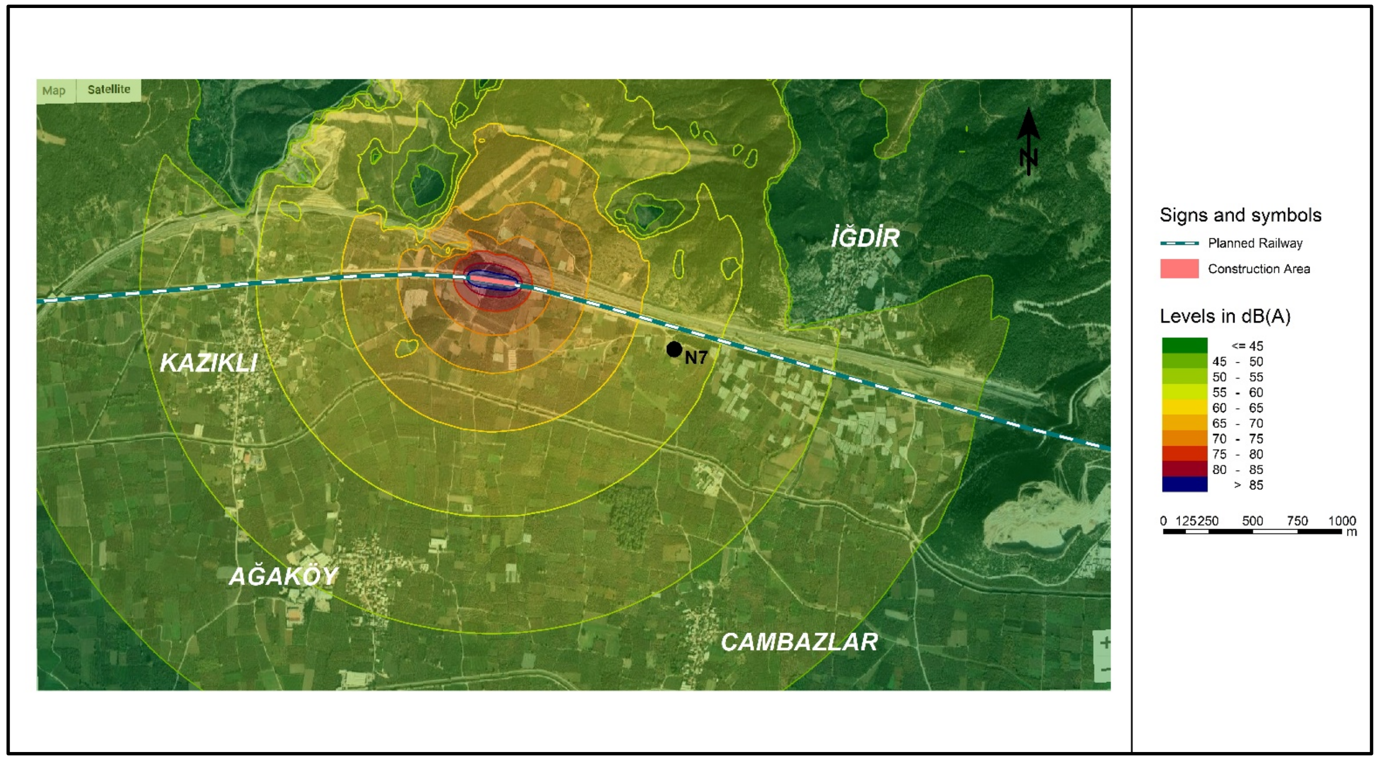
75 - 80
80 - 85
> 85
0 0.250.5 1 1.5 2
km


İGDİR
KAZIKLI
N7
AĞAKÖY
CAMBAZLAR
Signs and symbols
Planned Railway
Construction Area
Levels in dB(A)
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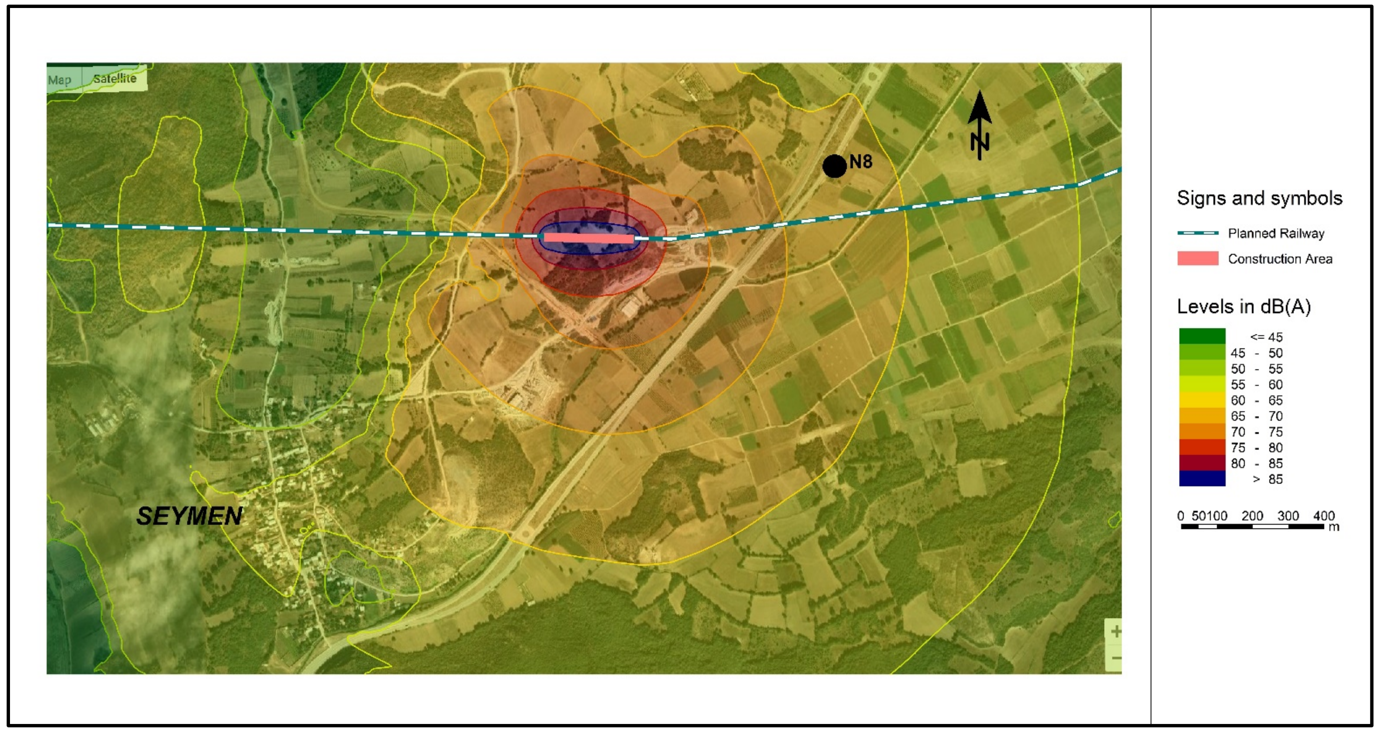
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
> 85
0 125250 500 750 1000
m


N8
SEYMEN
Signs and symbols
Planned Railway
Construction Area
Levels in dB(A)
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55 - 60
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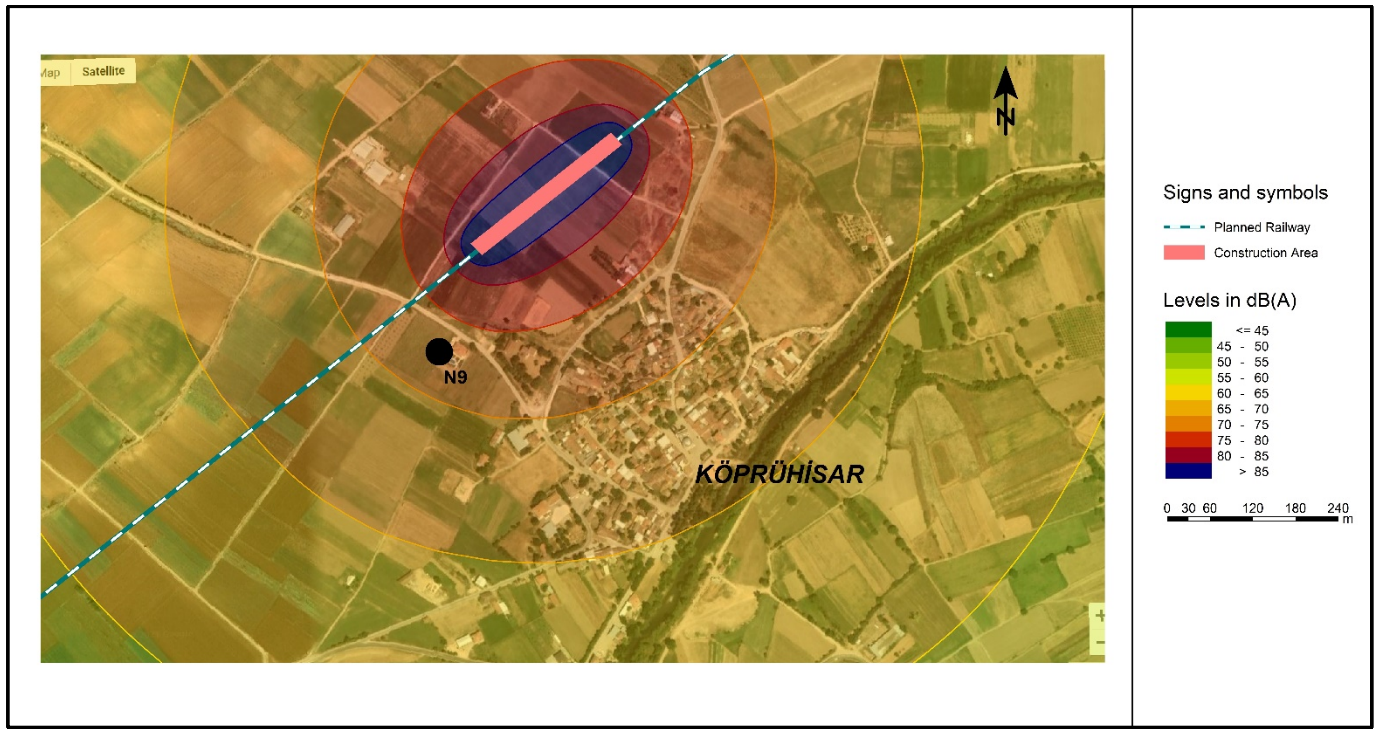
65 - 70
70 - 75
75 - 80
80 - 85
> 85
0 50100 200 300 400
m


KÖPRÜHİSAR
N9
Signs and symbols
Planned Railway
Construction Area
Levels in dB(A)
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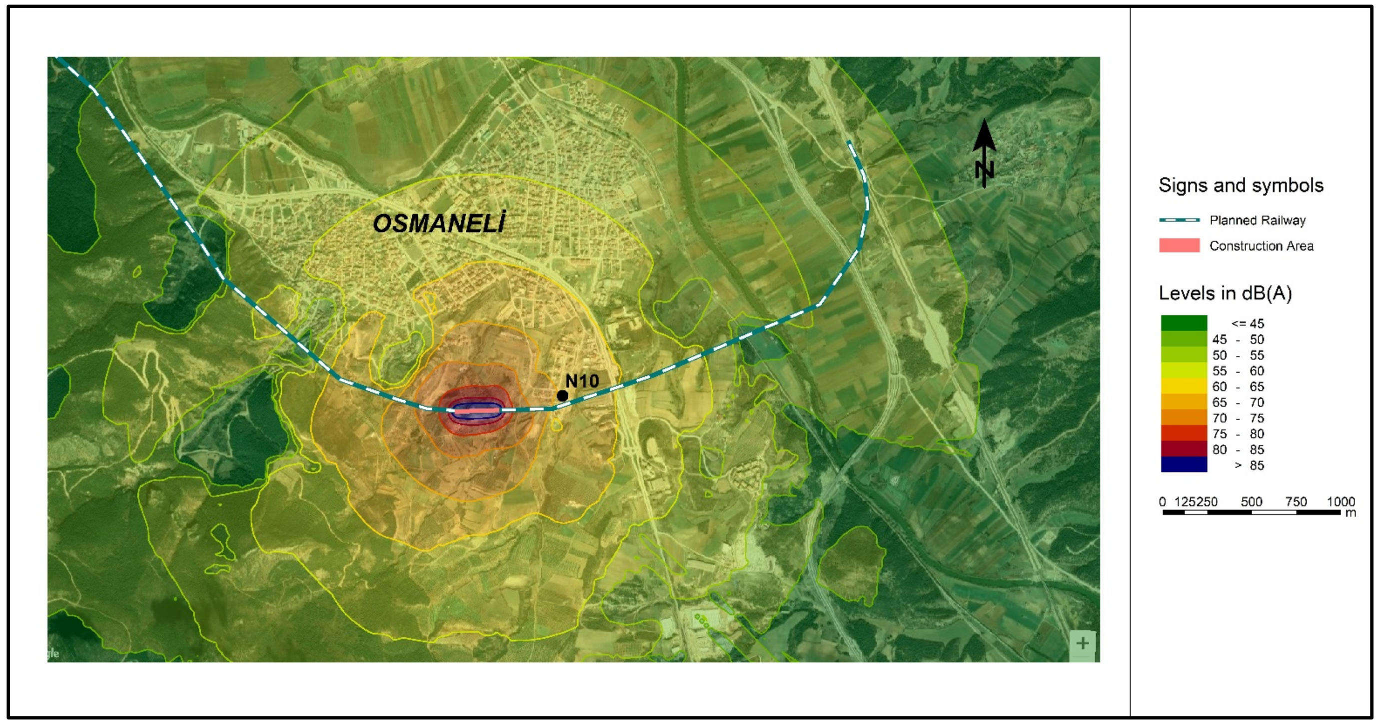
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
> 85
0 30 60 120 180 240 m


OSMANELİ
N10
Signs and symbols
Planned Railway
Construction Area
Levels in dB(A)
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55 - 60
60 - 65
65 - 70
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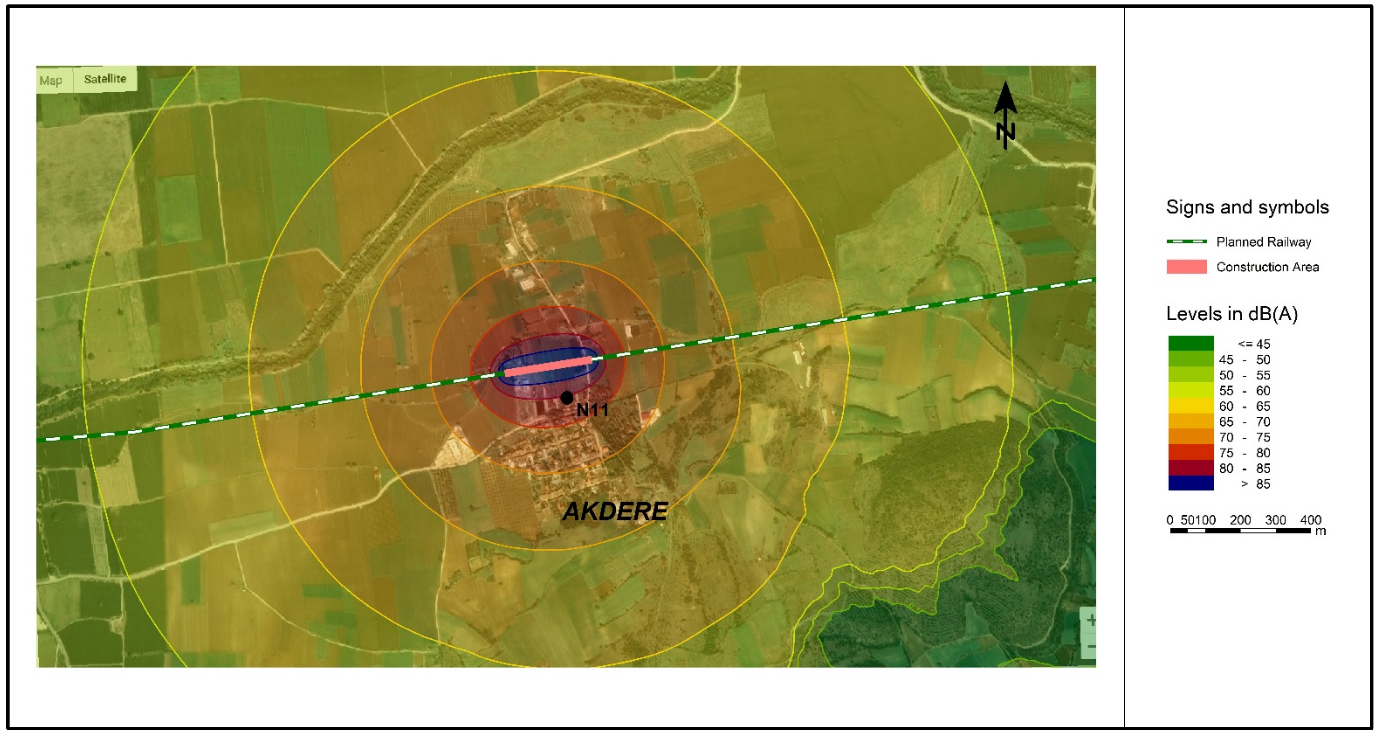
75 - 80
80 - 85
> 85
0 125250 500 750 1000 m


AKDERE
N11
Signs and symbols
Planned Railway
Construction Area
Levels in dB(A)
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55 - 60
60 - 65
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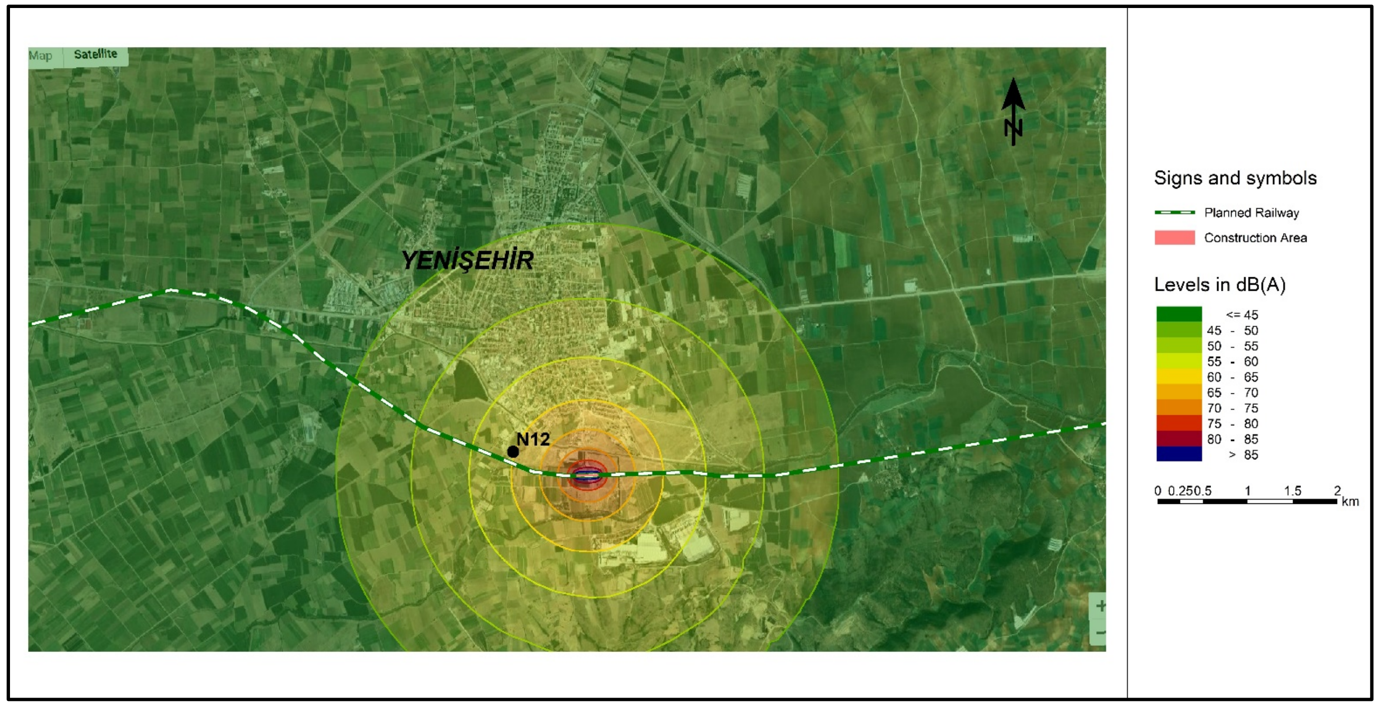
75 - 80
80 - 85
> 85
0 50100 200 300 400 m


YENİŞEHİR
N12
Signs and symbols
Planned Railway
Construction Area
Levels in dB(A)
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45 - 50
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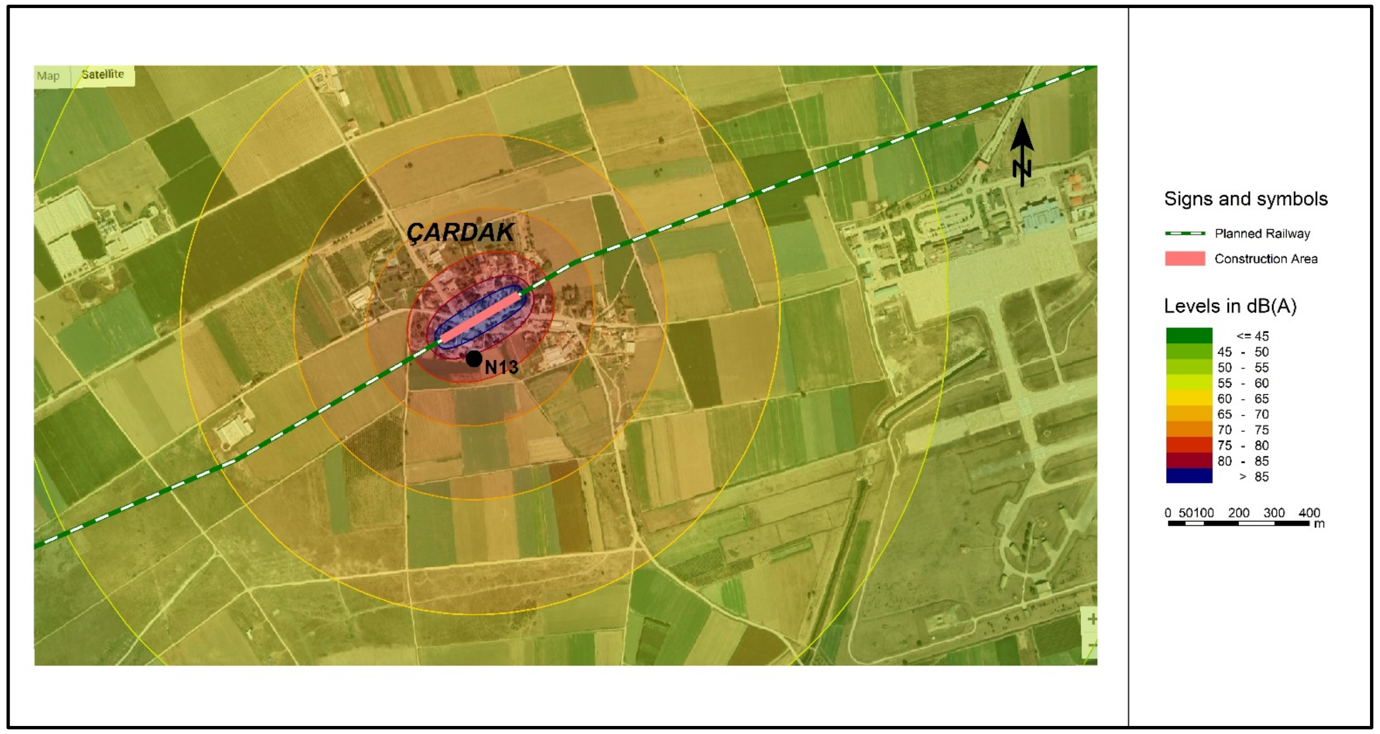
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
> 85
0 0.250.5 1 1.5 2 km


ÇARDAK
N13
Signs and symbols
Planned Railway
Construction Area
Levels in dB(A)
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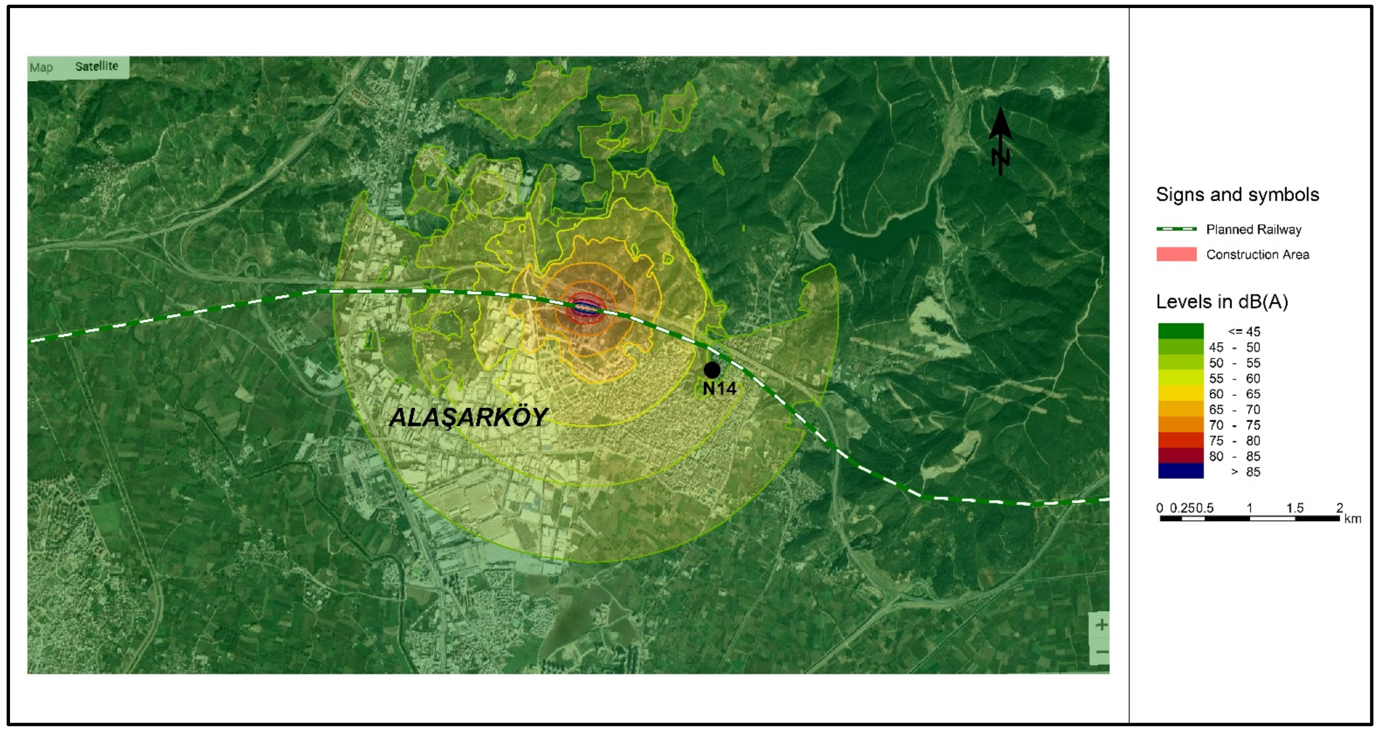
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
> 85
0 50100 200 300 400 m


ALAŞARKÖY
N14
Signs and symbols
Planned Railway
Construction Area
Levels in dB(A)
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65 - 70
70 - 75
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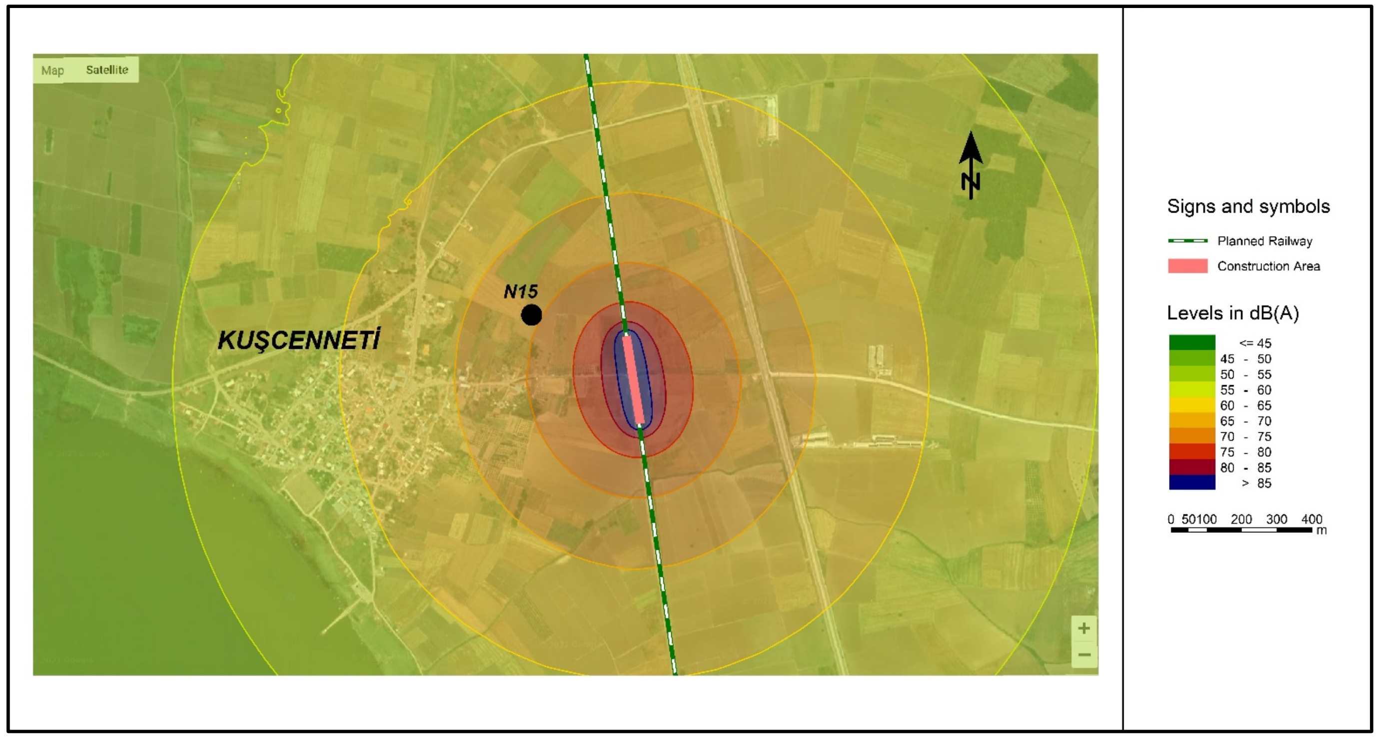
80 - 85
> 85
0 0.250.5 1 1.5 2 km


KUŞCENNETİ
N15
Signs and symbols
Planned Railway
Construction Area
Levels in dB(A)
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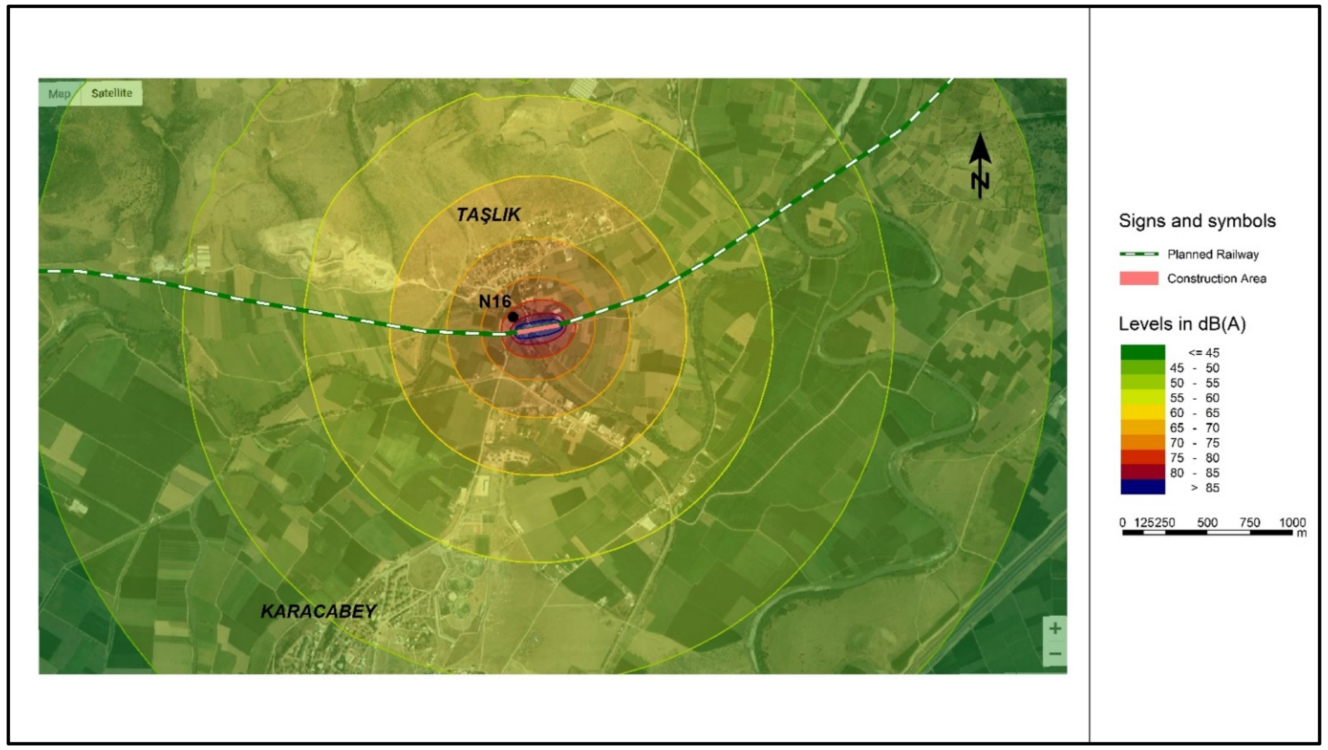
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
> 85
0 50100 200 300 400 m


TAŞLIK
N16
KARACABEY
Signs and symbols
Planned Railway
Construction Area
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
> 85
0 125250 500 750 1000 m

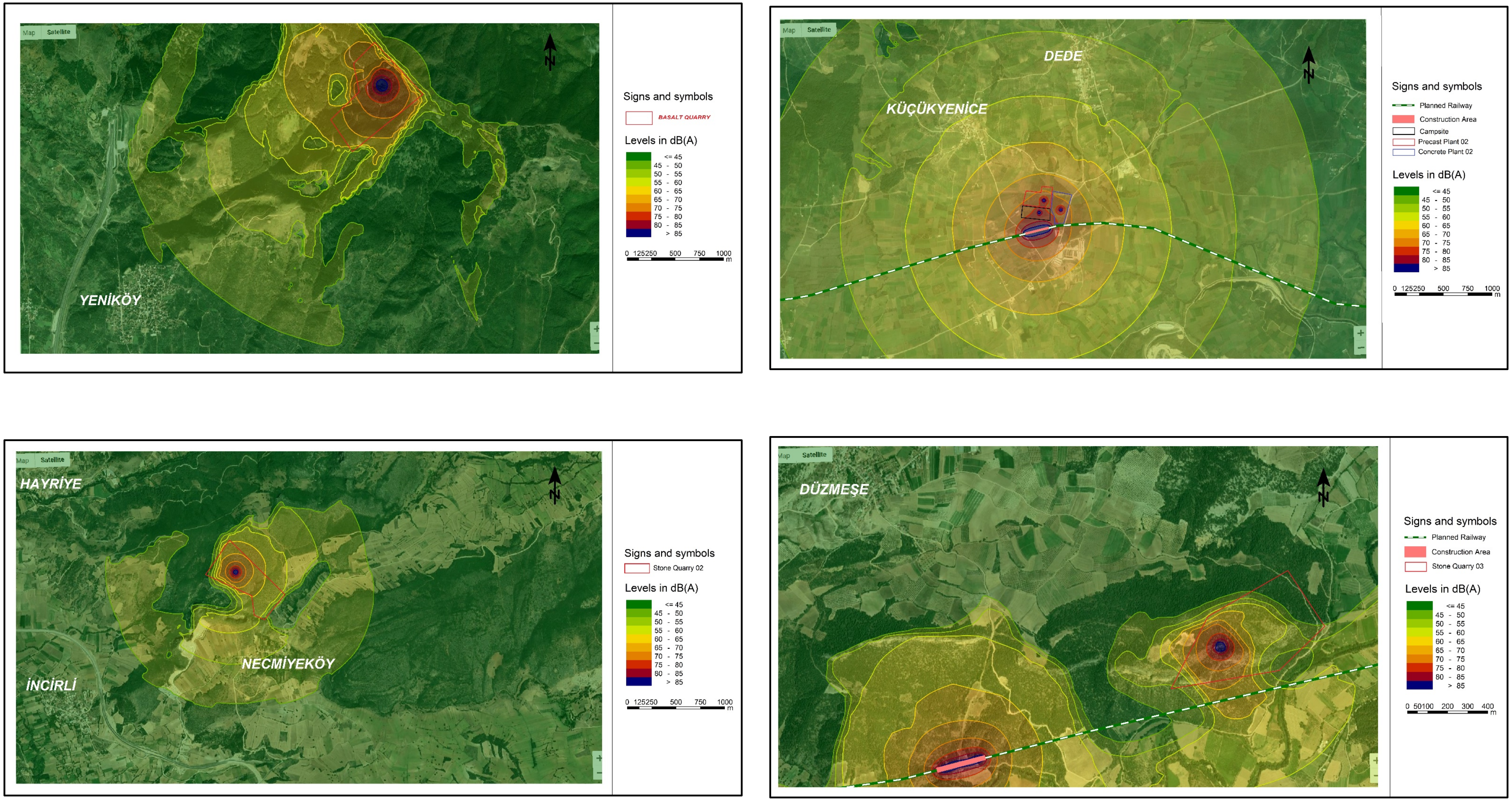


Figure 90: Daytime Grid Noise Maps for the Construction Phase

8.1.9.3.2 Commissioning/Operation Phase

Potential impacts from noise during the operational phase of the Project are mainly caused by the trains that will pass through the railway.

During the operation phase, impacts will be mainly associated to the following ***impact factors***:

- Noise emissions

The Project actions related to the abovementioned impact factor is the following:

- Operation of the railway and stations

As mentioned above, impacts from noise during operational phase will be due to mainly the noise generated by the trains passing through the railway. According to the Feasibility Report provided by the Owner, the expected number of train trips per day are given below:

Table 133 Expected Train Trip Numbers over Years

	Freight Train (Trip Number)					Passenger Train (Set)	
Years	Bursa-İstanbul	Bursa-İzmir	Bursa-Ankara	Bursa-Kocaeli	Bursa-Eskişehir	Bursa-Ankara	Bursa-İstanbul
2022	1.800	1.800	1.800	1.800	1.800	10.254	11.689
2023	2.080	2.080	2.080	2.080	2.080	10.428	11.992
2024	2.200	2.200	2.200	2.200	2.200	10.740	12.351
2025	2.320	2.320	2.320	2.320	2.320	11.063	12.722
2026	2.480	2.480	2.480	2.480	2.480	11.394	13.104
2027	2.600	2.600	2.600	2.600	2.600	11.736	13.497
2028	2.800	2.800	2.800	2.800	2.800	12.088	13.902
2029	2.960	2.960	2.960	2.960	2.960	12.451	14.319
2030	3.120	3.120	3.120	3.120	3.120	12.825	14.748
2031	3.320	3.320	3.320	3.320	3.320	13.209	15.191
2032	3.520	3.520	3.520	3.520	3.520	13.606	15.646
2033	3.800	3.800	3.800	3.800	3.800	14.014	16.116
2034	4.080	4.080	4.080	4.080	4.080	14.434	16.599
2035	4.400	4.400	4.400	4.400	4.400	14.867	17.097
2036	4.720	4.720	4.720	4.720	4.720	15.313	17.610
2037	5.000	5.000	5.000	5.000	5.000	15.773	18.138
2038	5.360	5.360	5.360	5.360	5.360	16.246	18.683
2039	5.720	5.720	5.720	5.720	5.720	16.733	19.243
2040	6.160	6.160	6.160	6.160	6.160	17.235	19.820
2041	6.560	6.560	6.560	6.560	6.560	17.752	20.415

	Freight Train (Trip Number)					Passenger Train (Set)	
2042	7.040	7.040	7.040	7.040	7.040	18.285	21.027
2043	7.520	7.520	7.520	7.520	7.520	18.833	21.658
2044	8.000	8.000	8.000	8.000	8.000	19.398	22.308
2045	8.240	8.240	8.240	8.240	8.240	19.980	22.977
2046	8.487	8.487	8.487	8.487	8.487	20.580	23.667
2047	8.742	8.742	8.742	8.742	8.742	21.197	24.377
2048	9.004	9.004	9.004	9.004	9.004	21.833	25.108
2049	9.274	9.274	9.274	9.274	9.274	22.488	25.861
2050	9.552	9.552	9.552	9.552	9.552	23.163	26.637
2051	9.839	9.839	9.839	9.839	9.839	23.857	27.436

In this section, the environmental noise generated by trains to be operated are evaluated as cumulative for the purpose of evaluating the worst situation during the Project. Therefore, it is assumed that 10 freight trains and 24 passenger trains will pass through a railway section in a day.

The noise levels of the trains were included in the model using the standard called “RMR 2002”[37] which is a The Dutch railway noise computation method which is already defined in the library of Sound Plan Essential 5.0. For model input following assumptions have been made for the noise sources:

- 15 passenger trains and 6 freight trains will pass through a railway section between the hours 07:00 am and 22:00 pm.
- 9 passenger trains and 3 freight trains will pass through a railway section between the hours 22:00 pm and 7:00 am.
- Average speed of the passenger and freight trains are taken as 215 km/hr and 120 km/hr respectively.
- For the passenger train, train type is chosen as: “Disc braked urban subway and rapid tram”.
- For the freight train, train type is chosen as: “Block braked freight trains”.
- Railway track type is chosen as: “Railway track with single block or double block (concrete) sleepers, in ballast bed.
- Railway switch type is chosen as: “jointless rails (fully welded tracks) with or without jointless switches or corssings”.
- For the operation of other project units (quarries, stores, concrete&precast plants, borrow sites, and camp sites), point sources with a sound level of **125 dBA** have been used in the model studies.

The determined 16 study area, where the baseline measurements were carried out, are modelled for the cumulative assessment of the operation phase. Also, additional 4 study area including Basalt Quarry, Stone

[37] Netherlands national computation method published in ‘Reken- en Meetvoorschrift Railverkeerslawaai '96, Ministerie Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, 20 November 1996’

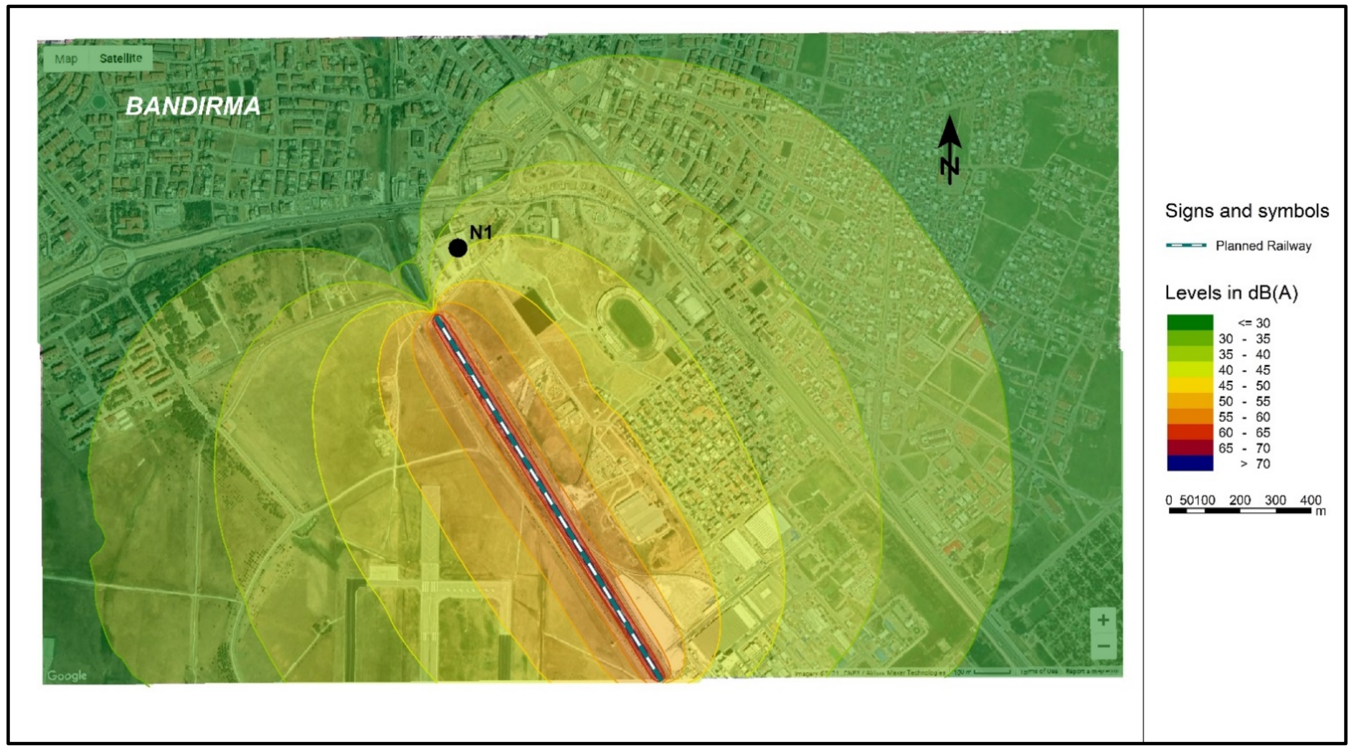
Quarry-2, Stone Quarry-3 and Concrete Plant-2 were modelled to see the impact of noise generated on the closest settlements.

The calculated noise levels at the chosen receptors, where baseline noise measurements were conducted, the cumulative results and the comparison of the results with the IFC and Turkish standards are presented in Table 134. According to the modelling results, the day and night-time cumulative results of all the receptors assessed except N10 are below the Turkish Regulatory noise limits. When the cumulative results are compared with IFC noise limits, all the daytime results except N10 and N14 below the limit of 55 dBA. However, all the night-time results except N1 are above the limit of 45 dBA. Also, it is observed that the increase in background levels for the receptors N2, N3, N5, N6, N9, 10, 11, 12, 13, 14 and 16 are exceeding the limit of 3 dBA for the daytime results and all the receptors except N1 exceeds the 3 dBA limit for the night-time results.

The daytime grid noise maps obtained for the construction phase are presented in **Figure 91**.

Table 134: Comparison between Modelled Operational Noise Levels and Baseline Noise Levels

Receptor	Corresponding Railway km	Distance to Railway Section (m)	Modelled Noise Level (originated from Project activities) (dBA)					The Baseline Noise Level (dBA)					Modelled Noise Level + The Ambient Noise Level (dBA)					Difference between ambient and modelled sound levels (dBA)				
			IFC		Turkish			IFC		Turkish			IFC		Turkish			IFC		Turkish		
			Day (07-22)	Night (22-07)	Day (07-19)	Evening (19-23)	Night (23-07)	Day (07-22)	Night (22-07)	Day (07-19)	Evening (19-23)	Night (23-07)	Day (07-22)	Night (22-07)	Day (07-19)	Evening (19-23)	Night (23-07)	Day (07-22)	Night (22-07)	Day (07-19)	Evening (19-23)	Night (23-07)
N1	000+000	225	39.0	38.8	39.0	39.0	38.8	50.3	42.6	51.3	45.1	42.8	50.6	44.1	51.5	46.1	44.3	0.3	1.5	0.2	1.0	1.5
N2	024+500	180	47.4	47.3	47.4	47.4	47.3	47.0	39.1	47.9	41.4	39.2	50.2	47.9	50.7	48.4	47.9	3.2	8.8	2.8	7.0	8.7
N3	039+450	55	52.9	52.9	52.9	52.9	52.9	47.6	40.0	48.5	42.6	40.2	54.0	53.1	54.2	53.3	53.1	6.4	13.1	5.7	10.7	12.9
N4	060+000	150	47.2	47.1	47.2	47.2	47.1	49.0	41.5	49.9	43.9	41.7	51.2	48.2	51.8	48.9	48.2	2.2	6.7	1.9	5.0	6.5
N5	079+360	35	51.6	51.5	51.6	51.6	51.5	48.9	40.8	49.8	43.8	40.8	53.5	51.9	53.8	52.3	51.9	4.6	11.1	4.0	8.5	11.1
N6	048+420	100	50.6	50.5	50.6	50.6	50.5	50.4	42.3	51.4	45.2	42.4	53.5	51.1	54.0	51.7	51.1	3.1	8.8	2.6	6.5	8.7
N7	068+400	70	50.7	50.6	50.7	50.7	50.6	51.7	41.6	52.7	46.4	41.5	54.2	51.1	54.8	52.1	51.1	2.5	9.5	2.1	5.7	9.6
N8	088+350	140	50.5	50.5	50.5	50.5	50.5	51.4	43.5	52.4	46.1	43.7	54.0	51.3	54.6	51.8	51.3	2.6	7.8	2.2	5.7	7.6
N9	121+850	75	52.9	52.8	52.9	52.9	52.8	44.9	39.2	45.4	42.2	39.1	53.5	53.0	53.6	53.3	53.0	8.6	13.8	8.2	11.1	13.9
N10	146+500	15	60.6	60.5	60.6	60.6	60.5	44.5	38.8	44.9	41.8	38.6	60.7	60.5	60.7	60.7	60.5	16.2	21.7	15.8	18.9	21.9
N11	113+700	60	50.8	50.7	50.8	50.8	50.7	49.3	41.8	50.2	44.2	42.0	53.1	51.2	53.5	51.7	51.2	3.8	9.4	3.3	7.5	9.2
N12	109+400	110	49.9	49.9	49.9	49.9	49.9	48.4	40.9	49.3	43.4	41.1	52.2	50.4	52.6	50.8	50.4	3.8	9.5	3.3	7.4	9.3
N13	098+350	75	51.3	51.2	51.3	51.3	51.2	47.0	39.8	47.9	42.1	40.0	52.7	51.5	52.9	51.8	51.5	5.7	11.7	5.0	9.7	11.5
N14	060+380	80	52.7	52.7	52.7	52.7	52.7	51.8	43.8	52.7	46.4	44.0	55.3	53.2	55.7	53.6	53.2	3.5	9.4	3.0	7.2	9.2
N15	014+400	245	44.8	44.7	44.8	44.8	44.7	50.1	40.4	51.1	44.9	40.2	51.2	46.1	52.0	47.9	46.0	1.1	5.7	0.9	3.0	5.8
N16	044+150	95	50.3	50.3	50.3	50.3	50.3	45.8	39.9	46.2	43.0	39.8	51.6	50.7	51.7	51.0	50.7	5.8	10.8	5.5	8.0	10.9
IFC Noise Standards[1,2]			Industrial; commercial areas										70	70	-	-	-	≤3 (Noise impacts should not result in a maximum increase in background levels of 3 dBa the nearest receptor location off-site.				
			Residential; institutional; educational areas										55	45	-	-	-					
Turkish Noise Standards[3,4]			Sensitive areas with Schools, libraries and conference rooms, hospitals and health centres										-	-	60	55	50	-				
			Industrial areas										-	-	70	65	60					
			Locations with commercial areas and sensitive areas (dominated by residential areas)										-	-	65	60	55					
			Locations with commercial areas and sensitive areas (dominated by commercial areas)										-	-	68	63	58					
			Construction sites										-	-	70	-	-					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Planned Railway
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65 - 70
> 70
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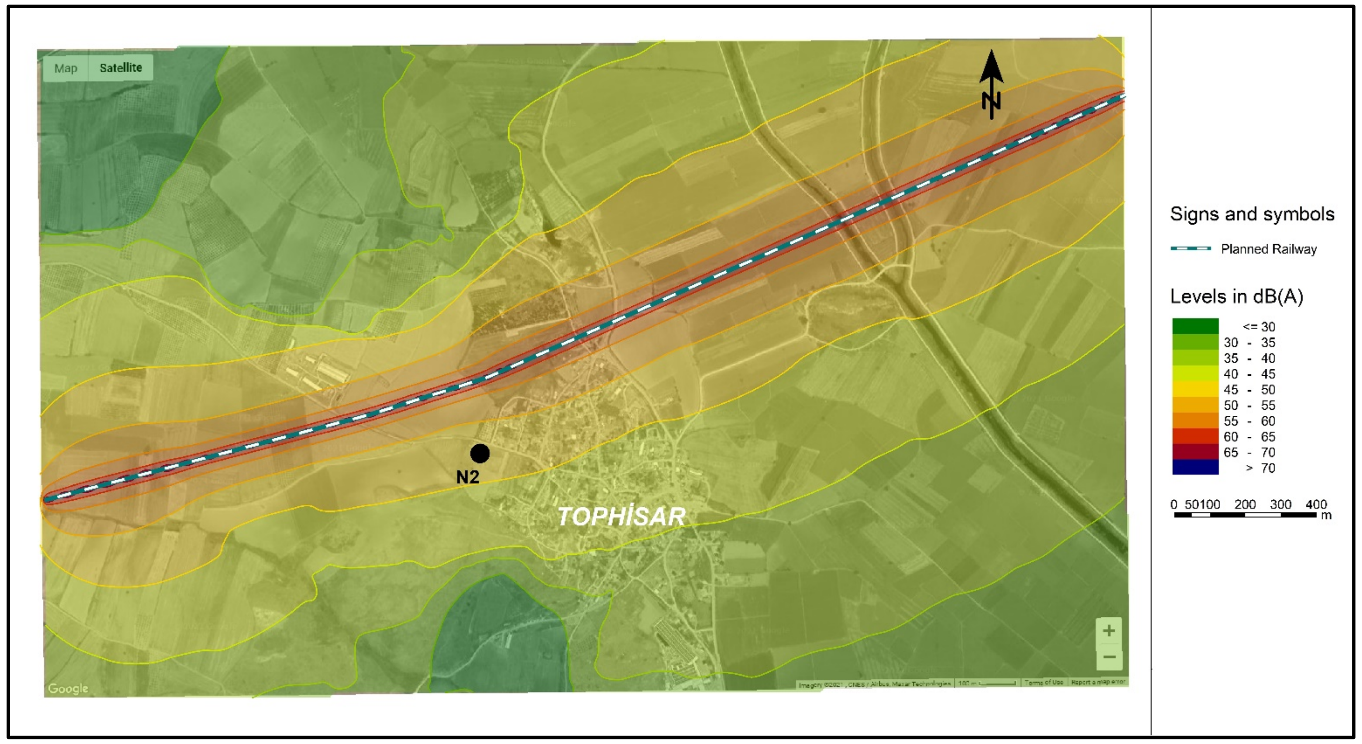
m


N2
TOPHİSAR
Signs and symbols
Planned Railway
Levels in dB(A)
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30 - 35
35 - 40
40 - 45
45 - 50
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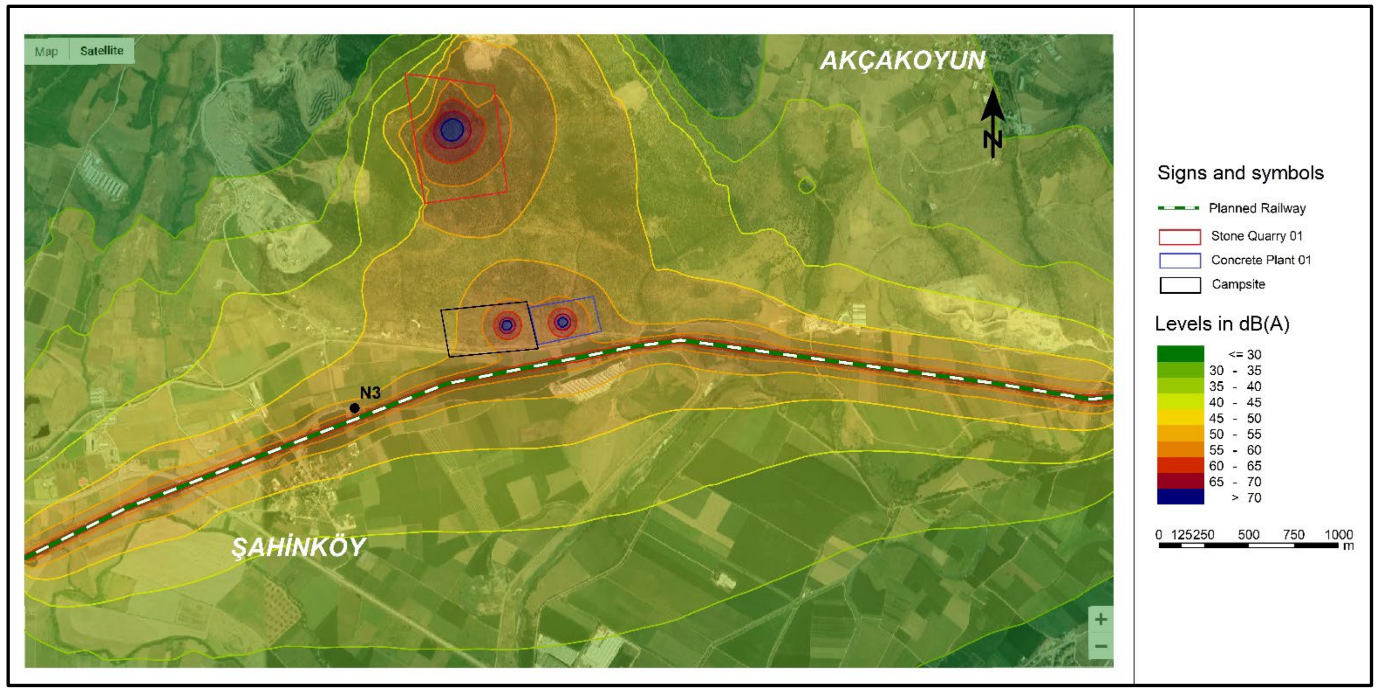
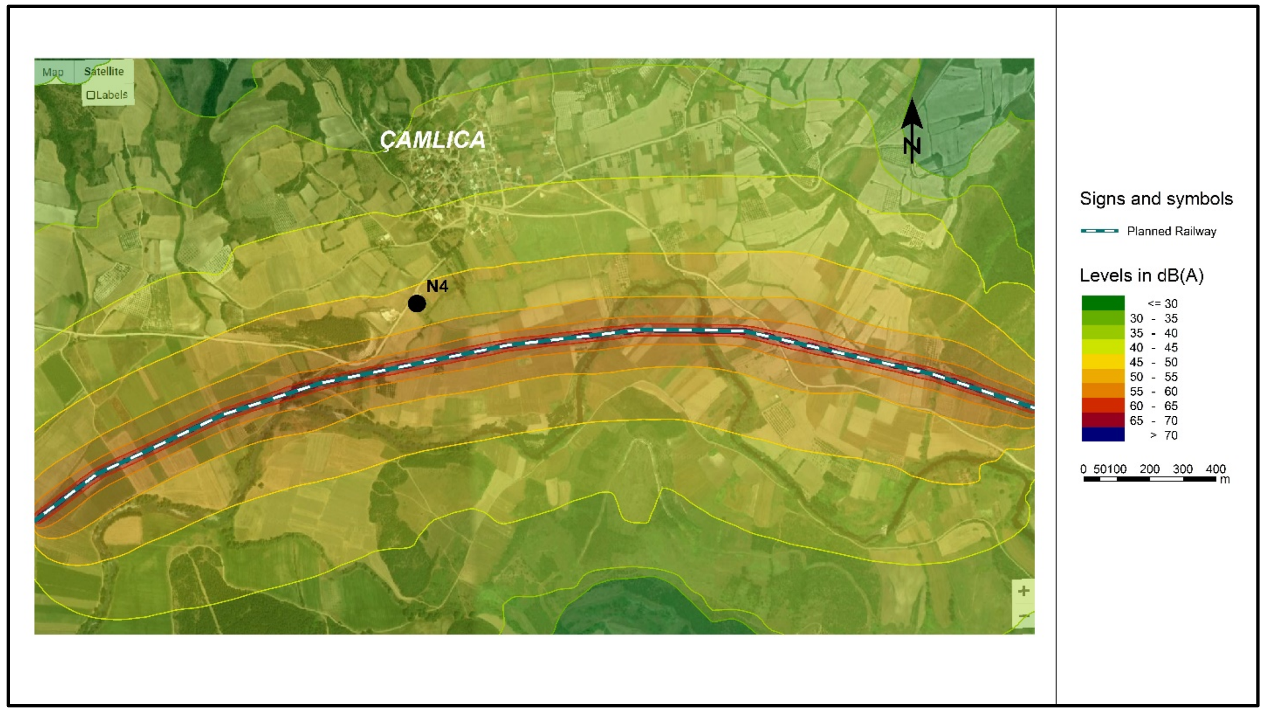
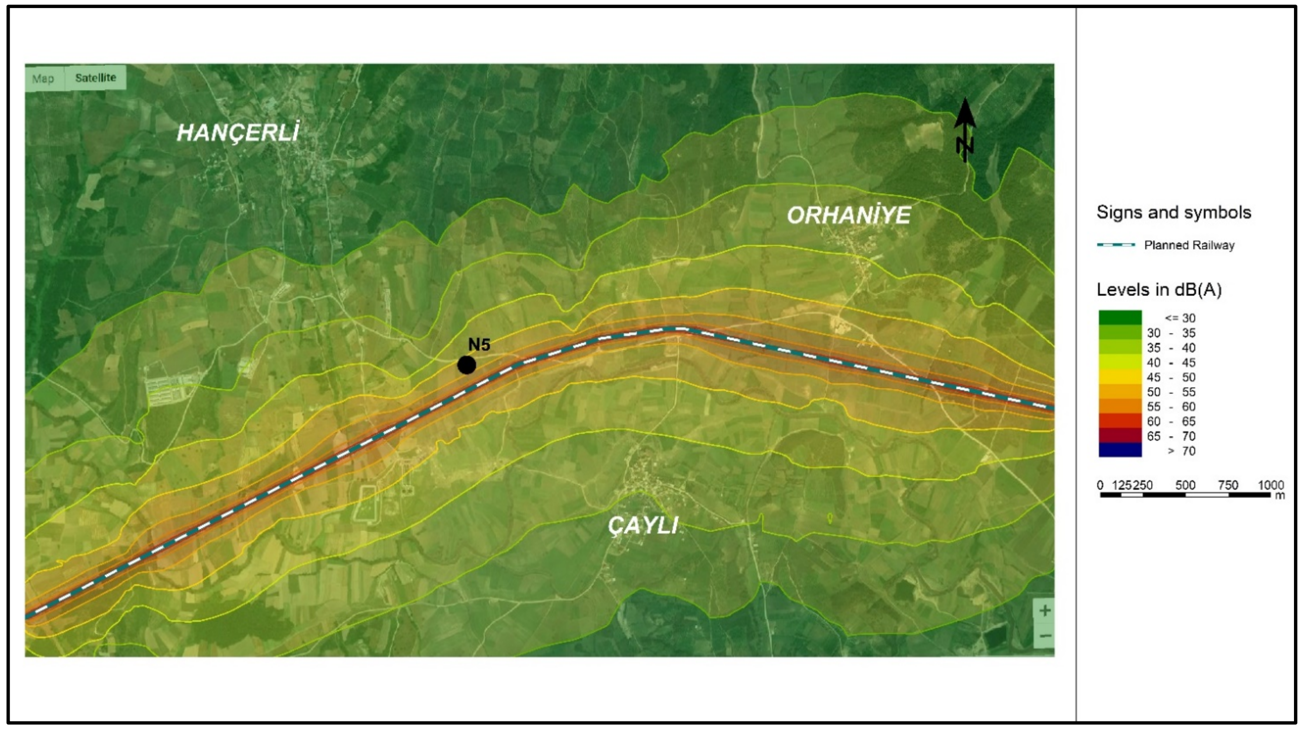
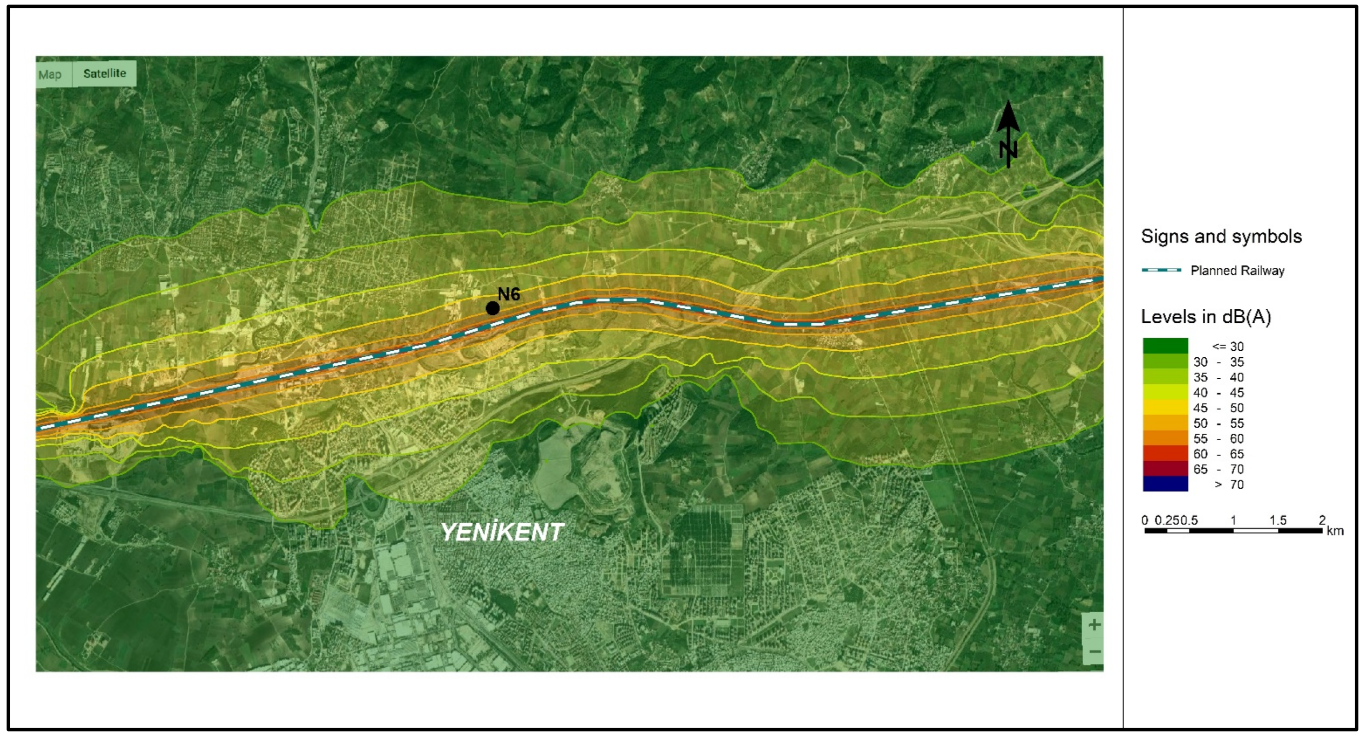
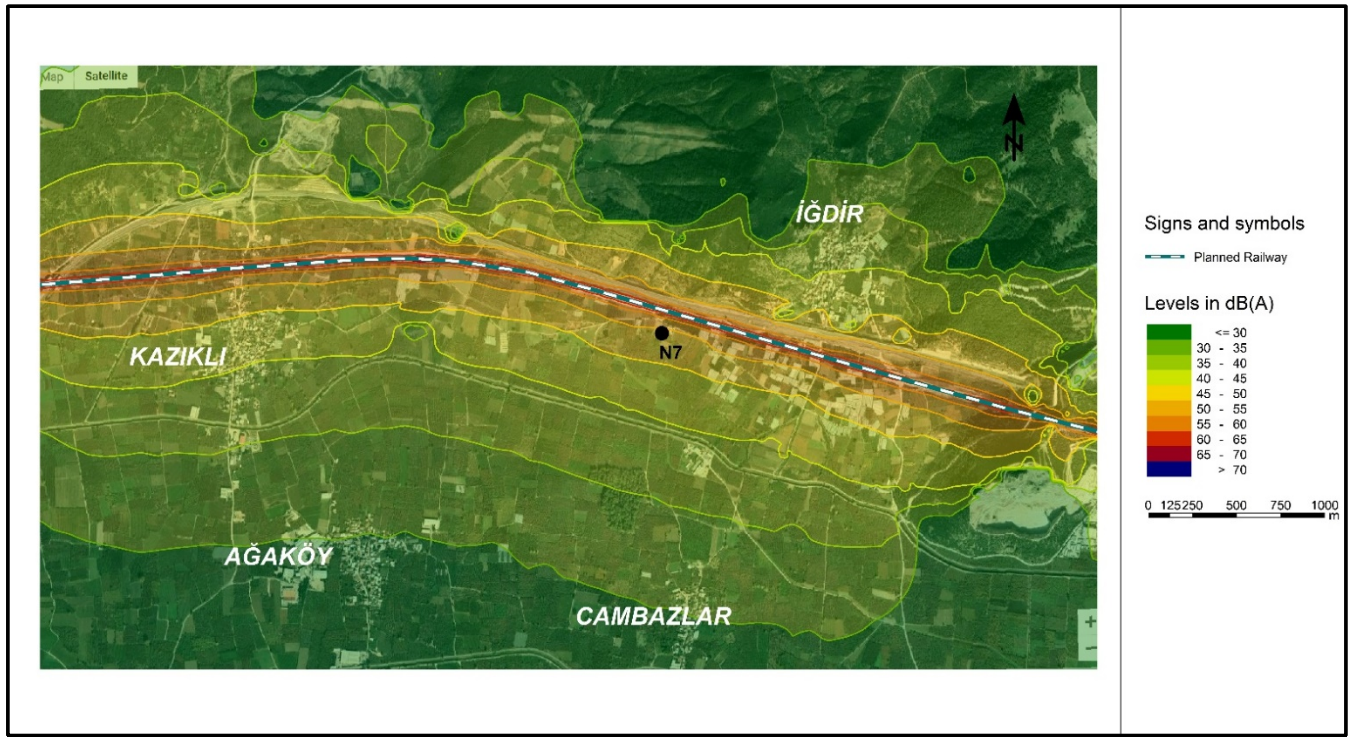
55 - 60
60 - 65
65 - 70
> 70
0 50100 200 300 400
m

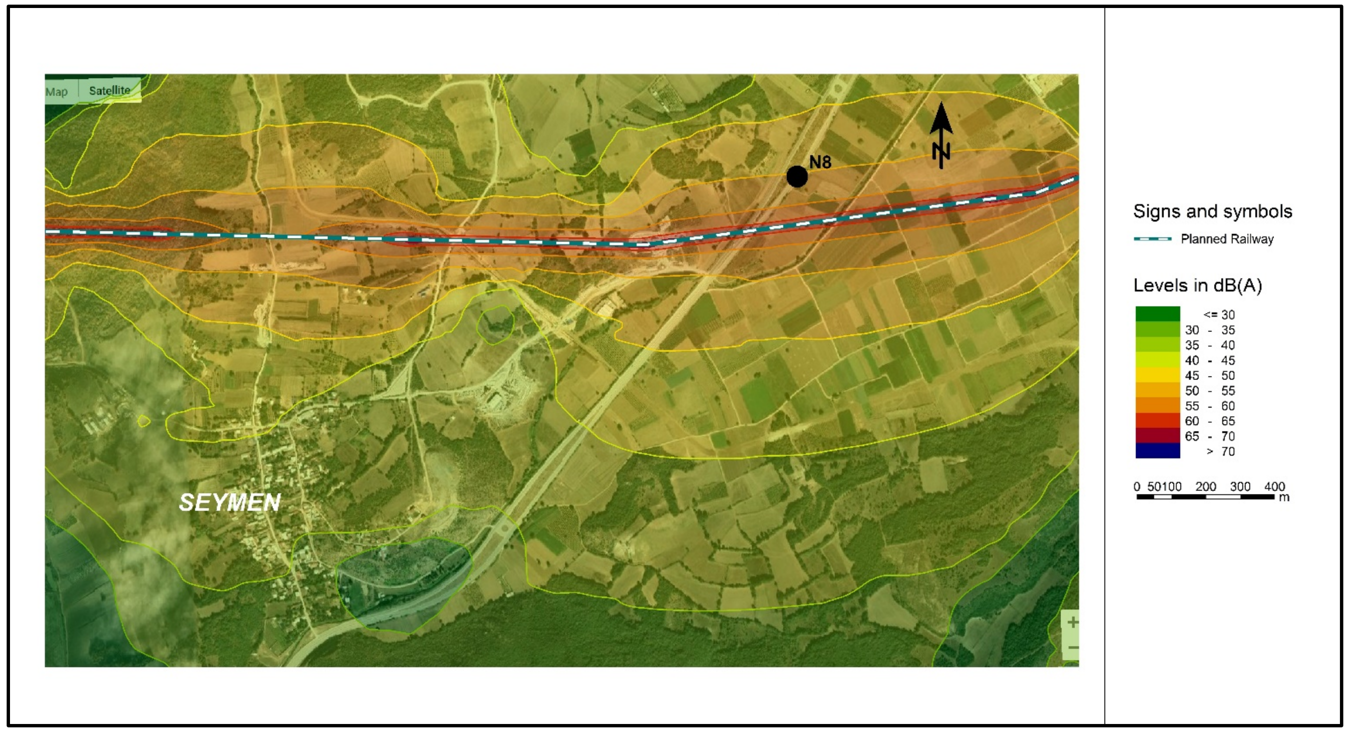

AKÇAKOYUN
N3
ŞAHİNKÖY
Signs and symbols
Planned Railway
Stone Quarry 01
Concrete Plant 01
Campsite
Levels in dB(A)
<= 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
> 70
0 125250 500 750 1000
m

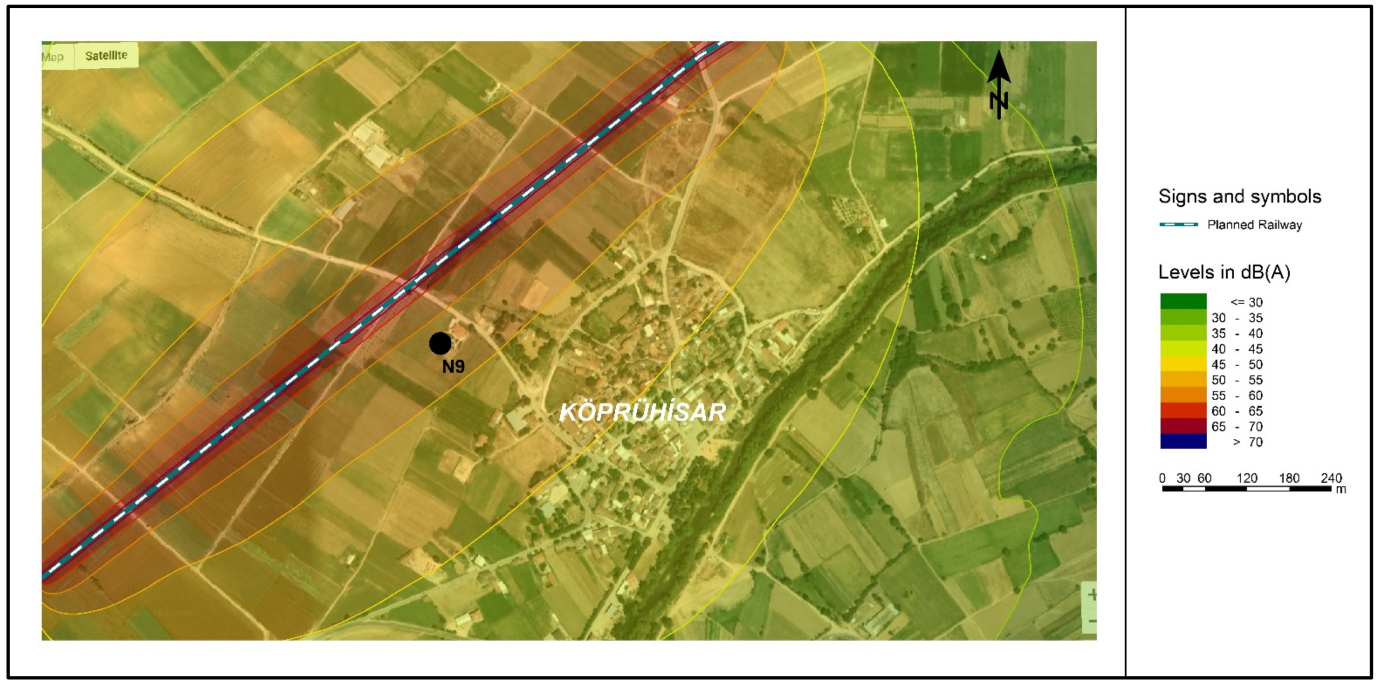

ÇAMLICA
N4
Signs and symbols
Planned Railway
Levels in dB(A)
<= 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
> 70
0 50100 200 300 400
m

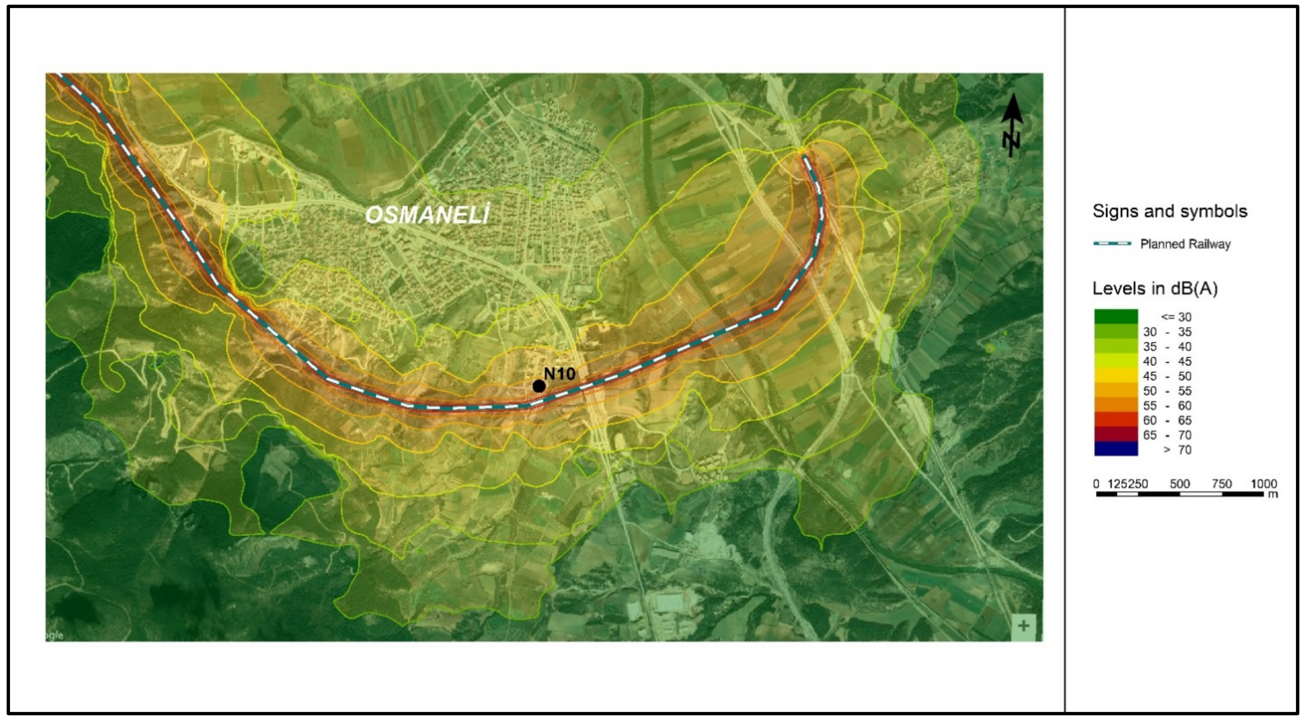

HANÇERLİ
ORHANİYE
N5
ÇAYLI
Signs and symbols
Planned Railway
Levels in dB(A)
<= 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
> 70
0 125250 500 750 1000 m

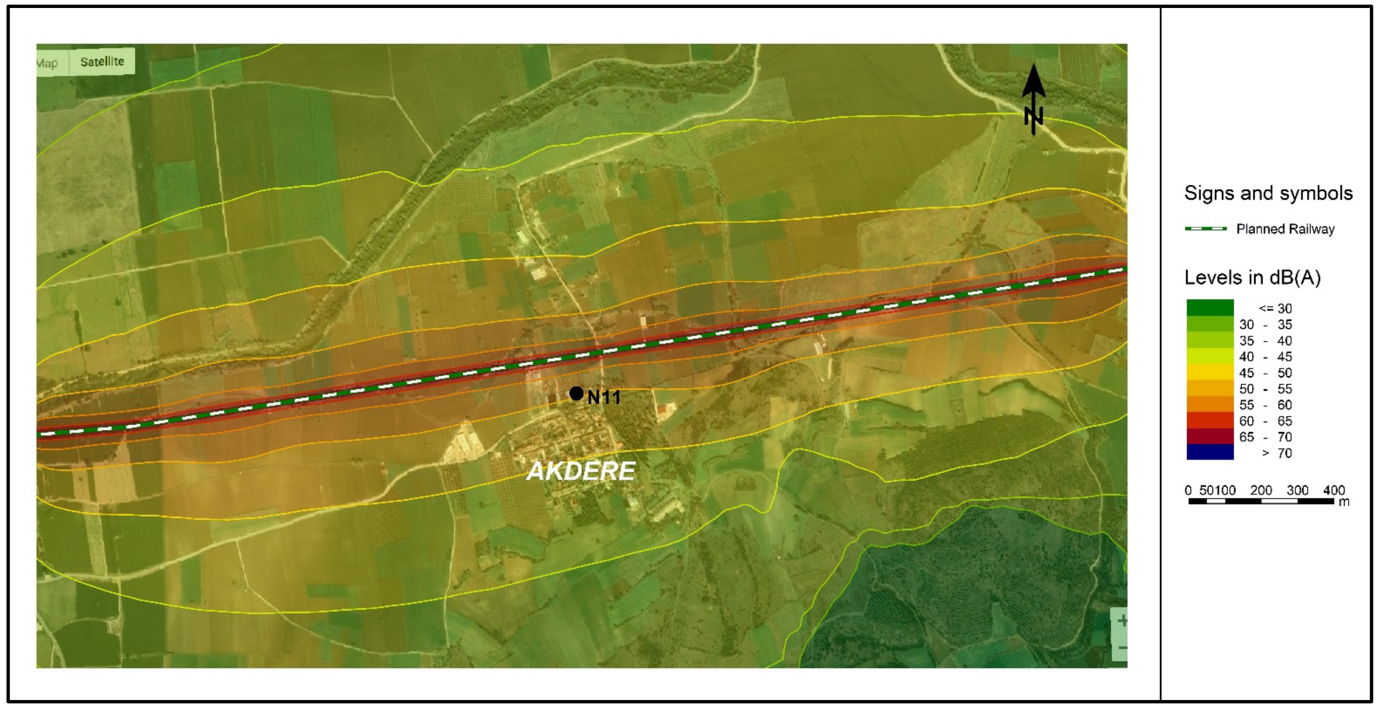

N6
YENİKENT
Signs and symbols
Planned Railway
Levels in dB(A)
<= 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
> 70
0 0.250.5 1 1.5 2 km

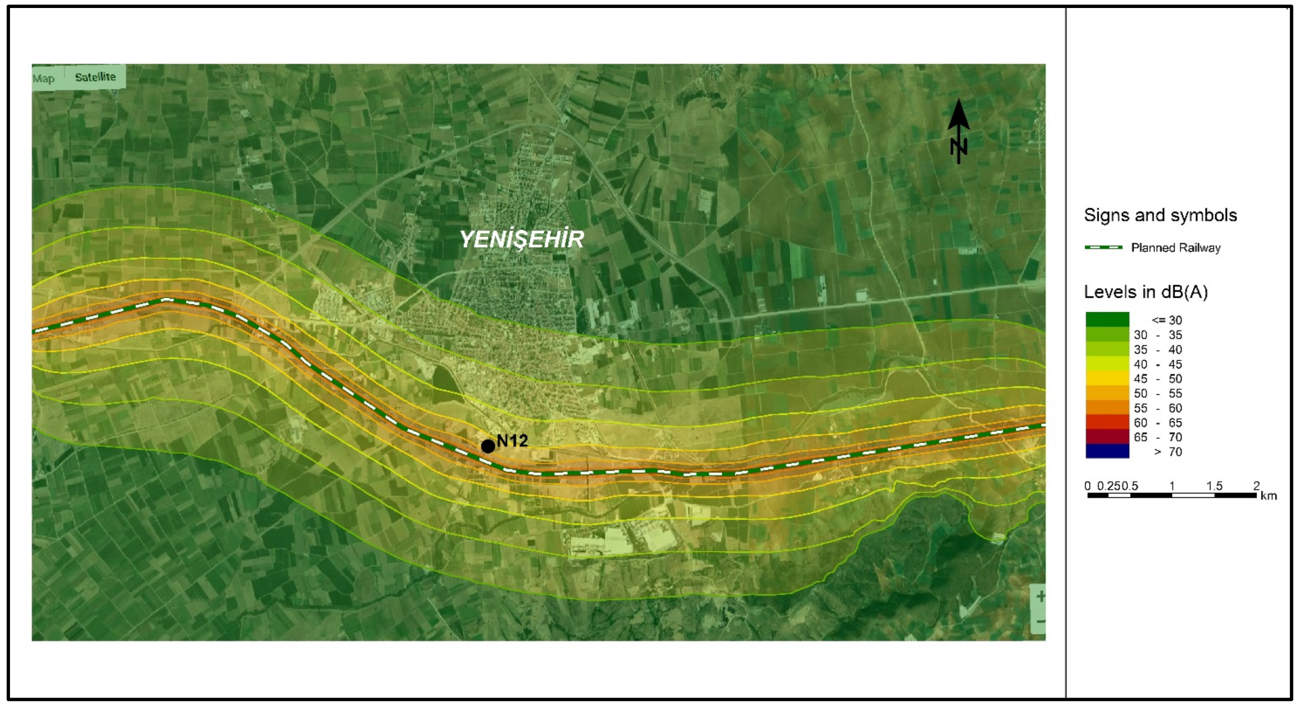

İĞDİR
KAZIKLI
N7
AĞAKÖY
CAMBAZLAR
Signs and symbols
Planned Railway
Levels in dB(A)
<= 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
> 70
0 125250 500 750 1000 m


N8
SEYMEN
Signs and symbols
Planned Railway
Levels in dB(A)
<= 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
> 70
0 50100 200 300 400 m


N9
KÖPRÜHİSAR
Signs and symbols
Planned Railway
Levels in dB(A)
<= 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
> 70
0 30 60 120 180 240 m


OSMANELİ
N10
Signs and symbols
Planned Railway
Levels in dB(A)
<= 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
> 70
0 125250 500 750 1000 m


N11
AKDERE
Signs and symbols
Planned Railway
Levels in dB(A)
<= 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
> 70
0 50100 200 300 400 m


YENİŞEHİR
N12
Signs and symbols
Planned Railway
Levels in dB(A)
<= 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
> 70
0 0.250.5 1 1.5 2 km

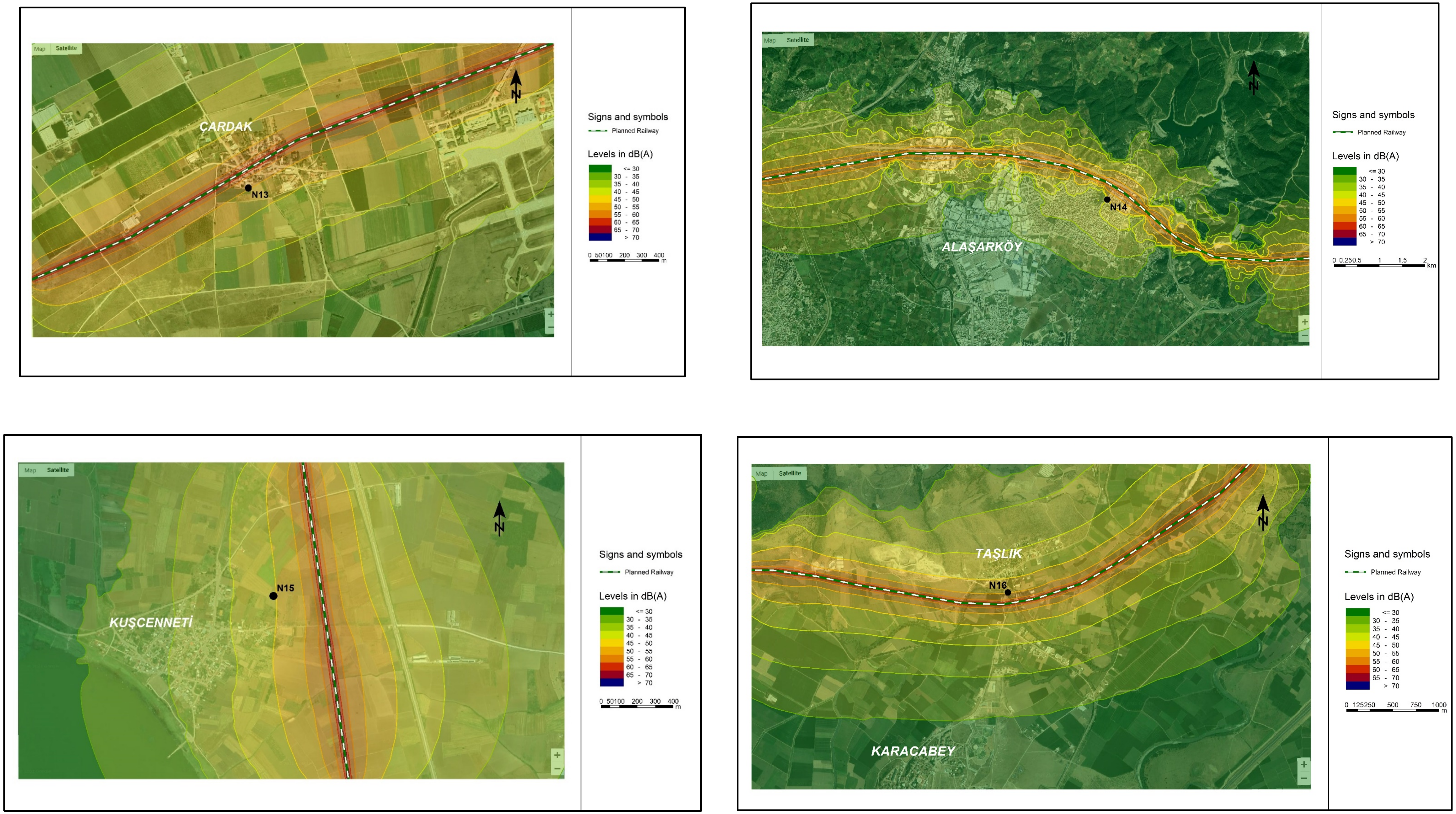


Figure 91: Daytime Grid Noise Maps for the Operational Phase

8.1.9.3.3 Decommissioning and Closure Phase

A new impact is not expected other than those listed in the construction phases during the decommissioning and closure phase of the Project.

8.1.9.4 Mitigation Measures

8.1.9.4.1 Construction Phase

The mitigation measures listed below follow the mitigation hierarchy and will be implemented for the construction phase.

During the construction stage, provisions of the “Regulation on Assessment and Management of Environmental Noise” and “Regulations on Work Health and Safety" will be followed with the purpose of protecting health of employees with respect to noise. Accordingly:

- Appropriate personal protective equipment and materials such as helmet, ear protector or ear plug will be provided to protect workers from noise.

The following control measures recommended by IFC will be applied where possible:

- Selection of equipment with lower sound power levels;
- Installing silencers for fans;
- Installing suitable mufflers on engine exhausts and compressor components;
- Installing acoustic enclosures for equipment casing radiating noise;
- Installing vibration isolation for mechanical equipment;
- Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas;
- Re-locating noise sources to less sensitive areas to take advantage of distance and shielding;
- Reducing Project traffic routing through community areas wherever possible;
- Developing a mechanism to record and respond to complaints;
- In addition, regular maintenance will be made for the construction equipment to ensure decreasing the possible high noise levels generated by the equipment; and
- Monthly monitoring campaign will be conducted during the construction phase at baseline locations

In case of any complaints, acoustic barriers will be installed without gaps and with a continuous minimum surface density of 10 kg/m^2 in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective.

8.1.9.4.2 Commissioning and Operational Phase

The provisions of the Regulation on Assessment and Management of Ambient Noise and Regulations on Work Health and Safety will be followed with the purpose of protecting health of employees with respect to noise. Accordingly, appropriate personal protective materials such as helmet, ear protector or ear plug will be given to protect workers from noise. In addition, maintenance of the equipment will be made regularly to ensure high noise levels are minimized.

Following methods will be applied to reduce the potential noise effects during the operational period of the Project:

- A “Noise Management Plan” will be developed for the operational phase to confirm adequacy of implementation of mitigation measures during the operational period.
- The receptors exceeding the regulatory limits will be monitored for at least1 year period during the operation in a monthly basis.
- In case the noise monitoring results indicates that the noise levels are still higher than allowed o any complaint is received, then noise abatement measures will be implemented (e.g. noise barriers along railways or next to receptor buildings, soundproofing, relocation of the sensitive receptor etc).
- Trees will also be planted around the Project Site to establish a sound barrier.
- Maintenance of the trains and railway will be made regularly to reduce the roughness of running surfaces, so the noise levels are minimized.

8.1.9.5 Residual Impacts

8.1.9.5.1 Construction Phase

The impact factor is evaluated considering duration, frequency, geographic extent and intensity for construction phase. Residual impact values for the impact factors are then calculated and classified considering all mitigations as described above and further elucidated in the noise management plan.

Noise impacts for the construction phase of the Project are evaluated in the matrix provided in Table 135. As can be seen in the matrix all impact factors considered for noise originated from construction activities have negligible residual impacts on the Project personnel and nearby communities.

Table 135 Noise Impact Matrix for Construction Phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features		Impact Value	Mitigation effectiveness	Residual impact value
Construction Noise Emissions	Duration:	Short	Very high	Reversibility:	Short-term	**Low**	Medium-high	**Negligible**
	Frequency:	Continuous						
	Geo. Extent:	Local						
	Intensity:	Very high						

8.1.9.5.2 Commissioning and Operational Phase

Considering the cumulative results in Table 134, and the noise modelling results in the noise maps in Figure 91; the settlement areas close to the planned railway are expected to be impacted by the noise during the operational phase.

The impact factor is evaluated considering duration, frequency, geographic extent and intensity for operation phase. Residual impact values for the impact factors are then calculated and classified considering all mitigations.

Noise impacts for the operation phase of the Project are evaluated in the matrix provided in Table 136. As can be seen in the matrix, noise emissions has negligible impact on nearby communities at the operation phase after mitigation measures.

Table 136 Noise Matrix for Operation Phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features		Impact Value	Mitigation effectiveness	Residual impact value
Operational Noise Emissions	Duration:	Medium-short	Very high	Reversibility:	Short-term	**Low**	Medium-high	**Negligible**
	Frequency:	Frequent						
	Geo. Extent:	Local						
	Intensity:	High						

8.1.9.5.3 Decommissioning and Closure Phase

A new impact is not expected other than those listed in the construction and operation phases in the decommissioning and closure phase (after the mitigation) of the Project.

8.1.9.6 Monitoring

A monitoring programme of noise at the baseline locations and receptors exceeding the limit values during construction and the commissioning and operational phase will be in place. The monitoring campaign will be conducted by 48 hours continues measurements at the locations.

8.1.10 Vibration

Vibration can cause fatigue, stomach problems, headache, loss of balance and "shakiness" shortly after or during exposure. The symptoms are like those that many people experience after a long car or boat trip. After daily exposure over several years, whole-body vibration can affect the entire body and result in a number of health disorders. Studies of bus and truck drivers found that occupational exposure to whole-body vibration could have contributed to several circulatory, bowel, respiratory, muscular and back disorders.[38]

The Project has the potential to generate vibration during the construction phase only due to the blasting operations. This section aims to assess impacts of vibration.

The vibration impacts are assessed in the AoI which includes potentially affected settlements and sensitive environmental features. During impact assessment, the Project actions and impact factors defined in Methodology Section are considered, and the mitigation and management measures are defined in this Section. As detailed below, the main approach to impact analysis is based on the calculations of predicted vibration impacts during the construction phase of the Project.

Vibration impact assessment in the scope of the Project has been conducted in compliance with the Turkish limits provided in the Regulation on Assessment and Management of Environmental Noise, which are listed in Table 137. It should be noted that there is no numerical evaluation of the blasting activities in the IFC guidelines.

Table 137: Turkish Standards on Vibration Limits for Blasting

Vibration Frequency (Hz)	Peak Allowed Vibration Speed (mm/sec)
1	5
4-10	19
30-100	50

[38] Canadian Centre for Occupational Health and Safety, https://www.ccohs.ca/oshanswers/phys_agents/vibration/vibration_effects.html, Access Date: 01.08.2019

8.1.10.1 Impact Analysis

8.1.10.1.1 Construction Phase

Holes will be opened and then blastings will be made with millisecond-delayed capsules at the quarries where the filling materials will be obtained, at the tunnels and escape tunnels locations, and also some part on the railway route. The blasting pattern to be made will be drilled with a maximum diameter of 89 mm at 3 m hole intervals in the places where blasting will be carried out. A maximum of 35.5 kg of explosive (ANFO + emulsion) will be placed in the holes and detonation will be carried out by taking safety precautions as a result of capsule connections.

Regardless of the amount of explosive material to be used at one time, the effect to be felt by the method to be used is related to the amount to be detonated in each hole. The amount of explosive material to be used in each shot in the planned blasting patterns was determined as 35.5 kg per hole.

During the vibration assessment, the general form of the blast-induced ground vibration estimation formula given below was used. This formula was obtained as a result of thousands of measurements, monitoring and statistical analyzes made both in the USA and in other countries according to the “Blaster’s Handbook”[39] published by International Society of Explosives Engineers (ISEE).

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

Where;

PPV: Peak particle velocity (mm/s)

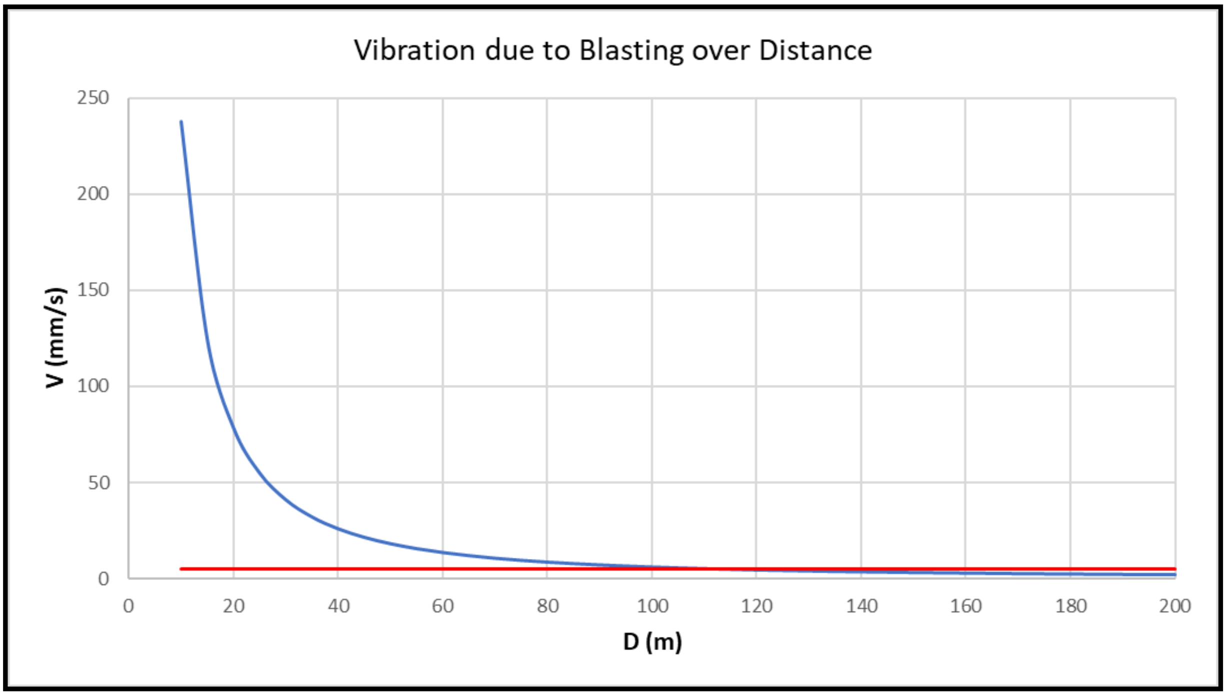
k: Ground vibration transmissibility coefficient

D: Distance between the blasting point (m)

W: Weight of explosives per delay (kg)

Considering that the maximum amount of explosives per a single hole to be used in tha blastings will be 35.5 kg, the following graph is obtained using the equation above. It is calculated that the vibration levels go below the limit of 5 mm/s after 111.5 m distance.

[39] International Society of Explosives Engineers. (2011). ISEE blasters' handbook. Cleveland, Ohio: International Society of Explosives Engineers.



The locations of the vibration sources (i.e, where the blastings will be carried out), the distance of the nearest receptor to the vibration source, and the calculated vibration values on these receptors are presented in Table 138. Since the blasting operations for the railway route for the tunnels are completed for Section 2, vibration is not assessed in the locations where the blasting operations were completed in Section 2.

Table 138: Calculated Vibration Levels on the Nearest Receptors

Vibration Source	Blasting Location	Distance to the Nearest Receptor (m)	Settlement Name	W (kg)	V (mm/s)	Exceedance of the limit of 5 mm/s
Rock Quarry	Rock Quarry-01	700	Şahinköy	35.5	0.27	-
	Rock Quarry-02	300	Necmiyeköy	35.5	1.03	-
	Rock Quarry-03	1700	Düzmeşe	35.5	0.06	-
Borrow Site	Borrow Site-01	750	Danişment	35.5	0.24	-
	Borrow Site-02	520	Hayırlar	35.5	0.43	-
	Borrow Site-03	750	Evciler	35.5	0.24	-
	Borrow Site-04	1300	Yörükyenicesi	35.5	0.1	-
	Borrow Site-05	1600	Badırga	35.5	0.07	-
Tunnels	S1-Tunnel-01	770	Hayriye	35.5	0.23	-
	S1-Tunnel-02	780	Derehöyük	35.5	0.22	-
	S1-Tunnel-03	2500	Düzmeşe	35.5	0.03	-
	S1-Tunnel-04	2000	Düzmeşe	35.5	0.05	-
	S1-Tunnel-05	1400	Düzmeşe	35.5	0.09	-
	S1-Tunnel-06	1800	Düzmeşe	35.5	0.06	-
	S1-Tunnel-07	1400	Selçik	35.5	0.09	-
	S1-Tunnel-08	280	Osmaneli	35.5	1.15	-
	S1-Tunnel-09	125	Osmaneli	35.5	4.17	-
	S1-Tunnel-10	10	Osmaneli	35.5	237.52	232.52

Vibration Source	Blasting Location	Distance to the Nearest Receptor (m)	Settlement Name	W (kg)	V (mm/s)	Exceedance of the limit of 5 mm/s
	S3-Tunnel-01	285	Hayırlar	35.5	1.12	-
	S3-Tunnel-02	485	Hayırlar	35.5	0.48	-
	S3-Tunnel-03	45	Evciler	35.5	21.41	16.41
	S3-Tunnel-04	480	Evciler	35.5	0.48	-
	S3-Tunnel-05	500	Evciler	35.5	0.45	-
	S3-Tunnel-06	1200	Emirleryenicesi	35.5	0.11	-
	S3-Tunnel-07	750	Yörükyenicesi	35.5	0.24	-
	S3-Tunnel-08	150	Bursa	35.5	3.12	-
Escape Tunnels	S1: Escape T01	1800	Hayriye	35.5	0.06	-
	S1: Escape T02	2000	Hayriye	35.5	0.05	-
	S1: Escape T03	1600	Derehöyük	35.5	0.07	-
	S1: Escape T04	1000	Derehöyük	35.5	0.15	-
	S1: Escape T05	150	Orhaniye	35.5	3.12	-
	S1: Escape T06	550	Orhaniye	35.5	0.39	-
	S1: Escape T07	15	Osmaneli	35.5	124.15	119.15
	S1: Escape T08	100	Osmaneli	35.5	5.97	0.97
	S3: Escape T01	-*	-	35.5	-	-
	S3: Escape T02	-*	-	35.5	-	-
	S3: Escape T03	-*	-	35.5	-	-
Railway Route	S3: 3+280 – 4+700	250	Bandırma	35.5	1.38	-
	S3: 17+990 – 20+520	500	Yeşilçomlu	35.5	0.45	-
	S3: 20+800 – 22+900	125	Danişment	35.5	4.17	-
	S3: 23+620 – 24+460	200	Tophisar	35.5	1.97	-
	S3: 31+480 – 32+550	500	Fevzipaşa	35.5	0.45	-
	S3: 47+120 – 48+730	400	Harmanlı	35.5	0.65	-
	S3: 49+020 – 50+000	250	Çarık	35.5	1.38	-
	S3: 57+760 – 58+420	950	Çeşnigir	35.5	0.16	-
	S3: 75+265 – 75+600	600	Badırga	35.5	0.34	-
	S3: 76+350 – 76+950	950	Badırga	35.5	0.16	-
	S3: 78+600 – 79+880	200	Çaylı	35.5	1.97	-
	S3: 95+000 – 95+530	150	Bursa	35.5	3.12	-
	S1: 117+950 – 119+900	30	Ebeköy	35.5	40.95	35.95
	S1: 133+030 – 133+450	2300	Orhaniye	35.5	0.04	-
	S1: 136+480 – 137+160	300	Düzmeşe	35.5	1.03	-
	S1: 142+520 – 142+860	50	Selçuk	35.5	18.09	13.09
	S1: 147+070 – 147+500	80	Osmaneli	35.5	8.53	3.53
	S1: 148+440 – 148+910	130	Osmaneli	35.5	3.92	-

* The information regarding the location of these tunnels were not provided by the Contractor.

It can be seen from the calculations that it is expected that blasting operations in some of the locations will have a vibration impact on the close receptors.

8.1.10.1.2 Commissioning/Operation Phase

During the operational phase, not any blasting operations will be carried out, thus not any vibration effects due to the Project activities is expected.

8.1.10.1.3 Decommissioning and Closure Phase

During the decommissioning and closure phase, not any blasting operations will be carried out, thus not any vibration effects due to the Project activities is expected.

8.1.10.2 Mitigation Measures

The mitigation measures listed below will be implemented during the blasting activities for the construction phase.

- A Blasting Management Plan will be developed and properly implemented through the blasting operations.
- All blasting activities with current pattern will be carried out at least 111.5 meters away from receptors/settlements. If blasting activities are to be carried out at a location closer than 111.5 meters to a receptor/settlement, blasting pattern and explosive quantities will be optimised.
- Proper and timely communication and information exchange between the Investor and residents is essential to prevent unnecessary concerns. The Contractor will inform residents on the proposed blasting times and/or any deviation from this programme.
- Construction and blasting activities will be scheduled to minimise potential vibration related impacts.
- During blasting, vibration measurements will be made in risky areas and the results will be recorded.

8.1.10.3 Residual Impacts

8.1.10.3.1 Construction Phase

The impact factor is evaluated considering duration, frequency, geographic extent and intensity for construction phase. Residual impact values for the impact factors are then calculated and classified considering all mitigations as described above and further elucidated in the blasting management plan.

Vibration impacts for the construction phase of the Project due to the blasting operations are evaluated in the matrix provided in Table 135. As can be seen in the matrix all impact factors considered for vibration originated from construction activities have negligible residual impacts on the Project personnel and nearby communities.

Table 139 Vibration Impact Matrix for Construction Phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features		Impact Value	Mitigation effectiveness	Residual impact value
Construction Vibration Effects	Duration:	Short	Very high	Reversibility:	Short-term	**Low**	Medium-high	**Negligible**
	Frequency:	Moderately frequent						
	Geo. Extent:	Local						
	Intensity:	Very high						

8.1.10.3.2 Commissioning and Operational Phase

No impacts are expected due to vibration during the commissioning and operational phase.

8.1.10.3.3 Decommissioning and Closure Phase

No impacts are expected due to vibration during the decommissioning and closure phase.

8.1.11 Traffic and Infrastructure

8.1.11.1 Impact Analysis

8.1.11.1.1 Construction Phase

During construction phase impacts will be mainly associated to the impact factor increased road traffic.

The activities related to the construction phase will require the movement of trucks entering and leaving the project area for the transportation of machinery, equipment, construction material (e.g., concrete, building materials) and staff. During transportation, existing roads will be used. Predicted increase in traffic load is given in table below.

Since the Project is a linear Project and the route consists of three provinces, the number of vehicle on the main roads along the BBYO Project route was estimated according to the traffic volume map. The number of vehicles assumed to increase with the Project's construction phase was estimated according machinery and equipment to be used in the construction phase of the Project sections.

Table 140: Traffic Load Increase on Main Roads in Construction Phase

Vehicle Type	Presumed Number of Vehicles along the BBYO Route	Number of Vehicle Increase with the Project's Construction	Traffic Load Increase (%)
Vehicle	15,000*	600**	4

**The number was estimated as low as possible to stay on the safe side according to the Traffic Volume Map (Figure 39) on the BBYO route.*
***The number of vehicles is estimated assuming that construction is ongoing at all three sections and considering heavy vehicles, mainly trucks will use the main routes routinely. Please refer to Table 26 for the estimated number and type of equipment to be used in the Project.*

During the construction activities, approximately %4 increase will be expected in terms of heavy vehicle flow rate per day.

During the construction phase of the Project, permanent service roads will be opened along the 201 km BBYO route on both sides of the route. Additionally about 110 km of permanent service road is planned as the tunnel access roads.

In order to provide access to the associated facilities to be established within the scope of the BBYO Project, around 22 km total service road is planned for the access to quarries by using the existing village and forest roads.

Expected impacts of the traffic load during the construction phase can be listed as below:

- Increase in traffic load will cause an increase in the noise along the access roads to the construction sites.
- Increase in traffic load where existing village roads will be used.
- Dust formation in the stabilized roads especially due to heavy vehicle movements.
- High speed of heavy vehicles is a concern for local communities.
- Increased road traffic could lead to accidental wildlife losses.
- Usage of existing roads can cause damage on the roads due to heavy vehicles.

8.1.11.1.2 Commissioning and Operational Phase

No impact is expected in the vehicle traffic load on the main roads as indicated in the construction phase.

Expected impacts of the railway traffic during the operation phase can be listed as below:

- Occupational safety risks with respect to train/worker accidents
- Community related concerns at locations and trespassers on rail lines and facilities which may incur risks from moving trains, electrical lines and equipment, etc.

8.1.11.1.3 Decommissioning and Closure Phase

A new impact is not expected other than those listed in the construction phases in the decommissioning and closure phase of the Project.

8.1.11.2 Mitigation Measures

A Traffic Management Plan will be prepared within the scope of the Project to maintain traffic safety on the roads to be used (in site and off site) and to prevent the risks which may outcome due to Project activities ensuring "safe site, safe vehicle and safe driver" at all times.

Following points will be considered as a minimum during the construction phase of the Project regarding traffic management:

- Referring to Section 5, a continuous stakeholder engagement process and grievance mechanism will be in place:
  - to exchange information on the project with the local community and other stakeholder and
  - to record and respond any complaints and concerns raised by the local community members and other stakeholders
- Consideration will be given to traffic volumes at the rush hours of the day and delivery of equipment and materials will be utilised at quieter periods to avoid increased congestion on the roads used by the nearby communities.
- It will be ensured that the roads will be made suitable for the heavy vehicle use by taking necessary permits and making necessary arrangements. In case of any damage on the roads, necessary maintenance works shall be made.
- Journey Management System will be implemented including a route survey to clarify the transportation route of the equipment/material prior to transportation.
- Project site will be equipped with suitable and sufficient lighting to ensure sufficient visibility of operators.
- If reversing cannot be avoided at the work areas, necessary reversing procedures will be identified including installing reversing aids on vehicles, reversing sensors etc. Trained banksman will be used when reversing cannot be avoided.
- Parking areas will be designated with signs and reverse parking will be implemented.
- The routes to be used by pedestrians will be segregated from heavy vehicle routes.
- The speed limits will be implemented. Operators shall obey the speed limits within the camp sites, Project site road and other roads used to access the Project site. A speed control mechanism will be implemented by e.g., using hand-held radar and random speed controls. The discipline procedure will be established and implemented for the operators who are breaching the speed limits.

- No vehicle/equipment/material will be allowed to enter work areas before obtaining approval from the security.
- Changes of the condition of the roads will be monitored regularly and necessary road correction remediation actions will be taken where necessary.
- Weather monitoring system will be established to ensure sufficient control measures are in place and driving will not be allowed under adverse weather conditions which can impact the safety of the operators.
- Loading areas will be designed appropriately to prevent/minimize vehicle/pedestrian contact and property damages.
- All operators will be licensed/certified. Repair and maintenance of vehicles will be done by the authorized services.
- Fatigue and distraction procedures will be established considering the local legal requirements and the nature of the work.
- An external grievance mechanism will be established for the affected communities to express their concerns about the traffic management.
- Project disclosure activities will include informing communities about the project traffic management controls and grievance mechanism. Collaboration with local communities and responsible authorities will be ensured to improve signage, visibility, road safety conditions especially near the roads and other locations where children may be present.
- Appropriate traffic signs, signals, lights and markings will be placed at the required areas to prevent potential accidents/incidents. Barriers will be placed at the required areas to protect both human and assets.

During the operation of the Project, the national regulatory safety requirements for the railways will be complied with. The following will be considered for the pedestrian safety and potential trespassers:[40]

- Clear and prominent warning signages at potential points of entry to track areas (e.g. stations)will be placed. The warning signs will be monitored regularly to ensure that they are not removed, damaged, etc. and replaced as needed.
- Fencing or other type of barriers will be placed at the station ends to prevent access to tracks by unauthorized people.
- Stakeholder Engagement Plan will be implemented during the operation phase which will also include information/training of local people especially to young people, regarding the dangers of trespassing.
- The design criteria of the stations will ensure that the authorized route is safe, clearly indicated, and easy to use.
- CCTV will be ensured at all stations and at the areas to be determined where trespassing occurs frequently, with a voice alarm system to deter trespassers.
- Operational safety measures will be in place for the traffic management at the stations and the parking areas. The capacity of the parking areas of the stations will be assessed during the design studies and

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necessary technical arrangements will be ensured to provide safe access and egress of the vehicles and pedestrians to/from the stations.

- There will be no level crossings in the Project, therefore the risks relevant to level crossings on the pedestrians are eliminated in the BBYO Project.

8.1.11.3 Residual Impacts

8.1.11.3.1 Construction Phase

The residual impact on traffic component after the application of the abovementioned mitigation measures during construction phase is presented in the following table.

Table 141 Impact Assessment Matrix for Traffic Component During the Construction Phase After Mitigation

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
Increased Road Traffic	Duration:	Medium-long	Medium-low	Short-mid-term	**Low**	High	**Negligible**
	Frequency:	Highly frequent					
	Geo. Extent:	Local					
	Intensity:	Low					

8.1.11.3.2 Commissioning and Operational Phase

The residual impact on railway traffic component after the application of the abovementioned mitigation measures during operation phase is presented in the following table.

Table 142 Impact Assessment Matrix for Railway Traffic Component During the Operation Phase After Mitigation

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
Increased Railway Traffic	Duration:	Long	Medium-low	Mid term	**Medium**	High	**Negligible**
	Frequency:	Highly frequent					
	Geo. Extent:	Local					
	Intensity:	Medium					
Increased Traffic at Stations	Duration:	Long	Medium-low	Mid term	**Low**	High	**Negligible**
	Frequency:	Highly frequent					
	Geo. Extent:	Project footprint					
	Intensity:	Project footprint					

8.1.11.3.3 Decommissioning and Closure Phase

A new impact is not expected other than those listed in the construction and operation phases in the decommissioning and closure phase (after the mitigation) of the Project.

8.1.11.4 Monitoring

Monitoring activities are required to verify the effectiveness of the mitigation measures proposed. They are listed below:

- Investigation of the incidents and accidents and use of lesson's learned to improve traffic mitigations.
- Driver education monitoring to ensure it takes place.
- Comments and/or complaints incoming from grievances to improve traffic mitigations and to prevent air quality and noise impacts, if any.

Monitoring should in particular be designed to identify failure or ineffectiveness of mitigation measures in terms of road safety and nuisance prevention.

8.1.12 Landscape and Visual

This chapter presents the findings of the assessment of potential effects of the Project with regard to landscape character and visual aesthetics during both construction and operational phases.

The following legislation is considered to be relevant:

- Environment Law No. 2872 (1983), amended by Law No. 5491[145] (last amended in 2017);
- Law No. 2863 (1983) on the Preservation of the Cultural and Natural Assets
- Law No. 2873 (1983) on National Parks, amended by Law No. 5400 (2005);
- Forest Law No. 6831 (1956)[148] (last amended in 2004); and
- Law No. 4881 (2003) on the Approval of the European Landscape Convention.

Turkish legislation does not include specific requirements for landscape and visual assessment. IFC Performance Standards is considered for the assessment of this component.

Methodology

The key steps for conducting this study are listed below:

- Assessment of existing baseline situation by taking into consideration of environment, human receptors, cultural heritage.
- Desktop review
- Site visit
- Identification of potential impact associated with the project.
- Identification of mitigation measures
- Describe the residual impacts.

Study Area

Study area is presented in Section 6.1 which was 500 m buffer on either side of the route. It is considered that no significant effects are expected beyond this distance. According to the previous project experience, 500 m study area is sufficient in this instance to identify those receptors possible to be affected by the Project.

Sensitivity of the receptors:

Sensitivity	Receptor Value
High	Clear views from touristic attractions or residential property, nationally or internationally recognised landscapes
Medium	Several viewers like publicly open recreational areas, recognized but unremarkable landscapes
Low	Fewer viewers like publicly open spaces, landscapes of poor quality and low importance
Negligible	Almost no viewers, landscapes of poor quality and low/no importance

It should be noted that, the assessment of determining the significance of effect based on the professional judgement. According to the information provided, and most up to date available data, it is assumed that there will not be any visual effect for the project at the tunnel.

According to the available resettlement information, where the properties located directly on the route, they will be subject to physical resettlement. According to the current high speed trains in Turkey, it is assumed that the maximum height of the rolling stock and temporary stockpiled mounds will be 4 m.

It should also be noted that, there are not any publicly available recognised landscape areas assessment for the study area. Thereof, the assessment has been conducted from aerial photos, field studies and publicly available data. The viewpoint locations were identified from publicly accessible locations only.

Baseline

The 201 km long BBYO Project will start from Bandırma, pass through Kuşcenneti, Karacabey, Teknosab, Bursa, Gürsu, Yenişehir Airport and Yenişehir stations and connect to the Ankara-Eskişehir-Istanbul High Speed Train Line in the Osmaneli region. The Project railway route will pass through Balıkesir, Bursa and Bilecik Provinces.

The study area has been defined as 500 m on either side of the project route for the purpose of this assessment.

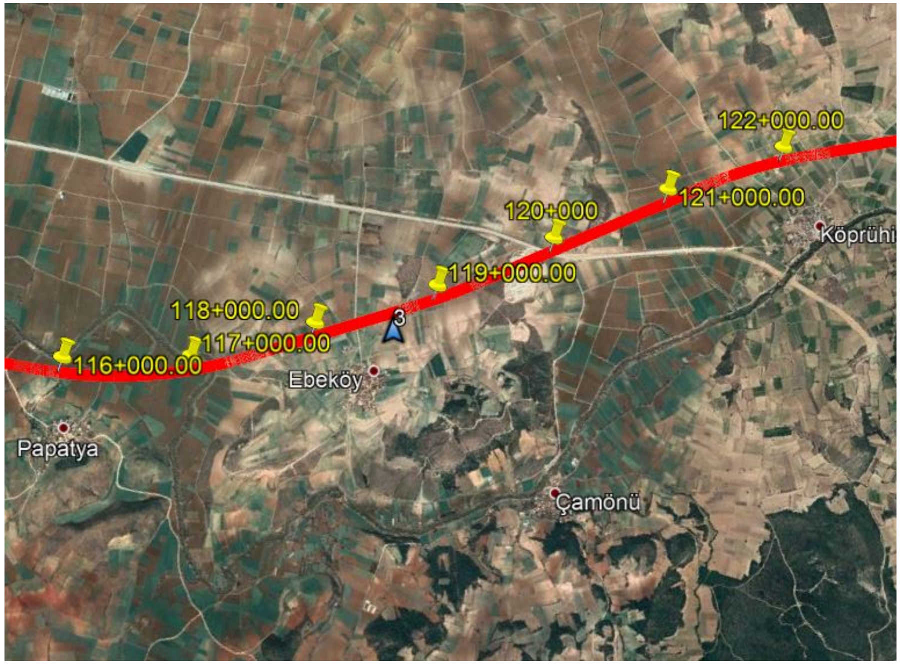
The Project is not located within any protected areas. However, a small portion of the footprint, and consequently of the Project LSA, in the western part partially falls within the internationally recognized Manyas Lake (Kuş Lake) Key Biodiversity Area (KBA) and Important Bird Area (IBA). The Marmara Islands KBA and IBA is located at 5 km from the local study area defined in Section 7.2.5, while the Uluabat Lake KBA, IBA and Ramsar Site, the Armutlu Peninsula KBA and IPA (Important Plant Area), the Ulu (Uludag) Mountain KBA and IPA, and Kocaçay Delta KBA and IPA are located at 20 km from the Project LSA (please see Figure 41 in Section 7.2.5). the landscape character areas are defined in Section 7.2.5.

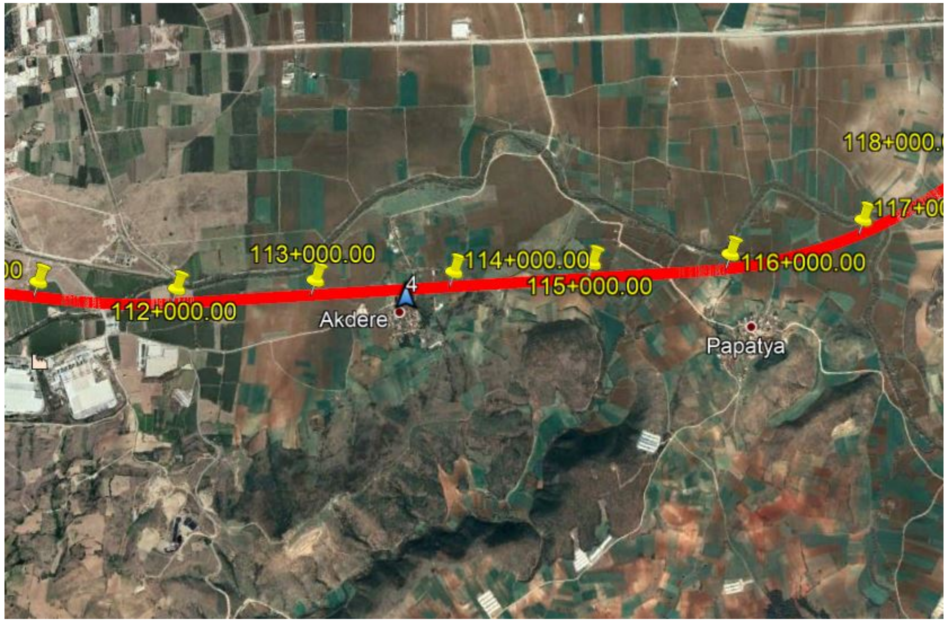
Viewpoint Locations

The below 14 points have been identified along the route represent the views of different receptor groups. The location of viewpoints is also shown in below figures.

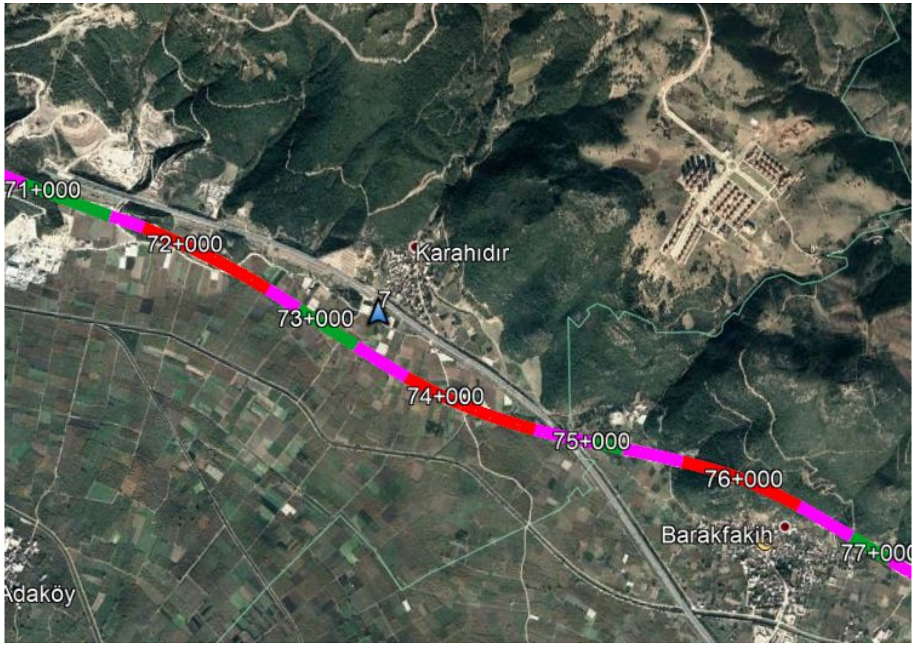
No	Name of Viewpoint	Sensitivity	Aerial Photos
1	Looking towards the east of the route and close vicinity of Sakarya River. 148+100 km	High	

No	Name of Viewpoint	Sensitivity	Aerial Photos
2	The cemetery positioned towards to west of Osmaneli District. 144 km	Medium	

No	Name of Viewpoint	Sensitivity	Aerial Photos
3	Located towards to east of Ebeköy. 119 km	High	

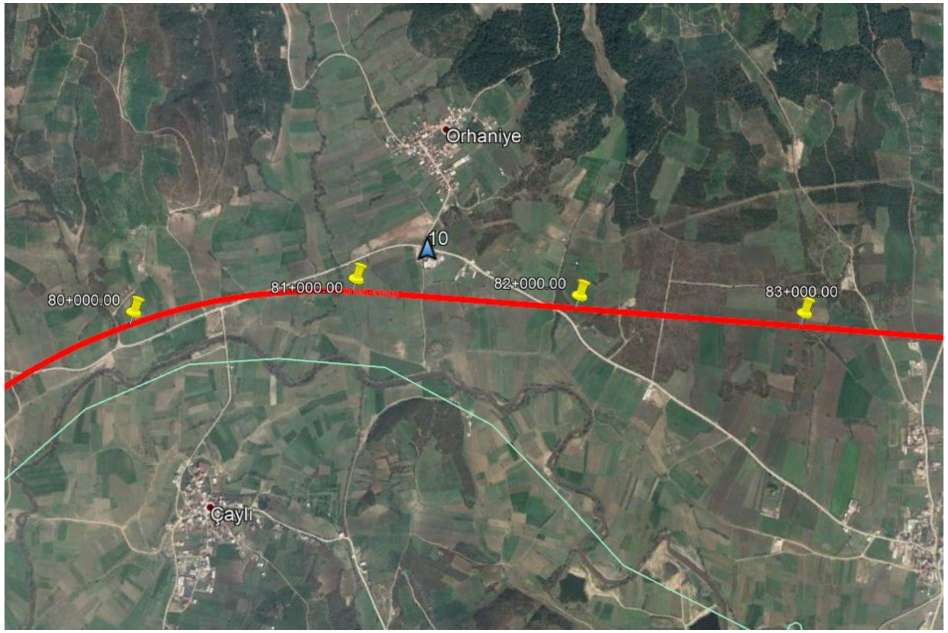
No	Name of Viewpoint	Sensitivity	Aerial Photos
4	Located 450 m south of Göksu Stream 114 km	High	

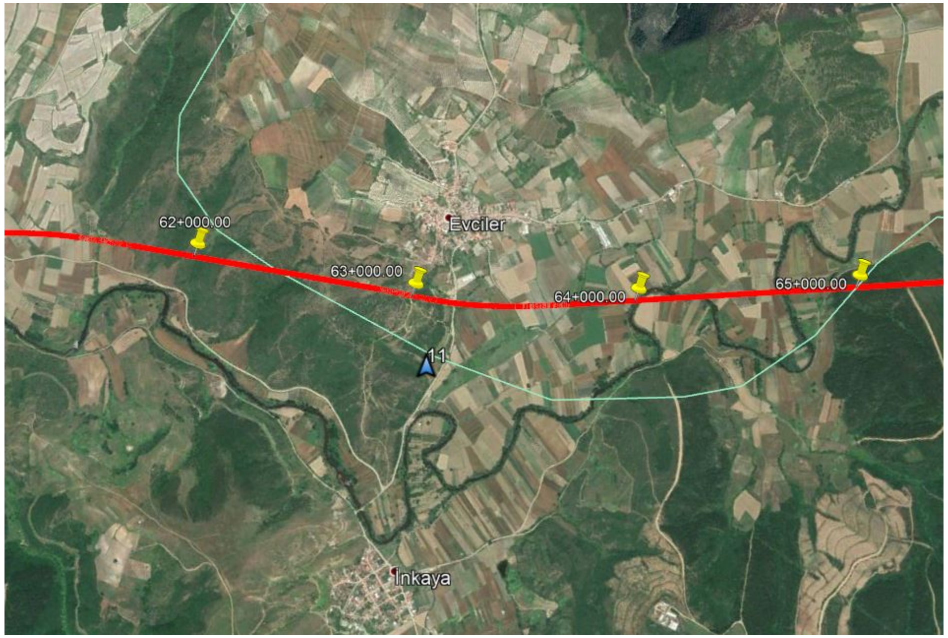
No	Name of Viewpoint	Sensitivity	Aerial Photos
5	Located northwest of the Yenişehir Airport 99 km	Medium	
6	Located south of the Narlodere Village 78 km	Medium	

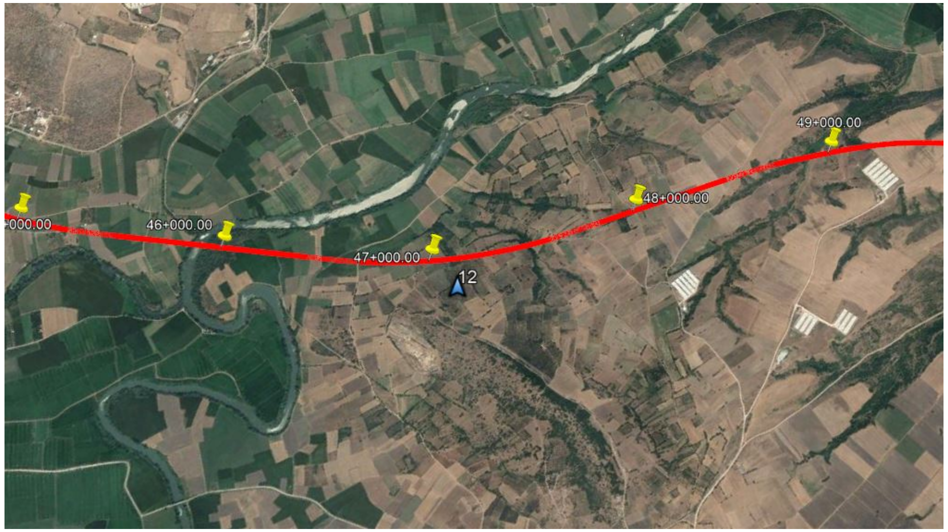
No	Name of Viewpoint	Sensitivity	Aerial Photos
7	Located north of the project route 73 km	Medium	

No	Name of Viewpoint	Sensitivity	Aerial Photos
8	Located south of the Nilüfer Stream parallel to route in section 3 95 km	Medium	

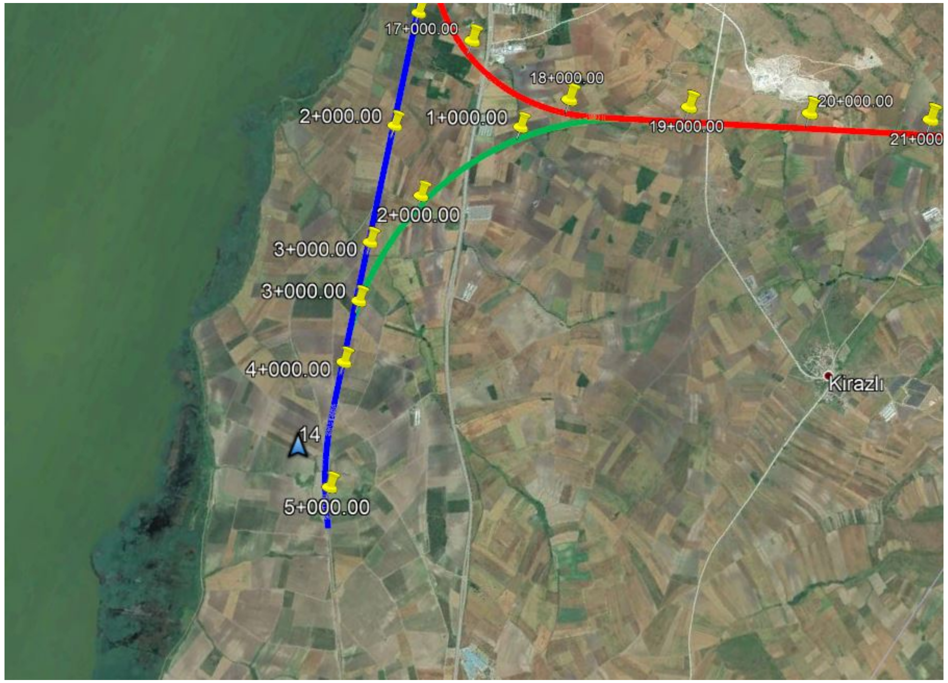
No	Name of Viewpoint	Sensitivity	Aerial Photos
9	Located south of Nilüfer Stream in route section 3 92 km	Medium	

No	Name of Viewpoint	Sensitivity	Aerial Photos
10	Located south of Orhaniye Village in section 3 81 km	Low	

No	Name of Viewpoint	Sensitivity	Aerial Photos
11	Inkaya cave located 900 km from project route in section 3 63 km	Low	

No	Name of Viewpoint	Sensitivity	Aerial Photos
12	Located north of Harmanlı Village in section 3 47 km	High	

No	Name of Viewpoint	Sensitivity	Aerial Photos
13	Located south of Yeşilçomlu Village in section 3 20 km	Medium	

No	Name of Viewpoint	Sensitivity	Aerial Photos
14	Located towards to project route in section 3 5 km	High	

Impacts on landscape during the construction phase

- Loss of existing vegetation (mainly woodland and shrublands)
- Temporary change to the local topography due to the stockpiling (max 4 m height)
- Demolition of the properties along the route
- Temporary change to the land use

Impacts on landscape during the operational phase

- Permanent change to the nature within the scope of Project footprint. (the railway corridor)
- Permanent modifications to existing landform
- Additional permanent structures including 29 tunnels, 35 bridges, 15 viaducts, 29 overpasses and 99 underpasses

Impacts on visual during the construction phase

- Temporary stockpiling materials
- Temporary awareness of the construction activities
- Tunnel and bridge construction approach

Impacts on visual during operational phase

- Permanent alteration to the nature of the viewing of prominent structures including bridges, viaducts, overpasses and underpasses and the linear corridor of the railway itself.
- Entrance and exit points of ground structures (tunnels) will only be visually visible during the operation. The below structures will have no perceivable change to the nature.
- Permanent visual awareness of above ground structures such as electrification and height of vertical structures (catenary posts).
- Increasing of visual awareness of the disturbance from passenger and freight train movements within the view.

Assessment on landscape

- The project will result in a permanent alteration to the character of landscape through the addition of new permanent linear feature (railway itself).
- For the parts of the route, the project follows the alignment of existing railway which could reduce the magnitude of change and impacts on nearby receptors.
- The project results in the loss of vegetation and habitat which would be noticeable.

In general, the project has low to moderate magnitude of landscape alteration for Section 1 and 3. For section 2 the infrastructure works have almost been completed by another contractor and landscape feature was already disturbed.

Assessment on visual

- At the eastern part of the project (section 1), it closely follows the alignment of existing railway which can be considered to be reduced the impacts to those section.

- The construction activities of tunnels themselves result in visual awareness. Following the construction, assumed that there will not be any visual impacts upon the receiving environment (all structures being located below ground).
- The majority of visual impacts will occur where the project passes through the proximity to residential areas. The settlements most likely effected will include Osmaneli, Akdere (114 km), Demirtaş Barbaros (60+500 km). the locations of these settlements are shown in above table.
- Inclusion of permanent above ground structures (bridges, viaducts) has effects on the visual awareness.
- Demolition of residential properties during the construction (detailed in RAP) will result in perceptual change to the landform.

In general visual impacts could be considered to a bit more during the construction phase. Following the construction, project will be perceived as an alteration to existing feature and reduce the significance of effect.

The effects of the project on the receptors are summarised below.

Table 143 Visual Impact Assessment on the Receptors

No	Phase	Sensitivity	Change of magnitude	Impact
1	Construction	High	No change	Negligible
	Operation	High	No change	Negligible
2	Construction	Medium	No change	Negligible
	Operation	Medium	No change	Negligible
3	Construction	High	No change	Negligible
	Operation	High	No change	Negligible
4	Construction	High	No change	Negligible
	Operation	High	Low	Low
5	Construction	Medium	No change	Negligible
	Operation	High	Low	Low
6	Construction	Medium	No change	Negligible
	Operation	Medium	No change	Negligible
7	Construction	Medium	No change	Negligible
	Operation	Medium	No change	Negligible
8	Construction	Medium	No change	Negligible
	Operation	Medium	No change	Negligible
9	Construction	Medium	No change	Negligible

No	Phase	Sensitivity	Change of magnitude	Impact
	Operation	Medium	No change	Negligible
10	Construction	Low	No change	Negligible
	Operation	Low	No change	Negligible
11	Construction	Low	No change	Negligible
	Operation	Low	No change	Negligible
12	Construction	High	No change	Negligible
	Operation	High	No change	Negligible
13	Construction	Medium	No change	Negligible
	Operation	Medium	No change	Negligible
14	Construction	High	Low	Low
	Operation	High	Low	Negligible

Mitigation measures

There are no industry standards or best practice guidance regarding with landscape mitigation and management within the scope of the local legislation. The proposed mitigation measures associated with the project comprises of professional judgement.

- The construction phase environmental and social management plans will include the Reinstatement and Landscape Management Plan.
- There should not be tall planting of trees within the 50 m railway corridor for the project due to avoid the disruption from potential vegetative contact with power supply and catenary posts. All planting activities should be in accordance with the Reinstatement and Landscape Management Plan.
- After the completion of construction, the areas used as construction area will be returned to their original use.
- Where topsoil stripped, and stored on site for reuse, the stockpile mounds will be stored at a maximum height of 2 m in order to prevent the integrity of topsoil.
- During the construction phase, restricted hours of working will be proposed especially for built up areas. Using machinery during those hours should be avoided in residential properties. This approach should be detailed in Traffic Management Plan and Noise and Vibration Management Plan.
- Stockpiles to have maximum 5 m height to reduce the visual awareness within the views.

Conclusion

During the operation phase, there will be permanent and long term effects on visual receptors due to the presence of structures (such as bridges, viaducts), changes in landform, presence of trains along the route and associated infrastructures (such as cables, signalling) that will be visible and disrupt the existing visual aesthetics. During the construction, the effect will be temporary and short term.

8.2 Biological Components

The LSA is situated in an area dominated by Modified Habitats (78%) mainly constitute of agricultural land. Within this highly modified landscape, patches of Natural Habitats are present (22%) but they are usually disconnected and of modest dimension with few exceptions. Critical Habitats (CHs) identified within the LSA are triggered by different flora and fauna species as assessed in Chapter 7.2.9.

The sensitivity of the various biodiversity components is defined as follows:

- general sensitivity of the component is considered to be **Medium-Low;**
- Natural habitats are considered having a **Medium** sensitivity;
- Critical Habitats (CHs) are considered having a **High** sensitivity.

The potential direct and indirect impacts are considered for Modified Habitats, Natural Habitats (NHs) and Critical Habitats (CHs),and varied according to their characteristics.

The impact assessment for biodiversity follows the semi-quantitative method described in the Impact Assessment Methodology Chapter 6.0, which is very briefly summarized again here. An impact value for an impact factor affecting a biodiversity feature is calculated by summing scores for impact criteria, such as duration and intensity, and multiplying by the sensitivity of the biodiversity feature. The sensitivity scale is given in the IA Methodology Chapter and Sensitivity rankings have been provided above. Critical Habitats (CHs) identified within the LSA are triggered by different flora and fauna species.

Project actions, resulting direct and indirect impact factors and biodiversity components potentially affected have been outlined in previous chapters and are explored more below. Impacts on general biodiversity, including flora fauna and habitats, are assessed in section 8.2.1 for the construction phase, in section 8.2.2 for the operation phase, and in section 8.2.3 for the decommissioning and closure phase.

Specific impacts on Critical Habitats, are discussed in depth in section 8.2.4 for the construction and operation phases.

Avoidance, mitigation and rehabilitation are proposed in this section according to the mitigation hierarchy principle. Monitoring measures are also proposed.

8.2.1 Construction Phase

The potential impacts on biodiversity are associated with the following impact factors:

1) vegetation and topsoil removal;
2) changes in local hydrology and water quality;
3) increase in vehicular traffic;
4) emission of noise and vibration;
5) introduction and spreading of alien species.

All the impact factors identified above are described and discussed in the following assessment.

1) Vegetation and topsoil removal

Construction works will cause direct habitat loss and habitat fragmentation. Vegetation present within footprint of the construction sites and associated facilities will be cleared and the topsoil will be removed, ground will be excavated, excavated materials will be moved to storage areas, ground will be flattened and compacted in order to create a suitable ground for construction.

The areas affected by this impact factor will be limited to the Project footprints, including associated and temporary facilities present during the construction phase. A corridor of 15 meters is considered for construction.

Flora species present in the area will be directly impacted by vegetation clearing at the beginning of construction during ground preparation works.

The removal of vegetation causes the destruction of suitable habitats for fauna species that use the vegetation present as food, shelter or nesting site. Local fauna could be directly impacted by the vegetation clearing and soil disturbance activities performed during site preparation. Species characterized by low mobility (such as reptiles and amphibians) may not be able to move ahead of construction. Species with a hiding strategy to escape predators might also be accidentally killed during the construction operations. Nesting sites could be impacted by vegetation clearing with different effects depending on timing and the species reproduction strategy.

2) Changes in local hydrology and water quality

Construction activities, such as surface levelling and grading, will cause changes in local morphology and hydrology. The crossing points between the railway and the permanent and temporary streams are particularly sensitive to this impact factor. The project footprint is expected to cross permanent and temporary streams at least 54 times according to available information.

Changes of local hydrology will generate an habitat modification for fish species as the river features (e.g. water velocity and river-bed characteristics) will be modified in the proximity of the river crossings. Without proper mitigation and monitoring measures the diversion could also cause temporary habitat fragmentation due to temporary dry out of the diversion channel or physical structure that could limited fish mobility upstream.

In addition, during the construction phase any uncontrolled release of sediment or other potential pollutants may cause a change in water quality (e.g. dissolved oxygen) and a loss in nursery habitat caused by silt deposition and accumulation. Particulate run-off and sediment release caused by construction preparation activities and by the diversion of the rivers would likely have a localised impact with sediments and pollutants moving downstream. Terrestrial fauna species, especially invertebrate fauna, could also be impacted by pollution. Using a precatory approach, a 100 m buffer is considered around project facilities in correspondence of aquatic habitats.

3) Increase in vehicular traffic

During construction, an increase in vehicular traffic is expected within the construction site and the different project facilities. In addition, construction and improvement of access roads may lead to increases in average vehicle speeds. Therefore, accidental collisions with wildlife might occur.

Increased vehicular traffic may result in direct mortality for fauna species and indirect habitat degradation. Road kills can have a significant impact on some wildlife populations. Animals subject to roadkill are attracted to roads for a variety of reasons.

More in general, traffic can have an important influence on the behaviour of wildlife and on its distribution, thus the use of the space, of local populations (Sr. Clair and Forrest, 2009). Amphibians might be attracted by stagnant water that forms at roadside or within the construction area. Reptiles and other ectotherms go there to bask in the sun, some birds use roadside gravel to aid their digestion of seeds. Songbirds come to dust bathe on dirt roads, where they are vulnerable to vehicles as well as predators. Vultures, crows, foxes and other scavengers seek out roadkill and often become roadkill themselves. Mammals might be attracted by organic waste or to de-icing salts, browsing herbivores are attracted to the vegetation of roadside edge, rodents proliferate in the artificial grasslands of road verges, and many large mammals find roads to be efficient travel ways.

4) Emission of noise and vibration

The emission of noise and vibration is expected to be of high intensity for the construction phase. Construction activities such as vegetation clearance, surface levelling and grading, excavation of construction material, transport and temporary stockpiling of material, construction of the facilities are expected to generate noise and vibration.

The emission of noise and vibration could cause indirect habitat degradation due to temporary avoidance of surrounding areas by sensitive fauna species. Noise has the greatest effect on wildlife that relies heavily on auditory signals for survival and especially on birds and mammals. Disturbance from anthropogenic noise, for example, is known to be correlated with reduced densities of breeding birds (Reijnen *et al*., 1995; Canaday and Rivadeneyra, 2001). The effects of noise disturbance from human activity on wildlife are mostly perceived over short distances in a species- specific way (up to ~ 300 m, Reijnen *et al*., 1995; Canaday and Rivadeneyra, 2001). Therefore, using a precautionary approach, a 300 m buffer is considered around Project components, associated facilities and temporary facilities present during construction.

The effects of vibration on wildlife is poorly studied, however avoidance behaviour around the source of vibration is likely to exist for birds, reptiles and amphibians. Birds and reptiles are highly sensitive to vibration (e.g., Shen 1983), which low-frequency noise can be a source of information about approaching predators and prey. Also, amphibians have exquisite sensitivity to vibration (Lewis and Narins 1985): there are species that use low-frequency acoustic cues detected via ground vibrations to communicate, to time their emergence from burrows (Dimmittand Ruibal 1980).

During the construction phase, most fauna species may temporarily avoid construction areas and their immediate vicinities and, according to Helldin *et al.* (2012), this behaviour is mainly due to the increase in human activity. An impact could be expected especially during the breeding period on birds and mammals, which may be frightened by noise and might abandon their nest /mating ground. In particular, the breeding period for bird species in the area ranges from April to July, with a peak period from May to June.

5) Introduction and spreading of alien species

Removal of natural vegetation cover and soil disturbance could facilitate the spreading of invasive alien (non-native) species accidentally introduced by cars, trucks and other heavy machinery usen during construction. Invasive alien spcies tend to have an advantage in disturbed ecosystems, and if they penetrate into a habitat, they can potentially change its functionality and species composition, including priority biodiversity species. Using a precautionary approach, a 100 m buffer around the Project facilities is considered for this impact factor.

Local fauna that depends on those ecosystems could also be indirectly affected. The habitats around the construction sites could experience a decrease in biodiversity in the immediate vicinity of the roads, with a consequent trivialization (potential appearance of more dominant species) of the ecosystem in a small buffer area close to the roads with a higher traffic.

The effects of these potential impacts on biodiversity, and in particular on natural habitats, are quantified and discussed below. The areas potentially impacted are represented from Figure 92 to Figure 94 and their numerical estimation is presented in the table below.

Direct impacts from vegetation clearing and disturbance of terrestrial topsoil will impact 4% of the total LSA. All the direct impacts will be mainly concentrated on agricultural fields (I1.2, I1.4 and I1.1 EUNIS habitat types respectively). The project will largely make use of existing access roads and adjacent areas, that have a higher level of degradation than the average in the LSA, and as such will minimize further habitat destruction/degradation.

Direct impacts will affect 4% of the total natural habitats present in the LSA. Most of the direct impacts will be on coniferous woodland (G3.7, 47.36 ha), maquis vegetation (F5.2, 34.88 ha) and deciduous forests (G1.7, 33.26 ha).

Indirect impacts in the 100 m buffer deriving from construction, such as changes in morphology and hydrology, increase in vehicular traffic and introduction of invasive alien species, could impact a total of 19% of the LSA. Indirect impacts from construction in the 100 m buffer will be mainly on agricultural fields (I1.2, I1.4 and I1.1 EUNIS habitat types respectively).

Indirect impacts within the 100 m buffer could potentially affect 15% of the total natural habitats. They will be mostly on coniferous woodland (G3.7, 238.51 ha), mesotrophic pasture (E2.1, 118.28 ha) and pseudomaquis vegetation (F5.3, 100.38 ha).

Indirect impacts in the 300 m buffer deriving from construction, such as noise and vibration, could impact a total of 56% of the LSA. Indirect impacts within the 300 m buffer will be mostly on agricultural fields (I1.2, I1.4 and I1.1 EUNIS habitat types respectively).

Indirect impacts within the 300 m buffer could potentially affect 49% of the total natural habitats. They will be mostly on coniferous woodland (G3.7, 851.96 ha), mesotrophic pasture (E2.1, 415.01 ha) and pseudomaquis vegetation (F5.3, 304.42 ha).

Table 144 Direct and indirect impacts on EUNIS habitats calculated within the LSA for the construction phase

Code	Habitat	Direct impacts (ha)	Indirect impacts within 100 m (ha)	Indirect impacts within 300 m (ha)	Total LSA (ha)
Natural habitats					
C1.2	Permanent mesotrophic lakes, ponds and pools	-	-	-	2.85
C1.6	Temporary lakes, ponds and pools	0.04	2.56	7.08	8.05

Code	Habitat	Direct impacts (ha)	Indirect impacts within 100 m (ha)	Indirect impacts within 300 m (ha)	Total LSA (ha)
C2.2	Permanent non-tidal, fast, turbulent watercourses	0.01	0.29	1.14	3.32
C2.3	Permanent non-tidal, smooth-flowing watercourses	3.06	22.83	81.52	144.05
C2.5	Temporary running waters	0.23	1.32	3.22	4.66
E1.C	Dry mediterranean lands with unpalatable non-vernal herbaceous vegetation	11.47	7.74	24.36	51.77
E2.1	Permanent mesotrophic pastures and aftermath-grazed meadows	28.52	118.28	415.01	749.13
F5.2	Maquis	34.88	46.01	172.18	315.15
F5.3	Pseudomaquis	22.59	100.38	304.42	568.03
G1.1	Riparian and gallery woodland, with dominant alder, birch, poplar or willow	1.07	12.54	48.01	80.46
G1.7	Thermophilous deciduous woodland	33.26	81.51	220.59	390.44
G3.7	Lowland to montane mediterranean pine woodland (excluding black pine [Pinus nigra])	47.36	238.51	851.96	1714.48
G3.9	Coniferous woodland dominated by [Cupressaceae] or [Taxaceae]	23.14	19.16	55.44	206.62
G4.B	Mixed mediterranean pine - thermophilous oak woodland	11.05	78.30	245.15	770.05
H3.2	Basic and ultra-basic inland cliffs	1.45	4.88	12.77	22.68
	Natural habitats sub-total	*218.12*	*734.31*	*2,442.84*	*5,035.62*
Modified habitats					
E5.1	Anthropogenic herb stands	0.09	0.92	0.92	12.18
G1.C	Highly artificial broadleaved deciduous forestry plantations	10.07	13.73	59.56	187.58
G1.D	Fruit and nut tree orchards	41.81	241.69	663.89	1060.76

Code	Habitat	Direct impacts (ha)	Indirect impacts within 100 m (ha)	Indirect impacts within 300 m (ha)	Total LSA (ha)
G2.4	Olive - carob woodland	-	-	0.68	12.73
G3.F	Highly artificial coniferous plantations	33.44	104.29	366.14	630.37
I1.1	Intensive unmixed crops	71.95	338.19	940.14	1648.40
I1.2	Mixed crops of market gardens and horticulture	300.75	1803.25	5221.64	8675.70
I1.3	Arable land with unmixed crops grown by low-intensity agricultural methods	1.57	10.52	40.21	91.82
I1.4	Inundated or inundatable croplands, including rice fields	102.84	616.24	1810.41	3003.66
J1.1	Residential buildings of city and town centres	0.86	6.29	44.87	159.01
J1.2	Residential buildings of villages and urban peripheries	3.47	28.70	151.64	334.35
J2.3	Rural industrial and commercial sites still in active use	18.62	139.46	485.60	846.97
J3	Extractive industrial sites	11.36	33.40	118.52	257.87
J4.2	Road networks	6.88	97.11	297.07	410.48
J4.3	Rail networks	25.34	3.51	5.29	31.96
J4.4	Airport runways and aprons	2.23	23.05	77.39	166.53
J5.4	Highly artificial non-saline running waters	0.72	3.06	17.66	22.97
	Modified habitats sub-total	*632.02*	*3463.41*	*10301.64*	*17553.32*
	Total	***850.14***	***4,197.73***	***12,744.48***	***22,585.06***

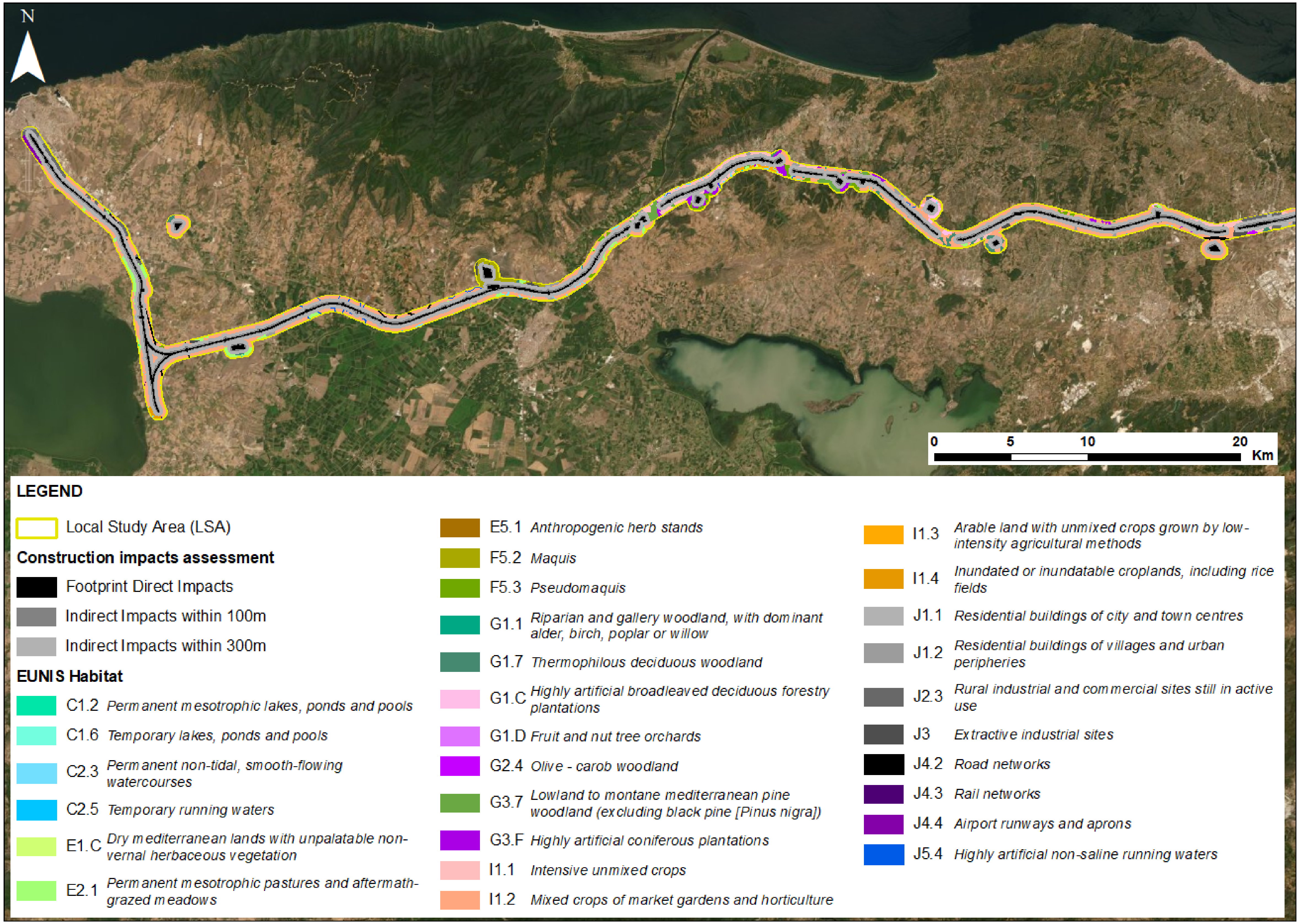


Figure 92 Map of the construction impacts on EUNIS habitats within the LSA (Bandirma-Bursa line view)

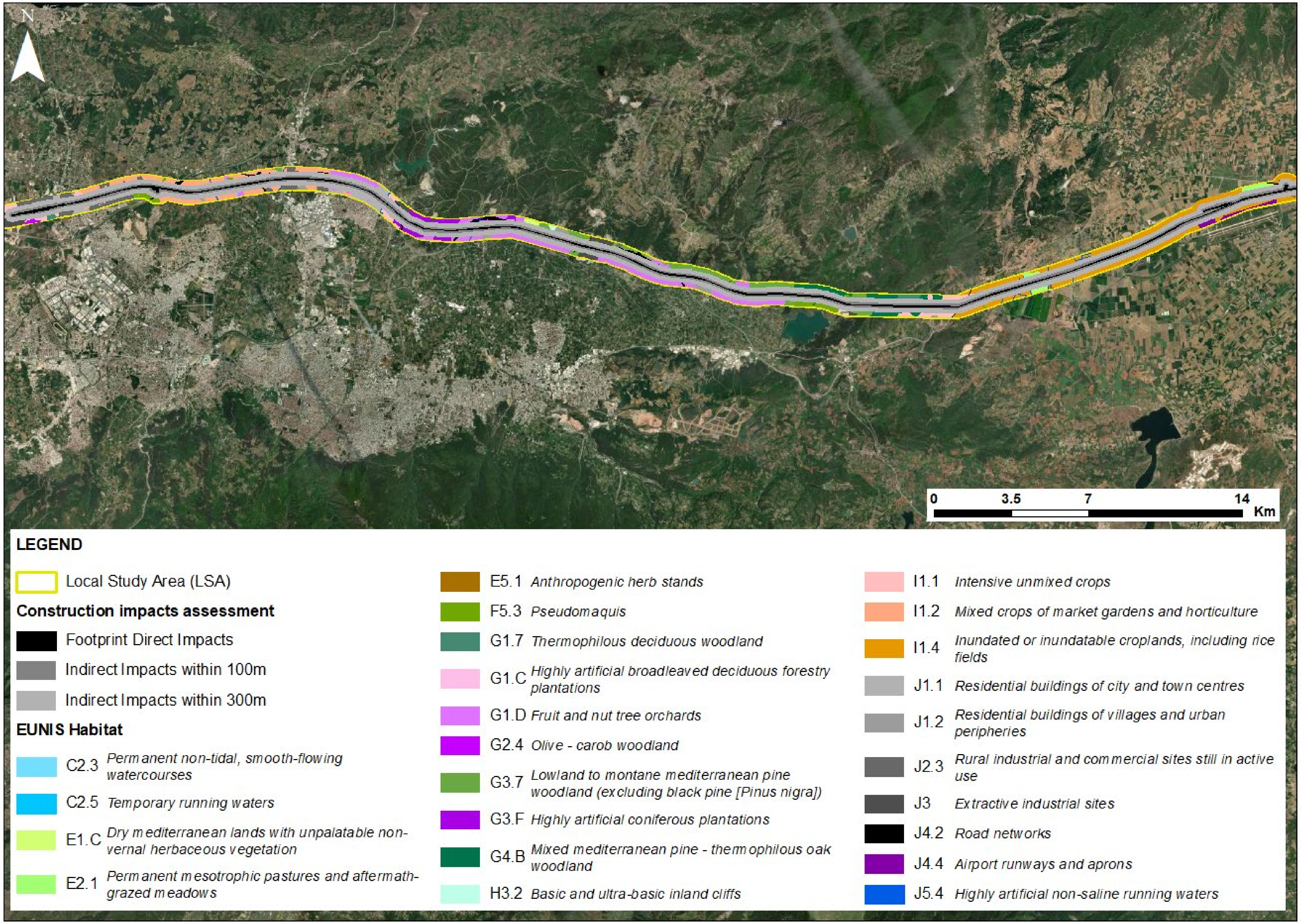


Figure 93 Map of the construction impacts on EUNIS habitats within the LSA (Bursa-Yenişehir line view)

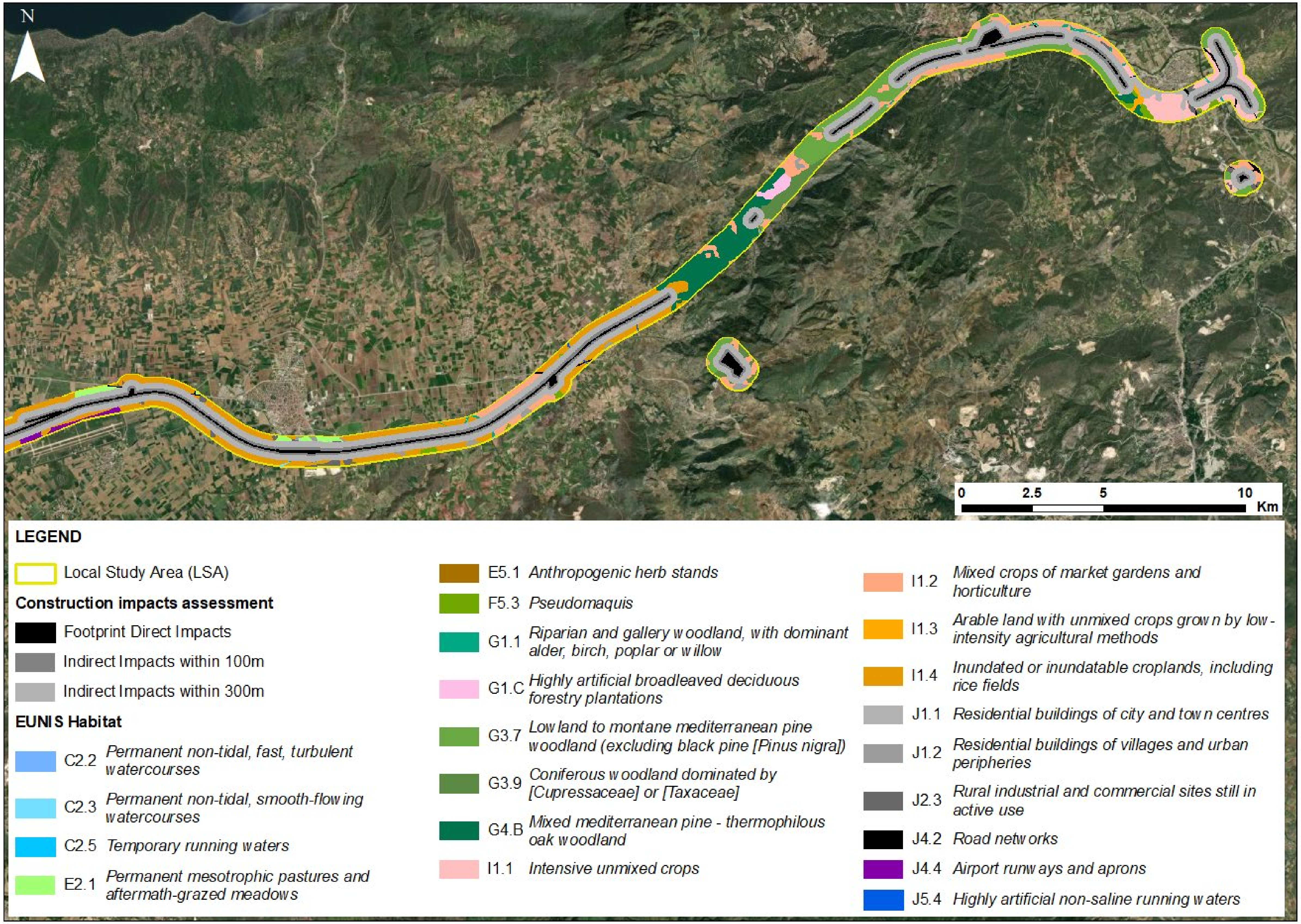


Figure 94 Map of the potential construction impacts on EUNIS habitats within the LSA (Yenişehir-Osmaneli line view)

8.2.1.1 Mitigation measures

The mitigation measures listed below follow the mitigation hierarchy and are proposed for the construction phase for the entire area that will be disturbed by the Project:

- **Avoidance**

Avoidance measures have been considered particularly during the design of the facilities and include:

- minimisation of the footprint of individual facilities;
- utilization of the existing modified habitat for placement of temporary facilities was prioritized as much as possible (e.g. the location and number of the planned storage sites was revised from 6 to 5 and the location was changed in order to avoid the use of natural habitat in 3 of the 5 remaining locations).

- **Minimization**

1) vegetation and topsoil removal:

- limits of clearing and construction areas will be clearly signed or fenced in order to reduce the risk of footprint creep;
- in order to minimize the mortality, biological surveys (pre-construction surveys) will be implemented before vegetation clearance to identify and relocate fauna species. An expert wildlife ecologist will perform pre-construction surveys in the areas to be cleared (not earlier than 7 days before). The survey will focus on fauna species with limited mobility (e.g. reptiles and amphibians) that cannot move ahead of construction. If any of these species are observed, they will be collected by the ecologist and translocated to undisturbed but similar sites within the LSA.
- topsoil present under the temporary facility footprint shall be stripped before construction activities and it will be used for restoration at the end of the construction phase. If the topsoil and stockpiles are stored for a long period of time (more than 2 years) the topsoil stockpiles shall be seeded with appropriate methods in order to avoid erosion form wind/ rain, protect the organic matter content. The revegetation of stockpiles areas will be performed favouring fast growing and ground covering flora species able to minimize soil erosion;
- vehicle movement will be restricted to the existing roads that connect the construction sites with the surrounding areas. Off road driving will be prohibited in order to avoid any unnecessary disturbance of natural vegetation.

2) changes in local hydrology and water quality:

the same mitigation measures elaborate for Hydrogeology and Surface water (section 8.1.3.2) are applicable for this impact factors. In addition, the following specific measures will be applied:

- culverts/channels will be used as appropriate in correspondence of river crossing or drainage features to avoid the interruption of waterways and drainage features and the formation of stagnant water. These culverts/channels will be implemented an installed in a way that will ensure the continuity of the water feature and will not constitute a barrier to fish movement;
- if erosion phenomena are observed in correspondence of river crossing environmental engineering techniques will be put in place to stop the erosion and ensure soil protection and the development of natural vegetation. Environmental engineering techniques will include as appropriate: erosion control mat, live crib wall, rock mattresses, hydro seeding and afforestation with appropriate species etc.

3) increase in vehicular traffic:

- install speed limits and animal crossing signs on the access road and enforce speed limit along the site access road.

- avoid the accumulation of stagnant water and organic waste within the construction site and on the roads, that could attract wildlife, especially amphibians;
- if fauna species are encountered employees and contractors will wait until it moves on by itself or they will ask the assistance of the Environmental technician for its safe removal and relocation in a suitable environment.
- awareness among employees and contractor working on site about the protected species/habitats potentially present in the area will be developed, in order to ensure constant monitoring and promote actions to be taken if wildlife is encountered.

4) emission of noise and vibration:

   the same mitigation measures elaborate for Noise (section 8.1.8.2) are applicable for this impact factors. In addition, the following specific measures will be applied:

- night works in proximity of natural habitats will be avoided (from 8 pm to 6 am) to reduce impacts to nocturnal fauna species;
- rock blasting activities will be performed during daytime and at regular times to enhance local fauna habituation to noise and to avoid disturbance during critical hours for many species (dusk and dawn).

5) introduction and spreading of alien species:

- the use of non-native flora species, and especially of species classified as invasive alien species must be avoided during rehabilitation/restoration works.
- if spreading of invasive species is observed, an appropriate eradication program will be developed and implemented.

- **Rehabilitation/Restoration**

Areas cleared during construction for temporary use, such as borrow pit, camp areas, concrete plants and storage areas, will be restored, as soon as possible, with the goal of producing a stable vegetative cover to minimize erosion, dust and spreading of invasive alien species, and the aim of re-establish the original habitat with a positive impact on biodiversity.

Only plants that are native to the region will be used for restoration, soil improvement, erosion control, stream banks and habitat rehabilitation. Seeding and planting of grass shrubs and tree species typical of the local vegetation species, such as Mediterranean maquis and mixed forest vegetation succession, will be used to ensure optimal ground cover. The action is expected to produce positive effects on local flora, fauna and habitats.

8.2.1.2 Residual impacts

Considering the application of the abovementioned mitigation measures, the impact on biodiversity components is presented in the following tables and it is expected to be:

- for the general component: **Negligible;**
- for Natural Habitats: **Low.**

The main residual impacts on natural habitats could derive from vegetation removal and introduction and spreading of alien species, but also with a lower score from changes in local hydrology and increase in vehicular traffic.

In order to monitor these impacts, mitigation measures are suggested in the following chapter.

Table 145 Residual impact assessment matrix for biodiversity component during construction phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
vegetation and topsoil removal	Duration:	Medium-long	Medium-low	Long term	**Low**	Medium-high	**Negligible**
	Frequency:	Sporadic					
	Geo. Extent:	Project footprint					
	Intensity:	Medium					
changes in local hydrology	Duration:	Medium-long	Medium-low	Short-mid-term	**Low**	Medium	**Negligible**
	Frequency:	Sporadic					
	Geo. Extent:	Local					
	Intensity:	Medium					
increase in vehicular traffic	Duration:	Medium-long	Medium-low	Short-mid-term	**Low**	Medium	**Negligible**
	Frequency:	Moderately frequent					
	Geo. Extent:	Local					
	Intensity:	Low					
emission of noise and vibration	Duration:	Medium-long	Medium-low	Short-term	**Negligible**	Medium	**Negligible**
	Frequency:	Highly frequent					
	Geo. Extent:	Local					
	Intensity:	Medium					
introduction and spreading of alien species	Duration:	Medium-long	Medium-low	Mid term	**Low**	Medium	**Negligible**
	Frequency:	Sporadic					
	Geo. Extent:	Local					
	Intensity:	Negligible					

Table 146 Residual impact assessment matrix for Natural Habitats during construction phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
vegetation and topsoil removal	Duration:	Medium-long	Medium	Long term	**Medium**	Medium-high	**Low**
	Frequency:	Sporadic					
	Geo. Extent:	Project footprint					
	Intensity:	Medium					
changes in local hydrology	Duration:	Medium-long	Medium	Short-mid-term	**Low**	Medium	**Low**
	Frequency:	Sporadic					
	Geo. Extent:	Local					
	Intensity:	Medium					
increase in vehicular traffic	Duration:	Medium-long	Medium	Short-mid-term	**Low**	Medium	**Low**
	Frequency:	Moderately frequent					
	Geo. Extent:	Local					
	Intensity:	Low					
	Duration:	Medium-long	Medium	Short-term	**Low**	Medium	**Negligible**

emission of noise and vibration	Frequency:	Highly frequent					
	Geo. Extent:	Local					
	Intensity:	Medium					
introduction and spreading of alien species	Duration:	Medium-long	Medium	Mid term	**Low**	Medium	**Low**
	Frequency:	Sporadic					
	Geo. Extent:	Local					
	Intensity:	Negligible					

8.2.1.3 Monitoring

The following monitoring activities are foreseen in natural habitats to ensure the implementation and effectiveness of the proposed mitigation measures:

- indirect and direct inadvertent impacts on natural habitats and river crossing present around the construction site will be monitored monthly in order to assess eventual footprint creep outside designated areas, signs of erosion or stagnant water accumulation, functioning of culverts/channels for fish passages, presence of waste or hazardous substances spill;
- accidents involving wildlife or the observation of live animal or carcasses along the access road or on the construction site will be recorded. Additional mitigation measures to discourage wildlife presence on site and avoid roadkill will be taken if needed;
- presence and spreading of invasive flora species within and around the construction site will be monitored every three months during the vegetative season by an expert botanist, if necessary, extirpation campaign will be put in place in order to avoid the spreading of the invasive species.

8.2.2 Operation Phase

The potential impacts on biodiversity deriving from the above actions are associated with the following **impact factors**:

1) presence of new buildings/infrastructures;
2) changes in local hydrology and water quality;
3) emission of noise and vibration;
4) highspeed railway traffic;
5) Introduction and spreading of alien species.

The direct impacts are expected within the facilities footprints (turbines, substations, roads, powerline etc.). Indirect impacts were conservatively considered within a buffer of 100 and 300 meters from the facilities.

All the impact factors identified above are described and discussed in the following assessment.

1) <u>Presence of new buildings/infrastructures</u>

   The presence of permanent facilities will cause a loss of available natural habitat during the entire operation phase that will directly and indirectly affect habitats, flora and fauna species. The habitat loss is calculated in Table 147.

   In addition, the presence of the new linear infrastructure may cause habitat fragmentation on many patchesof natural habitats that may not be able to maintain viable populations in the long run (Fahrig

2003). Using a precatory approach, a 100 m buffer is considered around the facilities for habitat fragmentation.

Railways can be both physical and behavioural barriers to wildlife movement. In fact, this is considered one of the railways' greatest impacts. This barrier, however, is not continuous for the entire length of the railway but it opens in correspondence of the frequent tunnels, bridges and viaducts. In addition, many sections are planned parallel and in close proximity to existing highways.

2) Changes in local hydrology and water quality

At the end of the construction phase stream and river crossing will be fully rehabilitated, therefore effects on freshwater habitat s are expected to be minimal. In addition, any erosion phenomena may cause release of sediment into the water causing a change in water quality (e.g. dissolved oxygen) and a loss in nursery habitat caused by silt deposition and accumulation. The incidental introduction of pollutants from railway operation and maintenance is another potential threat to freshwater habitats. Terrestrial fauna species, especially invertebrate fauna, could also be impacted by degraded water quality. Using a precatory approach, a 100 m buffer is considered around project facilities in correspondence of aquatic habitats.

If not properly planned, railway river crossing may also cause fragmentation of freshwater habitat since culvert, causeways and bridges structures may also constitute a barrier to fish movement. Although these barriers mostly cause local impediments to fish passage, the ubiquity of such small barriers has cumulative river basin-scale effects (Rodgers et al. 2014). Together with the many tidal barrages and floodgates that control flows and alter fish abundance, biomass and community structure (Williams and Watford 1997; Kroon and Ansell 2006; Boys et al. 2012), road and rail crossings play major roles in obstructing fish migrations (J. H. Harris, 2016).

3) Emission of noise and vibration

Noise levels vary, depending on the landscape and weather, open and flat areas allow noise to travel further than forest or mountains areas. Measurement campaigns on high speed trains in several European countries over 10 years revealed sound values ranging from 85.5 to 97 dB(A) when the train speed was between 250 and 350 km/h (Gautier et al. 2008); in Japan, the noise was compared as a function of distance and a high noise level of 64 dB at 200 m was observed from a railway in the countryside, a value similar to that of near residential areas (65.7 dB). Matsumoto et al. (2005)

Research has been inconclusive regarding noise effects on wild and domestic animals from transportation noise sources and from high-speed train in particular (Hanson C.E., 2008). The emission of noise and vibration is relevant during the operational phase, but in the long term it also can be defined more usual and "predictable" in time and space. In fact, animals exposed to prolonged or repeated human disturbance may eventually adapt both behaviourally and physiologically and become "habituated" (Petrinovich 1973). Additionally, the fact that the noise from high speed train is not associated with an immediate risk suggests that the animals are able to habituate to the sound.

In general, once animals become habituated to noise, especially when it is steady and associated with clearly non-threatening activity, they suffer very little adverse response. During the operations phase the following effects are expected on local fauna:

- likely change in species composition in the LSA, with less noise-tolerant species moving further away to avoid areas of high noise;
- selection for more noise tolerant individuals within the population of species closed to the project;
- habituation of some species and individuals to the noise impacts.

Noise levels up to 60 dBA do not result in negative or adverse response to animals or livestock. Although the vibrations of approaching trains can be felt along the rails and this may give warning to some terrestrial vertebrates (Heske 2015), the effects of noise disturbance from human activity on wildlife are mostly perceived over short distances in a species- specific way (up to ~ 300 m, Reijnen et al., 1995; Canaday and Rivadeneyra, 2001). Therefore, using a precautionary approach, a 300 m buffer is considered along the railway.

4) <u>Highspeed railway traffic</u>

High Speed Railways (HSRs) pose a direct collision risk for many fauna species. HSR generally run at speeds up to 250–300 km/h, which is one of the factors influencing the rates of wildlife-vehicle collision (WTC), since wildlife is sometimes not able to recognize the donger in time,in fact, frequently, the birds react to the train's approach when it is almost upon them (Eladio L. García de la Morena et. al, 2017). The highest mortality seems to occur in line with moderate traffic flow, since the presence of long time lapses without traffic encourages animals to cross the railway, while an higher traffic volume deters animals from attempting to cross (Dorsey et al. 2015).

Wildlife may also be attracted to railways infrastructure and therefore be exposed to higher risk of collision. Amphibians might be attracted by stagnant water that forms at railroad side. Reptiles and other ectotherms may go there to bask in the sun. Species that use man-made structures and the railway infrastructures as a habitat for feeding, resting, and even nesting (Havlin, 1987; Li et al., 2010; Morelli et al., 2014; Malo et al., 2017) were found to be attracted, such as passerines, pigeons and doves, large corvids (e.g *C. corone*) and midsize corvids (e.g. *P. pica*), whereas some bird species representative of open and agricultural areas were found to avoid it.

Birds are particular subject to collision risk depending on their flight behavior (e.g. species that fly close to the ground are exposed to a high collision risk, Juan E. Malo et al., 2017). In addition, the use of various infrastructure elements, in particular by birds, such as poles, catenary and embankments, strongly determines the fauna risk of collision (Morelli et al., 2014; Mainwaring, 2015): almost 40% of the crossing events under the catenary occurred for birds resting on the infrastructure moments before the train arrival.

Also birds of prey, such as *Buteo buteo, Milvus migrans and Gyps fulvus*, were observed in several occasions approaching the railway. One possible explanation is the attractiveness of perches along the rails and of railway verges as a hunting ground). Moreover, all three species scavenge regularly the trails looking for carcasses or prey, primarily rabbits and rodents (Planillo et al., 2015), increasing their vulnerability to collisions (SCV 1996; van der Grift and Kuijsters 1998).

5) <u>Introduction and spreading of alien species</u>

Habitat changes also take place in railway corridors, as their verges commonly differ from the surrounding landscape, but are homogeneous along the railway network. These changes can be exploited by generalist species or by opportunistic individuals, using them as shelters or corridors. They can be used by invasive species as well.

Railway causeways, in fact, are often colonized by invasive alien species due to their ecological characteristics. Invasive alien species tend to have an advantage in disturbed ecosystems, and if they penetrate into a habitat, they can potentially change its functionality and species composition, including priority biodiversity species. In some cases invasive alien species are even used for rehabilitation and consolidation of the railway slopes (e.g. *Robinia pseudoacacia*) and, given suitable conditions, can than expand into the surrounding habitat.

Local fauna that depends on those ecosystems could also be indirectly affected. The habitats around the construction sites could experience a decrease in biodiversity in the immediate vicinity of the roads, with a consequent trivialization (potential appearance of more dominant species) of the ecosystem in a small buffer area close to the roads with a higher traffic.

Using a precautionary approach, a 100 m buffer around the Project facilities is considered for this impact factor.

The effects of these potential impacts on biodiversity, and in particular on natural habitats, are quantified and discussed below. The areas potentially impacted are represented from Figure 95 to Figure 97 and their numerical estimation is presented in Table 147.

Direct impacts from presence of new buildings/infrastructures will impact 3% of the total LSA. All the direct impacts will be mainly concentrated on agricultural fields (I1.2, I1.4 and I1.1 EUNIS habitat types respectively). The project will largely make use of existing access roads and adjacent areas, that have a higher level of degradation than the average in the LSA, and as such will minimize further habitat destruction/degradation.

Direct impacts will affect 2% of the total natural habitats present in the LSA. Most of the direct impacts will be on coniferous woodland (G3.7, 23.06 ha), mesotrophic pastures (E2.1, 20.45 ha) and mixed coniferous-deciduous forests (G4.B, 11.05 ha).

Indirect impacts in the 100 m buffer deriving from operation, such as changes hydrology and habitat fragmentation and introduction and spreading of alien species, could impact a total of 17% of the LSA. Indirect impacts from operation in the 100 m buffer will be mainly on agricultural fields (I1.2, I1.4 and I1.1 EUNIS habitat types respectively).

Indirect impacts within the 100 m buffer could potentially affect 12% of the total natural habitats. They will be mostly on coniferous woodland (G3.7, 202.37 ha), mesotrophic pastures (E2.1, 110.58 ha) and pseudomaquis vegetation (F5.3, 83.63 ha).

Indirect impacts in the 300 m buffer deriving from operation, such as noise and vibration and emission of light, could impact a total of 53% of the LSA. Indirect impacts within the 300 m buffer will be mostly on agricultural fields (I1.2, I1.4 and I1.1 EUNIS habitat types respectively).

Indirect impacts within the 300 m buffer could potentially affect 40% of the total natural habitats. They will be mostly on coniferous woodland (G3.7, 761.52), mesotrophic pastures (E2.1, 381.00 ha) and pseudomaquis vegetation (F5.3, 274.22 ha).

Table 147 Direct and indirect impacts on EUNIS habitats calculated within the LSA for the operation phase

Code	Habitat	Direct impacts (ha)	Indirect impacts within 100 m (ha)	Indirect impacts within 300 m (ha)	Total LSA (ha)
Natural habitats					
C1.2	Permanent mesotrophic lakes, ponds and pools	-	-	-	2.85
C1.6	Temporary lakes, ponds and pools	0.04	2.56	7.08	8.05
C2.2	Permanent non-tidal, fast, turbulent watercourses	0.01	0.29	1.14	3.32

Code	Habitat	Direct impacts (ha)	Indirect impacts within 100 m (ha)	Indirect impacts within 300 m (ha)	Total LSA (ha)
C2.3	Permanent non-tidal, smooth-flowing watercourses	3.06	20.73	77.05	144.05
C2.5	Temporary running waters	0.23	1.24	3.11	4.66
E1.C	Dry mediterranean lands with unpalatable non-vernal herbaceous vegetation	1.02	3.08	23.19	51.77
E2.1	Permanent mesotrophic pastures and aftermath-grazed meadows	20.45	110.58	381.00	749.13
F5.2	Maquis	0.57	12.33	64.50	315.15
F5.3	Pseudomaquis	11.03	83.63	274.22	568.03
G1.1	Riparian and gallery woodland, with dominant alder, birch, poplar or willow	1.07	12.54	48.01	80.46
G1.7	Thermophilous deciduous woodland	9.38	50.65	134.30	390.44
G3.7	Lowland to montane mediterranean pine woodland (excluding black pine [Pinus nigra])	23.06	202.37	761.52	1,714.48
G3.9	Coniferous woodland dominated by [Cupressaceae] or [Taxaceae]	-	0.81	9.12	206.62
G4.B	Mixed mediterranean pine - thermophilous oak woodland	11.05	78.30	245.16	770.05
H3.2	Basic and ultra-basic inland cliffs	-	-	2.33	22.68
	Natural habitats sub-total	*80.96*	*579.11*	*2,031.75*	*5,031.74*
Modified habitats					
E5.1	Anthropogenic herb stands	4.80	7.31	7.38	12.18
G1.C	Highly artificial broadleaved deciduous forestry plantations	-	0.38	8.41	187.58
G1.D	Fruit and nut tree orchards	41.81	241.69	663.89	1060.76
G2.4	Olive - carob woodland	-	-	0.68	12.73
G3.F	Highly artificial coniferous plantations	12.02	74.12	272.82	630.37
I1.1	Intensive unmixed crops	67.18	329.42	915.83	1648.40
I1.2	Mixed crops of market gardens and horticulture	284.84	1760.26	4973.10	8675.70

Code	Habitat	Direct impacts (ha)	Indirect impacts within 100 m (ha)	Indirect impacts within 300 m (ha)	Total LSA (ha)
I1.3	Arable land with unmixed crops grown by low-intensity agricultural methods	1.57	10.52	39.83	91.82
I1.4	Inundated or inundatable croplands, including rice fields	102.84	614.02	1803.30	3003.66
J1.1	Residential buildings of city and town centres	0.86	6.29	44.87	159.01
J1.2	Residential buildings of villages and urban peripheries	3.47	28.70	148.64	334.35
J2.3	Rural industrial and commercial sites still in active use	16.10	135.17	473.16	846.97
J3	Extractive industrial sites	6.94	31.20	113.75	257.87
J4.2	Road networks	6.88	96.29	294.99	410.48
J4.3	Rail networks	25.34	3.51	5.29	31.96
J4.4	Airport runways and aprons	2.23	23.05	77.39	166.53
J5.4	Highly artificial non-saline running waters	0.68	3.05	17.70	22.97
	Modified habitats sub-total	*577.56*	*3365.00*	*9861.04*	*17553.32*
	Total	***658.52***	***3944.11***	***11892.78***	***22,585.06***

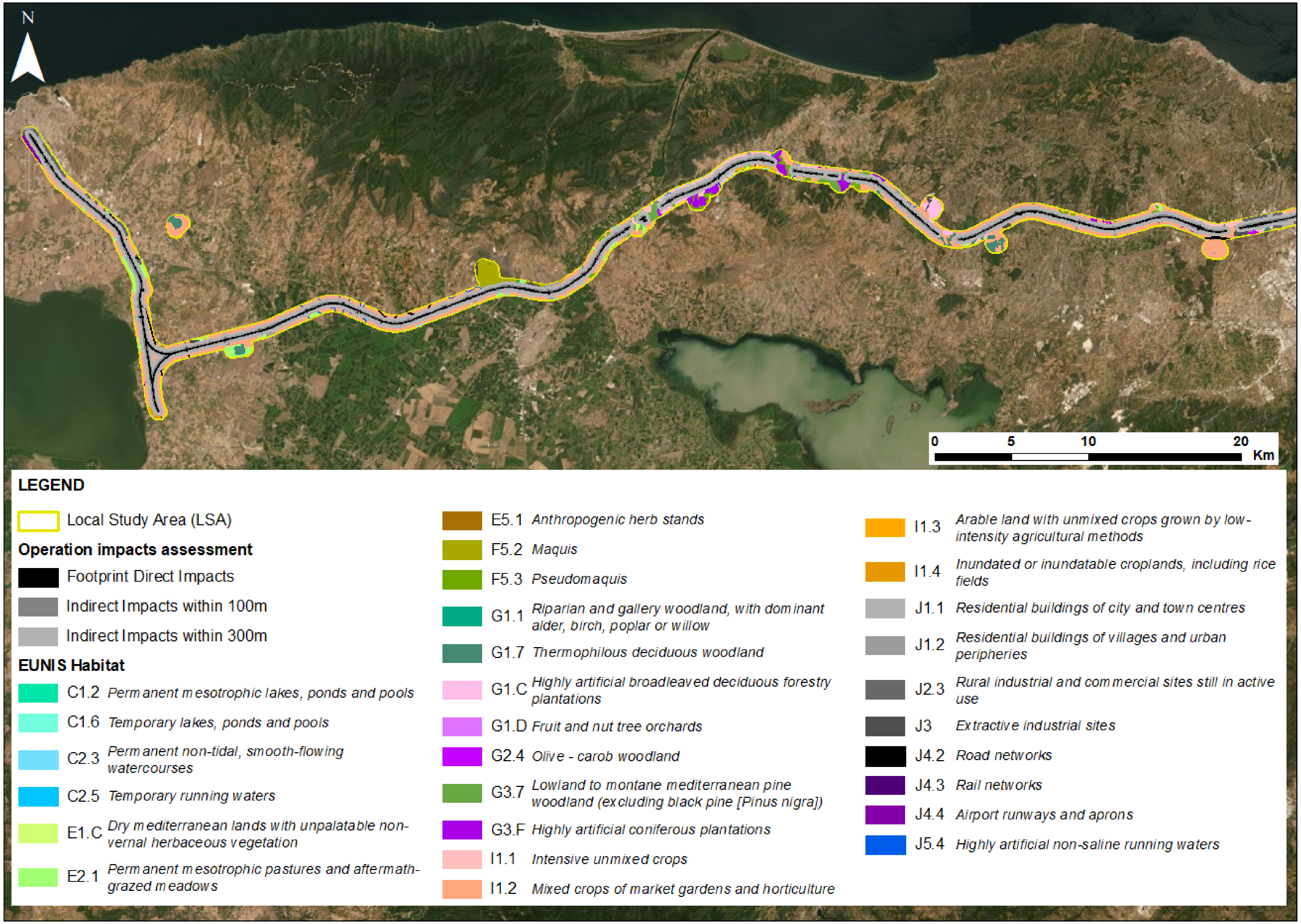


Figure 95 Map of the potential operation impacts on EUNIS habitats (Bandirma-Bursa line view)

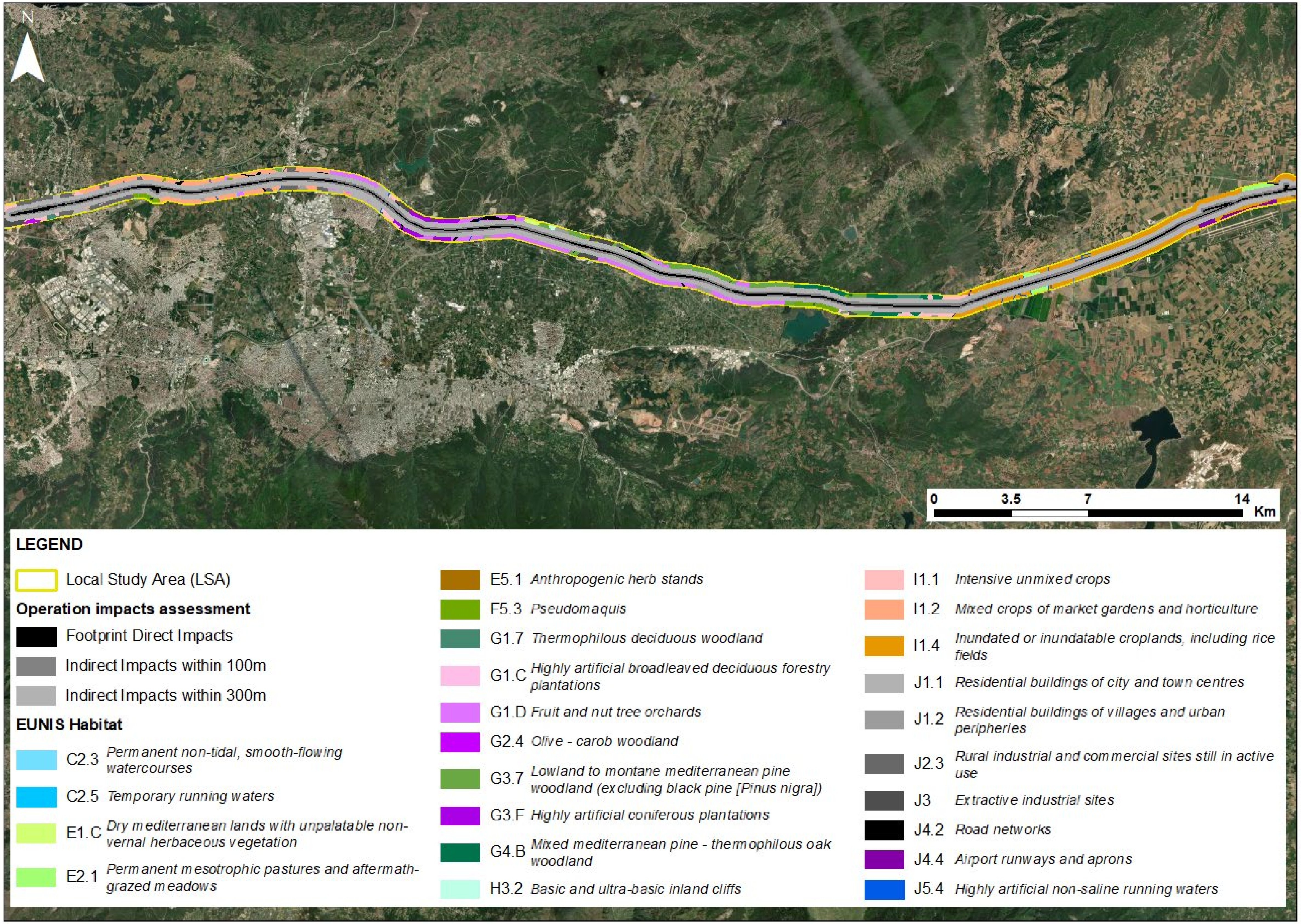


Figure 96 Map of the potential operation impacts on EUNIS habitats (Bursa-Yenişehir line view)

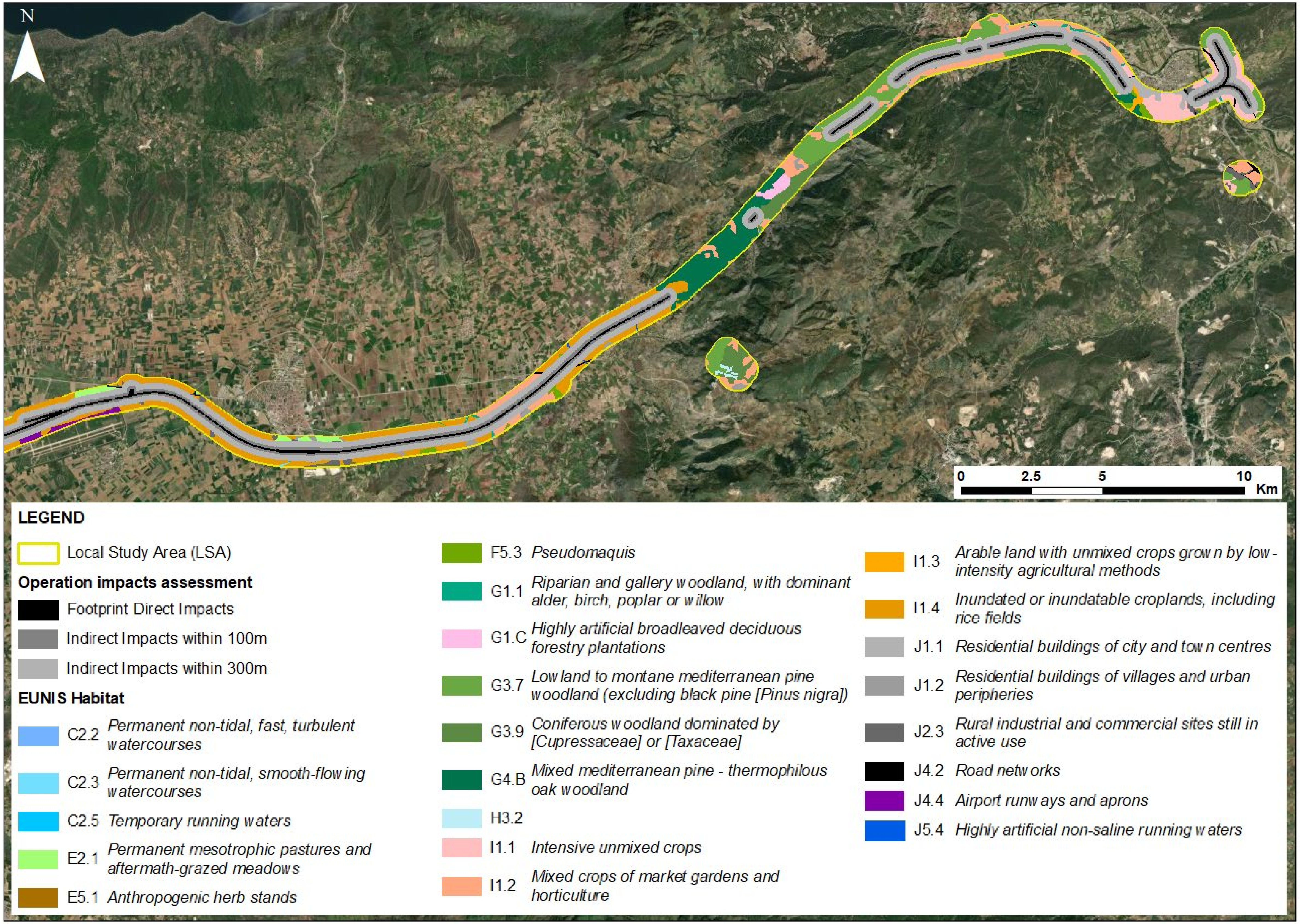


Figure 97 Map of the potential operation impacts on EUNIS habitats (Yenişehir-Osmaneli line view)

8.2.2.1 Mitigation measures

The mitigation measures listed below follow the mitigation hierarchy and are proposed for the operation phase for the entire area that will be disturbed by the Project.

- **Avoidance**:

Avoidance measures have been considered particularly during the design of the facilities and include:

- minimisation of the footprint of individual facilities;
- utilization of the existing modified habitat for placement of temporary facilities was prioritized as much as possible (e.g. the location and number of the planned storage sites was revised from 6 to 5 and the location was changed in order to avoid the use of natural habitat in 3 of the 5 remaining locations).

- **Minimization**

1) Presence of new buildings/infrastructures:

- channels/culverts will be used as appropriate in correspondence of river crossing or drainage features to avoid the interruption of waterways and drainage features and the formation of stagnant water. These culverts/channels will be implemented an installed in a way that will ensure the continuity of the water feature and will not constitute a barrier to fish movement.
- based on the results of the monitoring, if needed additional mitigation measure could be planned in specific section of the railway where is observation of wildlife crossings are reported: fencing of particular section of the railway to avoid wildlife crossing and conduct wildlife toward safe crossing locations; creation of underpasses or overpasses designed in a way to be conductive for wildlife.

2) Changes in local hydrology and water quality:

the same mitigation measures elaborate for Hydrogeology and Surface water (section 8.1.3.2) are applicable for this impact factors. In addition, the following specific measures will be applied:

- if erosion phenomena are observed in correspondence of river crossing environmental engineering techniques will be put in place to stop the erosion and ensure soil protection and the development of natural vegetation. Environmental engineering techniques will include as appropriate: erosion control mat, live crib wall, rock mattresses, hydro seeding and afforestation with appropriate species etc.

3) Emission of noise and vibration:

the same mitigation measures elaborate for Noise (section 8.1.8.2) are applicable for this impact factors.

4) Highspeed railway traffic:

- based on the results of the monitoring, if needed additional mitigation measure could be planned in specific section of the railway where is observation of wildlife crossings are reported: fencing of particular section of the railway to avoid wildlife crossing and conduct wildlife toward safe crossing locations; creation of underpasses or overpasses designed in a way to be conductive for wildlife.

5) Introduction and spreading of alien species:

- the use of non-native flora species, and especially of species classified as invasive alien species must be avoided during rehabilitation/restoration works.

- if spreading of invasive species is observed, an appropriate eradication program will be developed and implemented.

- **Rehabilitation/Restoration:**

Areas cleared during construction for temporary use, such as borrow pit, camp areas, concrete plants and storage areas, will be restored, as soon as possible, with the goal of producing a stable vegetative cover to minimize erosion, dust and spreading of invasive alien species, and the aim of re-establish the original habitat with a positive impact on biodiversity.

Vegetation and topsoil restoration activities will be performed on all temporary facilities, which account for a total of 191.93 ha, in order to restore the original habitat with a positive impact on biodiversity. Of the total hectares temporarily occupied, 109.63 belong to 8 borrow pits, 34.09 ha to 5 storage areas, 30.17 ha refers to 5 camp areas and 18.03 ha to 4 concrete plants.

Only plants that are native to the region will be used for restoration, soil improvement, erosion control, stream banks and habitat rehabilitation. Seeding and planting of grass shrubs and tree species typical of the local vegetation species, such as Mediterranean maquis and mixed forest vegetation succession, will be used to ensure optimal ground cover. The action is expected to produce positive effects on local flora, fauna and habitats.

8.2.2.2 Residual impacts

Considering the application of the abovementioned mitigation measures, the impact on biodiversity components is presented in the following tables and it is expected to be:

- for the general component: **Low;**
- for Natural Habitats: **Low**.

The main residual impacts could derive from presence of new buildings/infrastructures, but also for natural habitats from changes in local hydrology, highspeed railway traffic and spreading of alien species.

In order to monitor these impacts, mitigation measures are suggested in the following chapter.

Table 148 Residual impact assessment matrix for biodiversity component during operation phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
presence of new buildings/ infrastructures	Duration:	Long	Medium-low	Long term	**Medium**	Medium-high	**Low**
	Frequency:	Continuous					
	Geo. Extent:	Project footprint					
	Intensity:	Low					
	Duration:	Long	Medium-low	Short-mid-term	**Low**	Medium	**Negligible**
	Frequency:	Sporadic					

changes in local hydrology	Geo. Extent: Local Intensity: Medium					
highspeed railway traffic	Duration: Long Frequency: Frequent Geo. Extent: Local Intensity: Medium	Medium-low	Short-mid-term	**Low**	Medium	**Negligible**
emission of noise and vibration	Duration: Long Frequency: Frequent Geo. Extent: Local Intensity: Medium	Medium-low	Short-term	**Negligible**	Medium	**Negligible**
introduction and spreading of alien species	Duration: Long Frequency: Sporadic Geo. Extent: Local Intensity: Negligible	Medium-low	Mid term	**Low**	Medium	**Negligible**

Table 149 Residual impact assessment matrix for Natural Habitats during operation phase

Impact Factor	Impact Factor Features	Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
presence of new buildings /infrastructures	Duration: Long Frequency: Continuous Geo. Extent: Project footprint Intensity: Low	Medium	Long term	**High**	Medium-high	**Low**
	Duration: Long Frequency: Sporadic	Medium	Short-mid-term	**Low**	Medium	**Low**

changes in local hydrology	Geo. Extent:	Local					
	Intensity:	Medium					
highspeed railway traffic	Duration:	Long	Medium	Short-mid-term	**Medium**	Medium	**Low**
	Frequency:	Frequent					
	Geo. Extent:	Local					
	Intensity:	Medium					
emission of noise and vibration	Duration:	Long	Medium	Short-term	**Low**	Medium	**Negligible**
	Frequency:	Frequent					
	Geo. Extent:	Local					
	Intensity:	Medium					
introduction and spreading of alien species	Duration:	Long	Medium	Mid term	**Medium**	Medium	**Low**
	Frequency:	Sporadic					
	Geo. Extent:	Local					
	Intensity:	Negligible					

8.2.2.3 Monitoring

The following monitoring activities are foreseen to ensure the implementation and effectiveness of the proposed mitigation measures:

- the rehabilitation of storage areas, borrow pits, camp areas, and concrete plants will be monitored at least twice a year for the next 3 years during the vegetative season (March to October) in order to ensure the correct re-vegetation of the area and intervene in a timely manner in case of signs of vegetation stress or erosion;
- river crossing present along the railway will be monitored at least twice a year for the next 3 years in order to assess the functioning of culverts/channels for fish passages, and the presence of signs of erosion or stagnant water accumulation and the presence of waste or hazardous substances spill;
- accidents involving wildlife or the observation of live animal or carcasses along railway and/or on-board recordings will be collected for at least 3 years of operation. Based on the observations additional mitigation measures to discourage wildlife crossing will be taken if needed.
- presence and spreading of invasive flora species within and around the railway route will be monitored at least twice a year for the next 3 years during the vegetative season by an expert botanist, if necessary, extirpation campaign will be put in place in order to avoid the spreading of the invasive species;

8.2.3 Decommissioning/Closure Phase

The potential impacts on biodiversity are associated with the following impact factors:

4) increase in vehicular traffic;

5) emission of noise and vibration;

6) introduction and spreading of alien species;

7) re-establishment of natural morphology and hydrology (positive impact);

8) re-establishment of natural vegetation (positive impact).

The general focus of the decommissioning and closure phase is to rehabilitate the disturbed lands to create stable, non-polluting and self-sustaining ecosystem capable of being incorporated into the future landscapes, which will be consistent with activities in the general surrounding area.

However, considering that Decommissioning and Closure will not happen for many years, the future land use of the area is not known and no detailed information is available at this stage, it is not possible to discuss in the details the effects of this Phase on the biodiversity component.

In general, it is expected that during decommissioning, indirect negative impacts deriving from increase in vehicular traffic, emission of noise and vibration and introduction and spreading of alien species will be similar to those of construction activities. However, positive impacts deriving from the re-establishment of natural morphology and hydrology and the restoration of the disturbed areas will allow to reclaim most of the areas with an expected overall positive effect on biodiversity.

8.2.4 Critical Habitat

Impacts are assessed separately during construction and operation for the Critical habitats identified during the baseline assessment:

- 3 flora species;
- 2 fish species;
- 1 bird species.

Table 150 Results of Critical Habitat screening according to Criterion 1 (IFC PS6, 2019)

Taxon	Scientific Name	Common Name	IUCN Red List / Flora RDB	Endemism	Obs. / Lit.	Potential Critical Habitat in the LSA
Flora	*Aubrieta olympica*	-	EN	Regional endemic	O	Criterion 1a
	Centaurea sakariyaensis	-	CR	Local endemic /RR	O	Criterion 1a, 2a
	Ornithogalum pascheanum	-	EN	Regional endemic	O	Criterion 1a

Taxon	Scientific Name	Common Name	IUCN Red List / Flora RDB	Endemism	Obs. / Lit.	Potential Critical Habitat in the LSA
Fish	*Barbus niluferensis*	Simav Barbel	NT	Endemic / RR	L	Potential Criterion 2a
	Cobitis puncticulata	Brown spined loach	EN	Endemic / RR	L	Potential Criterion 1a; 1c; 2a
Bird	*Falco cherrug*	Saker falcon	EN	-	L	Potential Criterion 1a

8.2.4.1 Construction phase

8.2.4.1.1 Impact analysis

Flora species triggering Critical Habitat

The main potential impacts that could affect flora species during the construction phase are:

1) vegetation and topsoil removal;

2) changes in local hydrology and water quality;

3) introduction and spreading of alien species.

The general effects of these impact factors were described in the previous chapters, while the potential direct and indirect impact that could occur on the individual flora species triggering Critical Habitat are summarized in the table below. It is important to highlight that the areas investigated represent a small part of the LSA and were not conducted during the flowering period and therefore, additional studies are needed to map the species distribution and eventual additional direct or indirect impacts deriving from the Project.

Table 151 Flora Species Potential Triggering Critical Habitat

Species	Flora RDB	Endemism	Potential direct impacts	Potential indirect impacts
Aubrieta olympica	EN	Regional endemic	One population was identified within the Project construction footprint (borrow pit) in H3.2 habitat	No population was identified with 100 m from the Project construction footprint.
Centaurea sakariyaensis	CR	Local endemic /RR	One population was identified within the Project construction footprint (borrow pit) in H3.2 habitat	No population was identified with 100 m from the Project construction footprint.
Ornithogalum pascheanum	EN	Regional endemic	Three populations were identified within the Project construction	No population was identified with 100 m

Species	Flora RDB	Endemism	Potential direct impacts	Potential indirect impacts
			footprint (two storage areas and a borrow pit) in F5.3, E1.C and G1.7 habitats	from the Project construction footprint.

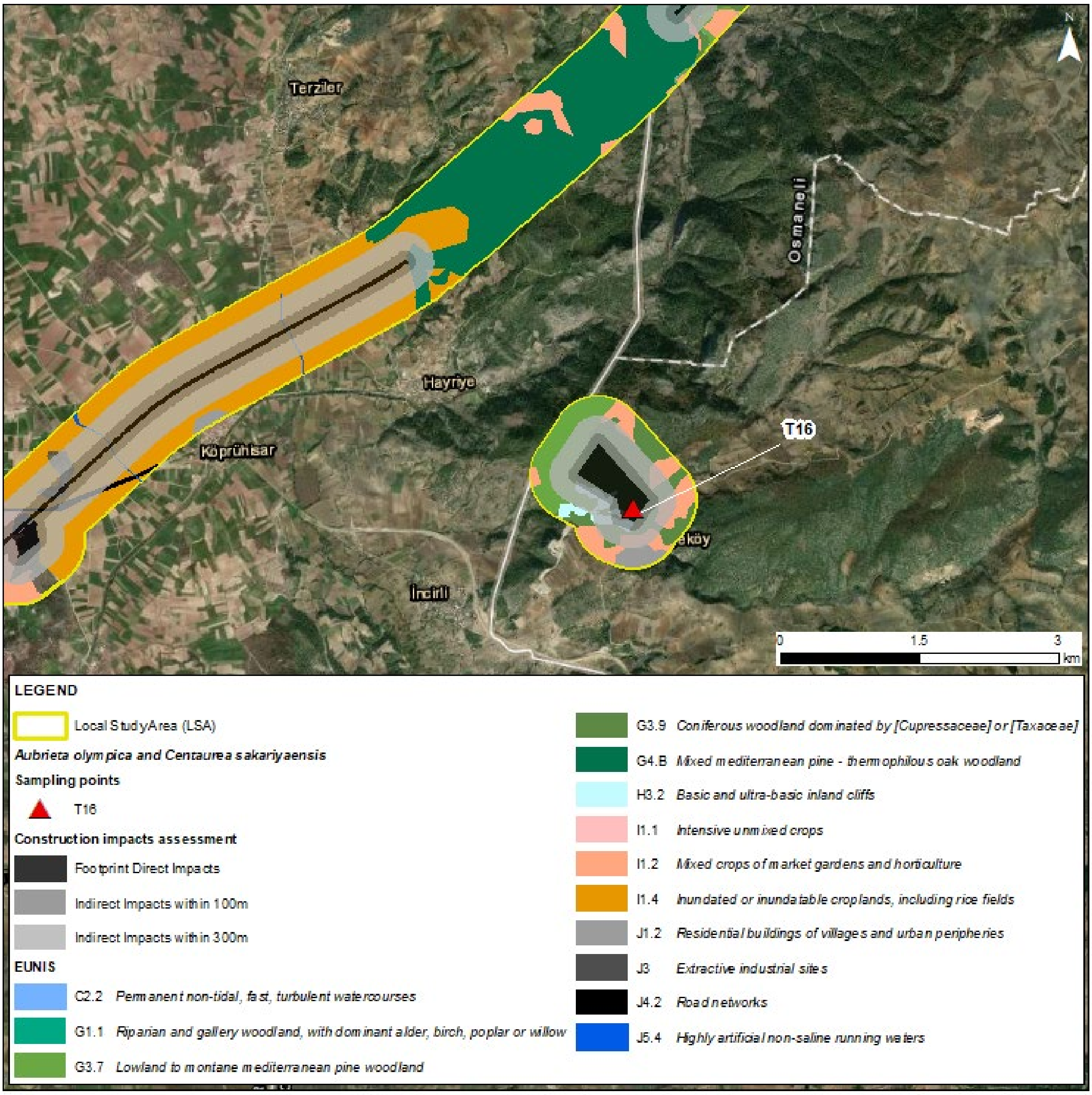


Figure 98 Map of the construction impacts on identified populations of *Aubrieta olympica* and *Centaurea sakariyaensis* within the LSA

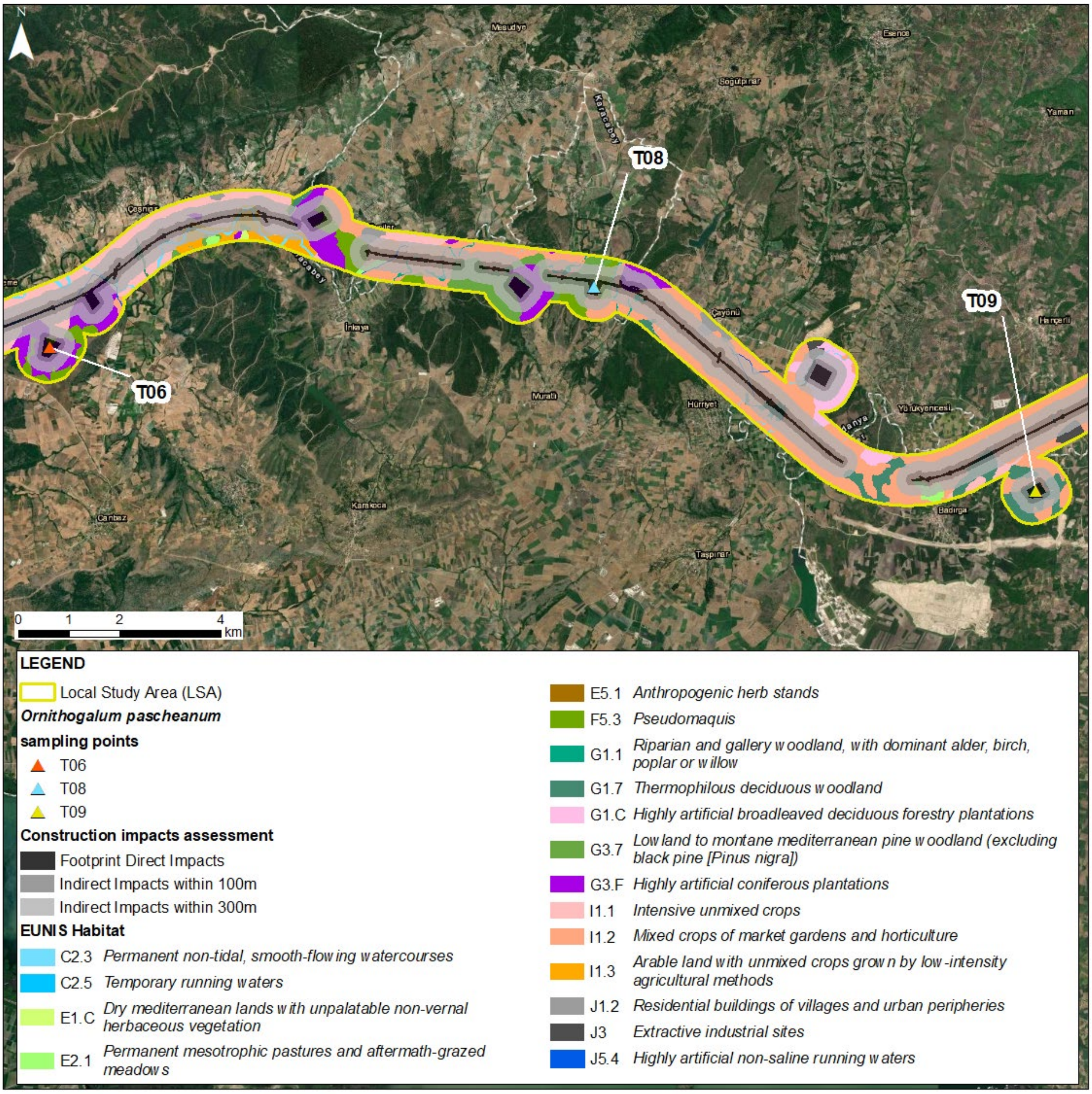


Figure 99 Map of the construction impacts on identified populations of *Ornithogalum pascheanum* within the LSA

<u>Fish species triggering potential Critical Habitat</u>

The main potential impacts that could affect fish species triggering CH during the construction phase are:

1) changes in local hydrology and water quality;

2) emission of noise and vibration.

Potential direct and indirect impacts are summarized in the table below.

Table 152 Fish Species Potential Triggering Critical Habitat

Species	Common Name	IUCN Red List	Endemism	Potential direct impacts	Potential indirect impacts
Barbus niluferensis	Simav Barbel	NT	Endemic / RR	Direct impacts could be associated with loss of habitat or even individuals (adults and eggs) in case of dramatic changes in local hydrology and water quality during construction works.	Indirect impacts from the project could occur in a 100 m and 300 m buffer and are mainly associated with the potential degradation of the habitat due to possible changes in local hydrology and water quality and repulsion due to the presence of noise and vibration.
Cobitis puncticulata	Brown spined loach	EN	Endemic / RR		

Figure 100 Map of the construction impacts on potential critical habitat triggered by fish species within the LSA

<u>Bird species triggering Potential Critical Habitat</u>

The main potential impacts that could affect bird species during the construction phase are:

1) vegetation and topsoil removal;
2) increase in road traffic;
3) emission of noise and vibration.

Potential direct and indirect impacts are summarized in the table below.

Table 153 Bird Species Potential Triggering Critical Habitat

Species	Common Name	Flora RDB	Endemism	Potential direct impacts	Potential indirect impacts
Falco cherrug	Saker falcon	EN	-	No direct impact is expected on this species.	Indirect impacts from the project could occur in a 100 m and 300 m buffer and are mainly associated with the possible changes in the foraging areas because of habitat fragmentation and attraction or repulsion of prays due to the presence of noise

8.2.4.1.2 Mitigation measures

In addition to the avoidance, minimization and rehabilitation/restoration measures proposed in the Section 8.2.1.1, the following measure are proposed specifically for Critical Habitats.

- for flora species triggering Critical Habitats:
  - Additional studies: during the flowering period of the species identified as triggering CH (from April to June) and in any case before the beginning of site preparation (vegetation clearing and topsoil removal) an expert botanist will perform surveys in the areas to be cleared of vegetation and its immediate surroundings. The data regarding date, location, population extension and number of individuals will be recorded to allow for the correct planning and execution of the following mitigation measures.
  - Flora avoidance: direct disturbance in areas where flora species triggering CH are identified will be avoided whenever feasible, alternatively the following measures will be applied;
  - Flora Salvaging and Direct Translocation: individuals belonging to flora species determining CH impacted by the project footprint shall be identified, salvaged prior to construction and translocated to the appropriate sites. The identification and flagging of individuals to be translocated will take place preferably during the flowering season of the species, while the translocation of individuals be performed during the dormant stage in order to minimize stresses to the plant. The data regarding date, location, source populations and number of individuals collected and translocated will be recorded.
  - Flora On-site Conservation: within the mine fence line, conservation of flora species determining CH situated in the vicinity of the Project (100 m) shall be guaranteed. These areas will be by clearly identified both on the maps and in the field as exclusion zone where soil and vegetation will be preserved, and access will not be permitted.
  - Seed collection: seed collection will be performed for the endemic flora species, identified within the LSA, with particular regard for those determining CH. The seed collection and conservation will follow the best practice indicated by the Millenium Seed Bank. Seeds collected will be separately stored for each species and sub population using clearly identifiable codes and will be donated to the Ankara Seed Bank for storage and scientific research.
- for fish species triggering Critical Habitats:

- no construction activities involving modification of river or stream beds and shoulders should be conducted during breeding and spawning period of Simav Barbel (*Barbus niluferensis*) and Brown spined loach (*Cobitis puncticulata*) from May to July within their potential range:
- regular inspections of the diverted river or streams areas must be conducted to remove fish from isolated in-water work zones, if necessary;

- for bird species triggering Critical Habitats: no additional mitigation measure is considered necessary.

8.2.4.1.3 Residual impacts

Considering the application of the abovementioned mitigation measures, the impact on Critical Habitats is presented in the following tables and it is expected to be:

- for flora species triggering Critical Habitats: **Low**
- for fish species triggering Critical Habitats: **Low**
- for bird species triggering Critical Habitats: **Low**

Table 154 Residual impact assessment matrix for flora species triggering CH during construction phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
vegetation and topsoil removal	Duration:	Medium-long	High	Long term	**High**	Medium-high	**Low**
	Frequency:	Sporadic					
	Geo. Extent:	Project footprint					
	Intensity:	Medium					
changes in local hydrology	Duration:	Medium-long	High	Short-mid-term	**Medium**	Medium	**Low**
	Frequency:	Sporadic					
	Geo. Extent:	Local					
	Intensity:	Medium					
introduction and spreading of alien species	Duration:	Medium-long	High	Mid term	**Medium**	Medium	**Low**
	Frequency:	Sporadic					
	Geo. Extent:	Local					
	Intensity:	Negligible					

Table 155 Residual impact assessment matrix for fish species triggering CH during construction phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
changes in local hydrology	Duration:	Medium-long	High	Short-mid-term	**Medium**	Medium-high	**Low**
	Frequency:	Sporadic					
	Geo. Extent:	Local					
	Intensity:	Medium					
emission of noise and vibration	Duration:	Medium-long	High	Short-term	**Low**	Medium-high	**Negligible**
	Frequency:	Highly frequent					
	Geo. Extent:	Local					
	Intensity:	Medium					

Table 156 Residual impact assessment matrix for bird species triggering CH during construction phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
vegetation and topsoil removal	Duration:	Medium-long	High	Long term	**High**	Medium-high	**Low**
	Frequency:	Sporadic					
	Geo. Extent:	Project footprint					
	Intensity:	Medium					
increase in vehicular traffic	Duration:	Medium-long	High	Short-mid-term	**Medium**	Medium	**Low**
	Frequency:	Moderately frequent					
	Geo. Extent:	Local					
	Intensity:	Low					
emission of noise and vibration	Duration:	Medium-long	High	Short-term	**Low**	Medium	**Low**
	Frequency:	Highly frequent					
	Geo. Extent:	Local					
	Intensity:	Medium					

8.2.4.1.4 Monitoring

In addition to the monitoring measures proposed in the Section 8.2.1.3, the following measure are proposed specifically for Critical Habitats:

- for flora species triggering Critical Habitats:
  - Flora Salvaging and Direct Translocation*:* Translocation sites identified for flora species shall be monitored periodically for any sign of stress or disturbance. During the first two years after translocation monitoring shall occur monthly during the vegetative season. After the first three years monitoring shall occur every three months during the vegetative season (unless particular issues are recorded during previous monitoring)
  - Flora On-site Conservation: on-site Conservation Areas identified for flora species shall be monitored periodically and any signs of disturbance will be noted (e.g. trampling, dust deposition, soil erosion, presence of stagnant water). During Constriction monitoring shall occur monthly.
  - Seed collection: the number of seeds collected and their viability shall be tested by the Ankara Seed Bank in order to assess the need of additional collection campaigns.
- for fish species triggering Critical Habitats: observations and removal of fish species from isolated in-water work zones and diversion tunnels intake should be registered and communicated to the biodiversity advisor;
- for bird species triggering Critical Habitats: no additional mitigation measure is considered necessary.

8.2.4.2 Operation phase

8.2.4.2.1 Impact analysis

Flora species triggering Critical Habitat

The main potential impacts that could affect flora species during the operation phase are:

1) presence of new buildings/infrastructures;

2) changes in local hydrology and water quality;
3) introduction and spreading of alien species.

The populations impacted by the project during the construction phase are clearly considered impacted also during this phase since the maximum footprint is considered. However, the impact in the 100 m buffer of the temporary facilities that will be rehabilitated is expected to be limited to the construction phase.

It is important to highlight that the areas investigated represent a small part of the LSA and were not conducted during the flowering period and therefore, additional studies are needed to map the species distribution and eventual additional direct or indirect impacts deriving from the Project.

Species	Flora RDB	Endemism	Potential direct impacts	Potential indirect impacts
Aubrieta olympica	EN	Regional endemic	One population was identified within the footprint of a temporary facility to be rehabilitated (borrow pit) in H3.2 habitat	No population was identified with 100 m from the Project operation footprint.
Centaurea sakariyaensis	CR	Local endemic /RR	One population was identified within the footprint of a temporary facility to be rehabilitated (borrow pit) in H3.2 habitat	No population was identified with 100 m from the Project operation footprint.
Ornithogalum pascheanum	EN	Regional endemic	Three populations were identified within the footprints of a temporary facilities to be rehabilitated (two storage areas and a borrow pit) in F5.3, E1.C and G1.7 habitats	No population was identified with 100 m from the Project operation footprint.

Fish species triggering Potential Critical Habitat

The main potential impacts that could affect fish species during the operation phase are:

4) changes in local hydrology and water quality;
5) emission of noise and vibration.

Potential direct and indirect impacts are summarized in the table below.

<table>
<tr><th>Species</th><th>Common Name</th><th>IUCN Red List</th><th>Endemism</th><th>Potential direct impacts</th><th>Potential indirect impacts</th></tr>
<tr><td>Barbus niluferensis</td><td>Simav Barbel</td><td>NT</td><td>Endemic / RR</td><td rowspan="2">No direct impact is expected on this species.</td><td rowspan="2">Indirect impacts from the project could occur in a 100 m and 300 m buffer and are mainly associated with the potential degradation of the habitat due to possible changes in local hydrology and water quality and repulsion due to the presence of noise and vibration.</td></tr>
<tr><td>Cobitis puncticulata</td><td>Brown spined loach</td><td>EN</td><td>Endemic / RR</td></tr>
</table>

Bird species triggering Potential Critical Habitat

The main potential impacts that could affect bird species during the operation phase are:

6) presence of new buildings/infrastructures;

7) emission of noise and vibration.

8) highspeed railway traffic.

Potential direct and indirect impacts are summarized in the table below.

Species	Common Name	Flora RDB	Endemism	Potential direct impacts	Potential indirect impacts
Falco cherrug	Saker falcon	EN	-	Direct impacts could be associated with collision with highspeed train or other infrastructures.	Indirect impacts from the project could occur within a 100 m and 300 m buffer and are mainly associated with the possible changes in the foraging areas because of habitat fragmentation and attraction or repulsion of prays due to the presence of noise

8.2.4.2.2 Mitigation measures

In addition to the avoidance, minimization and rehabilitation/restoration measures proposed in the section 8.2.2.1, the following measure are proposed specifically for Critical Habitats.

- for flora species triggering Critical Habitats:
  - conservation of flora species determining CH, situated in the vicinity of the Project (100 m) or translocated shall be guarantee. These areas will be by clearly identified both on the maps and in the field as exclusion zone where soil and vegetation will be preserved, and access will not be permitted. Additional mitigation/offset measures will be put in place if needed based on the results of the periodic monitoring.
- for fish species triggering Critical Habitats:
  - no additional mitigation measures.
- for bird species triggering Critical Habitats:
  - use of barrier-like structures to reduce the proportion of birds flying under the catenary in locations of high collision risk, such as in the vicinities of IBA and major river crossings. Additional mitigation measures will be put in place if needed based on the results of the monitoring.

8.2.4.2.3 Residual impacts

Considering the application of the abovementioned mitigation measures, the impact on Critical habitats is presented in the following tables and it is expected to be:

- for flora species triggering Critical Habitats: **Low**
- for fish species triggering Critical Habitats: **Low**

- for bird species triggering Critical Habitats: **Medium**

Table 157: residual impact assessment matrix for flora species triggering CH during construction phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
presence of new buildings/ infrastructures	Duration:	Long	High	Long term	**Very High**	High	**Low**
	Frequency:	Continuous					
	Geo. Extent:	Project footprint					
	Intensity:	Low					
changes in local hydrology	Duration:	Long	High	Short-mid-term	**Medium**	Medium	**Low**
	Frequency:	Sporadic					
	Geo. Extent:	Local					
	Intensity:	Medium					
introduction and spreading of alien species	Duration:	Long	High	Mid term	**Medium**	Medium-high	**Low**
	Frequency:	Sporadic					
	Geo. Extent:	Local					
	Intensity:	Negligible					

Table 158: residual impact assessment matrix for fish species triggering CH during construction phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
changes in local hydrology	Duration:	Long	High	Short-mid-term	**Medium**	Medium	**Low**
	Frequency:	Sporadic					
	Geo. Extent:	Local					
	Intensity:	Medium					
emission of noise and vibration	Duration:	Long	High	Short-term	**Low**	Medium	**Low**
	Frequency:	Frequent					
	Geo. Extent:	Local					
	Intensity:	Medium					

Table 159: Residual impact assessment matrix for bird species triggering CH during construction phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
presence of new buildings/ infrastructures	Duration:	Long	High	Long term	**Very High**	Medium-high	**Medium**
	Frequency:	Continuous					
	Geo. Extent:	Project footprint					
	Intensity:	Low					
highspeed railway traffic	Duration:	Long	High	Short-mid-term	**Medium**	Medium-high	**Low**
	Frequency:	Frequent					
	Geo. Extent:	Local					
	Intensity:	Medium					

emission of noise and vibration	Duration:	Long	High	Short-term	**Low**	Medium	**Low**
	Frequency:	Frequent					
	Geo. Extent:	Local					
	Intensity:	Medium					

8.2.4.2.4 Monitoring

In addition to the monitoring measures proposed in the section 8.2.2.3, the following measure are proposed specifically for Critical Habitats.

- for flora species triggering Critical Habitats: On-site Conservation Areas and translocation sites identified for flora species shall be monitored periodically and any signs of disturbance will be noted (e.g. trampling, dust deposition, soil erosion, presence of stagnant water). During operation monitoring shall occur every three months (unless particular issues are recorded during previous monitoring). These monitoring will allow to assess the eventual need of additional mitigation/monitoring measures.
- for fish species triggering Critical Habitats: no additional monitoring measures.

for bird species triggering Critical Habitats: accidents involving wildlife and in particular birds along railway route will be estimated using on-board recordings for at least 3 years of operation. The data collected will be analysed to estimate bird collision risk as well as the presence of eventual areas with higher collision risk. Based on the observations additional mitigation measures to protect birds from collision risk will be taken if needed.

8.2.5 No Net Loss/Net Gain Assessment for Natural Habitats and Critical Habitats

The present net loss assessment identifies and discusses residual and unavoidable impacts on Natural Habitats and Critical Habitats identified in the previous chapters.

8.2.5.1 Natural Habitats

For natural habitats direct impacts are mainly associated with habitat loss in correspondence of the footprint of the Project and its associated facilities. At the end of the construction phase restoration/rehabilitation activities will be conducted on all temporary facilities, therefore the only direct impacts remaining will be those due to presence of permanent buildings/infrastructures. Monitoring and mitigation measures will be planned and carried out at the end of the construction phase to ensure the full recovery of the natural habitats.

Indirect impacts from the project could occur in a 100 and 300 m buffer and that could cause changes in the habitat suitability. However, mitigation and monitoring measures presented for the construction and operation phases are considered sufficient for indirect impacts on natural habitats indirectly impacted.

Considering that no detailed information is available at this stage on the decommissioning and closure plan, using a precautionary approach, the net loss is calculated conservatively at the end of the operation phase.

Net loss of natural habitat will affect 2% (80.96 ha) of the total natural habitats present in the LSA. Most of the net loss impacts will be on coniferous woodland (G3.7, 23.06 ha), mesotrophic pastures (E2.1, 20.45 ha) and mixed coniferous-deciduous forests (G4.B, 11.05 ha).

Considering the limited footprint of the Project and the extension of the natural habitats impacted in their areas of distribution, it is not expected that the Project will have substantial adverse impacts on natural habitats. However, in order to ensure no net loss and preferably net gain of natural habitats, additional conservation action /offset measures will be implemented. These measures could include:

- protection of existing natural forest that could be otherwise threatened by impacts other than the Project (e.g. overgrazing, developments);
- reforestation of suitable areas using mix of tree species and planting schemes on techniques to maximize biodiversity and mimic mixed forest vegetation succession.
- creation of ecological corridors to enhance connection between separated patches of natural habitats.

Table 160: Net Loss of Natural Habitats calculated within the LSA

Code	Habitat	Net Loss		Total LSA
		ha	%	ha
C1.2	Permanent mesotrophic lakes, ponds and pools	-	-	2.85
C1.6	Temporary lakes, ponds and pools	0.04	<1	8.05
C2.2	Permanent non-tidal, fast, turbulent watercourses	0.01	<1	3.32
C2.3	Permanent non-tidal, smooth-flowing watercourses	3.06	2	144.05
C2.5	Temporary running waters	0.23	5	4.66
E1.C	Dry mediterranean lands with unpalatable non-vernal herbaceous vegetation	1.02	2	51.77
E2.1	Permanent mesotrophic pastures and aftermath-grazed meadows	20.45	3	749.13
F5.2	Maquis	0.57	<1	315.15
F5.3	Pseudomaquis	11.03	2	568.03
G1.1	Riparian and gallery woodland, with dominant alder, birch, poplar or willow	1.07	1	80.46
G1.7	Thermophilous deciduous woodland	9.38	2	390.44
G3.7	Lowland to montane mediterranean pine woodland (excluding black pine [Pinus nigra])	23.06	1	1,714.48
G3.9	Coniferous woodland dominated by [Cupressaceae] or [Taxaceae]	-	-	206.62
G4.B	Mixed mediterranean pine - thermophilous oak woodland	11.05	1	770.05
H3.2	Basic and ultra-basic inland cliffs	-	-	22.68
	Total	***80.96***	***2***	***5,031.74***

8.2.5.2 Critical Habitats

Flora species triggering Critical Habitat

Three flora species potentially triggering CH were observed in the LSA (*Aubrieta olympica, Centaurea sakariyaensis, Ornithogalum pascheanum*).

For these species direct impacts are mainly associated with loss of populations present under the footprint of the Project and its associated facilities. Since little is known about the ecological requirements of these flora species, using a precautionary approach, it is considered that it will not be possible to restore the specific ecological niche of the species triggering CHs directly impacted by the Project. Moreover, considering that the translocation of natural species in the wild is not always successful and no information are available at the moment on the survival rate of these particular species, the potential positive effects of these actions were not considered at present.

The net loss is therefore calculated conservatively as the area affected by direct impacts at the end of the construction phase or in the worst-case scenario based on current knowledge of the species distribution.

Indirect impacts from the project could occur in a 100 m buffer and are mainly associated with the possible changes in local hydrology that could cause changes in the habitat suitability and with competition due to introduction and spreading of alien species into disturbed habitats. Mitigation and monitoring measures presented for the construction and operation phase are considered sufficient for indirect impacts on populations of the species indirectly impacted.

The net loss of flora species determining CH was estimated based on current information and it is reported in the table below. Using a precautionary approach, these numbers do not consider the positive effect of “Flora Salvaging and Translocation” activities since little is known on the species survival rate.

It is also likely that other populations of these species exist in the LSA since field studies were limited. Additional studies during the flowering period of the species are needed to identify all the populations potentially present within the project footprint, including temporary facilities and its immediate surroundings in order to assess the actual direct and indirect impacts of the Project and estimate the distribution and abundance of these species.

Table 161: potential Net Loss of flora species determining CH

Species	Common Name	Flora RDB /IUCN Red List	End.	Net Loss
Aubrieta olympica	-	EN	Regional endemic	One population within the footprint of a temporary facility to be rehabilitated (borrow pit) in H3.2 habitat
Centaurea sakariyaensis	-	CR	Local endemic /RR	One population within the footprint of a temporary facility to be rehabilitated (borrow pit) in H3.2 habitat
Ornithogalum pascheanum	-	EN	Regional endemic	Three populations within the footprints of a temporary facilities to be rehabilitated (two storage areas and a borrow pit) in F5.3, E1.C and G1.7 habitats

The feasibility and long-term success of “Flora Salvaging and Translocation” measures need to be monitored to assess if the measure suggested within the ESIA is sufficient to ensure No Net Loss/Net Gain of flora species directly impacted by the Project.

In case the results of the monitoring will show that “Flora Salvaging and Translocation” measures are not sufficient, additional offset measures will be implemented. These measures could include:

a) protection of existing populations that could be otherwise threatened by impacts other than the Project (e.g. overgrazing, developments);

b) reinforcement of existing populations and/or creation of new populations using seeds or other propagules sustainably collected in the wild, preferably passing through a stage of multiplication and growing in a controlled environment.

If necessary, these activities will be performed in collaboration with local research centre and institutions (e.g. Ankara Seed Bank, University) to identify the multiplication and translocation protocols and ensure ongoing protection and monitoring of the populations.

<u>Fish species triggering potential Critical Habitat</u>

Two fish species, the Simav Barbel (*Barbus niluferensis*) and the Brown spined loach (*Cobitis puncticulata*), were identified as triggering CH within the LSA.

Net loss for this species could be associated with loss of habitat or even individuals (adults and eggs) in case of dramatic changes in local hydrology and water quality during construction works. While during operation impacts could occur from habitat fragmentation in case river crossings are not properly designed and implemented.

Strong mitigation measures are in place to avoid any permanent loss. Ecological rehabilitation of water crossings and, when necessary, the use of culverts/channels or other artificial infrastructures will be planned and implemented in such a way as to ensure the continuity of the water feature and not to constitute a barrier to fish movement.

These mitigation measures presented for the construction and operation phase are considered sufficient to avoid any long-term loss, however monitoring on freshwater habitat during both construction and operation phase will be crucial to ensure these measures are properly applied, and ensure that corrective actions are in place in a timely manner, if needed.

Table 162: potential Net Loss of fish species determining CH

Species	Common Name	Flora RDB /IUCN Red List	End.	Net Loss
Barbus niluferensis	Simav Barbel	NT	Endemic / RR	Net loss could be associated with loss of habitat or even individuals (adults and eggs) in case of dramatic changes in local hydrology and water quality during construction. Habitat fragmentation during operation could occur on river crossing.
Cobitis puncticulata	Brown spined loach	EN	Endemic / RR	

Bird species triggering Potential Critical Habitat

One bird species, the Saker falcon (*Falco cherrug*), was identified as triggering CH within the LSA.

Direct impacts on this species are expected only during operation due to potential collisions with highspeed trains. The effectiveness of mitigation measures and the residual loss need to be estimated through monitoring activities proposed in the above sections.

Mitigation and monitoring measures presented for the construction and operation phase are considered sufficient for indirect impacts on the species. Since the habitat loss due to the Project is limited, indirect impacts on this species are expected to be low. It must be noted that these species have a quite wide distribution range and is well adapted to live and hunt in a variety of open terrain including grassy landscapes and agricultural areas which are abundant in the LSA.

Table 163: potential Net Loss of bird species determining CH

Species	Common Name	Flora RDB /IUCN Red List	End.	Net Loss
Falco cherrug	0	EN	-	Net loss associated with collision with highspeed train or other infrastructures.

In order to offset any loss due to the Project, in addition to the mitigation measures already suggested, additional offset measures will be implemented. These measures include:

a) Artificial nest boxes: nesting boxes will be installed in appropriate and protected areas. The nests will be located at least at 5 km distance from the highspeed railway. Artificial nests can have a very positive effect on reproduction of this species, offering breeding opportunity for new pairs of Saker falcon in order to compensate for the potential loss of the population.

b) Monitoring and protection of nesting site: known nest locations can be monitored and protected from collecting of eggs and young during the breeding season. These birds are often illegally used in falconry or sold in Arabian countries for profit.

Educational activities will be performed in villages and local schools with the aim of sensitizing the population on the protection of local fauna and the potential damage of illegal practices such as hunting and egg collection.

8.3 Social Components

This Chapter of the report assesses construction and operation impact of the proposed Bandırma-Bursa-Yenişehir-Osmaneli ("BBYO") High Standard Railway Project based on, stakeholder concerns and expectations, expert opinions and the review of the equivalent projects according specific baseline conditions and the receptors of the Project AoI on;

- Population Change;
- Economy and Employment;
- Community health and Safety;
- Resettlement and Land Acquisition;
- Infrastructure and Services; and

- Vulnerable People

8.3.1 Population Change

8.3.1.1 Impact Analysis

8.3.1.1.1 Construction Phase

Population influx impact is expected depending on the employment opportunities of the direct and indirect workers and job seekers during the construction phase of the Project which may lead social unrest to local communities. During the construction phase of the Project 4,300 construction workers is expected to be employed in the peak period in Section 1 and Section 3. The construction period of the Project is expected to be completed in three years.

It is proposed that where applicable personnel to be employed during the construction phase be recruited from the settlements nearby the Project site, to control the population influx and contribute to the local economy. The locally employed population will continue to reside in their current residential areas which will not create additional pressure.

However, if the specific skilled positions cannot be sourced locally, nonlocal personnel will be employed, and they will be accommodated in prefabricated workers accommodations during the construction phase.

The Project workers will be accommodated in the workers accommodation located in 14 different workers camps including the workers accommodations of the subcontractors of Kalyon. The villages and neighbourhoods where the camps are planned to be established are considered sensitive receptors. The locations of the workers camps are explained in Section 3.3.7.1.5. The camp sites which are already being used by Duygu and Çelikler workers and their subcontractors are explained in Section 3.3.7.2. According to the baseline results, it has been observed that the population figures of Şahin, Çiftlik and Balçıkhisar villages are less than the numbers of the workers that will be accommodated in the camps and this can affect the intensity of the impact especially in these areas. In addition, the neighbourhood of Badırga is determined as religious minority and special mitigation measures including the Cultural Awareness Training should be applied for the workers who will be reside in Badırga.

Interviews with local community members and Mukhtars suggest that there is currently some Project-related influx in the Project area, and certain negative impacts are currently visible in Bursa-Yenişehir section of the Project which is currently under construction by Duygu and Çelikler. The mention impacts include more specific topics, such as increased traffic, noise and dust impacts which are assessed in the relevant chapters of this ESIA.

8.3.1.1.2 Operation Phase

After the completion of the Project Bursa - Bilecik - Ankara – Istanbul provinces will be connected. In this way, the distance between Bursa and Ankara will be reduced to 2 hours and 10 minutes. It is anticipated that 30 million passengers and 59 million tons of freight will be transported annually in the Bursa - Osmaneli section of the project.

The transportation mobility of the passengers and freights will lead new economic sectors and long term employment especially the planned station locations which will create long term population increase in the AoI.

The station locations which are planned to be constructed within the scope of the BBYO Project are presented in Section 3.3.4.

During the household surveys, perception of the PAPs on the population change impact is collected.

According to the results of the household surveys, among the settlements within the impact area, the population increase impact is expected mainly in Nilüfer district with the rate of 85.7% based on the SPSS results.[SC1] As mentioned before, the zonning permits have been granted in this region and the residential areas have been constructed rapidly and the realization of the major projects such as the health campus and the metro line leaded major population growth in this District. In parallel with the station location planned in Balat neighbourhood in Nilüfer District, continuous population increase is expected according to the results of the household surveys.

Population decrease impact is also expected by the local communities especially in the areas where land acquisition resulted livelihood impacts. In Yenişehir-Bursa section households whom were affected by the resettlement and the land acquisition of the agricultural lands already moved to urbanized areas.

8.3.1.1.3 Decommissioning and Closure Phase

Decommissioning phase may lead population decrease in the area as a result of out-migration of the operation phase Project workers. The main potential negative impact at Project closure can be increase in poverty and an increase in formal and informal unemployment due to decrease in Project employment and a decrease in demand for goods and services in the area.

8.3.1.2 Mitigation Measures

- Priority for the employment opportunities of the Project will be given to people whom lost their livelihoods.
- Equal payment for the equal jobs will be provided to local and nonlocal labour force,
- A bank account will be provided to workers and payment will be provided through the accounts,
- Where applicable priority will be given to local people,
- Workers accommodations will be designed in compliance with Workers' accommodation: processes and standards A guidance note by IFC and the EBRD (2009) and the basic needs of the workers will be provided within the borders of the accommodation to limit the interaction of the workers with the local communities to prevent the pressure on the local utilities and the services (Please see Section 10.4.2.4.),
- In case of the recruitment of the foreign labour, cultural awareness training will be provided to workers to prevent any cultural conflicts,
- Workers Code of Conduct will be prepared and applied,
- Mukhtars of; Kuşcenneti, Taşlık, Hürriyet, Balat ,İğdir, Çardak and Akdere will be informed about the construction of the workers accommodation and the workers that will be accommodated in the camps will be registered in the village/neighbourhood system,
- The mukhtars of the villages and the neighbourhoods will be informed about the recruitment opportunities of the Project (announcements, banners) to reduce the requirement of the nonlocal labour force,
- Where applicable, vocational trainings will be provided to local people, to maximize to local labour force,
- A grievance mechanism will be established and this mechanism will record any gender based complaints and necessary measures will be taken accordingly.
- A Contractor Management Plan will be prepared and all subcontractors will be monitored to avoid, child and forced labour.
- Equal tender process will be applied

- Equal procurement opportunities will be provided lo local small businesses through the Local Procurement Plan,
- Before the procurement, local suppliers will be identified and if required,
- Capacity development will be applied including the OHS and HR,
- The impact on the livelihood sources of the PAPs will be taken into consideration during the land acquisition
- Adequate overpasses and underpasses will be provided where PAPs engages with agriculture and animal husbandry,
- Resettlement Action Plan (RAP) and Livelihood Restoration Plan (LRP) will be applied to prevent the outmigration of PAPs due to livelihood losses.

8.3.1.3 Residual Impacts

8.3.1.3.1 Construction Phase

Construction phase population impact is assessed as negative and medium term. Considering the vicinity of the workers accommodations to the residential areas frequency of the impact is assessed moderately frequent. Geographical extent of the influx impact will be limited with the closest residential areas and the impact will occur at local level and the intensity of the impact is assessed as medium. The receptor sensitivity especially in the villages of Şahin, Çiftlik and Balçıkhisar is assessed as medium since the population will be doubled with the additional population that may create pressure on the social environment. The reversibility of the impact is medium since the completion of the construction phase, camps will be removed.

Population decrease during the construction phase may occur as a result of the loss of agriculture based livelihoods and resettlement. Duration of this impact will be long term and frequency will be sporadic. The extent will be limited with the Project footprint where land acquisition impact occurs. The intensity of the impact is medium and the sensitivity of the impact is assessed as medium to high.

Impacts on population during construction is assessed in below table.

Table 164 Impact Assessment Matrix for Population Change Component During the Construction Phase After Mitigation

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
Population increase during construction	Duration:	Medium	Medium	Mid term	**Medium**	High	**Negligible**
	Frequency:	Moderately frequent					
	Geo. Extent:	Local					
	Intensity:	Medium					

8.3.1.3.2 Commissioning and Operational Phase

Impacts on population during operation is assessed in below table. The operational activities may result long term population increase at regional level. The intensity of the impact will be high where the stations will be constructed. The reversibility of the impact will be long term and the impact will occur during the operation period.

The population decrease impact were asked to the PAPs who participated to the household surveys, even thought the extend of the impact is currently unknown and will mainly depend on the access to the agricultural lands during the operation phase, the participants assumed that PAPs whom become landless or will have difficulty to access to lands may decide to out-migrate is a negative impact at regional level.

Table 165 Impact Assessment Matrix for Population Change Component During the Operation Phase After Mitigation

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
Population decrease during operation	Duration:	Long	Medium-high	Irreversible	**High**	Medium	**Medium**
	Frequency:	Sporadic					
	Geo. Extent:	Project footprint					
	Intensity:	Medium					
Population increase during operation	Duration:	Long	Medium	Long term	**High**	High	**Low**
	Frequency:	Highly frequent					
	Geo. Extent:	Regional					
	Intensity:	High					

8.3.1.3.3 Decommissioning and Closure Phase

Decommissioning phase activities are likely to be the migration of the Project workers from the area. Impacts related to population for the decommissioning phase is difficult to predict at this stage of the Project, as these will depend on how well the local communities have adapted to influx.

8.3.1.4 Monitoring

The following monitoring activities will be performed to ensure the implementation and effectiveness of the proposed enhancement measures,

- Community grievances register and performance indicator records in accordance with grievance mechanism to be produced for the Project,
- Stakeholder Engagement and consultation register and records in accordance with the Stakeholder Engagement Plan to be produced for the Project,
- Percentages of the local employees (which will be a performance indicators for ESMS to be prepared for the Project),
- Population figures of the settlements according to TURKSAT data

8.3.2 Economy and Employment

8.3.2.1 Impact Analysis

8.3.2.1.1 Construction Phase

The project will generate positive impacts due to the demand for workforce and the demand for good, materials and services. The Contractor will hire staff locally and nationally according to the skills required and the availability of workforce in the region. The required labour force during the construction phase of Sections 1 and 3 of the Project is presented below.

Table 166: Required labour force during construction

Personnel Distribution	Number of required employees
Skilled (Engineer)	260
Semi-skilled (Technician-Foreman)	230
Unskilled	3810
TOTAL	4,300

In the realized CLS, the available skills in the settlements were asked. It is stated that there is no unemployment in most of the rural settlements. Most of the settlements have security guards, construction workers, drivers and a small number of operators, technicians and engineers. The rural areas the neighbourhoods of Barbaros Geçit and Balat, which are specified in the Baseline section, with high young population and high education rate, have been identified as sensitive receptors in terms of employment.

In addition to the direct and indirect employment opportunities, the Project will also create economic contribution by purchasing goods and services such as fuel needs of mobile equipment, transportation, foods. passenger automobiles to be used in the Project, electrical energy needs of the Project, maintenance and repair materials, office supplies, vehicle, travel, logistics, food, accommodation, communication, security, and so forth.

8.3.2.1.2 Operation Phase

As mentioned before the Project will connect Bursa - Bilecik - Ankara – Istanbul provinces both for passengers and freight. This will include better accessibility for businesses in the Project region to expand their geographical markets and resources to other areas and countries.

The Project is expected to attract more investors in the Project region. The increased investment will bring in more employment opportunities to the local people, including diversification of economic activities. This is quite significant considering the fact that majority of the expropriated land are agricultural lands, and PAPs whom may be affected economically can shift and continue to attribute their income through newly introduced economic fields.

The districts where impacts on employment are expected the most were Bandırma and Karacabey, and there is an expectation of employment for the operation period. It has been stated that with the commissioning of the stations, different business sectors will increase in the districts and in parallel with the facilitation of transportation, the young population will not migrate to large centers. With the exception of Kestel district, small businesses operating in the region will also be positively affected during the operation period.

8.3.2.1.3 Decommissioning and Closure Phase

Decommissioning of the Project will result in retrenchment of Project workers over a number of years, which may lead to an increase in unemployment at the local level. The Project will implement the retrenchment procedure (part of the Labour Management Plan) in line with IFC PS2.

8.3.2.2 Enhancement Measures

- The Project will implement human resource policies and procedures in compliance with the IFC PS-2 on Labour and Working Conditions. Such policies are expected to provide more predictable employment opportunities for direct and indirect employees.

- The Project will enhance local employment in and referential employment will be given to qualified local people. Hiring preference criteria will prioritise settlements directly affected by the current activities of the Project.
- Formal, and transparent recruitment process will be implemented to provide equal opportunity to the applicants.
- The Worker Grievance mechanism will be established and implemented.
- Priority will be given to goods and services from local businesses.
- Equal tender process will be applied
- Equal procurement opportunities will be provided lo local small businesses through the Local Procurement Plan,
- Before the procurement, local suppliers will be identified and if required,
- Capacity development will be applied including the OHS and HR.

8.3.2.3 Residual Impacts

8.3.2.3.1 Construction Phase

The impact of employment opportunities is a positive impact considered a positive impact likely to occur mainly in the construction phase of the Project. The impact is direct and medium long term and will extend beyond the regional in case of non-availability of the skilled workers in the local extent. The procurement opportunities are likely to occur during the construction phase of the Project. Considering the application of the abovementioned enhancement measures, the impact on the procurement opportunities is depicted in the following table and it is expected to be positive and medium.

Table 167 Impact Assessment Matrix for Economy and Employment Component During the Operation Phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
Employment opportunities	Duration:	Medium-long	Medium	Mid term	**High**	High	**High**
	Frequency:	Highly frequent					
	Geo. Extent:	Beyond the regional					
	Intensity:	High					
Demand for goods and services	Duration:	Medium-long	Medium	Short-mid term	**Medium**	Medium	**Medium**
	Frequency:	Highly frequent					
	Geo. Extent:	Beyond the regional					
	Intensity:	High					

8.3.2.3.2 Operation Phase

The table below assesses the positive economic impact during the operation phase. Direct and indirect job opportunities and increase in economic development of Region could be improved with the proposed enhancement measures in long term.

Table 168 Impact Assessment Matrix for Economy and Employment Component During the Construction Phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
Economic contribution during the operation	Duration:	Long	Medium	Short-mid term	**Medium**	Medium	**High**
	Frequency:	Frequent					
	Geo. Extent:	Regional					
	Intensity:	Medium					

8.3.2.3.3 Decommissioning and Closure Phase

Decommissioning economic impacts is related with new economic sectors were released. The residual impact will be dependent on according to the extend of the communities to the Project.

8.3.2.4 Monitoring

- Employment agreements made with contractors and subcontractors,
- Training Records (training materials, participant list, training planning, photos) (which will be a performance indicators for ESMS to be prepared for the Project),
- Employment records (contracts, employee register), (which will be a performance indicators for ESMS to be prepared for the Project)
- Grievance Records. in accordance with grievance mechanism to be produced for the Project,

8.3.3 Community Health and Safety

8.3.3.1 Impact Analysis

8.3.3.1.1 Construction Phase

The main impact source of the traffic on the community health and safety is expected to be the vehicle increase due to construction works. Traffic-related accidents, which pose threats to human health and the environment, are generally caused by driver error. However, issues regarding regular maintenance of vehicles, road design or road construction and maintenance contribute to the traffic-related risk factors. During the social field studies it has been observed that traffic related impacts already exist in Section 2, especially related with the speed limit and usage of the high tonnage vehicles damaged village roads.

Traffic and infrastructure related impacts are assessed in Section 8.1.11.

The construction of the Project will require the employment of 4300 workers during the peak period. The population increase may lead infectious diseases, Sexually Transmitted Diseases (STD) and especially spread of Covid-19 in the AoI. According to the community-level survey, Covid-19 cases were reported in majority of the settlements and in the village of Seymen it is underlined that as a result of the interaction with the construction workers of Section-2 the Covid-19 cases increased in the settlements and four residents died. Covid-19 management information is provided in Section 10.4.5.

Other source of the communicable diseases may be the inadequate management of household waste. During the social field survey inadequate waste management of the camp areas in Section 2 was another concern which was raised by some of the interviewed residents. Waste management control measures are provided in Section 3.5.2.

During implementation of the planned activities, dust, noise, mud on roads and potential landslides/unstable slopes impacts are expected to occur from the demolition and clearance of objects that are located along the intended route. These specific impacts are assessed under the physical components impact assessment Section 8.1.

Blasting will be implemented at the quarries where the filling materials will be obtained and also on the railway route at some locations and where tunnel works will be carried out. Insufficient blasting control measures can result in both environmental and health and safety impacts on community members. The settlements and the communities which are likely to be most affected by the blasting activities are given in 8.1.10.

During the site visits, cases of Covid-19 were observed in the settlements in Section-2, where the camp sites of the Section-2 are located. Locations close to the campsites for Section-1 and Section-3 will also has higher sensitivity to infectious diseases compared to other settlements. During the social site visit, it was observed that some settlements do not have health units and these areas considered as high sensitivity in case of a possible infectious disease.

During the construction phase of the Project, security will be needed on the site. According to the results of the social field survey, there are security personnel who obtained a certification for private security living in the villages located in the AoI. Security personnel who are part of the community and who are familiar with local customs may serve as a positive and visible point of contact between the company and the community.

8.3.3.1.2 Operation Phase

During site interviews, the main concerns of the communities in the AoI was related with the noise impact during the operation. The noise impact is assessed in the Section 8.1.9 in details.

Another operational impact on the community members would be the infrastructure and equipment design and safety and malfunction in the units which can impact not only the workers but also the community members.

During the operation of the railway projects, railway traffic impacts are important for the community members especially for the potential trespasses. Trespassers on rail lines and facilities may incur risks from moving trains, electrical lines and equipment, and hazardous substances may impact the pedestrians. No level crossings exist in the Project, therefore no impacts relevant to level crossings will occur. Additionally, an increased traffic volume in the stations are expected which requires appropriate management controls. The traffic impact is assessed in Section 8.1.11 in details.

8.3.3.1.3 Decommissioning and Closure Phase

During the decommissioning phase, increased traffic may create impacts on community health and safety.

8.3.3.2 Mitigation Measures

A Community Health and Safety Management Plan will be prepared in the Project in line with the national and international standards (e.g., IFC PS4) to identify and assess the project adverse impacts on potentially affected communities and provide protection, prevention and mitigation measures proportionate to the impacts and risks. The minimum standards to be implemented for the management of community health and safety during the construction and operation phases of the BBYO Project are described below.

Infrastructure and Equipment Design and Safety

The design and construction of stations, tunnels and engineering structures and the production of superstructure, electrification, signalling and telecommunication, testing and commissioning in the BBYO Project will be conducted by the Contractor in line with the Technical Specifications specified in the Construction Contract executed on 17th of September 2020 by competent professionals.

Malfunctions in the structural elements and components of the Project which can be accessed by the community members can potentially impact the public. During the operation phase of the BBYO Project, Kalyon will be responsible from the regular maintenance of the Project's structural elements and components.

The accident/incident reporting and investigation process to be established in the Project will include the potential incidents and injuries to the community members associated with the construction and operation of the BBYO Project.

Blasting

A Safe Work Procedure on Blasting activities will be implemented for the blasting activities. The nearby settlements, which may be affected around the field of activity, will be notified of the date and time of the blasting. The blasting activities will be accompanied by Gendarme. Nobody other than the authorities will enter the firing field. Skilled personnel who are trained and certified for this work will be assigned in the firing of explosive materials. Blasting will be done by people with firing license. Explosives will be delivered to the quarries at a daily basis at required amounts by licensed companies within the scope of the ADR Regulation. In case an explosives storage area is planned in the quarries, all necessary legal permits shall be obtained.

Please refer to Section 8.1.6 for the blasting impacts on air quality and Section 8.1.10 for the vibration impacts of the blasting and the necessary mitigation measures to be implemented throughout the blasting activities.

Security

A Security Management Plan will be prepared in line with the national (Private Security Services Law No: 5188, 2004) and international (e.g., IFC PS4) standards within the scope of the Project to manage the security related impacts and ensure the security of the activities, assets, work premises at the BBYO Project and avoid potential impacts on workers and community members.

The Project will make an agreement with a private security company for the provision of unarmed trained security personnel. Details of the security team contact numbers and their contact numbers will be included in the Security Management Plan to be developed. Kalyon has an established corporate Code of Conduct for security arrangements which will be implemented for the BBYO Project as well. Kalyon's Security Code of Conduct is given below:

- Security personnel shall at all times fulfil the duty imposed upon them by Kalyon, by serving the Project and protecting the community and all persons against illegal acts, consistent with the high degree of responsibility required by their profession and this Code of Conduct.
- Security personnel shall respect and protect human dignity and maintain and uphold the human rights of all persons.
- Security personnel will remember at all times they should provide only preventative and defensive services seeking to exercise restraint and caution at all times and to clearly prioritize prevention of injuries or fatalities and peaceful resolution of disputes.
- Security personnel have no law-enforcement authority and will not encroach on the duties, responsibilities of public security forces.
- Security personnel may use force only as a matter of last resort and only for preventive and defensive purposes in proportion to the nature and extent of the threat, and in a manner that respects human rights. National principles of proportionality are to be respected in the interpretation of this provision. The arbitrary or abusive use of force is prohibited. The use of physical force at any time, should be reported to the Kalyon to enable the appropriateness of the action to be investigated.

- The use of firearms by security personnel is prohibited at all times.
- Security personnel are required to respect the right of local communities to associate, assemble, and speak out in opposition to the project.
- Security personnel shall not commit any act of corruption. They shall also rigorously oppose and combat all such acts. While the definition of corruption must be subject to national law, it should be understood to encompass the commission or omission of an act in the performance of or in connection with one's duties, in response to gifts, promises or incentives demanded or accepted, or the wrongful receipt of these once the act has been committed or omitted.
- Security personnel shall respect the law and the present Code. They shall also, to the best of their capability, prevent and rigorously oppose any violations of them. Security personnel who have reason to believe that a violation of the present Code has occurred or is about to occur shall report the matter to their superior authorities and, where necessary, to other appropriate authorities.

Following points will be considered as a minimum during the construction phase regarding security arrangements:

- Security will be provided at the camp sites and the construction areas by a third-party company or inhouse security personnel who will not have criminal records and past abuses.
- Security personnel will be trained adequately in their envisaged roles and responsibilities, the use of force (and where applicable, firearms), and appropriate conduct toward workers and affected communities and the applicable law.
- Security personnel will be trained in conflict resolution and cultural sensitivity.
- Security patrols will be done at regular intervals.
- Entry of unauthorized persons will be prevented by using appropriate tools and gadgets. Warning signs about unauthorized entry will be available at various locations at the Project crossings.
- Entry and removal of equipment/material will be controlled at the control points, the movement of equipment/material will be allowed after the approval of relevant department.
- A grievance mechanism will be in place for the affected communities to express their concerns about the security arrangements and acts of the security personnel.

During the operation phase of the Project, security aspects will be reconsidered based on the type of the transportation, i.e., passenger or freight. For example, during storage and transport of hazardous materials on the railway, a hazardous material security awareness program will be implemented, which may include the provisions for personnel security, prevention of unauthorized access, and measures to reduce risks.

The following control measures will be implemented at a minimum to ensure the visitors' safety and health in the Project during the construction phase:

- Relevant Project official will continuously accompany the visitors during their stay on the Project site and all visitors will be recorded.
- All visitors will be given brochures explaining the Project area, site rules and what to do in case of emergencies.
- PPE will be provided to visitors coming to the site in accordance with the PPE needs at the visited areas.

- All areas that may pose a danger to visitors (waste sites, generators, etc.) will be kept locked.
- All areas that pose a danger at the construction areas will be marked with appropriate signs.

Traffic and Pedestrian Safety

The entire route, which will be used for transportation and materials, will be determined following the finalization of the route design. According to the desktop analyses, it was expected that there would be an increase in traffic on the routes where the campsite and the borrow and quaries are located. Locations of this Project units are presented in detail in the relevant sections of the report. Following the determination of the route, this information will be processed into the Traffic Management Plan and the information will be shared with the relevant institutions and communities.

Please refer to Section 8.1.11 for further details about the traffic and pedestrian safety measures.

Transport of Dangerous Goods

A Hazardous Materials Management Plan will be implemented in the Project to ensure hazardous materials are properly transported, stored and used throughout the Project lifecycle in line with the Regulation on the Transportation of Dangerous Materials on Motorways and Regulation on Transportation of Dangerous Materials by Railway and international standards (e.g., IFC EHS Guidelines for Railways). Following points will be implemented as a minimum for the management of transportation of dangerous goods during construction and operation phases:

- Appropriate legally required control measures and certifications will be ensured for all transportation of dangerous materials on motorways ensuring that occupational safety, environmental safety standards are complied with.
- Appropriate legally required screening and acceptance procedure will be implemented for the rail transportation of bulk or packages representing a potential risk of release to the environment in the event of accidents.
- Use of tank cars and other rolling stock that meet national and international standards (e.g., thermal protection and puncture resistance) appropriate for the cargo being carried to be ensured.
- For the transportation of dangerous goods by railway spill prevention and control, and emergency preparedness and response plans will be in implemented which will include e.g., Routing and timing of hazardous materials transport to minimize risk to the community (e.g. restricting transport of hazardous materials on some routes), limiting train speed in developed areas, construction of protective barriers and other technical measures (e.g. drainage / receptacle provisions) at sensitive locations (e.g. water resources and settlements) and dissemination of emergency preparedness and response information to the potentially affected communities.

Community Exposure to Diseases

The control measures that will be implemented for the management of the environmental aspects including air, noise, water and soil quality in the Project including the pollution prevention measures will also reduce possible associated impacts on communities (Section 8.1).

Covid-19 which was declared as a pandemic worldwide continues to endanger the communities' health. The Project will implement strict Covid-19 measures in line with the national and international standards to minimize the impacts in the Project, therefore potential transmission to/from the communicates. Covid-19 pandemic management measures are given in Section 10.4.5. It is necessary to ensure that the communication between project workers and settlements should be kept to a minimum especially at the areas where the health units do not exist.

Emergency Preparedness and Response

Emergency Response Plans (ERP) will be prepared both for the construction phase and operation phases in accordance with the Regulation on Emergency Situations in Workplaces and Railway Safety Regulation.

The response procedures will be established in order to prevent the damages that can be caused by the determined possible and probable emergency situations and to limit their larger effects. The measures to be taken will be in accordance with the principles of protection from risks and will be based on collective protection. The ERP will consider the nearby settlements and the communication procedures in case of any emergency situation which would impact the community members.

Emergencies that may occur during the construction and operation activities of the project are determined by considering the following issues:

- Risk assessment results
- Fire and possibility of explosion
- Release of hazardous materials
- Workplace accidents requiring first aid and evacuation
- Natural disasters
- Sabotage
- Poisoning
- Emergencies related to confined spaces
- Emergencies related to working at height
- Emergencies related to remote working
- Occupational health incidents
- Failure or malfunction in the structural elements and components of the Project

Suitable and sufficient number of emergency response equipment will be provided at the camp sites and work sites in line with the regulatory requirements (Regulation on Protection of Buildings Against Fire). Emergency Response Plans will include the details of the emergency layouts and the emergency response equipment according to the work areas. These equipment will be periodically maintained as legally required.

A Covid-19 Emergency Response Plan will also be prepared within the scope of the Project (Section 10.4.5).

The emergency response teams will be established in line with the regulatory requirements (Regulation on Emergency Situations in Workplaces, First Aid Regulation). Necessary training will be delivered to emergency response team members and the trainings will be refreshed within the legally required intervals.

In order to follow the implementation steps of the prepared ERP regularly and to ensure their applicability, emergency drills will be held at least once a year. As a result of the drills, the ERP will be reviewed, and necessary corrections will be made accordingly.

In the event of changes in the workplace that may affect the determined emergencies or cause new emergencies, the ERP will be completely or partially renewed depending on the magnitude of the impact. The ERP will also be renewed according the legally legal period and also in case of any changes in the legislation, e.g., new procedures in the Covid-19 management, etc.

Throughout the Project lifecycle, all workers/operators will be provided with application-oriented information including all kinds of emergency, emergency response including first aid or evacuation accidents and incidents that may occur in railway operations, such as derailments, collisions, fire, explosion, spread caused by hazardous chemicals and natural disasters.

Infirmaries will be established at the construction camp sites. In case of incidents requiring medical treatment, the nearest hospitals will be used. The list of the hospitals along the BBYO Railway route are given in Table 169.

Table 169 Hospitals along the BBYO Railway Route

Section	Province	District	Name of the Hospital[41]	Village	Availability of primary health care center in the village
Bandırma-Bursa (95 km)	Balıkesir	Bandırma	■ Bandırma State Hospital	49. Kirazlı	X
				50. Ömerli	X
				51. Kuşcenneti	X
				52. Akçapınar	✓
				53. Doğruca	X
	Bursa	Karacabey	■ Karacabey State Hospital ■ Private Karacabey Health Clinic	54. Akçakoyun	✓
				55. ÇamlıcA	✓
				56. Danişment	✓
				57. Fevzipaşa	X
				58. Hayırlar	X
				59. Hürriyet	✓
				60. Karasu	X
				61. Muratlı	X
				62. Şahinköy	X
				63. Taşlık	✓
				64. Harmanlı	X
		Mudanya	■ Mudanya State Hospital	65. Çekrice	X
				66. Balabancık	X

[41] https://www.trhastane.com/

Section	Province	District	Name of the Hospital[41]	Village	Availability of primary health care center in the village
			Private Biyofiz Mudanya Medical Center	67. Dedeköy	✓
				68. Hasköy	✓
Bursa-Yenişehir (56 km)		Osmangazi	Bursa State Hospital Bursa Çekirge State Hospital Medical Park Bursa Hospital Private Ceylan International Hospital Private Doruk Bursa Hospital Private Aritmi Osmangazi Hospital Bursa Özel Hayat Hospital	69. Aksungur	X
				70. Alaşar	✓
				71. Çağlayan	✓
				72. Dereçavuş	✓
				73. Geçit	✓
				74. İsmetiye	✓
				75. Nilüfer	✓
				76. Barbaros	X
		Gürsu	Gürsu Cüneyt Yıldız State Hospital	77. İğdir	✓
				78. Karahıdır	X
				79. Kazıklı	✓
		Kestel	-	80. Barakfakih	X
				81. Dudaklı	X
				82. Gölbaşı	X
				83. Narlıdere	X
				84. Seymen	X
		Nilüfer	Uludağ University Medical Faculty Hospital Private Esentepe Hospital Private Bursa Anadolu Hospital Private Medicana Bursa Hospital Özel Acıbadem Bursa Hospital Private Medicabil Hospital	85. Badırga	X
				86. Balat	✓
				87. Doğanköy	X
				88. Yolçatı	✓
Yenişehir-Osmaneli (49 km)		Yenişehir	Bursa Yenişehir State Hospital	89. Akdere	X
				90. Çardak	✓
				91. Ebeköy	✓
				92. Karacaali	✓
				93. Köprühisar	✓
				94. Papatya	✓

Section	Province	District	Name of the Hospital[41]	Village	Availability of primary health care center in the village
	Bilecik	Osmaneli	■ Osmaneli State Hospital	95. Çiftlik	X
				96. Düzmeşe	X

8.3.3.3 Residual Impacts

8.3.3.3.1 Construction Phase

CHS impacts are assessed as negative and the duration of the impact is medium to long. Increased traffic and construction related environmental impacts is expected to occur moderately frequent. Although the frequency of the impact of communicable diseases and the interaction with the security personnel are sporadic in case of any important health and safety incident the impact may not be reversible.

Table 170 Impact Assessment Matrix for Community health and Safety During Construction Phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
Infrastructure and equipment design	Duration:	Medium-long	Low	Mid-term	**Low**	Medium	**Negligible**
	Frequency:	Moderately frequent					
	Geo. Extent:	Regional					
	Intensity:	Medium					
Blasting	Duration:	Medium	Very high	Short-mid-term	**Medium**	Low	**Medium**
	Frequency:	Frequent					
	Geo. Extent:	Local					
	Intensity:	Very high					
Traffic and Pedestrian Safety	Duration:	Medium-long	Medium-high	Short-mid-term	**Medium**	Medium	**Low**
	Frequency:	Moderately frequent					
	Geo. Extent:	Local					
	Intensity:	Medium					
Transport of dangerous Goods	Duration:	Medium-long	Medium	Short-mid-term	**Low**	High	**Negligible**
	Frequency:	Moderately frequent					
	Geo. Extent:	Regional					
	Intensity:	Low					
Community Exposure Diseases	Duration:	Medium-long	Very high	Mid-term	**High**	Medium	**Low**
	Frequency:	Sporadic					
	Geo. Extent:	Regional					
	Intensity:	Low					
Emergency Preparedness and Response	Duration:	Medium-long	Medium	Short-mid-term	**Low**	High	**Negligible**
	Frequency:	Moderately frequent					
	Geo. Extent:	Regional					

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
	Intensity:	Low					

8.3.3.3.2 Operation Phase

Considering the increased mobility during the operation phase, long term traffic increase is expected at regional level and infrastructure malfunctions may occur sporadic at the project footprint. With the given mitigation measures provided below the traffic impact will be medium and the infrastructure malfunctions will remain at the negligible level.

Table 171 Impact Assessment Matrix for Community health and Safety During Operation Phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
Operation traffic	Duration:	Long	Medium high	Long term	**High**	Medium high	**Medium**
	Frequency:	Highly frequent					
	Geo. Extent:	Regional					
	Intensity:	Medium					
Infrastructure and equipment design	Duration:	Long	Medium high	Long term	**High**	High	**Negligible**
	Frequency:	Sporadic					
	Geo. Extent:	Project footprint					
	Intensity:	Medium					

8.3.3.3.3 Decommissioning and Closure Phase

In order to prevent impacts, Project Site should be effectively and permanently blocked from all access to the public until such time that the site can be converted into a new beneficial land use based on changed conditions at the site

8.3.3.4 Monitoring

- Keep the record of the number of traffic-related incidents involving contractor workers, subcontractor workers and external persons;
- Keep the record of the number of full road closures caused by Project activities;
- Keep the record of the number of grievances received and percentage of grievances resolved positively.
- Keep the record Stakeholder engagements
- Keep and track the traffic accident /emergency response actions
- Keep and track Training Records of Drivers
- Training records on community health and safety
- Records of communicable diseases
- Air and noise measurements,
- Environment related grievance and the actions taken

- Training record to the security personnel
- Keep records of the Project maintenance and components malfunctions

8.3.4 Resettlement and Land Acquisition and Livelihoods

8.3.4.1 Impact Analysis

The Project includes approximately 201 km railway and 29 units of 35.6 km single tube tunnel in total (15.5 KM within the scope of Çelikler), 5 Cut-and-Cover, 26 viaducts of 6875 m in total, 9 overpasses and bridges, 83 underpasses, 192 culverts, 201km superstructure, electromechanical and signalling.

The existing land use of the Social AoI will be affected by the construction of the Project and its components as well as by the associated facilities. There will be loss of governmental and private land as a result of the Project

The Project execution will require permanent acquisition of land by using expropriation. The Project is expected to cause economic displacement and physical resettlement, however, at this stage, the magnitude of displacement is not completely known since the land acquisition files have not been prepared for Bandırma-Bursa and Yenişehir-Osmaneli sections.

This section aims to identify and assess the economic displacement related impacts because of the acquisition of land for Project purposes. The focus is on economic displacement because of the permanent need of agricultural lands, impact on businesses, relocation of the residential areas, limited access to forest lands and ecosystem usage, and unplanned damage to agricultural lands during the construction phase of the Project.

The expropriation works have been completed on the Bursa-Yenişehir route of the project, which is currently under construction. 83% of this area is private lands, 17% is forest lands, and 1% is pasture lands.

The expropriation process has not started as of April 2021 between the route between Bandırma and Bursa. According to the information obtained from the project company, a total area of 5,809,967 m^2 is needed in this area for the high-speed train construction. 91% of this area is private lands, 2% pasture lands and 7% forest lands.

Part of the expropriation process of the lands on the Yenişehir-Osmaneli route has been completed, and additional lands are needed for the realization of the project. In this section, a total of 1,716,612 m^2 of land is required for the realization of the project. 57% of these lands are private lands, 7% pasture lands and 36% forest lands. Details can be found in the table below.

Table 172 General Land acquisition information

	Route		Total required land (m^2)	Private parcels (m^2)	Pastura lands (m^2)	Forest land (m^2)	Forest easement right (m^2)	Status of land acquisition
1	**Bandırma**	**Bursa**	5,809,967	5,273,882	100,000	260,000	176,085	Not started
			100%	91%	2%	4%	3%	
2	**Bursa**	**Yenişehir**	3,222,806	2,666,567	20,000	67,000	469,239	Completed

	Route		Total required land (m²)	Private parcels (m²)	Pastura lands (m²)	Forest land (m²)	Forest easement right (m²)	Status of land acquisition
			100%	83%	1%	2%	15%	
3	**Yenişehir**	**Osmaneli**	1,716,612	974,380	125,000	304,000	313,232	Partially completed
			100%	57%	7%	18%	18%	

It should be noted that the land acquisition, expropriation and resettlement processes are not under the responsibility of Kalyon. AYGM and TCDD will have the main responsibilities for the required lands for the Project, preparation of the land acquisition files. Identification of the affected people, valuation and the compensation is processed in compliance with the Turkish Expropriation Law. During the RAP and the LRP studies, the gaps between the Expropriation Law and IFC PS-5 will be identified in detail and Kalyon will be responsible for the implementation of LRP during the construction phase of the Project and the land acquisition process that will be held by the governmental institutions, will be monitored by Kalyon.

8.3.4.1.1 Construction Phase

Physical Displacement

Bandırma-Bursa section: Since the land acquisition process has not been started for this section total number of the structures that will be physically displaced have not been determined yet. However considering the GIS studies and the field surveys it has been observed that, one petrol station and 4 structures[42] that are connected to agricultural lands will be affected. In Section-1 as follows.

Table 173 Loss of Housing / Structure and Other Assets located in Bandırma-Bursa

District	V/N	Required land (m²)	Affected structure
1. Karacabey	Taşlık	2750.00	Garden + structure
2. Mudanya	Evciler	1935.64	Petrol station
3. Mudanya	Çekrice	2650.00	Agricultural land + structure
4. Mudanya	Çekrice	698.00	Agricultural land + structure

It has been determined that there are 23 buildings in the Bursa-Yenişehir section, where the construction of the project is ongoing and may require relocation according to status of construction. Details provided in below table.

[42] Exact numbers of the structures will be determined following the completion of the land acquisition files.

Table 174 Loss of Housing / Structure and Other Assets located in Bursa-Yenişehir

District		V/N	Required land (m^2)	Affected structure
1.	Nilüfer	Yolçatı	2100.00	Agricultural land + structure
2.	Nilüfer	Yolçatı	2100.00	Agricultural land + structure
3.	Nilüfer	Balat	8471.37	Agricultural land + structure
4.	Osmangazi	Geçit	5,931.62	Greenhouse
5.	Osmangazi	Nilüfer	530.04	Agricultural land + structure
6.	Osmangazi	Demirtaş Sakarya	12,522.70	Agricultural land + structure
7.	Osmangazi	Demirtaş Sakarya	1,794.27	Agricultural land + structure
8.	Gürsu	Kazıklıköyü	675.08	Agricultural land + structure
9.	Gürsu	Kazıklıköyü	696.48	Agricultural land + structure
10.	Gürsu	Iğdırköyü	1,908.29	Agricultural land + structure
11.	Gürsu	Iğdırköyü	6,025.00	Greenhouse
12.	Gürsu	Iğdırköyü	4,811.06	Greenhouse
13.	Gürsu	Iğdırköyü	2,976.12	Greenhouse
14.	Gürsu	Iğdırköyü	1,835.93	Greenhouse
15.	Gürsu	Iğdırköyü	1,732.71	Greenhouse
16.	Gürsu	Iğdırköyü	943.79	Agricultural land + structure
17.	Gürsu	Iğdırköyü	299.65	Greenhouse
18.	Gürsu	Iğdırköyü	525.74	Greenhouse
19.	Gürsu	Iğdırköyü	467.42	Greenhouse
20.	Gürsu	Iğdırköyü	1,675.00	Greenhouse
21.	Gürsu	Karahıdırköyü	2,854.00	Greenhouse
22.	Gürsu	Karahıdırköyü	1,839.40	Greenhouse
23.	Kestel	Narlıdere	426.54	Greenhouse

According to the desktop research and field studies for the first section of the Project, 16 structures has been determined which will be potentially resettled including one factory.

Table 175 Loss of Housing / Structure and Other Assets located in Yenişehir-Osmaneli

1.	Yenişehir	Tabakhane	452460.00	Agricultural land + structure
2.	Yenişehir	Akdere	7500.57	Agricultural land + structure
3.	Yenişehir	Akdere	11604.41	Agricultural land + structure
4.	Yenişehir	Akdere	2169.17	Agricultural land + structure

5. Osmaneli	Camicedit	7386.00	Greenhouse.
6. Osmaneli	Camicedit	1303.00	Agricultural land + structure
7. Osmaneli	Camicedit	980.00	Agricultural land + structure
8. Osmaneli	Haceloğlu	103239.00	Factory
9. Osmaneli	Haceloğlu	4756.00	Agricultural land + structure
10. Osmaneli	Haceloğlu	2277.00	Agricultural land + structure
11. Osmaneli	Haceloğlu	3506.00	Agricultural land + structure
12. Osmaneli	Haceloğlu	145399.80	Agricultural land + structure
13. Osmaneli	Haceloğlu	364.00	Agricultural land + structure
14. Osmaneli	Haceloğlu	4436.00	Agricultural land + structure
15. Osmaneli	Haceloğlu	306.00	Agricultural land + structure
16. Osmaneli	Haceloğlu	860.00	Agricultural land + structure

Loss of Agricultural Land

The project is mainly passing through the agricultural lands. pass. A total of 3168 parcels and 23427555 m^2 agricultural land are affected within the scope of the Project. Karacabey constitutes the majority of these lands with 47%, followed by Yenişehir with 18%, Mudanya and Bandırma with 12%. Although the number of the parcels is high in Osmaneli, the area of the affected lands constitutes 4% of the total area. Information on the agricultural land affected by district is presented in the charts and table below.

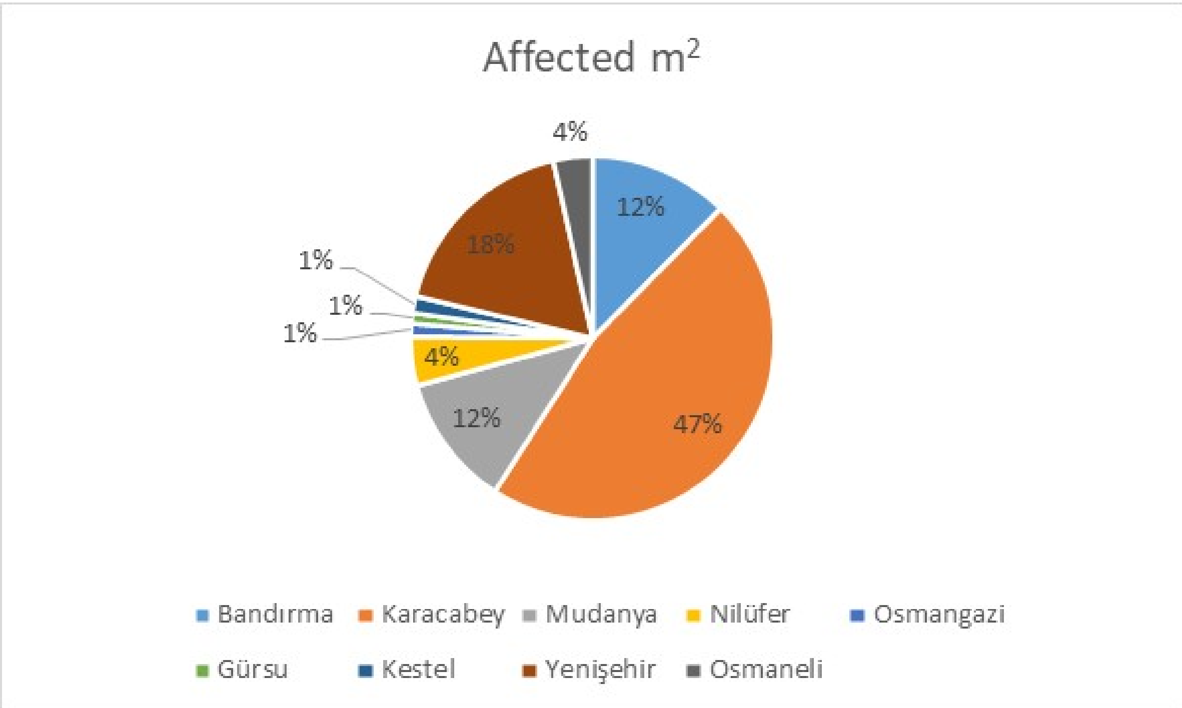


Figure 101 Affected Agricultural lands distribution along the BBYO Route

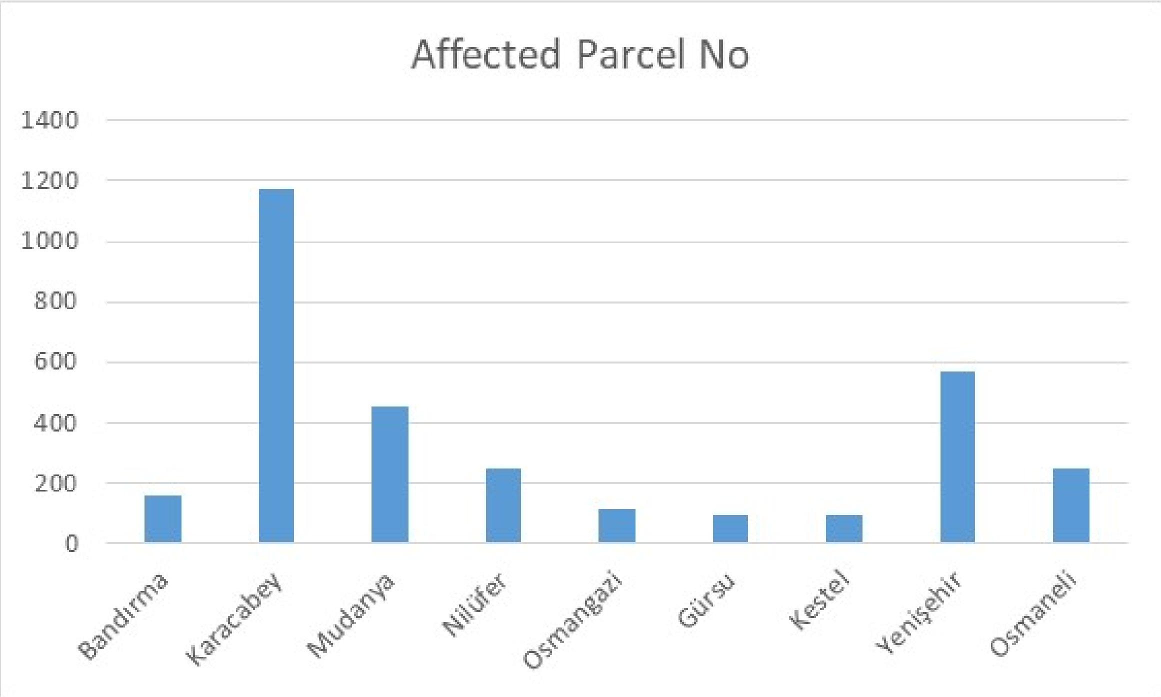


Figure 102 Number of affected parcel number long the BBYO Route

Table 176 Affected Agricultural Lands

District	V/N	Affected Parcel No	Affected Lands m^2
Bandırma	Doğruca	4	229537.43
	Akçapınar	1	15069.83
	Kuşcenneti	43	713268.96
	Aksakal	27	479070
	Yeşilçomlu	86	1462823.65
	TOTAL	161	2899769.87
Karacabey	Ariz	23	361065
	Aşağıfevzipaşa	74	736983.75
	Çamlıca	105	212107
	Canbaz	111	792353
	Çayönü	105	275946.43
	Çeşnigir	60	508973

District	V/N	Affected Parcel No	Affected Lands m^2
	Dağkadı	55	799979
	Danişment	44	628700
	Hamidiye	1	6700
	Harmanlı	114	1143212.04
	Hayırlar	31	490750
	Hürriyet	66	96429.38
	İnkaya	30	50634
	Karasu	33	589381.64
	Keşlik	6	1033526.45
	Mamuriyet	14	95875
	Muratlı	10	1029543
	Şahin	104	739912.65
	Taşlık	139	786894.01
	Tophisar	48	556491.16
	TOTAL	**1173**	**10935456.5**
Mudanya	Bademli	4	35750
	Balabancık	59	427888
	Çayönü	63	194302.3
	Çekrice	57	312713.49
	Dedeköy	25	406222.4
	Emirler Yenicesi	4	15508.14
	Evciler	55	230552.55
	Hançerli	87	655177.93
	Hasköy	3	29700
	İnkaya	16	33058

District	V/N	Affected Parcel No	Affected Lands m^2
	Küçükyenice	25	66744
	Orhaniye	19	147955
	Yörükyenicesi	40	197960.5
	TOTAL	**457**	**2753532.31**
Nilüfer	Ahmet Yesevi	1	9076.32
	Badırga	124	444238.36
	Balat	4	28840.46
	Çaylı	19	124938.83
	Yolçatı	91	289490.57
	Doğanköy	9	118978.24
	TOTAL	**248**	**1015562.78**
Osmangazi	Aksungur	2	11,247.41
	Alaşar	9	10,936.38
	Çağlayan	12	32,936.07
	Demirtaş Barbaros	8	6,688.86
	Demirtaş Sakarya	10	49,293.40
	Dereçavuş	19	28,806.50
	Geçit	20	88,324.51
	İsmetiye	9	15,661.33
	Nilüferköy	24	23,082.67
	TOTAL	**113**	**266,977.13**
Gürsu	İğdir	42	114,471.60
	Ksrahıdır	17	61,251.07

District	V/N	Affected Parcel No	Affected Lands m²
	Kazıklı	38	47,100.59
	TOTAL	97	222,823.26
Kestel	Barakfakih	12	28,994.55
	Dudaklı	11	11,579.51
	Gölbaşı	8	22,794.87
	Narlıdere	16	13,446.60
	Seymen	50	273,649.62
	TOTAL	**97**	**350,465.15**
Yenişehir	Akdere	86	477112.67
	Barçın	27	185096.1
	Çamönü	9	17789.6
	Çardak	13	135,648.57
	Çayır	100	717941.34
	Ebeköy	61	263359.32
	Hamidiye	2	9,260.00
	Hayriye	59	228156.49
	Karaköy	32	330515
	Köprühisar	82	468521.82
	Marmaracıkgöl	4	314,180.82
	Mekir	5	441,008.28
	Papatya	71	387553
	Tabakhane	16	166274
	Terziler	5	18069.73
	TOTAL	**572**	**4160486.74**
Osmaneli	Büyükyenice	23	40324.52

District	V/N	Affected Parcel No	Affected Lands m²
	Camicedit	111	379286.65
	Camikebir	22	67362.3
	Çiftlik	8	32617.11
	Dereyörük	9	28777.45
	Düzmeşe	27	139254.28
	Haceloğlu	47	131437
	Orhaniye	3	3422.43
	TOTAL	**250**	**822481.74**

Access to ecosystem services

Forest lands, pasture lands and river use related to access to ecosystem services were questioned. Although Nilüfer River passes through most of the places within its impact area, it has been stated that the pollution rate is quite high due to the industrial wastes in the vicinity and it is not used. This is followed by Karacabey. The required forest lands are mainly within the borders of Osmaneli District.

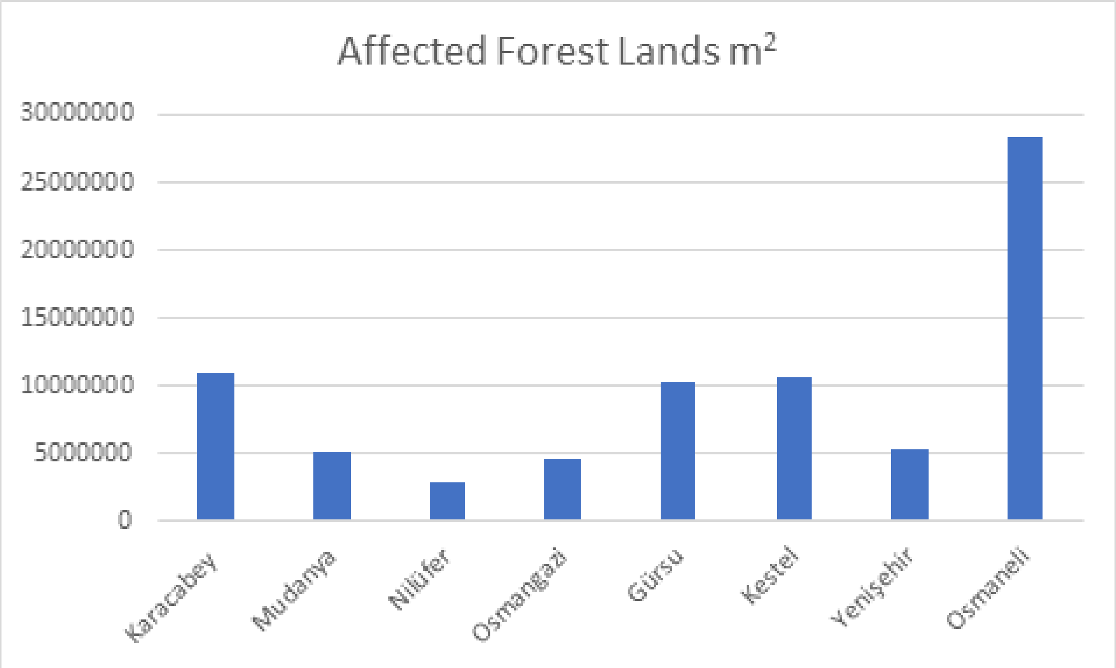


Figure 103 Affected forest lands distribution along the BBYO Route

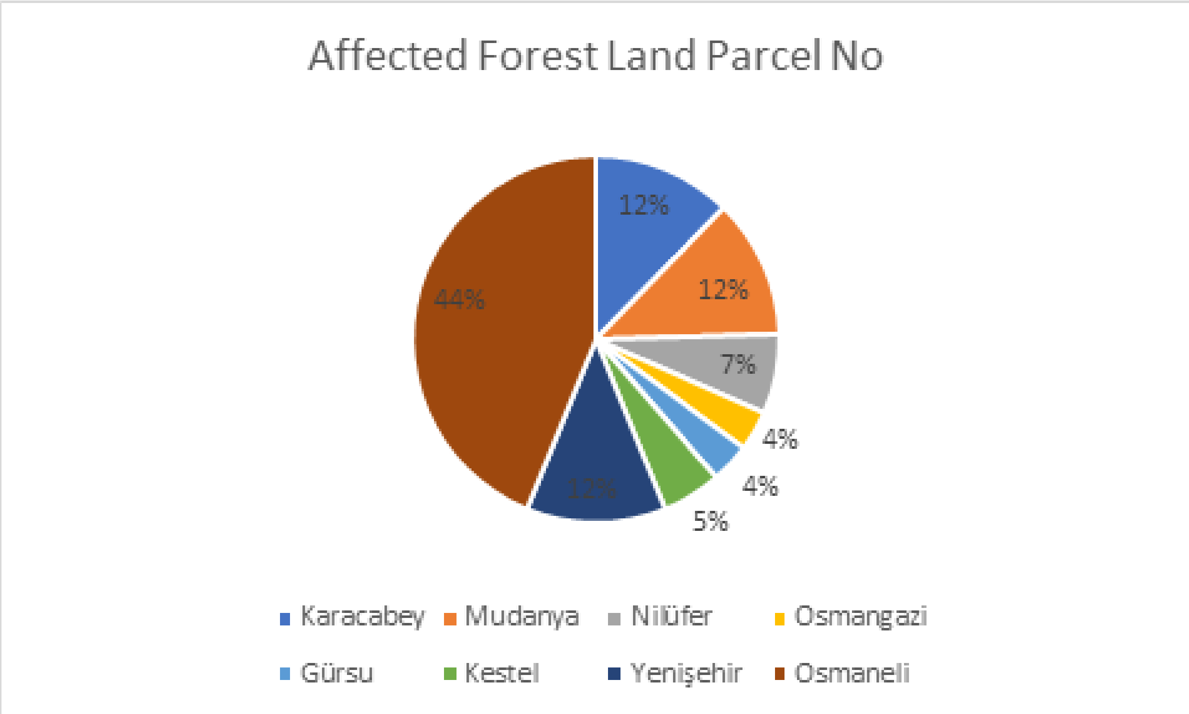


Figure 104 Affected forest lands distribution along the BBYO Route

Total of 47 parcels and 6505731.99 m^2 pasture land will be affected according to the desktop research. Affected pasture lands are located in Bandırma, Karacabey, Mudanya, Nülüfer Osmangazi and Yenişehir districts.

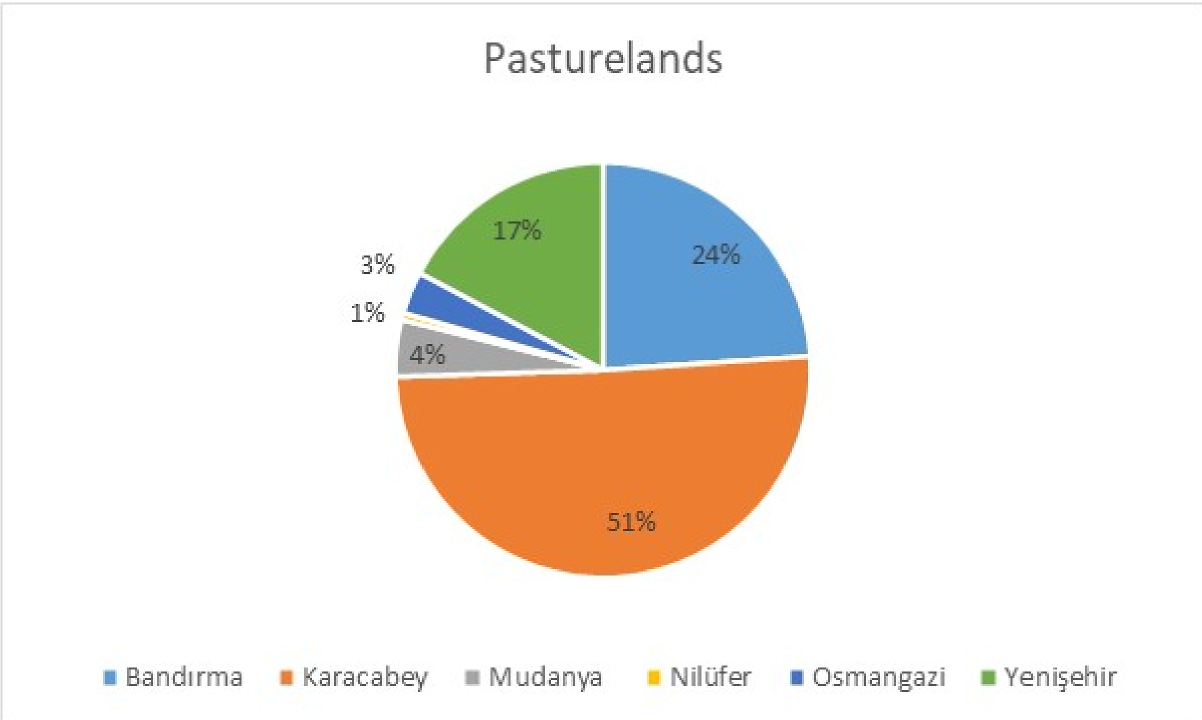


Figure 105 Affected pastureland distribution along the BBYO Route

Temporary loss or disruption of livelihood activities

Project vehicle movements and other construction activities can accidentally damage crops near the Project site or along the transportation road.

8.3.4.1.2 Operation Phase

During operation phase, the most likely potential impact would be the access to the agricultural lands in case of absence of the insufficient passageways including overpass and underpass. According to the results of the socioeconomic surveys al settlements expect sufficient number of access points to the agricultural lands.

8.3.4.1.3 Decommissioning and Closure Phase

After the operation phase, new beneficial land use impact may occur due to changed conditions at the route, The lands that will be used for the project should be rehabilitated and transferred to the local communities for the agricultural production purposes.

8.3.4.2 Mitigation Measures

- Physical and economic displacement impacts will be minimized during the design phase of the Project before the land acquisition of Section-1 and Section-3.
- Resettlement Action Plan and Livelihood Restoration Plan will be prepared and implemented to bridge the gaps between Turkish Expropriation Law and IFC PS-5.
- Vulnerable people that will be affected by the land acquisition will be determined and specific assistance will be provided including transportation and legal.
- During the recruitment process priority will be provided to people whom lost their livelihoods as a result of the establishment of the Project.
- All construction works will be continues within the borders of the designated areas and in case of an unplanned damage, loss of the affected PAPs will be compensated by the contractors.
- Before the start of the construction, the land owners/users will be allowed to harvest their crops and they will be informed in a timely manner.
- Community Liaison Officer will be hired and monitor the land acquisition process and collect grievances.
- If compensation alone is not sufficient to restore livelihoods, implementation of livelihood restoration in accordance with IFC requirements.
- Grievance mechanism will be established.
- Impacts to agricultural and pasture lands will be minimized as far as possible by keeping the Project construction footprint as narrow as possible, and efficiently restoring any damaged areas.
- Any business losses will be compensated at a full replacement value.
- All of the disturbed sites will be rehabilitated as appropriate and agreed upon, following the completion of construction works.
- Access roads will be constructed in parallel to the railway near agricultural areas and pasture areas to prevent the livelihood impacts.
- Any loss of or damage to crops caused by Project activities will be compensated.

- During operation it is essential that the water intake structures, dams, pipelines, canals and other structures be regularly inspected and be periodically maintained to ensure proper conveyance of water, avoid stagnation and prevent flooding and damages.

8.3.4.3 Residual Impacts

8.3.4.3.1 Construction Phase

All impacts caused by the resettlement and land acquisition have negative nature. The impact value of resettlement is assessed as very high high, loss of agriculture is high and access to ecosystem services is medium and the temporary land requirement and possible damage assessed as low. The frequency of all impacts are highly frequent, before the implementation of the proposed mitigation measures. The impact on the land acquisition and resettlement is expected to reduce to between medium and negligible proper compensation to the PAPs as sensitive receptors.

Table 177 Impact Assessment Matrix for Resettlement and Land Acquisition Construction Phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
Physical displacement	Duration:	Medium-long	Very high	Irreversible	**Very high**	Medium-high	**Medium**
	Frequency:	Highly frequent					
	Geo. Extent:	Regional					
	Intensity:	Medium					
Loss of agricultural land	Duration:	Medium-long	Very high	Mid-term	**High**	High	**Negligible**
	Frequency:	Highly frequent					
	Geo. Extent:	Regional					
	Intensity:	Medium					
Access to ecosystem services	Duration:	Medium-long	Medium	Mid term	**Medium**	High	Negligible
	Frequency:	Highly frequent					
	Geo. Extent:	Regional					
	Intensity:	Medium					
Temporary loss of livelihoods	Duration:	Medium-long	Medium-low	Short- term	**Negligible**	High	Negligible
	Frequency:	Highly frequent					
	Geo. Extent:	Regional					
	Intensity:	Medium					

8.3.4.3.2 Operation Phase

The overpasses and underpasses and have been included in the design to ensure access of local people to agricultural lands. However, comparing with the previous access conditions, long term access impact may be experience at the local level. The impact value before mitigation is assessed as high and wit the provision of the sufficient access points this impact is expected to reduce medium.

Table 178 Impact Assessment Matrix for Resettlement and Land Acquisition Construction Phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
	Duration:	Long	Medium high	Long term	**High**	Medium-high	**Medium**

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
Access to agricultural lands	Frequency:	Moderately frequent					
	Geo. Extent:	Local					
	Intensity:	Medium					

8.3.4.3.3 Decommissioning and Closure Phase

During decommissioning phase, the route can be rehabilitated and converted alternative uses by local communities.

8.3.4.4 Monitoring

- Overall spending on land acquisition
- Number of employees and consultants involved to the process
- Total number of private and governmental lands
- Total numbers of untitled land
- Total number of vulnerable people
- Number of agreed and non- agreed land plots
- Number and type of grievances, including legal actions arising from expropriation
- Number of vulnerable persons/households assisted
- Number of people whom were able to restore their livelihoods
- Conducting the monitoring activities within the scope of RAP and LRP to be prepared for the Project

8.3.5 Infrastructure and Services

8.3.5.1 Impact Analysis

8.3.5.1.1 Construction Phase

Education

Project activities are not anticipated to create an impact on education services during the construction phase, since the education service is being provided online during Covid-19.

Health

Influx of the Project workers may create pressure on the local health services. According to the baseline information there is no health facility in Danişment,Hayırlar, Evciler, Badırga, Dedeköy, Çiftlik, Balçıkhisar, İnönü and Camikebir villages and neighbourhoods. Muratlı, Ahmet Yesevi, Ebeköy and Düzmeşe has primary health care facilities where workers accommodations will be established. It has been observed thatexixting health services in AoI may not be able to provide service in case of increased demand especially considering the Covid-19.

Transportation

The potential impacts on the local road network as a result of the construction activities (i.e. transportation workers, material and equipment, waste disposal, etc.) are disruption to traffic and transportation due to road crossings and damage to local roads from heavy traffic movement to and from associated facilities..

Water

There are concerns regarding water infrastructure, especially in settlements where agriculture is the main source of income. It has been stated that in Osmangazi, Gürsu and Kestel districts, where construction is ongoing, spring and groundwater were affected by the tunnel and irrigation pipes of agricultural lands were damaged. Because it is a linear project, there are concerns about the same issues in Section-1 and Section-3.

8.3.5.1.2 Operation Phase

During the operation phase of the Project various provinces will be connected and the transportation from the Districts to the provinces is expected to ease connection to the health and education services and the industrial areas. The Project will provide the local communities accessibility to social, health and educational services and the pressure on the highway transportation will be reduced.

8.3.5.1.3 Decommissioning and Closure Phase

During the decommissioning phase, Project infrastructure will be removed from the Project site as much as possible. This will involve the transportation of such infrastructure from the Project site, which is likely to be conducted by road.

8.3.5.2 Mitigation Measures

- An Emergency Preparedness and Response Plan will be prepared and implemented during the construction phase of the Project.
- A traffic management plan will be prepared and implemented.
- Before the establishment of the construction and the workers accommodation an engagement with the local authorities including the Municipalities will be held and energy, transportation and water demand of the Project will be shared.
- Workers accommodation will provide health service to Project workers to not create pressure on the health services of the local communities.
- At minimum first aid and medical unit will be established.
- District or province government hospitals will be used when required.
- In case of a damage on the local infrastructure including but not limited to telecommunication, electricity, road and water sources immediate maintenance will be applied.
- A Project specific Grievance Mechanism will be used to record, avoid and solve the incident caused by the Project on the local infrastructure.

8.3.5.3 Residual Impacts

8.3.5.3.1 Construction Phase

The impacts regarding the infrastructure during the construction phase is observed to be negative and in regional extent. All of the potential impacts may cause high receptor sensitivity due to insufficient infrastructure services in the region, therefore, the overall impacts prior to mitigation measures are medium. The extent of the Project's impact is expected to be in regional level without any mitigation measures. With the implementation of proposed mitigation measures, the extent of the infrastructure related impacts are expected to be reduced.

Table 179 Impact Assessment Matrix for Impact on Infrastructure and Services Construction Phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
Health	Duration:	Medium-short	Medium	Short-term	**Negligible**	High	**Negligible**
	Frequency:	Sporadic					
	Geo. Extent:	Local					
	Intensity:	Negligible					
Transportation	Duration:	Medium-long	Medium-high	Mid-term	**Medium**	Medium	**Negligible**
	Frequency:	Moderately frequent					
	Geo. Extent:	Regional					
	Intensity:	Medium					
Water sources	Duration:	Medium-long	Medium-high	Short term	**Negligible**	Medium	**Negligible**
	Frequency:	Sporadic					
	Geo. Extent:	Project footprint					
	Intensity:	Medium					

8.3.5.3.2 Operation Phase

The Project will provide long term accessibility to several provinces in long term. Beyond the regional level better accessibility to social, health and educational services will be provided. With the usage of the railway, road traffic and travel time will also reduce. The assessment is provided in below table.

Table 180 Impact Assessment Matrix for Infrastructure and Services Operation Phase

Impact Factor	Impact Factor Features		Component Sensitivity	Impact Features - Reversibility	Impact Value	Mitigation effectiveness	Residual impact value
Infrastructure and Services	Duration:	Long	Medium high	Long term	**Very High**	High	**Very High**
	Frequency:	Highly frequent					
	Geo. Extent:	Beyond Regional					
	Intensity:	High					

8.3.5.3.3 Decommissioning and Closure Phase

A new impact is not expected other than those listed in the construction phases in the decommissioning and closure phase of the Project.

8.3.6 Cultural Heritage

Based on the desktop and filed work studies, a total of 56 archaeological and cultural heritage sites were located. Among them are also archaeological areas that are known to be previously registered such as the area called "Watchtowers" which is within the borders of Bilecik and "Koyunhisar Mound" which is within the Bursa Yenişehir District.

The numbering of the discovered archaeological areas was realized through the coding as Cultural Heritage Area "CHA" (see **Table *182***). The numbering was realized by taking into consideration the facts such as the interaction of the area with the Project field or its distance to it. This categorization and coloring is used in topographic maps (see Appendix G).

Table 181 Color Categorization by Effect

Code	Color	Distance to Route Axis	Explanation
CHA01		On the route	High Risk
CHA02		0-50 m	Risky
CHA03		50-100 m	Medium
CHA04		100-150 m	Low
CHA05		Above 150 m	No Effect

For the receptor sensitivity and importance of discovered areas from the Project route please see **Figure *106*** and **Table *182***.

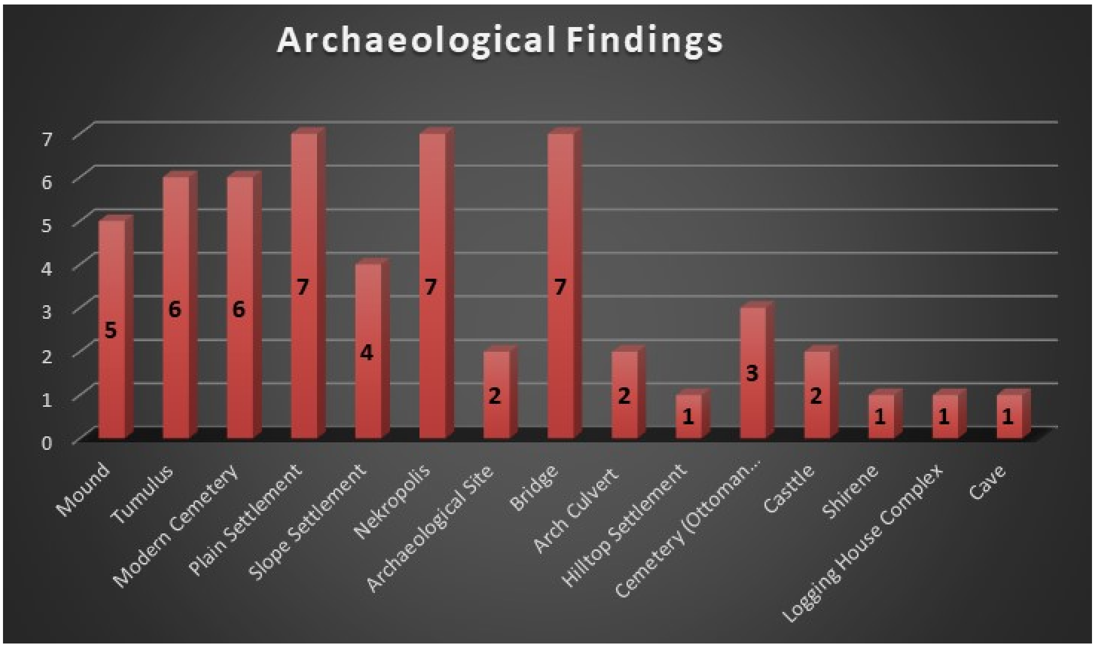


Figure 106 Statistics of Archaeological Findings

Some of the discovered areas were seen to be directly affected by the Project route whereas others were located around its close vicinities.

In terms of intangible cultural heritage, localities that were frequently visited by the locals, routes used by the migrating communities, festivals or religious events held at the settlements on the route stand out as the most possible factors that will be affected during the construction period by the increasing of human or vehicle traffic around the region. None of the visiting areas will likely be damaged from the activities along the route. The construction traffic should be limited or even halted for some time during the periods of intense human and traffic flows to the region.

Based on the conducted desktop study ve field survey, the following control measures will be implemented in the Project:

- The routes in Section 1 and Section 2 have been finalized and the construction activities are currently ongoing in Section 2. Based on the cultural heritage findings in Section 1 and Section 2, operators should act in accordance with the decisions that will be taken by the Museum Directorate or Provincial Regional Board for Preservation of Cultural and Natural Assets.
- Based on the fact that the Project route in Section 3 is not yet finalized, route change is proposed at the identified archaeological areas which lie directly on the construction area of the Project route, such as Kazçeşme mevkii Settlement, İncirli Çeşme Mevkii, Halvadca Çeşme Slope Settlement, Söğütçe Çeşme Mevkii SettlementSlope Settlement. If a route change is impossible then the Project operators should act in accordance with the decisions that will be taken by the Museum Directorate or Balıkesir Regional Board for Preservation of Cultural and Natural Assets.
- Cultural Heritage Management Plan and Chance Find Procedure, which are necessary for the management of the “chance finds” is prepared within the scope of this ESIA (Appendix G). All operators, who are to be engaged in the soil works, and project workers should receive training related to “project requirements, protection of cultural and archaeological heritage, laws and legislations related with the archaeological and cultural heritage and cultural heritage management plan and chance find procedures”.
- The construction activities around the identified cultural heritage findings shall be conducted with archaeological on-site monitoring.

Table 182 List of Archaeological Findings

No	Site Name	Province	District/ Village	Ranking Degree	Grading	Descriptions
1	Building Remains	Bursa	Nilüfer/ Doğanköy	1	**Negligible**	Assets with little or no surviving archaeological interest.
2	Building Remains	Bursa	Nilüfer/ Doğanköy			Assets with little or no surviving archaeological interest.
3	Ancient Bridge Abutment	Bursa	Karacabey/ Taşlık			Assets with little or no surviving archaeological interest.
4	Inönü Tumulus	Bilecik	Osmaneli/ İnönü	2	**Low**	Assets compromised by poor preservation and/or poor survival of contextual associations.
5	Büyükyenice Cemetery	Bilecik	Osmaneli/ İnönü			Designated or undesignated assets of local importance.
6	Büyükyenice Necropolis	Bilecik	Osmaneli/ İnönü			Designated or undesignated assets of local importance.
7	Osmaneli Modern Cemetery	Bilecik	Osmaneli/ Camicedit			Designated or undesignated assets of local importance.
8	Ebeköy Plain Settlement	Bursa	Yenişehir/ Ebeköy			Assets of limited value, but with potential to contribute to local research objectives.
9	Akdere Cemetery	Bursa	Yenişehir/ Akdere			Designated or undesignated assets of local importance.
10	Çardak Logging House Complex	Bursa	Yenişehir/ Çardak			Assets compromised by poor preservation and/or poor survival of contextual associations.

No	Site Name	Province	District/ Village	Ranking Degree	Grading	Descriptions
11	Tulumbayanı Mevki Settlement	Bursa	Yenişehir/ Marmaracık			Assets of limited value, but with potential to contribute to local research objectives.
12	Narlıdere Village Cemetery	Bursa	Kestel/ Narlıdere			Designated or undesignated assets of local importance.
13	Narlıdere Ottoman Settlement	Bursa	Kestel/ Narlıdere			Assets compromised by poor preservation and/or poor survival of contextual associations.
14	Karahıdır Ottoman Settlement	Bursa	Gürsu/ Karahıdır			Assets compromised by poor preservation and/or poor survival of contextual associations.
15	Tepeköy Geçidi Settlement	Bursa	Nilüfer/ Yolçatı			Assets compromised by poor preservation and/or poor survival of contextual associations.
16	Badırga Village Cemetery	Bursa	Nilüfer/ Badırga			Designated or undesignated assets of local importance.
17	Hoca Çeşme Mevkii Mill	Bursa	Karacabey/ Çeşnigir			Assets compromised by poor preservation and/or poor survival of contextual associations.
18	Taşlık village Cemetery	Bursa	Karacabey/ Taşlık			Designated or undesignated assets of local importance.
19	Şahinköy Cemetery	Bursa	Karacabey/ Şahinköy			Designated or undesignated assets of local importance.
20	Tophisar Village Cemetery	Bursa	Karacabey/ Tophisar			Designated or undesignated assets of local importance.
21	Halvadca Çeşme Slope Settlement	Balıkesir	Bandırma/ Yeşilçomlu			Assets compromised by poor preservation and/or poor survival of contextual associations.

No	Site Name	Province	District/ Village	Ranking Degree	Grading	Descriptions
22	Karakova Mevkii Tumulus	Balıkesir	Bandırma/ Kuşcenneti			Assets compromised by poor preservation and/or poor survival of contextual associations.
23	İnönü Necropolis	Bilecik	Osmaneli/ İnönü	3	**Medium**	Designated or undesignated assets that can contribute significantly to regional research objectives.
24	Büyükyenice Tumulus	Bilecik	Osmaneli/ İnönü			Designated or undesignated assets that can contribute significantly to regional research objectives.
25	Düzmeşe Roman Settlement	Bilecik	Osmaneli/ Düzmeşe			Designated or undesignated assets that can contribute significantly to regional research objectives.
26	Kuletepe Necropolis	Bilecik	Osmaneli/ Orhaniye			Designated or undesignated assets that can contribute significantly to regional research objectives.
27	Küçükyenice Necropolis	Bursa	Mudanya/ Balabancık			Designated or undesignated assets that can contribute significantly to regional research objectives.
28	İnkaya Cave	Bursa	Karacabey/ İnkaya			Designated or undesignated assets that can contribute significantly to regional research objectives.
29	Ottoman Bridge	Bursa	Karacabey/ Taşlık			Designated or undesignated assets that can contribute significantly to regional research objectives.
30	Harmanlı Slope Settlement	Bursa	Karacabey/ Harmanlı			Designated or undesignated assets that can contribute significantly to regional research objectives.
31	Late Ottoman Bridge 1	Balıkesir	Bandırma/ Doğruca			Designated or undesignated assets that can contribute significantly to regional research objectives.
32	Late Ottoman Bridge 2	Balıkesir	Bandırma/ Doğruca			Designated or undesignated assets that can contribute significantly to regional research objectives.

No	Site Name	Province	District/ Village	Ranking Degree	Grading	Descriptions
33	Late Ottoman Bridge 3	Balıkesir	Bandırma/ Doğruca			Designated or undesignated assets that can contribute significantly to regional research objectives.
34	Arch Culvert 1	Balıkesir	Bandırma/ Doğruca			Designated or undesignated assets that can contribute significantly to regional research objectives.
35	Arch Culvert 2	Balıkesir	Bandırma/ Doğruca			Designated or undesignated assets that can contribute significantly to regional research objectives.
36	Late Ottoman Bridge 4	Balıkesir	Bandırma/ Doğruca			Designated or undesignated assets that can contribute significantly to regional research objectives.
37	Doğruca Hilltop settlement	Balıkesir	Bandırma/ Doğruca			Designated or undesignated assets that can contribute significantly to regional research objectives.
38	Düzmeşe Tumulus	Bilecik	Osmaneli/ Düzmeşe	4	High	Undesignated sites of the quality and importance to be designated
39	Kuletepe Mound and Castle	Bilecik	Osmaneli/ Orhaniye			Nationally-designated Archaeological Monuments protected by the State Party's laws
40	Akdere Mound	Bursa	Yenişehir/ Akdere			Undesignated sites of the quality and importance to be designated
41	Üyücek Hill Mound	Bursa	Yenişehir/ Karaköy			Undesignated sites of the quality and importance to be designated
42	Çardak Mound	Bursa	Yenişehir/ Çardak			Undesignated sites of the quality and importance to be designated
43	Koyunhisar Mound	Bursa	Yenişehir/ Koyunhisar			Nationally-designated Archaeological Monuments protected by the State Party's laws

No	Site Name	Province	District/ Village	Ranking Degree	Grading	Descriptions
44	Nilufer Hatun Bridge	Bursa	Nilüfer/ Doğanköy			Nationally-designated Archaeological Monuments protected by the State Party's laws
45	Gökçetepe Tumulus	Bursa	Nilüfer/ Doğanköy			Undesignated sites of the quality and importance to be designated
46	Tepeköy Geçidi Mound	Bursa	Nilüfer/ Yolçatı			Undesignated sites of the quality and importance to be designated
47	Orhaniye Necropolis	Bursa	Mudanya/ Orhaniye			Undesignated sites of the quality and importance to be designated
48	Badırga Village Alevi Cemetery	Bursa	Nilüfer/ Badırga			Nationally- designated areas or activities associated with globally- important Intangible Cultural Heritage activities .
49	Irmak Baba Alevi Turbe	Bursa	Nilüfer/ Badırga			Nationally- designated areas or activities associated with globally- important Intangible Cultural Heritage activities .
50	Hoca Çeşme Mevkii Tumulus	Bursa	Karacabey/ Çeşnigir			Undesignated sites of the quality and importance to be designated
51	Casttle and Mound	Bursa	Karacabey/ Tophisar			Nationally-designated Archaeological Monuments protected by the State Party's laws
52	Tumulus and Necropol	Balıkesir	Bandırma/ Yeşilçomlu			Undesignated sites of the quality and importance to be designated
53	Kazçeşme mevkii Settlement	Balıkesir	Bandırma/ Yeşilçomlu			Undesignated sites of the quality and importance to be designated
54	İncirli Çeşme Mevkii Necropolis	Balıkesir	Bandırma/ Yeşilçomlu			Undesignated sites of the quality and importance to be designated

No	Site Name	Province	District/ Village	Ranking Degree	Grading	Descriptions
55	İncirli Çeşme Mevkii Slope Settlement	Balıkesir	Bandırma/ Yeşilçomlu			Undesignated sites of the quality and importance to be designated
56	Söğütçe Çeşme Mevkii Settlement	Balıkesir	Bandırma/ Kuşcenneti			Undesignated sites of the quality and importance to be designated

The preliminary works and archaeological surveys made possible the discovery of 56 archaeological findings. Many archaeological findings were discovered for the first time within the scope of this Project.

Around 20 archaeological findings from the total of 56 were recorded to overlap with the Project route. The remaining 36 archaeological findings are located out of the Project route. The necessary preventive measures that should be taken for these findings during the construction phase are listed within ESIA and its appendix of Cultural Heritage Management Plan.

These newly discovered archaeological findings will be reported to the responsible Museum Directorates before the commencing of construction activities for their on-site inspections. Following the inspections of the Museum Directorates the findings will be evaluated by the directorates of the Regional Boards for Preservation of Cultural and Natural Assets in relation to the Law numbered 2863. At this point, all decisions that will be taken related to the findings that overlap with the Project route will be abided.

As the primary goal of the Project is to prevent any possible damage on the archaeological and cultural heritage assets the possible route changes on localities where the route had overlapped with archaeological findings were expeditiously re-considered by the Project Engineering Department. Through this re-consideration route changes were realized in the Project. In locations where a route change is impossible as a result of different factors (closeness to a settlement, geological factors or other limitations etc.) a submission will be made to the responsible bodies of the Ministry of Culture and Tourism by a technical justification. Following this process, the Project operators will act in accordance with the decisions that will be taken by the Museum Directorate or Relevant Regional Board for Preservation of Cultural and Natural Assets.

The protection of the cultural heritage assets that overlap with the Project route will be achieved through preliminary fieldworks or, if needed, by salvage excavations. The permissions for those activities will be taken prior to the construction phase and will be under the control of the Museum Directorates. Plans for simultaneous activities will be made for localities where multiple overlappings are evident. These will in the end enable the fast progress of the work as well as prevent any delays.

Current state of this process, of which routes changes were already realized whereas archaeological field operations are still pending, are supplied in Table 183 and Table 184 in the form of an impact assessment table.

Table 183 Color Categorization by Effect

Code	Color	Distance to Route Axis	Explanation
CHA01		On the route	High Risk
CHA02		0-50 m	Risky
CHA03		50-100 m	Medium
CHA04		100-150 m	Low
CHA05		Above 150 m	No Effect

Table 184 Status of Archaeological Findings

No	Site Name	Province	District/ Village	Registered		Information will be taken for Museum	Approximately Distance Between Route, Archaeological Survey	Old Situation for Critical Archaeological site	Approximately Distance Between Route, After Route Evaluation	New Situation for Critical Archaeological Site	Actions Taken	Residual Risk
				Yes	No							
1	İnönü Necropolis	Bilecik	Osmaneli/ İnönü		X	X	On the Route axis		10 m		Preliminary Work Under the Supervision of Museum Directorate	
2	Inönü Tumulus	Bilecik	Osmaneli/ İnönü		X	X	65 m				Archaeological monitoring during all construction activities	
3	Büyükyenice Cemetery	Bilecik	Osmaneli/ İnönü		X	X	25 m				Archaeological monitoring during all construction activities	
4	Büyükyenice Necropolis	Bilecik	Osmaneli/ İnönü		X	X	On the Route axis		On the route axis		Preliminary Work Under the Supervision of Museum Directorate	
5	Büyükyenice Tumulus	Bilecik	Osmaneli/ İnönü		X	X	55 m				Archaeological monitoring during all construction activities	
6	Osmaneli Modern Cemetery	Bilecik	Osmaneli/ Camicedit		NA	NA	8 m				Archaeological monitoring during all construction activities	
7	Düzmeşe Roman Settlement	Bilecik	Osmaneli/ Düzmeşe		X	X	On the Route axis		On the route axis		Preliminary Work Under the Supervision of Museum Directorate	
8	Düzmeşe Tumulus	Bilecik	Osmaneli/ Düzmeşe		X	X	On the Route axis		15 m		Archaeological monitoring during all construction activities	
9	Kuletepe Mound and Castle	Bilecik	Osmaneli/ Orhaniye	X		X	On the Route axis		55 m		Archaeological monitoring during all construction activities	
10	Kuletepe Necropolis	Bilecik	Osmaneli/ Orhaniye		X	X	70 m		15 m		Archaeological monitoring during all construction activities	
11	Ebeköy Flat Settlement	Bursa	Yenişehir/ Ebeköy		X	X	On the route axis		On the route axis		Archaeological monitoring during all construction activities	
12	Akdere Mound	Bursa	Yenişehir/ Akdere		X	X	On the route axis		On the route axis		Preliminary Work Under the Supervision of Museum Directorate	
13	Akdere Cemetery	Bursa	Yenişehir/ Akdere		X	X	55 m		25 m		Archaeological monitoring during all construction activities	

No	Site Name	Province	District/ Village	Registered		Information will be taken for Museum	Approximately Distance Between Route, Archaeological Survey	Old Situation for Critical Archaeological site	Approximately Distance Between Route, After Route Evaluation	New Situation for Critical Archaeological Site	Actions Taken	Residual Risk
				Yes	No							
14	Üyücek Hill Mound	Bursa	Yenişehir/ Karaköy		X	X	165 m		20 m		Preliminary Work Under the Supervision of Museum Directorate	
15	Çardak Mound	Bursa	Yenişehir/ Çardak		X	X	290 m		50 m		Archaeological monitoring during all construction activities	
16	Çardak Logging House Complex	Bursa	Yenişehir/ Çardak		X	X	5 m		320 m		Archaeological monitoring during all construction activities	
17	Koyunhisar Mound	Bursa	Yenişehir/ Koyunhisar	X		X	On the route axis		On the route axis		Preliminary Work Under the Supervision of Museum Directorate	
18	Tulumbayanı Mevki Settlement	Bursa	Yenişehir/ Marmaracık		X	X	On the route axis		60 m		Archaeological monitoring during all construction activities	
19	Narlıdere Village Cemetery	Bursa	Kestel/ Narlıdere		NA	NA	50 m				Archaeological monitoring during all construction activities	
20	Narlıdere Ottoman Settlement	Bursa	Kestel/ Narlıdere		X	X	20 m				Archaeological monitoring during all construction activities	
21	Karahıdır Ottoman Settlement	Bursa	Gürsu/ Karahıdır		X	X	On the route axis				Archaeological monitoring during all construction activities	
22	Nilufer Hatun Bridge	Bursa	Nilüfer/ Doğanköy	X		NA	50 m				Archaeological monitoring during all construction activities	
23	Building Remains	Bursa	Nilüfer/ Doğanköy		X	X	10 m				Archaeological monitoring during all construction activities	
24	Building Remains	Bursa	Nilüfer/ Doğanköy		X	X	28 m				Archaeological monitoring during all construction activities	
25	Gökçetepe Tumulus	Bursa	Nilüfer/ Doğanköy		X	X	64 m				Archaeological monitoring during all construction activities	
26	Tepeköy Geçidi Settlement	Bursa	Nilüfer/ Yolçatı		X	X	25 m				Archaeological monitoring during all construction activities	
27	Tepeköy Geçidi Mound	Bursa	Nilüfer/ Yolçatı		X	X	On the route axis				Route change will be evaluated by construction team.	
28	Küçükyenice	Bursa	Mudanya/		X	X	88 m				Archaeological monitoring during	

No	Site Name	Province	District/ Village	Registered		Information will be taken for Museum	Approximately Distance Between Route, Archaeological Survey	Old Situation for Critical Archaeological site	Approximately Distance Between Route, After Route Evaluation	New Situation for Critical Archaeological Site	Actions Taken	Residual Risk
				Yes	No							
	Necropolis		Balabancık								all construction activities	
29	Orhaniye Necropolis	Bursa	Mudanya/ Orhaniye		X	X	150 m				Archaeological monitoring during all construction activities	
30	Badırga Village Alevi Cemetery	Bursa	Nilüfer/ Badırga		NA	NA	85 m				Archaeological monitoring during all construction activities	
31	Badırga Village Cemetery	Bursa	Nilüfer/ Badırga		NA	NA	300 m				Archaeological monitoring during all construction activities	
32	Irmak Baba Alevi Turbe	Bursa	Nilüfer/ Badırga		X	X	410 m				Archaeological monitoring during all construction activities	
33	İnkaya Cave	Bursa	Karacabey/ İnkaya		X	X	930 m				Archaeological monitoring during all construction activities	
34	Hoca Çeşme Mevkii Mill	Bursa	Karacabey/ Çeşnigir		X	X	260 m				Archaeological monitoring during all construction activities	
35	Hoca Çeşme Mevkii Tumulus	Bursa	Karacabey/ Çeşnigir		X	X	On the Route Axis				Archaeological monitoring during all construction activities	
36	Ancient Bridge Abutment	Bursa	Karacabey/ Taşlık		X	X	On the route axis				Route change will be evaluated by construction team.	
37	Ottoman Bridge	Bursa	Karacabey/ Taşlık		X	X	On the route axis				Route change will be evaluated by construction team.	
38	Taşlık village Cemetery	Bursa	Karacabey/ Taşlık		NA	NA	23 m				Archaeological monitoring during all construction activities	
39	Şahinköy Cemetery	Bursa	Karacabey/ Şahinköy		X	X	On the route axis				Route change will be evaluated by construction team.	
40	Casttle and Mound	Bursa	Karacabey/ Tophisar	X		X	103 m				Archaeological monitoring during all construction activities	
41	Tophisar Village Cemetery	Bursa	Karacabey/ Tophisar		NA	NA	50 m				Archaeological monitoring during all construction activities	
42	Harmanlı Slope Settlement	Bursa	Karacabey/ Harmanlı		X	X	On the route axis				Route change will be evaluated by construction team.	
43	Tumulus and	Balıkesir	Bandırma/		X	X	77 m				Archaeological monitoring during	

No	Site Name	Province	District/ Village	Registered		Information will be taken for Museum	Approximately Distance Between Route, Archaeological Survey	Old Situation for Critical Archaeological site	Approximately Distance Between Route, After Route Evaluation	New Situation for Critical Archaeological Site	Actions Taken	Residual Risk
				Yes	No							
	Necropol		Yeşilçomlu								all construction activities	
44	Kazçeşme mevkii Settlement	Balıkesir	Bandırma/ Yeşilçomlu		X	X	On the route axis				Route change will be evaluated by construction team.	
45	İncirli Çeşme Mevkii Necropolis	Balıkesir	Bandırma/ Yeşilçomlu		X	X	105 m				Archaeological monitoring during all construction activities	
46	İncirli Çeşme Mevkii Slope Settlement	Balıkesir	Bandırma/ Yeşilçomlu		X	X	On the route axis				Route change will be evaluated by construction team.	
47	Halvadca Çeşme Slope Settlement	Balıkesir	Bandırma/ Yeşilçomlu		X	X	On the route axis				Archaeological monitoring during all construction activities	
48	Söğütçe Çeşme Mevkii Settlement	Balıkesir	Bandırma/ Kuşcenneti		X	X	On the route axis				Route change will be evaluated by construction team.	
49	Karakova Mevkii Tumulus	Balıkesir	Bandırma/ Kuşcenneti		X	X	113 m				Archaeological monitoring during all construction activities	
50	Late Ottoman Bridge 1	Balıkesir	Bandırma/ Doğruca		X	X	141 m				Archaeological monitoring during all construction activities	
51	Late Ottoman Bridge 2	Balıkesir	Bandırma/ Doğruca		X	X	122 m				Archaeological monitoring during all construction activities	
52	Late Ottoman Bridge 3	Balıkesir	Bandırma/ Doğruca		X	X	121 m				Archaeological monitoring during all construction activities	
53	Arch Culvert 1	Balıkesir	Bandırma/ Doğruca		X	X	117 m				Archaeological monitoring during all construction activities	
54	Arch Culvert 2	Balıkesir	Bandırma/ Doğruca		X	X	93 m				Archaeological monitoring during all construction activities	
55	Late Ottoman Bridge 4	Balıkesir	Bandırma/ Doğruca		X	X	73 m				Archaeological monitoring during all construction activities	
56	Doğruca Hilltop settlement	Balıkesir	Bandırma/ Doğruca		X	X	10 m				Archaeological monitoring during all construction activities	

9.0 CUMULATIVE IMPACT ASSESSMENT

Cumulative impacts are defined as *"… those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones."* (IFC Good Practice Handbook: Cumulative Impact Assessment and Management).

Cumulative impacts can result from various types of interaction among different impact factors:

1) Impacts arising from the accumulation of different impact factors at a specific location or over a specific receptor; as an example the concurrent presence of the emission of noise, visual impact and shadow flicker during construction and operation at the same location;

2) Impacts arising from the same impact factor over the same receptor in a different geographic location; as an example the degradation of the same habitats in different locations may harm the population of associated species across their entire distribution area.

3) Impacts arising from the concurrent presence of impact factors caused by the Project and other development projects; as an example we can consider the emission of dust from the construction of the Project and the concurrent construction of a new road or industrial development at the same location.

The process followed for the assessment is consistent with the framework provided by IFC and illustrated in the figure below, as described in the following paragraphs.

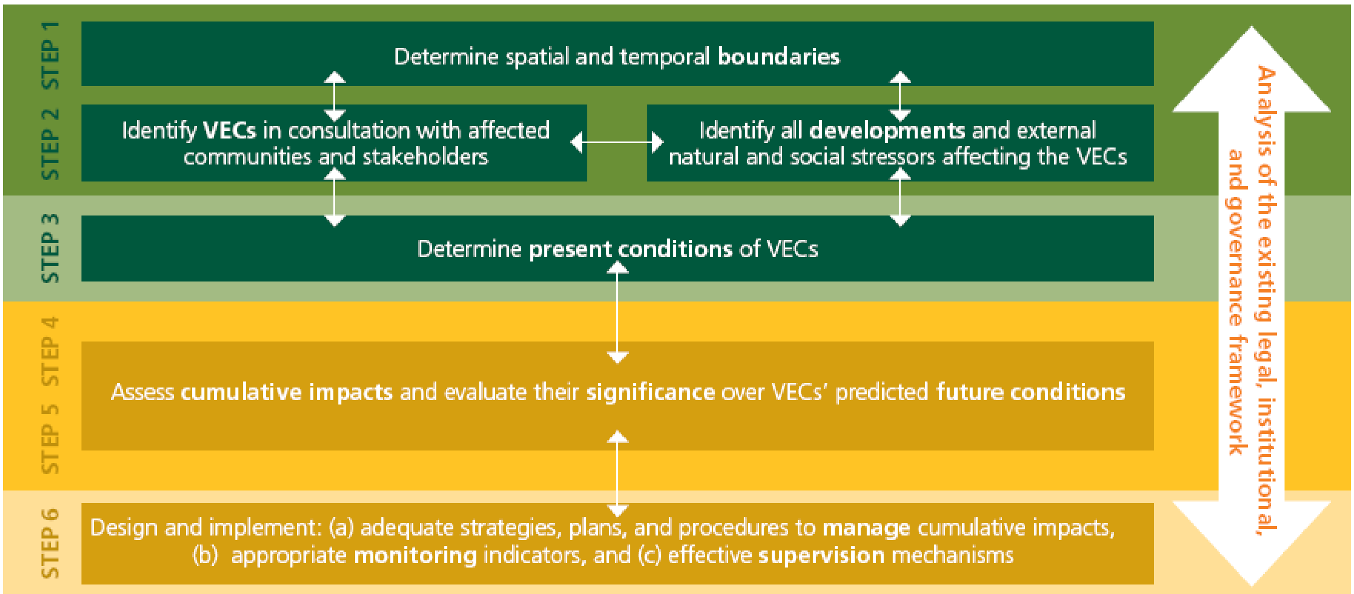


Figure 107 Cumulative Impact Assessment methodology

9.1 Step 1 – VECs, Spatial and Temporal Boundaries

9.1.1 Spatial Boundaries

The relevant spatial boundaries for this CIA are the same with each specific Area of Influence (AoI) defined in Section 6.1 for each relevant topic (physical, social, etc.).

However, for the better implementation of this CIA, the spatial boundaries for this CIA are extended within the Social components Study Area that extends to neighbouring settlements to the Project Area including the social area of influence.

9.1.2 Temporal Boundaries

The temporal boundary of the CIA contains the entire Project lifecycle (i.e., from construction until the end of closure). However, capability of reasonably predict future actions and tendencies (including the planning/implementation of other relevant projects in the region) limits the the CIA process.

Therefore, for this CIA, consideration is given to the scope that are practical for discussion and assessment of cumulative impacts with the other projects for the construction and the operation phase.

9.1.3 Valued Environmental and Social Components (VECs)

In this ESIA Report various sensitive receptors, sources and stakeholders have been identified which can be considered as VECs for the CIA. The potential identified VECs for the Project can be listed as:

- Water Resources (e.g., Kuşgölü Lake, Ulubat Lake, İznik Kale, Gölbaşı Dam, Yolçatı Pond, etc.),
- Soil Quality,
- Air Quality,
- Noise Quality,
- Climate (GHG emissions),
- Flora Species,
- Fauna Species,
- Settlements and People,
- People subjected to resettlement,
- Community Health & Safety,
- Population Stress due to Influx,
- Traffic and Infrastructure.

9.2 Step 2 – Other Activities and Environmental Drivers

The purpose of the Step-2 is to identify other projects and activities in the region that could potentially have impacts that overlap spatially and temporally with impacts of the Project on any common VECs.

Since no information could be gathered for the future period, only the projects that are likely to have a construction phase overlapping with the proposed project were considered. In this context, the closest existing/planned facilities along the BBYO route and some gathered information related to them are listed in the following table.

Table 185 Existing/planned facilities around the planned BBYO Project

Facility/Ongoing Activity	Location along the BBYO Route	Distance to the BBYO Project	Construction Period of the Project	Approximate Personnel Number	Use of Same Access Roads with BBYO Project	Location of the Camp Areas
Teknosab Organized Industrial Zone Construction	~ KM 73+000	~4 km	2018-2022	350-450	No	Bursa – Karacabey District
Emek-YHT- City Hospital Metro Line Project	~ KM 95+000	Near the Bursa Station Building	2021-2024	500-750	No	Bursa – Nilüfer District

Facility/Ongoing Activity	Location along the BBYO Route	Distance to the BBYO Project	Construction Period of the Project	Approximate Personnel Number	Use of Same Access Roads with BBYO Project	Location of the Camp Areas
General Directorate of Highways works on Yenişehir-Bilecik State Road	~ KM 120+000	Near the BBYO Route	2015-2021	250-350	Yes	Bilecik – Organized Industrial Zone
General Directorate of Highways works on İzmir-Pamukova State Road	~ KM 141+000	~6.5 km	2017-2021	150-200	No	Bursa – İznik District
General Directorate of Highways works on İznik Orhangazi State Road	~ KM 131+000	~15 km	2018-2021	150-200	No	Bursa – İznik District
Gemlik Automobile Factory and Port Construction	~ KM 58+000	~12 km	2020-2023	450-600	No	Bursa – Gemlik District

The possible environmental drivers were assessed in the CCRA and it was concluded that no significant effects are expected due to the natural hazards in the future period.

9.3 Step 3 – Establish Information on Baseline Status of VECs

Considering that the existing/planned facilities identified in Step 2 are already in construction period, the baseline studies conducted in scope of the ESIA reflects the results including the construction activities of these facilities.

Therefore, present conditions of the VECs have been established in the course of the baseline studies of the ESIA, and the results are described in Section 7. The Area of Influence (AoI) considered is sufficient to determine the present conditions in the areas where there is potential interaction between the BBYO Railway Project and the other projects considered.

9.4 Step 4 – Assess Cumulative Impacts on VECs

9.4.1 Construction Phase

As mentioned in Step 3, the cumulative impacts of the facilities identified in Step 2 on VECs for the construction period are already assessed in the Impact Assessment chapters of the ESIA since the construction periods of the existing/planned Projects and BBYO overlap.

Only VEC for the construction period that is not assessed cumulatively in the current chapters of ESIA could be specified as the population stress due to Influx in the locations where the camp areas are constructed.

Cumulative Impacts of Influx on Population

As given in Table 185, the information gathered for the existing/planned facilities, that are singled out for the assessment of cumulative impacts, are the generic personnel numbers and the location of the camps in district level.

The populations of the camp areas are compared with the population of the districts in Table 186 for each Project.

Considering that the personnel numbers are very low compared to the population of the districts, the impacts of these projects to the population in district level will be insignificant.

Table 186: Comparison of the Personnel Numbers with Populations

Facility/Ongoing Activity	Location of the Camp Areas	Approximate Personnel Number	Population of the District
Teknosab Organized Industrial Zone Construction	Bursa – Karacabey District	350-450	84,666
Emek-YHT- City Hospital Metro Line Project	Bursa – Nilüfer District	500-750	484,832
General Directorate of Highways works on Yenişehir-Bilecik State Road	Bilecik – Central District, Organized Industrial Zone	250-350	78,029
General Directorate of Highways works on İzmir-Pamukova State Road	Bursa – İznik District	150-200	44,102
General Directorate of Highways works on İznik Orhangazi State Road	Bursa – İznik District	150-200	44,102
Gemlik Automobile Factory and Port Construction	Bursa – Gemlik District	450-600	115,404

However, further researchs should be carried out and more detailed information should be obtained regarding the locations in nieghbourhood/village level of these facilities/projects in order to assess cumulative impacts of influx more precisely.

The further studies should be conducted and potential cumulative impacts of influx should be assessed in the Influx Management Plan to be prepared.

9.4.2 Commissioning and Operational Phase

Also, for the operation phase following VECs are singled out in the region considering the potential impacts of BBYO Project and other existing/planned facilities:

- Noise Quality,
- Climate (GHG emissions),
- Community Health&Safety,
- Traffic and Infrastructure.

Since the information and details regarding the operational phase of other existing/planned facilities are very limited, the cumulative impacts on these VECs for the operational phase could not be assessed at the time of this report.

Assessment of cumulative impacts on these selected VECs during operational phase will be conducted further once the Contractor handovers the site.

9.5 Step 5 – Assess Significance of Predicted Cumulative Impacts

Although the cumulative impacts for the operational phase could not be assessed in this CIA due to the lack of information, these impacts on VECs identified in Section 9.4.2 could be significant considering the impacts of BBYO Project and potential impacts of the other Projects. Therefore, proper implementation of the measures given in below section is very important for managing the potential cumulative impacts.

9.6 Step 6 – Management of Cumulative Impacts – Design and Implementation

For the management of cumulative impacts, multiple stakeholders need to be involved in a collective responsibility to eliminate or minimise the impacts. Below considerations would be needed to effectively manage the cumulative impacts:

- Kalyon will conduct a close engagement and consultation activities with the projects mentioned in this CIA.
- Collaborative planning/process for protection and enhancement of VECs.
- Collaborative planning to potential route revisions to avoid cumulative impacts on the components.
- Establish the environmental and social management system including policies, procedures and plans in order to mitigate the potential cumulative impacts especially at the locations presented in Table 185.
- The further studies should be conducted related to the details and information of the existing/planed facilities in operational phase, and cumulative impacts should be assessed in the management plans to be prepared, once the Contractor handovers the site.

Since the proposed Project will be one of the largest infrastructure projects in the region, the specific mitigation and monitoring measures described in Section 8, will be important to manage the cumulative impacts.

10.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM (ESMS)

10.1 Environmental and Social Management System Structure

The Environmental and Social Management System (ESMS) will ensure that the Project:

- complies with all applicable Turkish legislation as well as Equator Principles, World Bank Environmental and Social Standards, EBRD requirements and IFC Standards;
- implements Good International Industry Practices (GIIP) to minimize potential environmental and social impacts during the construction, operation and decommissioning phases;
- is executed in compliance with the commitments addressed in the ESIA for the minimization of potential environmental and social impacts;
- works in accordance with high standards of safety;
- cares for the protection of own employees and public;
- promotes its policies through training, supervision, regular reviews and consultation;
- generate local socio-economic benefits by using local and regional labour forces;
- engages and communicates with the local community and other stakeholders through a stakeholder engagement program.

The ESMS addresses more in detail the following environmental and social aspects:

- Environmental aspects

- Stakeholder management and social aspects
- Occupational Health and Safety, Labour Issues and community Health & Safety aspects

The ESMS included here is intended to describe the framework for the general management issues. This ESMS will be further developed and management plans will be developed to describe the minimum requirements for the implementation of the relevant management systems including the following elements:[43]

- Policy
- Identification of Risks and Impacts
- Management Programs
- Organizational Capacity and Competency
- Emergency Preparedness and Response
- Stakeholder Engagement
- External Communications and Grievance Mechanisms
- Ongoing Reporting to Affected Communities
- Monitoring and Review

10.2 Overall Environmental and Social Management System

10.2.1 Policy

A Project specific Health and Safety, Environment, Social and Human Resources Policy statements will be established and communicated with all stakeholders including the workers, subcontractors, suppliers, community members, etc. and routinely reviewed.

Kalyon Holding has established a Health, Safety and Environment Policy at corporate level, available on the company website.[44] Accordingly, Kalyon is committed to:

- To follow HSE Legislation and HSE Customer Specifications,
- To generalize zero accident culture in all employees,
- To increase HSE consciousness, participation to practices of the employees by education programs and awarding,
- To evaluate HSE risks and dangers in all activities, to take necessary precautions to eliminate or to minimize HSE dangers and risks,
- To report accidents and incidents, to research the reasons,
- To continuously improve by reviewing HSE Management System performance and to report the results to the related parties,
- To integrate the best practices in HSE field in Kalyon Group HSE Management System,
- To prevent adverse potential effects to damage the environment,

[43] IFC, Environmental and Social Management System Implementation Handbook

[44] https://kalyonholding.com/Our-Health-Safety-and-Environment-HSE-Policy

- To keep consumption of natural resources at a minimum,
- To reduce adverse effects on social environment by establishing efficient relationships with local communities.

10.2.2 Identification of Risks and Impacts

In order to identify and manage the project risks, a risk assessment study will be conducted at the beginning of the construction works and will be repeated at the beginning of each phase, in case of any changes and as per legally required intervals. The findings of this study will be taken into consideration and a detailed risk register will be prepared identifying the potential environmental, health & safety and social risks associated with the individual work items. This will be a living document and be updated during the course of the project.

10.2.3 Management Programs

As part of the ESMS, Management Plans will be established in order to avoid, minimize and compensate with the risks and impacts identified in the Project. The efficiency of the control measures established with the management plans will be verified against the objectives and targets set. The management plans will emphasize preventive and proactive actions, i.e., 1) try to avoid causing social or environmental damage; 2) if not possible, then minimize the impact; 3) if not possible, then compensate or offset the damage. Please see Section 10.3 for further details about the management plans to be prepared.

10.2.4 Organizational Capacity and Competency

An ESMS team will be established who will take the responsibility of the ESMS. The team can include environment, health and safety, operations or production, contracts and purchasing, human resources experts. The following roles and responsibilities shall be ensured in the Project.

The **Project Management** will ensure that:

- the Project will be executed in line with the Policy statements of the Project itself;
- the required resources are in place to implement the environmental and social mitigation measures identified in the ESIA.

The HSE Engineer(s)/HSE Manager will supervise the overall environmental and social management activities associated with the Project at all phases of the Project. HSE Engineer(s) will be appointed in the beginning of pre-construction activities.

The role of the HSE Engineer(s)/HSE Manager will be to:

- supervise the implementation of the environmental and social mitigation measures identified in the ESIA;
- ensure the ESMS and the associated management plans and procedures are further developed and detailed during the course of the project lifecycle;
- coordinate with Community Relations Officer the monitoring the stakeholder engagement activities being performed in line with the stakeholders programme and the public complaints are recorded and addressed.

The Community Relation Officer (CRO) will supervise the overall implementation of the social management activities of the Project. He/she reports to the Management and is responsible for the implementation and operation of the Stakeholder Engagement Plan (SEP) and in this respect acts as an interface between the BBYO Project, contractors, subcontractors and stakeholders. The CRO is responsible for implementing and organizing engagement activities described in this plan. The CRO is also responsible for monitoring the Plan implementation and for proposing corrective actions and reports to the Management. The CRO is furthermore responsible for:

- ensuring that SEP is up to date and appropriate to the nature and scale of the Project;
- proposing to the management, if necessary, amendments and/or updates to the SEP and issuing revisions.

10.2.5 Emergency Preparedness and Response

Emergency Preparedness and Response Plans will be prepared both for the construction phase and operation phases in accordance with the Regulation on Emergency Situations in Workplaces and Railway Safety Regulation. The Plans will consider the potential emergencies that would impact the work force, nearby settlements, environment and assets..

10.2.6 Stakeholder Engagement

A Project specific Stakeholder Engagement Plan has been prepared. The SEP implementation principles are presented in Section 5.

10.2.7 External Communications and Grievance Mechanisms

The community, inquiries, concerns and complaints regarding environmental and social impacts will be managed by the grievance mechanism established as part of the SEP (Section 5).

10.2.8 Ongoing Reporting to Affected Communities

The system to communicate internally and externally regarding environmental and social issues are included in the stakeholder engagement activities (Section 5).

10.3 Environmental and Social Management Plan

10.3.1 Management Mechanism

A Site HSE Manager for the Project will be appointed in the beginning of the pre-construction activities to supervise the implementation of overall environmental and social mitigation activities defined by the ESMS.

10.3.2 Construction Phase

Risks and impacts related to environmental and social issues shall be identified and assessed throughout the Project's construction phase.

The identification and assessment of environmental issues and incidents shall be performed within scope of the Project's area of influence (as defined by WB ESS1 and IFC PS 1), including the area likely to be affected by:

- Project activities and facilities that are directly owned, operated or managed as a component of the Project;
- impacts from unplanned but predictable developments caused by the Project that may occur later or at a different location;
- indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.

Kalyon will determine and sustain management plans and procedures in order to identify the environmental and social aspects of the Project, specify the mitigation measures and perform Project construction activities with minimum impact on the environment and communities.

The planning of environmental and social aspects will be performed in line with national and international standards.

Environmental and social objectives and targets shall be set at “Management Review” meetings minimum annually and assessed by the Top Management. Corrective and preventive action shall be taken, if necessary, in the event of failure to achieve the environmental objectives and targets.

Environmental and social plans and programs shall be monitored annually in order to achieve the environmental and social objectives. Such plans and programs shall set deadlines and identify the persons responsible for achieving the relevant objectives.

If and when necessary, the environmental management programs shall be amended according to regarding legislations and laws.

The basic environmental and social issues, which are addressed by the Management System for the construction phase as summarized below,

- Air emissions management
- Noise management
- Wastewater management
- Waste management
- Hazardous materials management
- Soil management
- Water and energy resources management
- Biodiversity and cultural heritage management
- Demographic profile and land use
- Stakeholder engagement
- Resettlement and livelihood
- Labour and occupational health and safety management
- Emergency response management
- Subcontractor management

10.3.3 Operation Phase

An HSE Manager will be appointed in the beginning of the operations to supervise the implementation of overall environmental and social mitigation activities defined by the ESMS.

The HSE Manager and TCDD during the operation phase will be the point of contact for Project internal and external stakeholders.

In addition to the overall management system requirements described in Section 10, the Project will develop additional operational plan and procedures as part of the environmental and social management system.

All potential environmental and social impacts of the operation phase of a railway project and mitigation measures will be considered. These will include the following, but not limited to;

- Air and noise management

- Operational railway traffic related risks and impacts management
- Wastewater management (mainly due to maintenance activities)
- Waste management (mainly due to maintenance activities)
- Management of hazardous materials (mainly due to maintenance activities and railway transportation)
- Soil management (mainly due to maintenance activities)
- Biodiversity and cultural heritage management
- Stakeholder engagement
- Labour and occupational health and safety management
- Emergency response management

10.4 Labour Issues and Health & Safety Management Plan

10.4.1 Labour Conditions

The BBYO Project will require the involvement of maximum 4300 personnel in the construction phase of the Project. The operation phase employment is not yet foreseen in the Project. Please see Section 8.3.2 for further information about the employment plan of the Project.

One shift of activity is planned for the construction phase of the Project, compromising 6 days of working in a week. It is planned to increase to number of work shifts to two especially in the summer period. Necessary notifications and permissions will be obtained before conducting any night shift activity in the Project. Weekly working hours will not exceed the 45 hours according to Labour Law No. 4857. The Project will also comply with the Covid-19 government restrictions regarding work-time.

A Project specific Human Resources and Human Rights Policy and management system will be established to manage labour rights, working conditions, worker's organisations, child/forced labour, non-discrimination and equal treatment, retrenchment, grievance mechanism, worker's engaged by third parties, security and health issues.

An employee grievance mechanism will be established during construction and operation phases.

10.4.2 Human Rights Impact Assessment

As part of the ESIA studies, Project human rights impact assessment was held to identify the mitigation methods for the potential impacts on the local communities and Project direct and indirect workers in compliance with Equator Principles IV, specifically the following clause:

"The client is expected to include assessments of potential adverse Human Rights impacts and climate change risks as part of the ESIA or other Assessment, with these included in the Assessment Documentation."

Methodology

The Human Rights impacts of the Project may be many, and they vary according to the context, type and scale of the Project. The content shall be tailored to the local conditions and to the nature and characteristics of the Project and shall address potential risk and impacts in at least the following areas:

- Civil and Political Rights
    - Freedom of expression

- Right to life and security
- Privacy

- Labour Rights
  - Child labour
  - Collective bargaining and freedom of association
  - Modern slavery (forced labour/human trafficking)
  - Grievance mechanism and remedy
  - Job security/right to work
  - Non-discrimination
  - Occupational health and safety (H&S)
  - Wages (pay equity, standard of living)
  - Working hours
- Social rights
  - Right to education
  - Right to health
  - Right to participate in the cultural life of the community
  - Right to water
  - Social insurance
- Vulnerability
  - Gender and the rights of individuals
  - Children, disabled individuals, and migrants
- The following risk classification is used in the human rights impact assessment for the pre-mitigation conditions and with the implementation of the proposed mitigation measures, the risks of the human rights aspects are reduced.

Definition	Risk Classification
Human rights violation is in place and no mitigation measure can be applicable.	High
Potential risks are in place for workers and external stakeholders but can be mitigated with appropriate control measures.	Medium
The risks are in place for workers and external stakeholders at minimal level in general and can be further mitigated with additional control measures.	Low

10.4.2.1 Legal Framework for Human Rights

National Requirements

The Constitution of the Republic of Turkey is the fundamental legal document guaranteeing respect to human rights as stated in Article 2 of Chapter II of the Constitution:

“The Republic of Turkey is a democratic, secular and social state governed by rule of law, within the notions of public peace, national solidarity and justice, respecting human rights, loyal to the nationalism of Atatürk, and based on the fundamental tenets set forth in the preamble.”

The following national legislation and international conventional will be applicable to the Project:

- Constitution of the Republic of Turkey
- The Law on the Human Rights and Equality Institution of Turkey (TIHEK) (Law No. 6701, 2016)
- Labour Law (Law No. 4857, 2003) and related regulations
- Occupational Health and Safety Law (Law No. 6331, 2012) and related regulations
- Regulation on the Implementation of the Law Concerning Private Security Services

International Requirements

The following international standards will be applicable to the Project:

- International Labour Organisation (ILO) conventions ratified by Turkey
- Equator Principles 4 (2020)
- IFC Performance Standards (2012)
- Guidance Note on Implementation of Human Rights Assessments under EPs (2020)
- IFC Good Practice Note on Managing Contractors’ E&S Performance (2017)
- IFC Good Practice Handbook on Use of Security Forces: Assessing and Managing Risks and Impacts (2017)
- IFC/European Bank for Reconstruction and Development (EBRD) Worker’s Accommodation: Processes and Standards (2009)
- IFC Handbook for Addressing Project-Induced In-Migration (2009)
- IFC Good Practice Note on Addressing Grievances from Project-Affected Communities (2009)
- IFC Introduction to Health Impact Assessment (2009)
- IFC Stakeholder Engagement Handbook: A Good Practice Handbook for Companies Doing Business in Emerging Markets (2007)
- World Group Bank (WBG) General and Sector Specific Environmental, Health and Safety (EHS) Guidelines (2007)
- Tip Sheet for Company Leadership on Crisis Response: Facing the COVID-19 Pandemic
- Interim Advice for IFC Clients on Preventing and Managing Health Risks of COVID-19 in the Workplace
- Interim Advice for IFC Clients on Supporting Workers in the Context of COVID-19

- Interim Advice for IFC Clients on Developing a COVID-19 Emergency Preparedness and Response Plan (EPRP)
- Addressing Increased Reprisals Risk in the Context of COVID-19
- Interim Advice for IFC and EBRD Clients on Migrant Workers and COVID-19

10.4.2.2 Human Rights Context of Turkey

Human rights in Turkey are protected by various international regulations, conventions treaties in addition to the national legislation. The issue of human rights bacame high importance during the the negotiations with the European Union (EU) however, according to the internationally recognized instutitions Turkey has human rights issues include in particular with the etnic minorities, working conditions, gender issues, right to life, torture, freedom of expressin and freedom of religion, assebly, and association. To prevent the human rights impacts an action plan for human rights for Turkey was prepared by Ministry of Justice in March 2021. This plan aims;

- A stronger system for protection of human rights: The Action Plan seeks to ensure the installation of a strong and accessible human rights protection system that is capable of producing results with a view to ensuring the stability of the rule of law with all of its components
- Strengthening judicial independence and the right to a fair trial: The most basic feature of a fair trial is the reasoning of a decision. It is an indispensable principle for a person to know and understand which decision they are subjected to and for what reason.
- Legal foreseeability and transparency: When an application is submitted with an administration against one of its acts, it has to provide the individuals with a speedy and satisfactory reply; the bureaucratic red tape needs to be shortened and the cost of an act that is unlawful due to reasons originating from the part of the administration should not be placed on the individuals.
- Protection and promotion of the freedoms of expression, association and religion: The Action Plan further resumes the determination to preserve and improve the diversity and pluralism originating from the common history, culture and civilisation of our nation
- Strengthening personal liberty and security: The Action Plan envisages certain activities aimed at ensuring application of detention as an exceptional preventative measure. In this connection, it primarily seeks to strengthen the rights of objection and defence in case of detention.
- Safeguarding the physical and moral integrity and the private life of the individual: Protecting the honour and dignity of individuals as their physical and moral integrity and enabling them to live as respectable citizens in the society, are the most important reasons for the existence of the State.
- A more effective protection of the right to property: The Action Plan addresses the inviolability of the right to property in a tone that also reminds the administration of this fact. Having the support of the political will for strengthening the right to property, the Plan also proposes solutions to the problems stemming from the practice.
- Protecting vulnerable groups and strengthening social wealth: Another concept that continuously develops within the human rights discipline is the rights of the youth. In addition, it is aimed to protect and strengthen human rights with regard to areas such as healthy and liveable environment, public health, and informatics.

- High-level administrative and social awareness on human rights: By keeping the awareness on human rights at a high level, it is aimed to not only strengthen but also perpetuate the sensitivity at administrative and societal spheres towards rights and freedoms.

10.4.2.3 Project Human Rights Assessment

HRIA is prepared to identify, assess and mitigate the Project human rights impacts which is presented in table below.

Table 187 Human Rights Impact Assessment

Topic	Project Context	Stakeholders	Pre-mitigation	Mitigation Measures	Risk Categorization
	Human Resource				
Working conditions and working hours	The Turkish Labour Law sets rules for starting and ending of an employment relationship. Employment starts with an employment contract. The employment contract is not subject to any special form unless the contrary is stipulated by the Law. Workers are free to terminate their working contracts following the advance notice periods, and without an advance notice in situations of just cause identified by Labour Law Article 24. Wages may be paid in cash on a monthly basis, or more, but no less frequently. According to Labour Law Article 41, overtime work requires the employee's consent. Within the scope of the Project, 4300 workers will be employed at the construction phase of the Section 1 and Section 3. National	Project workers	Medium	▪ The Project will implement human resource policies and procedures in compliance with the IFC PS-2 on Labour and Working Conditions. Such policies are expected to provide more predictable employment opportunities for direct and indirect employees. A Human Resources and Human Rights Policy will be established and implemented. The copies of relevant human resources policy and any collective agreements will be readily available to workers. ▪ Formal, and transparent recruitment process will be implemented to provide equal opportunity to the applicants. ▪ The employees will be provided with a written contract. The contracts as a minimum will include information on terms and conditions of employment, including the period of employment, wages, hours of work, overtime arrangements, procedures for termination of the contract and any benefits. The contract will be in the native	Low

Topic	Project Context	Stakeholders	Pre-mitigation	Mitigation Measures	Risk Categorization
	requirements, ILO Conventions ratified by Turkey and IFC PS2 will be applied both direct and contractor workers.			language of the employee and it will be clear and understandable to the employee. A copy of contract will be given to the employee. ■ The Project will enhance local employment and referential employment will be given to qualified local people. Hiring preference criteria will prioritise settlements directly affected by the current activities of the Project. ■ The Worker Grievance mechanism will be established and implemented. ■ Priority will be given to goods and services from local businesses. ■ Equal tender process will be applied. ■ Equal procurement opportunities will be provided lo local small businesses through the Local Procurement Plan. ■ Before the procurement, local suppliers will be identified and if required. ■ Capacity development will be applied including the OHS and HR.	

Topic	Project Context	Stakeholders	Pre-mitigation	Mitigation Measures	Risk Categorization
				■ Necessary measures will be ensured for the safety and health protection of workers, including prevention of occupational risks and provision of information and training, as well as provision of the necessary organization and means and shall ensure that these measures are adjusted taking account of changing circumstances and aim to improve existing situations. ■ Project specific Camp Site Management Plan will be prepared and implemented within the scope of the Project in line with the IFC/EBRD's Guidance Note on Worker's Accommodation, 2009.	
Wages	The Labour Law (Law No. 4857, 2003) includes provisions on wages, their renumeration and payment conditions and stipulates that with the object of regulating the economic and social conditions of all employees working under an employment contract, either covered or uncovered by the Law, the minimum limits of wages shall be	Project workers	Medium	■ Payroll records of the direct and indirect workers will be controlled by Kalyon strictly. ■ The contracts of the workers will include the information regarding to salary and annual increase. ■ All workers will be paid equal for equal jobs.	Low

Topic	Project Context	Stakeholders	Pre-mitigation	Mitigation Measures	Risk Categorization
	determined every two years at the latest by the related Ministry. At the peak construction phase, the number of construction workforce, will be 4,300 and , and 250 of them will be skilled, 230 of them will be semi skilled and 3810 of them will be unskilled.				
Non-discrimination	Labour Law: Article 5 of the Labour Law of Turkey regulates the ban of discrimination in employment. According to that article 'no discrimination based on language, race, sex, political opinion, philosophical belief, religion and sex or similar reasons is permissible in the employment relationship. The same article also serves as a base for the principle of equal pay for equal value of work by stating that 'differential remuneration for similar jobs or for work of equal value is not permissible'	Project workers	Medium	■ Human Rights Policy will be prepared and implemented. ■ Workers code of conduct will be prepared and implemented indicating the non-discrimination. ■ Equality of treatment and prohibition harassment in the workplace, commitment on continual improvement, consultation and participation of workers will be promoted. ■ Employment decisions, such as recruitment, dismissal, promotion, will be transparent and will not be made (directly or indirectly) on the basis of personal characteristics such as sex, race, nationality, etc., but rather on the ability to do the job.	Low

Topic	Project Context	Stakeholders	Pre-mitigation	Mitigation Measures	Risk Categorization
Right to form and join trade unions and the right to strike	Unions and Collective Agreements Law No. 6356 (dated on 07.11.2012, Official Gazette No. 28460) ensures the rights of the workers to join the union and right to strike. The construction activities in Section 2 were commenced for tunnel works in 2016 and for infrastructure works in 2017. The construction activities are not yet commenced in Section 1 and Section 3. It is a common phenomenon that considering the limited construction period, unionization activities in the construction sector is not active.	Project workers	High	■ In case of the absence of the unions, workers representatives should be elected and periodical meetings will be held with the representatives. ■ The employer shall consult workers or representatives authorized by trade unions in enterprises with more than two workers' representatives or workers' representatives themselves in the absence of trade union representative to ensure the consultation and participation of workers.	Medium
Right not to be subjected to slavery, servitude or forced labour	Turkish Constitution: Article 18 of the Constitution states that 'no one can be forced to work. Slavery is prohibited'. Employers are not allowed to take deposits of money from workers and retain ID Cards. However, in construction projects carried out in Turkey, it can often be seen that overtime exceeds local	Project workers	Medium	■ Shift schedule of the direct and indirect workers will be strictly monitored and the annual overtime working hours will not extend 275 hours. ■ In compliance with the article 44 of the Labour Law employee's consent will be taken into consideration during the arrangements of the work on national day and public holidays.; The issue of whether or not work will be done on the national day and public holidays will be	Low

Topic	Project Context	Stakeholders	Pre-mitigation	Mitigation Measures	Risk Categorization
	standards due to the signing of a fixed-term work contract and the high turnover of employees due to the nature of the projects. In addition, work on the national day and public holidays can be required.			decided by the collective agreement or by employment contracts. The employee's consent is required if there is no provision in the collective agreement or in employment contracts. ■ There will not be forced labour and employees will be free to terminate their employment in accordance with national law.	
Right to abstain from work	According to Occupational Health and Safety Law No. 6331, workers have the right to leave their workstation in the event of serious, imminent and unavoidable danger.	Project workers	Medium	■ In the event of serious, imminent and unavoidable danger; workers shall leave their workstation or dangerous area and proceed to a place safety. Workers may not be placed at any disadvantage because of their action.	Low
Right of protection for the child	Labour Law No. 4857, Article 71 states that employment of children who have not reached the age of fifteen is prohibited. However, children who have reached the age of fourteen and have completed their primary education may be employed in light labour that will not hinder their physical, mental or moral development. For those who	Project workers	Medium	■ The minimum working age will be 18 for all direct and indirect workers. ■ Subcontractor monitoring system will be established by Kalyon to ensure that all subcontractors comply with work age limits.	Low

Topic	Project Context	Stakeholders	Pre-mitigation	Mitigation Measures	Risk Categorization
	continue their education, they may only work jobs that will not prevent their school attendance				
Right to social security, including social insurance	Social Insurance and General Health Insurance Act No. 5510 of 31 May 2006 determines the rights of beneficiaries and provides for general rules for the functioning of the insurance system and funding conditions. Also contains provisions on employers and workplaces, short-term and long-term insurances. All direct and indirect workers will have right for social insurance and general health insurance, however for the construction sector it is a common implementation to pay insurance on the minimum wage regardless to the salary which will create decrease on the pension payment.	Project workers	High	■ Social insurance payments of all direct and indirect workers will be strictly controlled by Kalyon. ■ If required awareness meetings will be held with the Project workers.	Medium
Migrant workers	During the social field surveys it has been observed that, agricultural	Project workers	Medium	■ Considering OHS, working conditions and personnel rights, migrant workers will not be	Low

Topic	Project Context	Stakeholders	Pre-mitigation	Mitigation Measures	Risk Categorization
	daily paid Syrian and Afghan refugees work in the neighborhoods of Harmanlı, Fevzipaşa in Karacabey, Karahıdır and Kazıklı neighborhoods in Gürsu, Barakfakih, Seymen and Narlıdere in Kestel are all districts of Osmangazi. It is estimated that daily agricultural workers will be in the region, especially in the summer period, where construction is expected to be intensive.			allowed to work unregistered in the field and monitoring studies will be carried out on this issue.	
Women employment	Turkey has no legislative developments in relation to part-time work for working parents in the public sector. The employment rate for women was 32.2% while it was 68.3% for men in 2019. In the construction sector, it is observed that female employees are generally employed as OHS or service personnel.	Project workers	High	▪ Equal wage policy for equal work for women employees will be implemented, ▪ Positive discrimination will be applied to female candidates during the recruitment process. ▪ The safety and needs of female staff staying in the camp will be met at a high level.	Medium

Topic	Project Context	Stakeholders	Pre-mitigation	Mitigation Measures	Risk Categorization
COVID-19 related rights	During the Covid-19 pandemic in Turkey one of the most vulnerable groups are labour force in different source of impacts; The employers reduced numbers of the workers during the Covid-19 pandemic. Due to the insufficient protection measures workers exposed to disease short-time working allowance/pay adapted in various sectors.	Project workers	High	■ A Covid-19 Emergency Response Plan and Risk Assessment will be prepared in line with the national government guidelines and international Covid-19 management resources. ■ All workforce will be requested complete daily self-screening for Covid-19 symptoms before starting the work, and they will be asked to report in case Covid-19 symptoms are recognized and not to work. ■ Regular Information, supervision and training will be ensured in the Project. ■ Vulnerable workers will be identified (older employees, those with underlying health conditions etc.) and will be monitored by the occupational physician. ■ In case of a positive case of any worker in the accommodation and/or construction site, direct contact personnel will be identified and will be subject to test. Test costs shall be paid by contractor/subcontractor ■ Covid-19 PPE (workers and medical staff) will be freely provided	Medium

Topic	Project Context	Stakeholders	Pre-mitigation	Mitigation Measures	Risk Categorization
				■ Control measures with respect to Covid-19 are further provided in Section 10.4.4.	
Socioeconomic and Cultural Context					
Freedom of thought and opinion	According to Article 25 of Constitution of Republic of Turkey. Everyone has the right to freedom of thought and opinion. No one shall be compelled to reveal his thoughts and opinions for any reason or purpose, nor shall anyone be blamed or accused on account of his thoughts and opinions.	■ Local communities ■ Project workers	Medium	■ A Stakeholder Engagement Plan and the Grievance mechanism will be established to provide stakeholders to express their thoughts and the opinions on the Project.	Low
Right to information	Law on the Right to Information No. 4982 (Issued on 24.10.2003, Official Gazette No. 25269) regulates the procedure and the basis of the right to information according to the principles of equality, impartiality	■ Local communities ■ Project workers	High	■ A Stakeholder Engagement Plan will be prepared for the Project and implemented in all phases of the Project.	Low

Topic	Project Context	Stakeholders	Pre-mitigation	Mitigation Measures	Risk Categorization
	and openness that are the necessities of a democratic and transparent government. Everyone has the right to information on the activities of public institutions and professional organisations, which qualify as public institutions. In accordance with Turkish Republic Ministry of Environment and Urbanisation Environmental Impact Assessment Regulation (Official Gazette Nov. 25, 2014; No: 29186), relevant requirements in relation with EIA Process have been disclosed to the public for Section 1 and Section 2. The EIA process of the Bandırma-Bursa section is not yet initiated.			▪ ESIA disclosure activities will be performed in order to inform all stakeholder of the Project impacts. ▪ During the construction and operation period of the project, all stakeholders will be informed about the status of the Project with various tools including the face to face meetings, project website, media.	
Right to an adequate standard of living and housing	According to the desktop research and field studies and background project information there will be need of resettlement and economic displacement in the Project (Please see Section 8.3.4).	▪ Local communities ▪ Project workers	High	▪ Resettlement Action Plan and Livelihood Restoration Plan will be prepared and implemented for the whole sections of the Project (i.e., Section 1, Section 2 and Section 3). ▪ Stakeholder Engagement Plan will be prepared and implemented.	Medium

Topic	Project Context	Stakeholders	Pre-mitigation	Mitigation Measures	Risk Categorization
	In Turkey, the acquisition and the expropriation process are held in compliance with the Turkish Expropriation Law which does not include the rights of the unofficial land users, vulnerable people and the livelihood restoration.			■ Grievance mechanism will be prepared and implemented.	
Right to health, food, water and sanitation	Potential risks to local residents identified in the ESIA include traffic increase in construction, communicable diseases, construction related environmental impacts, increase resources, security aspects, etc.	■ Local communities ■ Project workers	High	■ Traffic Management Plan will be prepared and implemented. ■ Security Management Plan will be prepared and implemented. ■ Community Health and Safety Plan will be prepared and implemented.	Medium
Right to take part in cultural life	The main impact identified in the ESIA is population influx during the construction phase which may create social unrest and gender based violence.	■ Local communities ■ Project workers	High	■ Influx Management Plan will be prepared and implemented.	Medium
Rights of minorities	It has been observed that the village of Badırga located in Nilüfer has Alevi population whom can be considered as an religious/cultural minority in Turkey. During the	■ Local communities	High	■ Cultural awareness training will be provided to the workers whom will be accommodated in the village of Badırga.	Medium

Topic	Project Context	Stakeholders	Pre-mitigation	Mitigation Measures	Risk Categorization
	construction phase of the Project a workers accommodation will be established in Badırga which may create impact on the daily life of the village.	■ Project workers		■ Camp Site Management and Security Management Plan will be prepared and implemented.	
Environmental issues	The fundamental law in Turkish Environmental Legislation is the Environmental Law No. 2872 (Issued on 11.08.1983, Official Gazette No.18132, amended by Law No. 5491). According to Environmental Law, citizens, as well as the State, bear responsibility for the protection of the environment based on the "polluter pays" and "user pays" principles. According to the Article 56 of Constitution of Republic of Turkey Everyone has the right to live in a healthy, balanced environment. It is the duty of the state and citizens to improve the natural environment and to prevent environmental pollution.	■ Local communities ■ Project workers	High	■ Suitable and sufficient environmental management plans for the waste, wastewater, noise and air quality will be established and implemented. ■ Establish in advance a relationship with municipal environmental department and monitoring of air and noise will be in accordance with local regulations. ■ The railway construction route and all operational areas which are operated by the contractor or subcontractors like quarries, tunnel construction locations, transportation routes, construction camp sites, are to be regularly monitored for environmental aspects and in case of a grievance, additional measurements will be held, and the results will be shared with the local communities. ■ Nearby communities will be informed in advance about the blasting activities.	Medium

Topic	Project Context	Stakeholders	Pre-mitigation	Mitigation Measures	Risk Categorization
	Turkey is not a not party to the Aarhus and Espoo Conventions and there is no climate change legislation in place.			■ Safety awareness campaigns will be considered with respect to blasting activities, traffic safety, construction area risks etc. which have the potential impacts on community members.	
Security management procedures	During the construction phase of the Project, armed and/or unarmed security will be needed on the site and especially during the access to the agricultural lands and the pasture land may create social tension between the security personnel and the local communities.	■ Local communities ■ Project workers	Medium	■ Before the construction, local communities will be informed about the risks of the entering the construction sites. ■ Security personnel will patrol the site area to prevent any unauthorized access onto the site. ■ Security Management Plan will be established and implemented by the Contractor, outlining expectations around security. ■ Conflict Management Training will be provided to armed security personnel. ■ The grievance mechanism for the Project will capture all grievances raised in relation to security and safety issues. These will be addressed promptly, and actions will be taken.	Low

Topic	Project Context	Stakeholders	Pre-mitigation	Mitigation Measures	Risk Categorization
COVID-19	The interaction between workers and nearby communities should be controlled and restricted due to avoid the spread of Covid-19.	■ Local communities ■ Project workers	High	■ The risk of disease transmission will be minimized in working and camping areas by implementing the Covid-19 control measures provided in the Human Resource Section of this table, thus the risk of transmission to community members will be reduced.	Medium

10.4.2.4 Human Rights Policy of the Project

A human rights policy for the Project will be prepared and implemented. All subcontractors will be informed about the human rights approach of the Project and this policy will be put in the visible locations of the Project site. The policy will include the following topics at minimum:

- Incorporate respect for human rights into management, governance practices and programs as defined in the International Bill of Human Rights and the International Labour Organization's Declaration on Fundamental Principles and Rights at Work.
- Contractors, suppliers and business partners to share this commitment to human rights – including those in regard to working conditions, freedom of association, freedom of speech, collective bargaining, maximum working hours, fair wages and benefits, equal opportunity and freedom from discrimination
- Not discriminate against any individual on the basis of race, colour, national or ethnic origin, religion, age, sex, sexual orientation, gender identity or expression, marital status, family status, pregnancy, disability, genetic characteristics or any other arbitrary characteristic unrelated to the individual's job performance.
- Promote diversity at all levels of the Project,
- Enhance employment, supply chain, training and community investment programmes to advance the socio-economic empowerment of women in communities, and eliminate barriers to the advancement and fair treatment of women in workplaces.
- Respect the collective and customary rights of local peoples near the Project construction and operation areas and ensure consultation with all relevant stakeholders is taken.
- Subscribe to the principle of informed consent when working on private land,
- Strive for continuous improvement in upholding and respecting human rights through ongoing dialogue with internal and external stakeholders
- Continue to not engage in all forms of child labour, forced labour and modern slavery for all activities in which we are engaged and across the entire supply chain
- When working with public or private security forces, implement a human rights and security approach consistent with the Voluntary Principles on Security and Human Rights.
- Establish confidential mechanisms to identify, receive and respond to human rights and ethical concerns from any stakeholder and in a neutral manner
- Continually review and evaluate changing human rights conditions in the jurisdictions in which we operate

Take action to terminate any contracts or arrangements with our contractors and suppliers should we become aware that their practices and performance conflict with the requirements of this Human Rights Policy.

10.4.2.5 Key Performance Indicators and Monitoring

Following indicators will be monitored during the assessment of the human rights impacts of the Project.

Table 188: Key Performance Indicators

Indicator	Monitoring Measure
Adaptation of human rights policy	Policy implementation
Percentage of suppliers screened on the basis of human rights performance	Percentage
The importance of human rights for the company according to its employees	Training database
Number of human rights lawsuits against the Project by employees	Number of cases
Number of human rights lawsuits against the Project by communities	Number of cases

10.4.3 Worker's Accommodation

Construction camp sites will be constructed along the BBYO route by the Contractor and the subcontractors. The location and the capacity of the camp sites are provided in Section 3.3.7.1.5

Project specific Camp Site Management Plan will be prepared within the scope of the Project in line with the IFC/EBRD's Guidance Note on Worker's Accommodation, 2009. Following points will be considered and included as a minimum into the Camp Site Management Plan to be developed:

- The minimum room space will be 4 square metres per person (assuming a height of 2.4m).
- The rooms will be adequately ventilated and lit.
- Adequate number of toilets and sanitary fittings will be provided (1 toilet, 1 hand wash basin, 1 urinal and 1 bathroom with bench per 15 person).
- The camp site will be built with adequate materials, kept in good repair and kept clean and free from rubbish and other refuse.
- Both natural and artificial lighting will be provided and maintained at the camp sites, e.g., window area represents not less than 5% to 10% of the floor area. Emergency lighting will be provided.
- Drinking water quality will be regularly monitored.
- Wastewater, sewage, food and any other waste materials will be adequately discharged, in compliance with local or World Bank standards. Specific containers for rubbish collection will be provided and emptied on a regular basis.
- Pest extermination, vector control and disinfection will be carried out throughout the living facilities in compliance with local requirements, especially during the Covid-19 pandemic period.
- Rooms/dormitories will be kept in good condition, aired and cleaned at regular intervals, built with easily cleanable flooring material.

- Sanitary facilities will be located within the same buildings and provided separately for men and women.
- Density standards are expressed either in terms of minimal volume per resident or of minimal floor space. Usual standards range from 10 to 12.5 cubic metres (volume) or 4 to 5.5 square metres (surface).
- A minimum ceiling height of 2.10 metres will be provided.
- In collective rooms, standards range from 2 to 8 workers to share the same room. All doors and windows will be lockable with mobile partitions or curtains to ensure privacy.
- Every resident will be provided with adequate furniture such as a table, a chair, a mirror and a bedside light.
- The minimum space between beds of 1 metre will be ensured. Triple deck bunks are prohibited.
- Sanitary and toilet facilities will be constructed of materials that are easily cleanable and will be cleaned frequently and kept in working condition.
- Shower/bathroom facilities will be provided with an adequate supply of cold and hot running water.
- Canteen, cooking and laundry facilities will be built in adequate and easy to clean materials and will be cleaned frequently and kept in working condition. Canteens have a reasonable amount of space per worker. Standards range from 1 square metre to 1.5 square metres.
- Adequate facilities for washing and drying clothes will be provided. Standards range from providing sinks or tubs with hot and cold water, cleaning soap and drying lines to providing washing machines and dryers.
- Food provided to workers to contain an appropriate level of nutritional value.
- Sufficient number of first aiders with adequate first aid training will be available at each camp site. Adequate number of first aid kits will be stoked at the camp sites. Infirmaries will be established at the camp sites. The distance and the transportation arrangements to the nearest hospitals will be arranged in advance via the Emergency Response Plans to be prepared.
- Suitable and sufficient number of emergency response equipment including fire response and fire detection systems will be provided at the camp sites. Emergency muster points will be designated and periodic maintenance of all equipment will be ensured.
- A Security Management Plan including clear measures to protect workers against theft and attack will be implemented.
- A Camp Manager will be appointed for each camp site to monitor the compliance with the standards and engage with the workers.

10.4.4 Occupational Health and Safety

Labour Law No.4857 and Occupational Health and Safety Law No.6331 and relevant regulations and international standards (e.g., IFC PS2) will be applied throughout the Project. The following main principles shall apply at all phases of the Project:

- Risk Assessments will be prepared for all Project tasks and locations according to Regulation on Health and Safety Risk Assessment.
- Occupational safety specialist, occupational physician and other health staff will be appointed in the Project both for the Contractor and the subcontractors as per OHS Law No. 6331. In case there is lack of

personnel in the undertaking competent enough to be designated, a joint health and safety unit will partially or fully provide these services.

- ERP including a Covid-19 ERP will be implemented for the Project and drills will be conducted at least on an annual basis. Emergency Response Teams will be established and appointed personnel will have appropriate training as per Regulation on Emergency Cases in Workplaces and First Aid Regulation.
- In the event of serious, imminent and unavoidable danger; workers shall leave their workstation dangerous area and proceed to a place safety without any necessity to comply with the requirement. Workers will not be placed at any disadvantage because of their action.
- Workers (including subcontractors) and the workers' representatives will be informed about the safety and health risks and protective and preventive measures, their legal rights and responsibilities, workers designated to handle first aid, extra ordinary situations, disasters, fire-fighting and the evacuation.
- Workers (and/or workers' representatives) will be consulted regarding occupational health and safety aspects to make their proposal. Occupational health and safety committees will be established in line with the legal requirements.
- All workers including subcontractors will be adequately trained as per Regulation on Principles and Procedures for Health and Safety Training of Employees. Personnel who require vocational training will not be allowed to start working before obtaining the necessary training certification. All training will be refreshed within legally required internals and as frequently needed. A Training Programme will be in place to include as a minimum but not limited to:
  - Project Policies
  - Environmental and Social Management Plans and management controls
  - Legally required H&S Training
  - Vocational Training
  - Emergency response team members' training
  - Spill response and emergency response programs
  - Special technical training, e.g., working at height, confined space, etc.
  - Safety Awareness Training, e.g., traffic safety, near miss reporting, etc.
- Employees will be provided with appropriate personal protective equipment and will be monitored regularly about their usage.
- Employees will be subject to medical controls before the employment, periodically as within legally required intervals and as occupational physician deems necessary.
- All accidents, incidents and near misses will be reported and workers will be encouraged to share their observations. All accidents will be investigated to prevent further reoccurrences. Accident Reporting and Investigation Procedure will be established.
- All hazardous materials will have Safety Data Sheets and will only be used by authorized personnel. Regulation on Health and Safety Precautions Regarding Working with Chemicals requirements will be followed.

- A subcontractor management system will be established which will include the procedures to be implemented for the selection, evaluation and management of the subcontractors including auditing and training needs for the proper implementation of the environmental and social management programs.
- A monitoring system will be implemented to ensure that all control measures are actually being carried out in practice and all duties are fulfilled. All non-compliances, control measures, timescales and responsible personnel will be recorded in a system to be established. Appropriate communication system will be established between the Contractor and the subcontractors to monitor and track the completion of the corrective actions.

The main occupational health and safety issues that have the highest hazard and therefore accident potential in the construction and operation phase of a railway project are summarized in table below.

Table 189: Main construction and operation phase OHS issues

Construction Phase OHS issues	Operation Phase OHS issues
■ Working at height ■ Hot works ■ Lifting operations ■ Working in confined spaces ■ Working in remote locations ■ Excavation and ground works ■ Working with hazardous materials ■ Manual handling ■ Working with hand tools ■ Working around heavy vehicles ■ Site traffic and mobile plant ■ Occupational illnesses ■ Electrical hazards ■ Heat stress ■ Slip, trips	■ Train / worker accidents ■ Noise and vibration ■ Diesel exhaust ■ Fatigue ■ Electrical hazards and magnetic fields ■ Loading/unloading during freight transportation ■ Maintenance works (which may include physical, chemical, biological hazards, also confined space entry) ■ Occupational illnesses ■ Malfunction/collapse of structural elements impacting workers/public

A Project specific HSE Policy and Occupational Health and Safety Management Plan will be established to provide a safe environment for workers including subcontractors, visitors and community members and to protect environment and the assets.

The following procedures will be established at a minimum which will detail the safe work principles for each task:

- Accident/Incident Reporting and Investigation Procedure
- Health and Safety Rewarding and Discipline Procedure
- Permit to Work Procedure
- General Site Rules Procedure
- Working at Height Procedure
- Safe Use of Working Platforms, Scaffolds and Ladders Procedure
- Excavation Procedure

- Working in Confined Spaces Procedure
- Training Procedure
- Manual Handling Procedure
- Electrical Works Procedure
- Lifting Works Procedure
- Personal Protective Equipment Usage Procedure
- Fitness for Duty and Fatigue Management Procedure
- Maintenance and Calibration Procedure
- Operational Technical Procedures to be developed covering all processes including the design of the railway infrastructure, signal system and traffic, including maintenance and operation.[45]

10.4.4.1 Construction Phase OHS Management

The construction phase activities shall comply with the requirements given in the Regulation on Health and Safety at Construction Sites. The minimum workplace control measures to be implemented during the construction phase will be as following:[46]

- A work permit system will be implemented for high risk tasks including hot works, working at height, lockout/tag out, excavation, confined space entries, etc.
- If working at height cannot be eliminated, work equipment or other methods will be searched and used to prevent a fall from occurring. Collective protection systems, such as edge protection or guardrails, should be implemented before resorting to individual fall arrest equipment. All working at height works will consider the workers' fitness for duty and training, working platforms, safe access/egress, periodic controls, weather conditions, emergency rescue plan detailing the methods to be used to rescue workers if they become stranded or incapacitated while at height, etc.
- Appropriate hazardous materials storage areas will be established with suitable materials segregation, adequate ventilation, spill control and emergency response measures.
- All lifting operations will consider the appropriate type of lifting equipment, method of slinging, attachment points, size, weight of the load, safe lifting limits, periodic maintenance of all equipment, operator training requirements, exclusion zones, etc.
- For remote works, there will be suitably qualified first aider personnel in the work crew and suitable communication equipment will be available for the work team at all times.
- All manual handling activities will consider the task, individual, load and the environmental conditions.
- Work areas will be clearly signed, segregated and adequate lighting provisions will be ensured.
- All electrical systems and equipment will be properly selected, installed, used and maintained. Only authorized personnel will be allowed to use/maintain electrical systems.

[45] Procedures should comply with the national requirements specified in the Railway Safety Regulation and the TCDD General Orders Regarding the Safety Rules to be followed in Road Maintenance and Construction Works on the Railway, on the Side and Close to the Railways by Third Parties

[46] Health and safety in construction HSG150, Health and Safety Executive

- Proper housekeeping will be ensured at the construction areas including adequate cable management, appropriate storage, cleaning of wet surfaces.
- All excavation works will consider detection of underground and overhead services, the appropriate side supports, safe materials storage preventing side collapses safe access/egress, edge protections, ground and surface water inflow, accumulation of hazardous atmospheres, etc.
- Occupational health risks will be assessed for all work tasks including noise, dust, vibration, chemical exposure, etc. and appropriate organisational and engineering control measures will be ensured.
- No one will be allowed to enter confined spaces before ensuring the appropriate control measures including detection and monitoring the hazardous atmospheres, appropriate lighting and communication systems, emergency rescue equipment and procedures, etc.
- All workers including subcontractors will be equipped with suitable PPE considering the type of task they are involved.
- All equipment used at site will be periodically maintained and controlled as per Regulation on Health and Safety Conditions Regarding Use of Work Equipment.
- On site traffic management controls will be ensured. Please see Section 8.1.11 Traffic and Infrastructure Section for further detail about traffic management control measures.

10.4.4.2 Operation Phase OHS Management

All necessary control measures and management systems will be established to ensure that the BBYO Project operates in line with the national (Railway Safety Regulation) and international OHS requirement (e.g., 2016/798/EC Railway Safety Directive, IFC Environmental, Health, and Safety Guidelines for Railways). A Safety Management System will be established in line with the national Railway Safety Regulation and a Safety Management System Implementation Plan will be prepared in compliance with the legal requirements.

The minimum workplace control measures to be implemented during the operation phase will be as following:

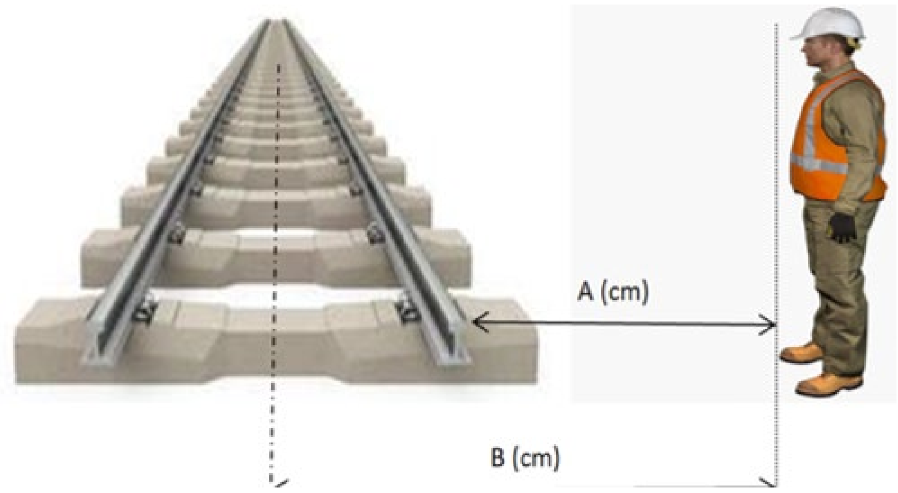
- Following will be implemented to prevent train/worker accidents:
  - Training workers in personal track safety procedures;
  - Blocking train traffic on lines where maintenance is occurring (“green zone working”) or, if blocking the line is not feasible, use of an automatic warning system or, as a last resort, human lookouts;
  - Design and construction of rail lines with adequate clearance for workers;
  - Segregation of stabling, marshalling, and maintenance areas from the running lines.
- For the management of noise and vibration impacts the following will be ensured:
  - Use of air conditioning systems to maintain cabin temperature and provide fresh air so that windows can remain closed, limiting wind and outside noise;
  - Reduction of internal venting of air brakes to a level that minimizes noise without compromising the crew’s ability to judge brake operation;
  - Installation of active noise cancellation systems;
  - Use of personal protective equipment (PPE) if engineering controls are not feasible or adequate to reduce noise levels;

- Use of dampers at the seat post to reduce the vibration experienced by the operator;
- Installation of active vibration control systems for locomotive suspension, cabs, or seat posts, as needed to comply with applicable international and national standards and guidelines.

- To minimize the workers exposure to diesel exhaust, the following will be implemented:
  - Limiting time locomotives are allowed to run indoors and use of pusher cars to move locomotives in and out of maintenance shops;
  - Ventilation of locomotive shops or other enclosed areas where diesel exhaust may accumulate;
  - Filtration of air in the train crew cabin;
  - Use of PPE where engineering controls are not sufficient to reduce contaminant exposure to acceptable levels
- Fatigue, particularly of operators, signallers, maintenance workers and others whose work is critical to safe operation, can pose a serious safety risk for railway workers and the general public. Rest periods will be scheduled in accordance with the national and international standards and good practices for work time. Operators will be encouraged to communicate their concerns if they are not feeling comfortable and fit to operate the locomotive.
- Railway, train and urban rail public transport operators are obliged to obtain a safety certificate within the framework of the procedures and principles specified in the Railway Safety Regulation.
- Only workers who are specifically trained and competent in working with overhead lines and conductor rails will be allowed to approach these systems.
- Zones will be identified regarding the elevated electric and electromagnetic fields and access will only be limited to the trained workers. Monitoring Plan will be established to ensure the national (Regulation on the Measures to be taken to Prevent the Environment and the People's Health from Negative Effects of Non-Ionizing Radiation) and international standards (such as International Commission on Non-Ionizing Radiation Protection) are ensured with respect to exposure to non-ionizing radiation.
- Safety signs and boards will be placed along the line in accordance with legal requirements.
- Due to the structure and speed of locomotives moving on the railway, an impact area is created which is defined as the hazard zone and can impact the personnel doing the maintenance and repair works on the railway infrastructure. The safety zone classification will be implemented in the Project (Table 190).

Table 190: Safety Zones in the Railway[47]

Speed (km/h)	0 ≤90	91 ≤160	160 <
B (cm)	220	250	300
A (cm)	145	175	225



A: Safety zone boundaries from the rail
B: Safety zone boundaries from the line axis

- During the operation phase, Kalyon will be responsible from the maintenance works on the BBYO Railway route. All maintenance crew will be trained in line with the national requirements (such as completion of Safety Rules to be Followed in the Construction, Maintenance and Repair Activities of Railway Infrastructure Training of TCDD, ECM certificate for freight locomotive maintenance crew) and the specific risks (such as confined space entry) related to the type of the maintenance will be assessed before conducting any maintenance activity. The maintenance activities can be conducted in the following manners which will all comply with the safety control measures in line with the regulatory requirements.
  - Works carried out by closing the road,
  - Works carried out by taking regional time permit,
  - Works carried out by implementing speed limitation,
  - Works carried out by using safety guards,
  - Works carried out by using electronic warning devices,
  - Works carried out by using panels,
  - Works carried out by using wire mesh/netting,
  - Works carried out by electrification.
  - Works carried out during emergencies.

[47] TCDD General Order 551 Regarding the Safety Rules to be followed in Road Maintenance and Construction Works on the Railway, on the Side and Close to the Railways by Third Parties

10.4.5 Covid-19 Management

The Covid-19 pandemic continues to create significant challenges on the companies and the workforce which require additional action to prevent transmission and therefore minimize the impacts on people and the business continuity.

According to the Covid-19 color code application implemented by the Ministry of Health, the color codes of Balıkesir, Bursa and Bilecik provinces where the Project will cross are presented in Figure 108, which are currently determined as "very high risk". According to the weekly Covid-19 cases for provinces, the number of Covid-19 cases are published as 430.63 for Balıkesir; 260.43 for Bursa; 340.62 for Bursa per 100 thousand population.

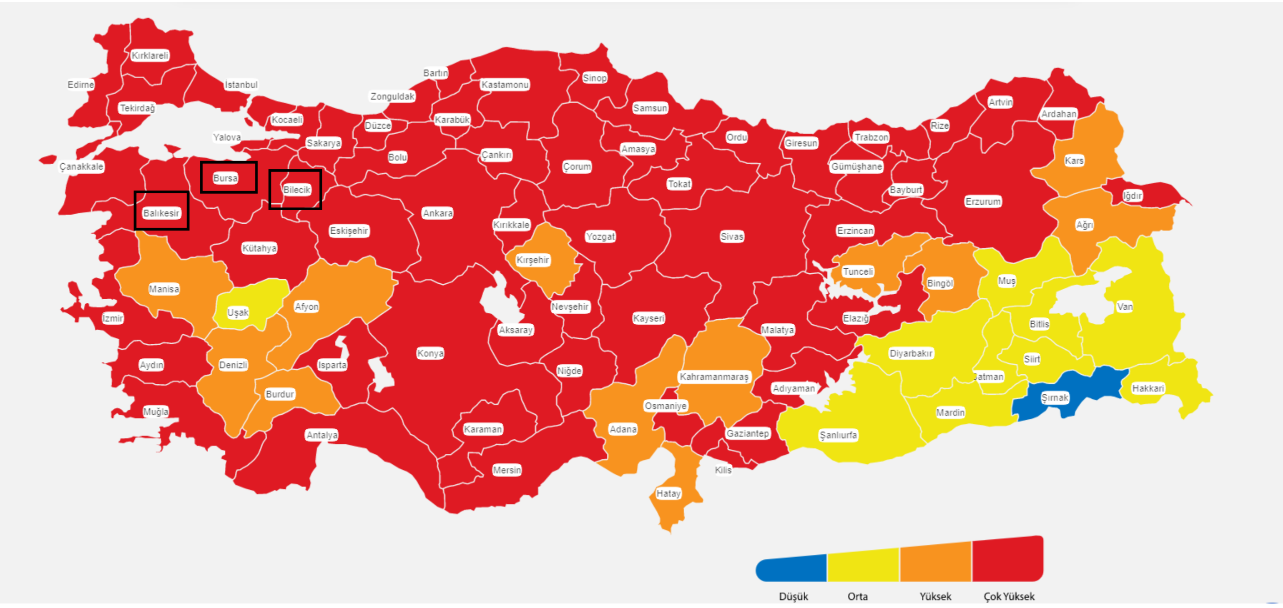


Figure 108 Covid-19 Risk Code for the Provinces (blude: low, yellow: medium, orange: high, red: very high, 20-26 March 2021)[48]

A Covid-19 Emergency Response Plan and Risk Assessment will be prepared in line with the national government guidelines and international Covid-19 management resources (e.g., IFC/EBRD):

- Covid-19 Pandemic Management and Operation Guidance, Ministry of Health, March 2021[49],
- Mandatory coronavirus COVID 19 pandemic measures on construction sites, the Ministry of Environment and Urbanization, March 2020[50],
- IFC Covid-19 Interim Advice resources[51],
- EBRD Covid-19 Guidance materials[52].

Following points will be considered and included as a minimum into the Covid-19 Emergency Response Plan and Risk Assessment to be developed:

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[48] https://covid19.saglik.gov.tr/

[49] https://covid19.saglik.gov.tr/TR-66393/covid-19-salgin-yonetimi-ve-calisma-rehberi.html

[50] https://www.emo.org.tr/genel/bizden_detay.php?kod=131143&tipi=2&sube=3

[51] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_tipsheet_covid-19_supportingworkers

[52] https://www.ebrd.com/sustainability-covid.html

- A Covid-19 responsible will be appointed at all camp sites.
- Regular and different communication methods will be used to raise the awareness of workers, i.e. posters, emails, training, toolbox talks, etc.
- All workforce will be requested complete daily self-screening for Covid-19 symptoms before starting the work, and they will be asked to report in case Covid-19 symptoms are recognized and not to work.
- Vulnerable workers will be identified by the workplace physicians and appropriate measures will be ensured to protect them.
- Adequate supervision of all workforce including subcontractors will be provided to ensure all control measures are implemented properly.
- Frequent cleaning regimes will be in place at the work areas and especially at the commonly used areas, i.e. sanitary facilities, dining halls, etc.
- Sufficient washing and hand sanitizing points will be provided at the camp sites, dining halls, work and office areas, etc.
- Sufficient and suitable PPE will be made available for workers, subcontractors and visitors at all time. PPE stocks will be tracked continuously and supplied in advance. Any type of PPE will be personal and will not be shared between the workforce.
- Procedures will be established within the Covid-19 Emergency Response Plan for the people who fall ill with suspected Covid-19 symptoms while at work and at the camp sites. Medical arrangements will be adequate to respond to potential Covid-19 cases. Suitable isolation rooms/areas will be designated in case of suspicious cases.
- Temperature checks will be applied at the start of each shift and more frequently as needed. HES (Life Fits into Home)[53] codes of all workforce including subcontractors will be collected.
- No visitors will be accepted to the work areas/camp sites without temperature control and HES code control.
- Covid-19 related wastes, e.g., waste masks, gloves, etc. will be disposed of in accordance with the MoEU Covid-19 Measures for the Waste Management of Single Use Masks, Gloves and Other Personal Hygiene Materials (April, 2020).
- All service buses will be disinfected frequently as determined by the government advice and social distancing requirements will be ensured inside the buses.
- Kalyon will monitor the Covid-19 cases in the workforce including subcontractors at a daily basis and implement the ERP procedure strictly to identify the potential contact personnel in the workforce and implement isolation to prevent potential further transmission.
- Kalyon will monitor the updates on the national and international guidelines on a daily basis and implement the necessary requirements in their works.

11.0 CONCLUSIONS

The ESIA for the project has been conducted following a series of phases including:

[53] https://hayatevesigar.saglik.gov.tr/hes.html

- Inception
- Alternative analysis
- Baseline
- Stakeholder engagement
- Impact assessment
- Definition of Environmental and Social Management System

The ESIA complies with the relevant Turkish regulation and it is aligned with the 2012 IFC Performance Standards and EHS Guidelines Railway. The various activities have been carried out by a working group including Turkish and International experts in environmental and social disciplines.

The general methodology for the impact assessment is based on the definition of Valued Environmental and Social Components (VECs), that are aspects of the physical, biological and social environment that are considered worthy of protection by the relevant legislation or by international standards, and of Assessment Endpoints (AE), that are specific and measurable aspects of the VECs that allow for the assessment of impacts (both positive and negative).

The process of assessing impacts has been based on the following steps:

- The identification of Project Components, as individual elements of the Project that are characterized by similar features and construction, operation and decommissioning procedures;
- The identification of Impact Factors, or factors that can change the environmental and social quality of the VECs like air emissions, water discharge etc.,
- The definition of the sensitivity of the VECs to the Impact Factors identified, based on the environmental and social data collected during baseline;
- The definition of the Impacts as a result of the interaction between Impact Factors and Sensitivity of the VECs for each of the identified Assessment Endpoints.

Each of the project components has been associated to one or more impact factor for each of the phases of construction, operation and decommissioning.

Impacts have been assessed considering the correct application of a set of standard mitigation measures that are drawn from good industry practice. Additional site or issue specific mitigation measures have been identified to address areas where high residual impacts are likely to occur, in order to ensure the impacts after additional mitigation measure are kept at an acceptable level.

Impacts have been assessed separately for the three phases of construction, operation and decommissioning, as the nature and extent of the impacts in the three phases is substantially different.

As a result of the Environmental and Social Assessment Study the following conclusion have been driven:

1) Continuous stakeholder engagement is necessary manage the social risks of the project.
2) An air and noise monitoring programme will be in place for the Project to be in compliance with regulatory requirements applicable to the project.
3) For the biodiversity components, a list of mitigation measures are defined for Project phases within the scope of ESIA including additional field studies for collect data and plan mitigation measures.
4) The project will develop an Environmental and Social Management System in line with the minimum requirements that are defined as part of the ESIA study.

5) Stakeholder Engagement Plan including an internal and external grievance mechanism will be applied in the Project.

6) Resettlement Action Plan and Livelihood Restoration Plan will be applied to prevent the outmigration of PAPs due to livelihood losses.

The mitigation measures to be in place for the minimisation of environmental and social impacts of the project is detailed in appropriate sections of the report.

The requirements of an Environmental and Social Management System is also provided as part of the Environmental and Social Impact Study focusing on

- Environmental and Social Management System Structure
- Environmental and Social Management Plan
- Labour Issues and Health & Safety Management Plan
  - Labour Conditions
  - Occupational Health and Safety
  - Community Health and Safety

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APPENDIX H

Air Quality Modelling

APPENDIX I

Noise Modelling

Signature Page

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